

Featured Abstracts: Valves; Valve and Aortic Surgery; Aortic Stenting

Thursday, June 19, 2003, 12:00 noon–1:25 PM

1 OFF-PUMP VALVE REPAIR USING THE COAPSYSTM DEVICE: A FEASIBILITY STUDY IN PATIENTS WITH FUNCTIONAL MITRAL REGURGITATION

Naresh Trehan¹, Yugal K. Mishra¹, Sanjay Mittal²

¹Ctvs, Escorts Heart Institute and Research Centre, Okhla Road, New Delhi, India; ²Clinical and Non Invasive Cardiology, Escorts Heart Institute and Research Centre, Okhla Road, New Delhi, India

OBJECTIVE: Functional mitral regurgitation (MR) results from dilatation of the mitral valve annulus and/or lateral papillary muscle displacement in dysfunctional left ventricles. The study objective was to evaluate the ability of the Myocor[®] Coapsys[™] device to restore leaflet apposition and valve competency off pump without atriotomy in patients with functional MR undergoing concomitant coronary artery bypass grafting.

METHODS: The Coapsys device was surgically implanted in 8 (6 male) patients with functional MR of grade 2 or larger. The mean age of the patients was 63 ± 6.4 years with a mean ejection fraction of 38.6 ± 3.9 percent. The Coapsys consists of anterior and posterior epicardial pads connected by a sub-valvular chord. The posterior pad was positioned at the annular level and centered relative to the posterior leaflet. The sub-valvular chord bisected the valve perpendicular to the coaptation line. The Coapsys was sized by reducing the device dimension, drawing the posterior leaflet and annulus toward the anterior leaflet. During sizing, MR grade was assessed real time using color flow Doppler echocardiography. Final device size was selected when MR was eliminated or minimized.

RESULTS: In all patients, MR was reduced to ≤1 following implantation. Mean MR grade was reduced from 2.9 ± 0.5 pre implantation to 0.8 ± 0.5 post implantation (p<0.001). All implants were performed off pump without atriotomy. No device related adverse events were noted.

CONCLUSIONS: The Coapsys consistently and significantly reduced or eliminated functional MR acutely. Follow up is currently underway to assess the chronic stability of the repair.

2 MINIMALLY INVASIVE MITRAL VALVE SURGERY-A COMPARISON OF THE PORT-ACCESS- AND THE TRANSTHORACIC CLAMP TECHNIQUE

Christian Detter, Tobias Deuse, Hendrik Treede, Dieter H. Boehm, Hermann Reichenspurner

Department of Cardiovascular Surgery, University Hospital Hamburg-Eppendorf, Hamburg, Germany

OBJECTIVE: The aim of this study was to compare the Port-Access and the transthoracic clamp technique for minimally-invasive, video-assisted mitral valve surgery (MIC-MVS).

METHODS: This retrospective study analyzes 120 consecutive patients undergoing MIC-MVS via a right lateral minithoracotomy operated on between 05/1997 and 11/2002. In the first group, the Port-Access technique (group1; n=60), and since 11/1999, the transthoracic clamp technique was used (group2; n=60). Mean age was 61.5±10.5 years (76 patients with isolated mitral valve insufficiency, 44 patients with combined mitral valve disease).

RESULTS: Eighty-one patients underwent mitral valve repair and 39 patients had valve replacement. Mean surgery time was 4.5±3.5 and 4.1±3.2 hours, aortic cross-clamp time 89±69 and 78±65 min, mean intensive care unit stay 1.5±2.1 and 1.6±2.5 days and hospital stay 9.0±10.5 and 9.2±9.7 days in groups 1 and 2, respectively. In group 1, there were 6 re-explorations for bleeding, one perforation of the right ventricle with the Endo-Vent-catheter and 2 reconstructions of the femoral artery necessary after femoral cannulation, compared to one re-exploration for bleeding in group 2. There was only one minor paravalvular leak after replacement and 2 cases of residual grade³ II mitral valve regurgitation after mitral valve repair in group 1, necessitating reoperation. There was no mortality, no cerebrovascular accident, no aortic dissection and no conversion to sternotomy in both groups.

CONCLUSIONS: MIC-MVS has become a standard approach for isolated mitral valve operations at our institution. The transthoracic clamp technique shortens the time of surgery and aortic crossclamping and reduces perioperative complication rates by simplifying the operative procedure.

3 MITRAL VALVE OPERATIONS AFTER PREVIOUS CARDIAC SURGERY: IS PORT-ACCESS MINI-THORACOTOMY THE APPROACH OF CHOICE?

Mauro Rinaldi, Alessia Alloni, Andrea M. D'Armini, Patrizio Spreafico, Marco Aiello, Mario Viganò

Cardiac Surgery, IRCCS Policlinico S. Matteo, Pavia, Italy

OBJECTIVE: In this paper we analyse the application of Port-Access surgery in redo mitral operations.

METHODS: Eighty-four patients underwent mitral replacement or repair. In 24 cases it was at least the third re-entry. Previous operations were on mitral and/or aortic valve in 60 cases, CABG ± mitral valve in 22, A-V canal in 2. In 18 pts LIMA was patent on LAD. A mini-thoracotomy in the fourth i.s. through a skin incision of 6 cm was used. An Hearport femoro-femoral cannulation was used in 67 cases. In 17 cases the Endo-Direct System was used. An endo-aortic balloon clamp was used in 78 cases. In 6 patients with low ejection fraction, ventricular fibrillation without aortic clamping was used.

RESULTS: The mean ECC and X-clamp times were 120 ± 53 and 72 ± 25 minutes. The mean operation time was 270 min. Hospital mortality was 4 cases (4.7 %). ICU stay and total hospital stay were 60 ± 118 hs (median 24 hs) and 11 ± 13 days (median 8 days). Blood loss from drains was 507 ± 514 ml (median 370). Only 41 pts (49 %) required blood products transfusions.

CONCLUSIONS: In this difficult group of patients, hospital mortality favourably compares with the literature. ECC, X-clamp, duration of surgery, ICU and hospital stay were acceptable. Transfusion rate was minimal. Port-Access is the technique of choice because allows a direct access and optimal exposure of the mitral valve with minimal dissection and avoids the anterior mediastinum in case of previous aortic or CABG surgery

4 ENDOVASCULAR STENT-GRAFTING FOR THORACIC AORTIC LESIONS

Robin H. Heijmen¹, Karl M. Dossche¹, Jos C. van den Berg², Wim J. Morshuis¹, Marc A. Schepens¹

¹Cardiothoracic Surgery, St. Antonius Hospital, Nieuwegein, Netherlands;

²Interventional Radiology, St. Antonius Hospital, Nieuwegein, Netherlands

OBJECTIVE: Endoluminal placement of covered stent-grafts emerges as a less-invasive alternative to open surgical repair of thoracic aortic lesions. The present report describes our 5-year experience with endovascular stent-grafting

METHODS: Since June 1997, a total of 47 patients (31 male, mean age 69 years) underwent 49 stent-graft repairs for atherosclerotic aneurysms (86%), penetrating ulcer (4%), intramural haematoma (4%), or (post-dissection) aortic rupture (6%). Lesions were predominantly localized in the transverse aortic arch (14%), proximal (26%), central (33%), or distal (18%) part of the descending thoracic aorta. In 4 patients (9%), the entire thoracic aorta was treated. Previous subclavian-carotid artery transposition was performed in 12/49 cases. AneuRx[™] (12%), Excluder[™] (27%) and Talent[™] (61%) stent-grafts were used. In 17 cases (35%), multiple stents were necessary for complete aneurysm exclusion.

RESULTS: In all but one patient (98%), the endovascular stent-grafts were successfully deployed. Hospital mortality consisted of 2 patients (4%, both non-surgical candidates). Monoparesis due to spinal ischaemia was observed in one patient (2%). After a median follow-up of 12 months (range, 1 to 47 months), there were 4 non-related late deaths (8%). Maximal aneurysm diameter either remained stable or decreased slightly over time in absence of an endoleak. Endoleaks occurred in 25% of cases during follow-up. In the majority the endoleaks sealed spontaneously, whereas in 5 patients a distal extension was inserted.

CONCLUSIONS: Endovascular stent-grafting for thoracic aortic lesions is a promising less-invasive alternative to open repair. Extended follow-up is necessary to determine its definite efficacy in the longer term.

5 VIDEOSCOPIIC INTRACARDIAC OPERATIONS-EXPERIENCE IN 180 PATIENTS

W. Clark Hargrove, III¹, Harvey L. Waxman², Jeanne T. Fox³, Rohinton J. Morris¹

¹Surgery, University of Pennsylvania, Philadelphia, PA, USA; ²Medicine, University of Pennsylvania, Philadelphia, PA, USA; ³Nursing, University of Pennsylvania, Philadelphia, PA, USA

OBJECTIVE: Videoscopic intracardiac operations were accomplished in 180 patients. These included mitral valve (MV) repair or replacement, atrial septal defect repair (ASD), and excision of an intraventricular fibroelastoma. The purpose of this study was to analyze the results in these 180 patients.

METHODS: Between December 1998 and May 2002, 180 patients underwent MV repair or replacement (n=171), ASD repair (n=8), or excision of a ventricular fibroelastoma (n=1) via a small right anterior thoracotomy (5-7 cm). In addition a 2-3 cm incision in the groin was used for femoral artery and vein cannulation for cardiopulmonary bypass. Visualization was via a transthoracic camera with robotic control (Aesop) and directly through the thoracic incision.

RESULTS: Patients' ages ranged from 8 to 86. Ejection fraction varied from 10% to 75%. MV operations were: complex repair 113 (66%), annuloplasty alone 32 (19%) replacement 26 (15%). Autologous pericardial patch was used in all ASD repairs. NYHA Class was I (13%); II (34%); III (39%); IV (13%). Aortic occlusion was accomplished with a balloon (Heartport) in 127 (71%) and with a transthoracic clamp in 49. Fibrillatory arrest was used in 4. Operative mortality was 2% (4 patients). Aortic dissection occurred in 2 patients, resulting in one death. Seven patients (3.8%) had strokes, including both aortic dissections. 6 required conversion to sternotomy. 42% of all patients received blood transfusions. Ten (5%) underwent reoperation for bleeding. There were no wound infections. There were no cases of deep venous thrombosis. There were 3 groin seromas.

CONCLUSIONS: Videoscopic cardiac operations on the mitral valve and aortic septum can be accomplished safely. Complex mitral valve repair can be done in most patients using standard repair techniques.

6 NONSTERNOTOMY, MINIMALLY INVASIVE AORTIC VALVE SURGERY: A SIX-YEAR EXPERIENCE WITH 482 PATIENTS

Ram Sharony, Eugene A. Grossi, Paul C. Saunders, Charles F. Schwartz, Julie Delianides, Patricia Ursomanno, Aubrey C. Galloway, Greg H. Ribakove, Alfred T. Culliford, Stephen B. Colvin

NYU Medical Center, New York, NY, USA

OBJECTIVE: Although minimally invasive aortic valve replacement (MIAVR) has recently become popular, additional outcome evaluation is required. This study analyzed a single institutional experience with MIAVR with respect to hospital morbidity and mortality.

METHODS: Between 12/96 and 06/02, 482 consecutive patients at a single institution underwent MIAVR, including concomitant procedures in 123 pts: 55 multiple valves, 18 CABGs, 21 myomectomies, and 29 other procedures. These patients (mean age 65 yrs; range 15-94) had severe stenosis (58.9%), severe insufficiency (33.0%), or mixed disease (8.1%). Thirty-three percent had a previous MI, 13.3% had a previous cardiac operation, and 17.3% were >80 years old. Right anterior minithoracotomy was performed in 87.3%. Ascending aortic cannulation was used in 68% of the patients while direct external cross clamping was used in 97% of cases.

RESULTS: Hospital mortality was 6.2% (30/482) overall and 5.3% (19/359) for isolated AVR. Mean aortic crossclamp and cardiopulmonary bypass times were 87 and 122 min, respectively. Postoperative complications included stroke in 2.3% (11/482) and 82.5% of patients were free from any complications. Neither aortic dissection nor mediastinitis was observed. Univariate analysis demonstrated that female gender, renal failure, CHF, and age >80 years were risk factors for mortality. Multivariable analysis revealed that age and CHF were independently associated with increased risk of mortality (p<0.05).

CONCLUSIONS: These results demonstrate that MIAVR is a safe procedure, with low morbidity and acceptable perioperative mortality, and may be used routinely in a large series of patients.

7 ENDOVASCULAR STENT-GRAFT TREATMENT OF THE DESCENDING THORACIC AORTA: PROSPECTIVE STUDY

Alessandro S. Bortone¹, Donato D'Agostino¹, Emanuela De Cillis¹, Giuseppe Mannatrizio¹, Vito Paradiso¹, Giovanni Dialetto², Maurizio Cotrufo², Luigi de Luca Tuppiti Schinosa¹

¹Cardiac Surgery, University of Bari, Bari, Italy; ²Cardiac Surgery, University of Naples, Naples, Italy

OBJECTIVE: Assessment of early and middle term results of endovascular stent-graft treatment for disease of the descending thoracic aorta.

METHODS: From March 1999 to December 2002, a total of 73 consecutive patients underwent our observation. They were divided into four groups: 20 with atherosclerotic aneurysm (Group A), 17 with post-traumatic pseudoaneurysm (Group B) and 23 affected by type B dissection (Group C). Thirteen pts (Group D) with chronic type B dissection were not suitable for endovascular treatment and therefore medical treatment was implemented. All patients underwent 5-mm angio-CT scan and angiography as preoperative assessment.

RESULTS: There were two hospital deaths (2.7%), one due to multiorgan failure 72 hours postoperatively and one to rupture of ascending aorta owing to device dislodgement. An optimal sealing of the graft was reached in 98.3%. However, in one patient the descending aorta had to be surgically replaced because of the calcified pseudoaneurysm still compressing the trachea and left bronchus. Seven patients underwent left carotid-subclavian bypass in order to achieve a sufficient neck for the proximal placement of the graft. In two patients iliac fenestration was performed. No spinal cord injuries were observed. At the follow-up performed with angio-CT scan within 72 hours and at 6 months, 12 months and once a year thereafter, no stent-graft related complications have been detected. In two patients with chronic dissection an asymptomatic type II endoleak was found. On the other hand 38.5% of medical-treatment patients died.

CONCLUSIONS: Endoluminal stent-graft treatment represents a valid option by itself especially if compared to medical therapy.

Featured Abstracts: Off-Pump I

Thursday, June 19, 2003, 1:45 PM–3:10 PM

8 NEUROCOGNITIVE OUTCOME, S100B AND NSE RELEASE IN CORONARY ARTERY BYPASS GRAFT SURGERY-COMPARISON OF THE OFF-PUMP AND ON-PUMP TECHNIQUES: A RANDOMIZED CONTROLLED STUDY

Vipin Zamvar¹, David Williams², Judith Hall², Nicola Payne³, Karen Young⁴, S Karthikeyan², John Dunne²

¹Cardiothoracic Surgery, Royal Infirmary of Edinburgh, Edinburgh, United Kingdom; ²Anaesthesia, University Hospital of Wales, Cardiff, United Kingdom; ³Cardiothoracic Surgery, Medical Data Research Centre, Portland, OR, USA; ⁴Immunology, UKNEQAS, Sheffield, United Kingdom

OBJECTIVE: Neurocognitive impairment after Coronary Artery Bypass Graft (CABG) surgery is a common complication. We conducted this randomised controlled trial to compare off-pump and on-pump techniques in patients with triple vessel disease, and assessed neurocognitive impairment and peri-operative neurological injury.

METHODS: Sixty patients undergoing CABG surgery for triple-vessel disease were prospectively randomised to off-pump or on-pump surgery. A standard battery of 9 neuropsychometric tests was administered to the patients preoperatively, and at 7 days and 10 weeks postoperatively. Serum levels of S100 β and NSE were measured at 5 time points perioperatively. Cardiotomy suction was not used to prevent contamination with extracerebral sources of S100 β .

RESULTS: Baseline characteristics in both groups were similar. Using the standard criteria of defining a patient as having neurocognitive impairment if he/she demonstrated deterioration greater than 1 S.D. in 2 or more tests (i.e. >20% of tests), the incidence of neurocognitive impairment at 7 days postoperatively was 26.7% (8 of 30) in the off-pump group, and 63.3% (19 of 30) in the on-pump group ($p = 0.004$); and at 10 weeks postoperatively was 10% (3 of 30) in the off-pump group, and 40% (12 of 30) in the on-pump group ($p = 0.017$). Intraoperative serum S100 β concentrations were higher in the on-pump group ($p = 0.002$); NSE concentrations were higher in the on-pump group at 2 hours ($p < 0.001$) and 24 hours ($p = 0.005$).

CONCLUSIONS: Off-pump CABG results in significantly less neurological injury and neurocognitive impairment.

9 POSTOPERATIVE OPCAB GRAFTS ASSESSMENT BY MULTISLICE COMPUTED TOMOGRAPHY

Roland G. Demaria¹, Helene Vernhet², Pascal Batistella¹, Jean-Marc Frapier¹, Thierry Aymard¹, Philippe Rouviere¹, Bernard Albat¹

¹Cardiovascular Surgery and ²Vascular and Thoracic Radiology, Arnaud de Villeneuve Hospital, Montpellier, France

OBJECTIVE: Selective coronary angiography is the standard but invasive procedure for the postoperative assessment of coronary artery bypass graft patency. The aim of this prospective study is to evaluate the multislice computed tomography (CT) as a means of postoperative patency assessment and anastomotic site control of arterial and venous coronary bypasses grafts performed with OPCAB techniques.

METHODS: Over a 6-month period, 20 patients who had been operated on by isolated coronary artery bypass with beating heart techniques benefited, seven days after surgery, from a patency and anastomotic site control with a multidetector angio multislice CT associated with cardiac gating (Light Speed, General Electric, USA).

RESULTS: Whole internal thoracic artery bypasses and venous grafts were visualized perfectly, even on the anastomotic site, with possibility of 3D reconstructions. The relationship between cardiac cavities and the bypasses are well established. Software allowed quantification of bypasses stenosis.

CONCLUSIONS: The postoperative control of coronary bypasses are possible by multislice CT with a very satisfactory resolution. That makes it possible to check the patency of coronary bypasses and the quality of anastomosis with a noninvasive method. The 3D reconstructions are very useful in the event of redo surgery.

10 REDUCED MORTALITY AND CEREBROVASCULAR MORBIDITY WITH OFF-PUMP CORONARY ARTERY BYPASS GRAFTING SURGERY IN OCTOGENARIANS

Ivo Martinovic¹, Ibrahim Farah², Rudolph Mair¹, Ewa Sames¹, Manfred Everlien², Christoph Gross¹

¹Cardiothoracic and Vascular Surgery, Linz, Linz, Austria; ²Cardiothoracic Surgery, Krefeld, Krefeld, Germany

OBJECTIVE: Off-pump coronary artery bypass surgery (OPCAB) is rapidly expanding recently and there is a question whether exact groups of patients might benefit most from this technique. The purpose of this retrospective study was to compare the results of coronary artery bypass grafting surgery (CABG) in octogenarians using cardiopulmonary bypass (CPB) or OPCAB techniques.

METHODS: Over a 5-year period (1997-2001), 142 patients older than 80 years of age were underwent operations for isolated myocardial revascularization (74 using CPB and 68 with OPCAB). There was statistically significant difference in preoperative comorbidities between groups: Parsonnet score was 28.2 ± 3.5 (OPCAB) versus 7.6 ± 2.4 (CPB), $p < 0.05$. OPCAB group had a higher incidence of extracardiac risk factors, cerebrovascular diseases, previous surgery and renal failure.

RESULTS: The operative mortality was 12.2% in the CPB group and 4.4% in the OPCAB group ($p = 0.04$). There were 6 postoperative strokes (8.1% in the CPB group and one (1.5%) in the OPCAB group ($p = 0.03$)). The OPCAB patients had a significant reduction of transfusions required ($p = 0.04$). Time to extubation (OPCAB = 8.2 ± 2.4 h, CPB = 16.4 ± 4.6 h, $p < 0.05$), length of intensive ($p < 0.05$) and hospital stay (OPCAB = 6.2 ± 2.3 d, CPB = 10.2 ± 3.4 d, $p < 0.05$) was significant shorter in OPCAB group. The odds ratio (OR) indicates that operative mortality and cerebrovascular accidents occur 3 times (OR = 3.215) more often in CPB patients than in OPCAB patients.

CONCLUSIONS: Although the incidence of extracardiac risk factors was significant higher in the OPCAB group, reduced operative mortality and reduced cerebrovascular morbidity for octogenarian patients were documented after OPCAB surgery.

11 OFF-PUMP CORONARY SURGERY REDUCE INCIDENCE OF STROKE ONLY IN PATIENTS WITH PRESENCE OF PREOPERATIVE STROKE PREDICTORS

Nirav C. Patel, Nilesh U. Patel, Georgia Panagopoulos, John C. Mc Cabe, Didier F. Loumet, V A. Subramanian

Cardiovascular and Thoracic Surgery, Lenox Hill Hospital, New York, NY, USA

OBJECTIVE: The aim of this study was to determine the effect of OPCAB on neurological outcomes in patients with or without historical stroke predictors.

METHODS: From January 1995 to June 2002, 3770 patients underwent isolated CABG using sternotomy at our institution. Patients were divided into two groups according to presence of one or more of the following preoperative stroke predictors (preoperative stroke, carotid disease, aortoiliac disease, PVD or extensive calcification of aorta). Multivariate regression analysis was performed to identify predictors of stroke.

Logistic Regression for Preoperative High Stroke-Risk Group			
Predictor	Odds Ratio	95% CI	P value
Preop stroke	3.804	1.85-7.79	0.0001
OPCAB	0.257	0.10-0.63	0.0030

Logistic Regression for Preoperative Low Stroke-Risk Group			
Predictor	Odds Ratio	95% CI	P value
Age	1.06	1.02-1.10	0.001
Renal failure	3.49	1.06-11.4	0.030
Diabetes	2.52	1.24-5.10	0.010
OPCAB	0.520	0.22-1.18	0.118

RESULTS: A total of 993 patients were in high risk group (436 OPCAB and 557 CABG on CPB). The low risk group consisted of 2777 patients of whom 1008 received OPCAB and 1769 received CABG on CPB. The rate of postoperative stroke was higher in CABG on CPB patients (4.7%; $n = 26$) than OPCAB patients (1.8%; $n = 8$) in the high risk group ($p = 0.001$). There was no

difference in stroke rates in the low risk group (0.9%: n=9 for OPCAB vs 1.5%: n=27 for CPB; p = 0.35). The results of multivariate logistic regression are shown in the table.

CONCLUSION: OPCAB reduces incidence of post-operative stroke only in patients with high risk of stroke and not in patients with low risk of stroke when compared to CABG on CPB.

12 RANDOMIZED TRIAL COMPARING OFF-PUMP TO ON-PUMP CABG IN HIGH RISK PATIENTS

Michel Carrier, Louis P. Perrault, Pierre Pagé, Raymond Cartier
Montreal Heart Institute, Montreal, PQ, Canada

BACKGROUND: Off-pump CABG remains controversial but the technique has been proposed to decrease postoperative mortality and morbidity in high risk patients. The objective of the study was to compare off-pump to on-pump CABG in patients with risk factors for mortality and morbidity.

METHODS: Between January 2002 and September 2003, 65 patients were prospectively randomized to undergo off-pump or on-pump CABG. Recruited patients had at least 3 of the following criteria: age greater than 65 years, high blood pressure, diabetes, serum creatinine greater than 133 mmol/L, left ventricular ejection fraction lower than 45%, chronic pulmonary obstructive disease, unstable angina, congestive heart failure, redo CABG, anemia and carotid atherosclerosis. Hospital mortality and morbidity were the primary end-points of the study.

RESULTS: 28 patients averaging 70 ± 8 years of age underwent 3 ± 1 off-pump CABG and 37 patients averaging 70 ± 6 years of age underwent 3.4 ± 1 on-pump CABG. Revascularization was complete in 21 off-pump (75%) compared to 33 off-pump (89%) patients (p=0.1). There was no hospital death in off-pump patients and 2 (5%) patients undergoing on-pump CABG died early following surgery (p=0.2). Two off-pump (7%) compared to 11 on-pump (30%) patients presented combined end-points including death, neurological injury, renal failure, respiratory failure and operative myocardial infarction after CABG (p=0.02).

CONCLUSION: The present study suggests that off-pump CABG significantly reduces morbidity following surgery in a group of high risk patients.

13 COMPETITIVE FLOW IN ARTERIAL COMPOSITE GRAFTS AND EFFECT OF GRAFT ARRANGEMENT IN OFF-PUMP CORONARY REVASCULARIZATION

Hiroyuki Nakajima, Junjiro Kobayashi, Osamu Tagusari, Ko Bando, Kazuo Niwaya, Michiko Ishida, Toshikatsu Yagihara, Soichiro Kitamura
Cardiovascular Surgery, National Cardiovascular Center, Osaka, Japan

OBJECTIVE: We sought to investigate the incidence of competitive flow in arterial composite grafts and to delineate the effect of the severity of coronary stenosis, territory of the target branch, and the arrangement of in-situ and free arterial graft in off-pump coronary artery bypass grafting (OPCAB).

METHODS: Consecutive 218 patients who underwent OPCAB with aorta no-touch technique using totally arterial composite graft between 12/2000

and 6/2002 were enrolled. We reviewed their coronary angiography before and early after operation. Competitive flow was defined as the phenomenon that at least one of the distal anastomotic sites of composite graft was not opacified in in-situ graft angiography, but clearly opacified in native coronary angiography. No. of distal anastomoses was 3.38 ± 0.94 per patient and 3.04 ± 0.76 per composite graft.

RESULTS: Early graft patency rate was 98.5% (719/730). Competitive flow was found in 15.6% (34/218). Univariate and multivariate analysis demonstrated that No. of distal anastomoses >4 (p=0.002) and right coronary artery stenosis $<75\%$ (p=0.01) were statistically significant predictors of competitive flow. Left coronary artery stenosis $<75\%$, one in-situ IMA for 3-vessel disease, method of anastomosis of free and in-situ grafts, and bilateral in-situ IMAs were not associated with the incidence of competitive flow.

CONCLUSIONS: In spite of satisfactory early graft patency rate, the incidence of competitive flow in arterial composite graft was relatively high. Competitive flow could not be avoided even by utilizing bilateral in-situ IMAs. The implication of competitive flow in arterial composite graft may differ from that in conventional bypass grafts in individual fashion.

14 CORONARY SURGERY WITH AND WITHOUT HEART LUNG MACHINE: A PROSPECTIVE RANDOMIZED TRIAL

Erik Fosse¹, Per Snorre Lingaas², Per Kristian Hol¹, Runar Lundblad², Kjell Arne Rein², Jan-Ludvig Svennevig²

¹Interventional Centre and ²Dept Cardiovascular Surgery, Rikshospitalet, Oslo, Norway

OBJECTIVE: In order to evaluate whether intraoperative and long term results differ between coronary performed on and off pump surgery a randomized trial was performed.

METHODS: 120 patients, 94 men and 26 women aged 65 (47-79) years were included in the study after informed consent. Randomization was performed after the patient was anaesthetized. On table an intraoperative angiography was performed to evaluate the immediate patency. The patients were followed up clinically and with repeated angiography at 3 and 12 months. Major complications as stroke, myocardial infarction and death were recorded.

RESULTS: The groups were compatible with respect to preoperative risk factors. The operation time was 193 minutes in the off-pump group and 161 minutes on the on-pump group (p=0.001). Average blood loss was 871 ml in the off-pump group and 697 ml in the on-pump group (p=0.007). Two major strokes were recorded in the on-pump group, none in the off-pump group. One patient in each group died within 30 days. IMA patency on table was 98% in the on-pump group and 100% in the off-pump group, at three months the patency was 98% in both groups. Vein graft patency was 98 and 97 % intraoperatively. At three months the vein graft patency was 91% in the on-pump group and 83% in the off-pump group. The difference was not statistically significant.

CONCLUSION: Coronary bypass surgery can be performed off-pump with the same clinical results and with the same quality of the grafts as in on-pump surgery.

Featured Abstracts: Outcomes in Innovative Techniques

Thursday, June 19, 2003, 3:40 PM-4:55 PM

15 TRANSMYOCARDIAL REVASCULARIZATION VERSUS MEDICAL THERAPY: FIVE-YEAR FOLLOW-UP OF A PROSPECTIVE RANDOMIZED TRIAL

Keith B. Allen¹, Robert D. Dowling², D A. Heimansohn¹, John J. Schier¹

¹St. Vincent Hospital, Indianapolis, IN, USA; ²Jewish Hospital, Louisville, KY, USA

OBJECTIVES: This study evaluated five-year mortality and angina status in patients prospectively randomized to either Transmyocardial Revascularization (TMR) or continued maximum medical management (MMM).

METHODS: 94 patients with medical refractory angina at two centers were randomized from March 1996 to July 1998 to receive either Holmium:YAG TMR through minimally invasive left thoracotomy (n=45) or continued maximum medical therapy (n=49). Mean follow-up was 5.2 ± 0.8 years. Blinded evaluators determined angina class.

RESULTS: Mortality follow-up was 100% (94/94). Angina follow up was available in 76% (34/45) of alive patients. Intent-to-Treat Kaplan-Meier survival at 5 years was 57% ± 8% for TMR patients versus 44% ± 8% for MMM patients (p=0.3). Cumulative hazard curves demonstrated increased risk of late death after one year in the medically managed patients. Mean angina class among TMR patients was 4.0 at baseline, 1.5 at one year, and 1.1 at five years (p<0.0001). The mean angina class at five years was significantly better in the TMR vs. the MMM group (1.1 vs. 2.5, p=0.0004). At five years, 96% (22/23) of TMR patients had a ≥ two-class improvement in angina scores compared to only 36% (4/11) of medically managed patients (p=0.0004).

CONCLUSIONS: Five-year follow-up of a prospective randomized trial demonstrates significant and sustained angina relief following sole therapy TMR compared to continued medical therapy-cumulative hazard curves demonstrated increased risk for late death among MMM patients. TMR performed via limited anterior thoracotomy should be considered in patients with refractory angina not amenable to CABG or PTCA.

16 CLINICAL BENEFITS OF ENDOSCOPIC VEIN HARVESTING IN OBESE PATIENTS

Amit N. Patel, A. Carl Henry, Robert F. Hebler, Jr., Baron Hamman, Richard E. Wood, Harold C. Urschel, Jr.

Cardiothoracic Surgery, Baylor University Medical Center, Dallas, TX, USA

BACKGROUND: Obese patients are at an increased risk for wound complications after coronary artery bypass grafting (CABG). The purpose of this study is to evaluate the benefits of EVH in obese patients under going CABG as compared to bridging vein harvesting (BVH).

METHODS: A prospective data database of all patients undergoing primary CABG was analyzed from April 2000 to September 2001. Obesity was defined as Body Mass Index (BMI) >30 and Morbid Obesity as BMI >35. There were 108 obese and 102 morbidly obese patients identified who received EVH. A cohort of 210 patients with BVH was identified with similar characteristics as the EVH group:

RESULTS: There were 420 patients in the study.

Obese Patients	EVH	BVH	P value
Mean total length of stay (days)	6.5	7.85	<0.05
Wound Complications (# of patients)	1	11	<0.05
Days to Ambulation	1.5	2.6	<0.05
Morbidly Obese Patients	EVH	BVH	P value
Mean total length of stay (days)	6.8	8.01	<0.05
Wound Complications (# of patients)	2	14	<0.05
Days to Ambulation	1.8	2.9	<0.05

CONCLUSION: Endoscopic vein harvesting in obese patients results in a shorter length of stay, decreased days to ambulation and fewer wound complications when compared to BVH.

17 GRAFT PATENCY FOLLOWING ENDOSCOPIC SAPHENOUS VEIN HARVESTING (EVH) IS EQUIVALENT TO OR BETTER THAN TRADITIONAL HARVEST

Zev Davis¹, Stanley Clark¹, Vincent Bufalino¹, David Garber¹, Matthew Budoff²

¹Edward Cardiovascular Institute, Naperville, IL, USA; ²UCLA, Los Angeles, CA, USA

OBJECTIVE: EVH is safe, effective, with less leg pain and morbidity than traditionally harvested saphenous veins and with no histologically evident vein damage. Long term graft patency following EVH remains unknown.

METHODS: 101 patients with EVH for CABG were studied by electron beam computed tomography (EBCT) to determine graft patency: A retrospective group of 51 patients (131 grafts) mean 3.74 ± 0.24 years post CABG and a prospective group of 50 patients (131 grafts). The prospective group had graft flow studies intraoperatively followed by EBCT 6 months post CABG.

RESULTS: Graft patency rate for the total group was 95%. Graft failure rate was 5.3% in the prospective group at 6 months and 4.5% in the retrospective group at 3.7 years post CABG. This is less than the historical failure rate of 13% in the first year post op, which increases further in subsequent years. Gender, hypertension, DM, and smoking did not affect graft occlusion. 40 of 46 individual grafts were patent (2 were diseased but patent) and 209 of 216 sequential grafts were patent (8 diseased but patent).

CONCLUSIONS: Graft patency following EVH for CABG is equivalent or better than traditional harvest techniques. Sequential grafting may have a beneficial effect.

	Pts, N	Grafts, n	Individual Grafts, n	Sequential Grafts, N	Graft Status By Ebct		
					Open	Occluded	Diseased But Patent
Retrospective	51	131	18	113	120	6	5
Prospective	50	131	28	103	119	7	5

18 COMPLEX HEART SURGERY USING A MINIMALIZED CARDIOPULMONARY BYPASS SYSTEM (CARDIOVENTION): FIRST CLINICAL RESULTS

Ingo Kutschka, Uwe Schönrock, Matthias Richter, Wolfgang Harringer

Thoracic and Cardiovascular Surgery, Klinikum Braunschweig, Braunschweig, Germany

OBJECTIVE: Minimalized heart lung machines with decreased foreign surface area and less hemodilution are currently available for hemodynamic support during CABG. We evaluated the potential use of one system (Cardiovention) for a wide range of cardiac surgery.

METHODS: The Cardiovention system was modified by integration of a left ventricular vent, bubble traps and a cardioplegia line. This enabled us to perform even open heart procedures with this setup. 91 patients (62 male, 29 female) were enrolled in this study (table). Outcome was evaluated by monitoring of blood loss, transfusion requirements, stay on ICU, duration of mechanical ventilation and renal function.

Operation	n	Mean Age (Years)	ICU-Stay (Days)	Mechanical Ventilation (Hrs)
CABG	63	67 ± 10	2.0 ± 2.1	16.8 ± 29.9
Aortic Valve Replacement (+CABG)	9 (+8)	65 ± 10	2.6 ± 3.1	24.0 ± 38.0
Ross Operation	1	44	1	14.0
Mitral-Valve-Replacement	2	57 ± 9	2.0 ± 1.0	14.0 ± 2.0
Mitral-Valve-Repair (+CABG)	4 (+4)	73 ± 9	2.1 ± 1.5	13.9 ± 3.9
Mitral-Valve-Repair +Tricuspid-Valve-Replacement	2	77 ± 4	3.0 ± 1.0	19.0 ± 4.0
Total	91	67 ± 10	2.1 ± 2.2	17.8 ± 29.2

RESULTS: Recovery was uneventful in all patients (table). Serum creatinine remained stable (baseline: 1.1 ± 0.6 mg/dl, 24 hrs postoperatively: 1.1 ± 0.8 mg/dl). A total of 44 patients (48%) did not need any blood products and overall transfusion requirements were modest (packed red blood cells: 1.4 ± 2.1 units, fresh frozen plasma: 1.5 ± 2.2 units, thrombocytes: 0.1 ± 0.4 units). Only 10

patients needed low dose norepinephrine postoperatively, indicating minimal systemic inflammatory response. No adverse neurologic events were seen.

CONCLUSIONS: The modified Cardiovention system provides safe circulatory support for a wide range of cardiac surgery with only minor modifications to the standard system setup. Systemic inflammatory response and transfusion requirements were low.

19 INTEGRATED ENDOSCOPIC ROBOTIC ASSISTED ATRAUMATIC CORONARY ARTERY BYPASS GRAFTING AND ANGIOPLASTY: A CLINICAL AND ANGIOGRAPHIC LONG TERM FOLLOW-UP

Marek Cisowski¹, Janusz Drzewiecki², Rafik Abu Samra¹, Włodzimierz Morawski¹, Sławomir Szczesniak¹, Andrzej Bochenek¹

¹First Department of Cardiac Surgery and ²First Department of Cardiology, Medical University of Silesia, Katowice, Poland

OBJECTIVE: Atraumatic coronary artery bypass (ACAB) has become a promising therapeutical option in patients with lesion in LAD artery- especially with type C or B lesions. To expand the benefits of ACAB concept to patients with multivessel disease, a hybrid myocardial revascularization procedure (HMR) combining endo-ACAB surgery of the LAD with PCI procedures for additional coronary lesions has recently been introduced.

METHODS: Between January 1999 and February 2002, 62 pts (46 male, 16 female, mean age 54.8 ± 20.1 years) underwent a HMR procedure. Robotic assisted endo-ACAB followed by PCI for additional coronary lesions-PTCA was performed in 16 pts (26%) and stenting in 46 pts (74%). Clinical follow-up period was 10 to 46 months.

RESULTS: There were no early and late deaths. Baseline Canadian Cardiology Society (CCS) class was 2.8 ± 0.7 versus 1.1 ± 0.9 ($p < 0.001$) 30 days after HMR procedure. Angiographic studies showed patent LIMA-LAD graft in 62 pts (100%). We showed good quality of anastomosis in 61 pts (98.3%) and moderate graft stenosis in one patient (1.7%). At long term follow-up the rate of MACE was 11.3%. Six pts (9.7%) developed restenosis after PCI, and one patient (1.6%) developed significant stenosis in site of LITA-LAD anastomosis.

CONCLUSIONS: The hybrid procedure is a safe and effective method for complete revascularization in selected pts with multi-vessel coronary artery disease. This method allows to perform complete revascularization with minimization of surgical trauma. So far, long-term results of HMR are limited by the results of PCI.

20 INTRACORONARY SHUNT FLOW MEASUREMENT FOR OFF-PUMP CORONARY ARTERY BYPASS SURGERY

Jurg Grunenfelder¹, Maurice Comber¹, Mario Lachat², Boris Leskosek¹, Gregor Zund¹, Marko Turina¹

¹Clinic for Cardiovascular Surgery, University Hospital, Zurich, Switzerland, ²University Hospital, Zurich, Switzerland

BACKGROUND: Intracoronary shunting is a useful, easy and inexpensive technique to maintain blood flow during off-pump surgery to lessen myocardial ischemia. Intracoronary shunts should provide a minimal flow for adequate myocardial protection.

METHODS: Two commercially available shunts were used to measure flow from a bulb size diameter of 1.00 mm to 3.00 mm ($n=10$) in an in-vitro setup. Shunts were perfused with Glycerin 47% at 37°C. Inlet pressure was raised from 0 to 160 mmHg in all intracoronary shunts.

RESULTS: In 3.0 mm shunts of both groups a mean pressure of 18 mmHg was necessary to provide 40 ml/min flow and maximum flow of 120-140 ml/min was measured at mean pressure 100 mmHg. In shunt A at 2.5 mm and 3.0 mm showed similar flow pattern (40 ml/min at 18 mmHg and 110 ml/min at 100 mmHg). Shunt B at 2.5 mm shows 22 ml/min at 18 mmHg and 85 ml/min at 100 mmHg which was significantly lower than shunt A ($p < .01$). Shunt A at 1.5 mm requires 62 mmHg for 40 ml/min and shows maximum flow of 58 ml/min at 100 mmHg, whereas flow in shunt B was insufficient (< 20 ml/min at 100 mmHg, $p < .01$). Only minimal flow was measured in 1.0mm shunts of both groups.

CONCLUSIONS: There is a clear pressure/flow correlation in 2.0 mm to 3.0 mm shunts with maximum flow of 160 ml/min. However, only shunt A of 1.5 mm diameter showed adequate flow at physiologic pressures. The possible value of 1.0 mm shunts are only for better visibility during the process of anastomosis.

Featured Abstracts: Anesthesia

Thursday, June 19, 2003, 4:55 PM-5:40 PM

21 AGGRESSIVE INTRAOPERATIVE THERMOREGULATION IMPROVES OFF-PUMP CORONARY ARTERY BYPASS GRAFTING OUTCOMES

Y. Joseph Woo¹, Albert T. Cheung²

¹Department of Surgery and ²Department of Anesthesia, University of Pennsylvania, Philadelphia, PA, USA

OBJECTIVE: During off-pump coronary artery bypass grafting (OPCAB), unintentional systemic hypothermia increases peripheral vasoconstriction and myocardial afterload, as well as coagulopathy and postoperative bleeding can occur. Elevating room temperature, warming intravenous fluids, and heating ventilator gases have limited effect. Warm air-circulating blankets placed around the entire periphery of the patient are cumbersome and pose a theoretical risk of blowing non-sterile air around the operative field. Commercially-available, computer-controlled, water-circulating, dorsal surface, active warming systems were utilized during OPCAB and patient outcomes were evaluated.

METHODS: Fifty-two consecutive patients underwent OPCAB by a single surgeon, either with the described adjunctive thermoregulator system or without (control). Age, ejection fraction and number of grafts were statistically equivalent. Perioperative parameters were retrospectively statistically compared among the two groups.

RESULTS: See Table. Thermoregulated patients began OPCAB at similar core temperature as controls but maintained more physiologic perioperative temperatures and demonstrated improved outcomes. There were no reexplorations, major morbidities, or mortalities in either group.

CONCLUSIONS: Aggressive thermoregulation during OPCAB reduced postoperative bleeding, transfusions, mechanical ventilation time, and length of stay and may be related in part to improving cardiac afterload and blood component function. These benefits may be greater in patients undergoing extensive off-pump revascularization, reoperations, and robotically-assisted cases.

Parameter	Control	Thermoregulator	p value
N	25	27	-
Starting Temperature	35.8 ± 0.2°C	36.0 ± 0.1°C	NS
Lowest Intraoperative Temperature	35.0 ± 0.2°C	35.8 ± 0.1°C	0.002
Ending Temperature	35.6 ± 0.2°C	36.7 ± 0.1°C	0.00004
One Hour Postoperative Temperature	35.8 ± 0.2°C	36.8 ± 0.1°C	0.0006
24 Hour Chest Tube Output	1144 ± 153 ml	769 ± 58 ml	0.015
PRBC Transfusion	2.7 ± 0.6U	1.3 ± 0.3U	0.027
Time to Extubation	11.1 ± 2.0 hr	7.2 ± 0.9 hr	0.045
Length of Stay	5.2 ± 0.3 days	4.1 ± 0.2 days	0.002

22 SPINAL (SUBARACHNOID) MORPHINE FOR OFF PUMP CORONARY ARTERY BYPASS SURGERY

Yatin Mehta, Uinay Kulkarni, K.K. Sharma, Rajiv Juneja, Yugal Mishra, Naresh Trehan

Anaesthesia & Critical Care, Escorts Heart Institute And Research Centre, New Delhi, India

OBJECTIVE: To study the effects of intrathecal morphine 8 µg/kg given preoperatively on extubation time, postoperative pulmonary functions, postoperative analgesia, after off pump CABG (OPCAB).

Design: A prospective, randomised, double blind, placebo controlled study. Participants: One hundred adult patients scheduled for elective OPCAB.

Interventions: Patients were randomised to receive 8 µg/kg intrathecal morphine (group 1) or placebo (group 2) subcutaneous sterile normal saline preoperatively. Anesthesia was standardised. Multivessel OPCAB was performed using Octopus stabilizer. Patients were extubated in the intensive care unit using predefined extubation criteria.

MEASUREMENTS AND MAIN RESULTS: Postoperatively, time to extubation were 9.47 ± 3.83 hours in group 1 versus 11.25 ± 3.94 hours in group 2 (p=0.025). Post extubation bedside spirometric lung volumes in percent of the preoperative lung volumes showed significant differences when compared in group 1 versus group 2 viz., forced vital capacity 39.66 ± 15.42% vs 31.85 ± 11.65% (p = 0.016), forced expiratory volume in the first second of 44.8 ± 16.18% vs 35.97 ± 13.32% (p=0.013) maximum voluntary ventilation of 39.40 ± 13.57% vs 33.11 ± 14.80% (p=0.056) expiratory flow rate of 47.76 ± 24.61% vs 37.37 ± 14.33% (p= 0.031). The visual analogue pain scores at rest and during coughing, at time intervals of 6, 12, 24 and 36 hours postoperatively were significantly better in group 1.

One patient in group 1 had low respiratory rate which responded to Inj. Naloxone. There was no mortality or neurological complication in either group.

CONCLUSION: Spinal morphine provided safe, superior analgesia facilitating early tracheal extubation.

23 CORONARY ARTERY BYPASS GRAFTING IN AWAKE SETTING

Zan K. Mitrev, Vlado Petrovski, Petar S. Risteski

Center for Cardiosurgery Filip II, Skopje, The former Yugoslav Republic of Macedonia

OBJECTIVE: Myocardial revascularization can be safely performed in selected patients with avoidance of the extracorporeal circulation, endotracheal general anesthesia and mechanical ventilation, making it the least invasive bypass grafting.

METHODS: Six stable angina patients (3 males, 3 females) enrolled for off-pump left internal mammary artery to left anterior descending grafting through complete sternotomy in an awake setting. One day prior to the operation, an epidural catheter was placed in high thoracic position (T1-T2) and was used for somatosensory and motor block.

RESULTS: One patient had to be intubated prior to sternotomy due to incomplete analgesia. Five patients underwent the procedure with visual analog scale pain index of mean 2.3, stable arterial gases (mean oxygen saturation of 97.4%) and stable hemodynamics. Left pleural spaces were entered in two patients during sternotomy and mammary artery harvesting, but did not affect the course of the procedure. One patient left the operating room walking to the intensive care unit. All of them were discharged on the second postoperative day with uneventful recovery and patent anastomoses on graftography one week later.

CONCLUSION: Awake coronary artery bypass grafting can be performed in highly-selected patients as least invasive means of myocardial revascularization.

24 SHOULD PROTAMINE DOSING FORMULAS BE RECALCULATED FOR OFF-PUMP CORONARY ARTERY BYPASS GRAFTING?

Y. Joseph Woo, Timothy J. Gardner

Department of Surgery, University of Pennsylvania, Philadelphia, PA, USA

OBJECTIVE: Since 1994, approximately 8,000 cardiac surgical procedures were performed at our institution utilizing activated clotting time (ACT) monitored heparin anticoagulation for cardiopulmonary bypass and protamine administration calculated from a standard unchanged formula. This formula incorporates physiologic consequences of bypass pump-induced dilutional coagulopathy, platelet dysfunction, and coagulation/fibrinolytic cascade component activation, and thus may overcorrect in off-pump coronary artery bypass grafting (OPCAB). This study evaluated a strategy of decreased protamine dosing in OPCAB.

METHODS: Fifty-one consecutive patients underwent OPCAB by a single surgeon with full heparinization calculated for a goal ACT of 400sec. A mean of 2.86 ± 0.12 grafts/patient were performed and 50% of the calculated protamine dose was administered.

RESULTS: Mean baseline ACT=138 ± 4sec. Initial mean heparinized ACT=451 ± 11sec and prior to protamine dosing, mean ACT=390 ± 9sec. After protamine administration, mean ACT=124 ± 2sec. ACT normalization was achieved with 50% protamine dosing in 47/51 patients, four patients required an additional 25% dose. All patients demonstrated intraoperative clinical evidence of hemostasis. Upon ICU arrival, mean partial thromboplastin time (PTT)=41.4 ± 2.4sec, statistically equivalent to a preoperative mean PTT=34.7 ± 3.3sec. (p=NS) Mean 8-hour chest tube output=405 ± 27ml and mean 24-hour output=790 ± 39ml which tends to reflect serous drainage from the LIMA harvest bed. Mean PRBC transfusion=1.6 ± 0.3units/patient. There were no transfusions of platelets, FFP, or cryoprecipitate, no re-explorations, and no mortalities. Patients were discharged a mean 4.5 ± 0.2days postoperatively.

CONCLUSIONS: A standard protamine dosing formula adequate for on-pump cardiac surgical procedures significantly overestimates protamine requirements for OPCAB. Patients treated with decreased protamine do not appear to have adverse outcomes.

Featured Abstracts: Anastomic Devices and Innovative Coronary Techniques

Friday, June 20, 2003, 8:00 AM-9:25 AM

25 THREE-MONTH PATENCY AND ANGIOGRAPHIC CHARACTERISTICS OF A NEW SUTURELESS CORONARY ANASTOMOTIC DEVICE IN A SHEEP MODEL

Yaron Bar-Ei¹, Fermin Tio², Rona Shofti³

¹Cardiac Surgery, Rambam Medical Center, Haifa, Israel; ²Pathology, Biomedical Research Foundation of South Texas, Inc., San Antonio, TX, USA; ³Faculty of Medicine, Technion, Israel Institute of Technology, Haifa, Israel

OBJECTIVE: The immediate and three month-patency and angiographic characteristics of a new sutureless distal coronary anastomosing device (DAD) were studied in a sheep model.

METHODS: In 7 sheep (DAD group), 4 right internal mammary artery (RIMA) and 3 saphenous veins were connected to various coronary arteries using the DAD. In 7 other sheep (Control Group), similar number of RIMAs and veins were anastomosed using conventional suturing techniques. Patency was assessed by immediate and 3-month flow rate measurements. Angiography was performed immediately postoperatively, and at one and 3 months subsequently.

RESULTS: All DAD anastomoses were patent at 3-month follow-up, one sutured anastomosis was found to be occluded at one-month angiography. Flow rates and pulsatility index (PI) measurements were not statistically different between the two groups. No difference was noted between the two groups in respect to anastomotic size as evidenced by immediate, one- and three-month postoperative angiography.

CONCLUSIONS: These results of pre-clinical studies in an animal model show that the DAD has similar 3-month post-operative patency and angiographic characteristics as conventional hand sutured anastomoses. Clinical confirmation of these results may make the DAD an attractive alternative to conventional hand-sutured anastomoses.

Flow Rates and Pulsatility Index

	DAD	Suture Control
Immediate flow rate (ml/min) (mean ± SD) Range	24.9 ± 20.4 10-70	27.9 ± 14.6 14-52
Immediate PI (mean ± SD) Range	4.38 ± 1.20 2.56-5.80	5.28 ± 3.11 2.24-9.63
3-mo flow rate (ml/min) (mean ± SD) Range	24.7 ± 10.7 9-44	18.5 ± 11.8 8-40
3-mo PI (mean ± SD) Range	6.73 ± 5.64 2.12-18.67	8.19 ± 6.07 3.21-20.0

26 ON-PUMP BEATING HEART SURGERY AS THE PROCEDURE OF CHOICE FOR UNSTABLE PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING(CABG)

James R. Edgerton¹, Katherine Jones¹, Morley A. Herbert², Syma L. Prince¹, David Carter¹, Tea Acuff¹, Todd M. Dewey¹, Mitchell J. Magee¹, Michael J. Mack¹

¹Cardiopulmonary Research Science and Technology Institute, Dallas, TX, USA; ²Medical City Dallas Hospital, Dallas, TX, USA

OBJECTIVE: To compare use of on-pump beating heart myocardial revascularization with the results of the CPB arrested heart, and off-pump beating heart with and without right heart assist. Patient groups and their outcomes were compared.

METHODS: We studied 4407 CABG patients from January 2000 through June 2002, with 2582 (59%) done on-pump arrested heart, 1522 (35%) off-pump, 197 (4%) on-pump beating heart, and 106 (2%) with right heart assist. Preoperative, intraoperative variables and outcomes of the groups were analyzed.

RESULTS: We found that the sickest patients tended to be selected to the on-pump beating heart group, resulting in the highest predicted risk of mortality (PROM = 0.043), higher than the arrested heart group (0.028; p=0.02), the right heart assist group (0.024; p=0.005), and the off-pump group (0.031; p=0.07). This group also had the lowest ejection fraction (45%; p=0.01), highest rate of recent myocardial infarction (53%; p=0.002), previous CABG (13.7%; p=0.004), cardiogenic shock (3.6%; p=0.002), resuscitation (3.6%; p=0.001), and arrhythmias (13.8%; p=0.003). Outcomes (including operative mortality) were not statistically different between the groups. The on-pump

beating heart group did have a slightly greater LOS (7.6 days; p=0.001), and a higher rate of post-operative cardiac arrest (3.1%; p=0.03) than the other groups. For most other parameters, on-pump beating heart patients fared better than on-pump arrested heart.

CONCLUSIONS: Normothermic CPB with a beating heart is safe, efficacious and may be the method of choice for patients in cardiogenic shock, requiring resuscitation, with previous CABG, recent MI, low ejection fraction, or unstable arrhythmias.

27 EXPERIMENTAL MINIMALLY INVASIVE CORONARY ARTERY BYPASS USING A BIOLOGIC GLUE: SHORT AND LONG TERM RESULTS

Steven R. Gundry

The International Heart Institute of Palm Springs, Desert Regional Med Center, Palm Springs, CA, USA

OBJECTIVE: Minimally invasive coronary artery anastomoses (CAA) using devices are in development but they offer the same disadvantages as cardiologists' stents. We have reported on our work creating an internal mammary artery CAA using a double balloon catheter system and a biologic glue (BioGlue). This report details the short and long term follow-up of these anastomoses.

METHODS: Five goats underwent a CAA from the IMA to the LAD via a thoracotomy. Three initial animals were placed on bypass and had the anastomosis constructed under cardioplegic arrest. Two angioplasty balloons were introduced into the distal IMA; one exited the back wall of the IMA 1 cm proximally and entered the LAD; the other was positioned proximal to the anastomosis to temporarily stent the LAD. Once the balloons were inflated, BioGlue was applied externally and allowed to set-up for two minutes; the balloons were removed; the distal end of the IMA was clipped, converting the side to side graft to an end to side graft. Subsequently, two animals had IMA-LAD bypass off pump. Animals were recovered and followed.

RESULTS: Animals were autopsied at one day, 3 months, 10 months, 12 months, and 27 months. All CAA were patent. Angiograms showed non-stenosed, non-aneurysmal graft sites. The 27 month animal (off pump) was allowed to grow from 41 kg to 60 kg prior to sacrifice; the CAA. Bioglu was still present and pliable.

CONCLUSION: We have shown that a biologic glue and a catheter system can produce long term CAAs in growing large animals.

28 CLINICAL STUDY ON THE EFFICACY OF A NEWLY DEVELOPED TOOL FOR AUTOMATED ONE-STEP PROXIMAL ANASTOMOSES IN CABG SURGERY (PAS-PORT SYSTEM)

Hendrik Treede¹, Wolfgang Harringer², Stefanos Demertzis³, Bernard Hausen⁴, Christian Delter¹, Hermann Reichenspurner¹

¹Department of Cardiovascular Surgery, Universityhospital Hamburg-Eppendorf, Hamburg, Germany; ²Department of Thoracic and Cardiovascular Surgery, Braunschweig Hospital, Braunschweig, Germany; ³Department of Thoracic and Cardiovascular Surgery, Cardiocentro Ticino, Lugano, Switzerland; ⁴Cardica Inc., Menlo Park, CA, USA

OBJECTIVE: Conventional proximal anastomoses in CABG surgery require full access and partial aortic clamping. The procedure is time-consuming and associated with a risk for embolic neurological injury. Goal of this prospective study was to determine feasibility, safety and efficacy of the novel PAS-Port system.

METHODS: Three centers enrolled patients awaiting elective CABG surgery. Outcome variables were intraoperative device performance, incidence of device related adverse events, early and late angiographic graft patency and 3 months stress EKG.

RESULTS: Of 60 eligible patients (m:47/f:13) 5 pts. were excluded due to inadequate vein size (n=4) or consent withdrawal (n=1). 47 of the 55 patients enrolled had at least one anastomosis successfully completed (44 pts. received a single, 3 pts. 2 implants each). 5 implants had to be removed (1 due to accidental damage, 4 due to leakage). Veins from 3.8 to 6 mm were successfully utilized (mean 4.8 mm). There were no implant-related adverse events. PredischARGE angiographic follow-up in 46 pts. (49 implants evaluated;

98% complete follow-up) showed all grafts to be patent (100% early patency rate). At 3 months postop. stress EKG demonstrated signs of myocardial ischemia in 1 of the 45 pts. evaluated to date.

CONCLUSION: The PAS-Port system allows for an easy attachment of veins to the implant. Proximal anastomoses can be performed safely in one single step within seconds without aortic clamping. This study demonstrates 100% early angiographic patency and absence of exercise induced myocardial ischemia at 3 month postop. in 98% of the patients.

29 EARLY BYPASS OCCLUSION WITH THE AORTIC CONNECTOR DEVICE

Oliver Reuthebuch, Alexander Kadner, Marko Turina

University Hospital Zurich, Zurich, Switzerland

OBJECTIVE: Off-pump coronary artery bypass grafting (OPCABG) has gained increasing acceptance due to the reduction of negative effects of extra-corporeal circulation. However, manipulation of diseased aorta may increase the risk for neurologic complications. The mechanical Symmetry-connector (SC) anastomosis device (St. Jude Medical) allows for performing a mechanical proximal vein-to-aorta anastomosis without side-clamping the aorta. This study reports early postop complications following usage of the SC device at our institution.

METHODS: Between 6/2001-4/2002, 77 SCs (1.3/patient) were deployed in 61 patients (51m/10f, mean age 68 ± 8.6 years) in OPCABG procedures. Graft flow was assessed using a flow probe.

RESULTS: Loading of the SC was simple. Time for anastomosis was <15s. No neurologic deficiencies were observed. 54/61 (89%) patients had an uneventful course. However 7 patients (11%) encountered device-related complications: 1 intraoperatively, 2 within 5 days and 4 within 6 months postoperatively. Angiography demonstrated occlusion of the neostium of the vein graft in 6 patients. 3 patients were reoperated within 6 days. 1 vein graft was dilated and 2 grafts were stented.

CONCLUSIONS: Based on these observations the routine use of the SC device is not advised and it should be reserved for patients with severely calcified ascending aorta where other alternative techniques are not possible. It appears that further investigations and improvements of the connector system are necessary to evaluate the benefits of this promising technology.

30 FIRST CLINICAL EXPERIENCE WITH A 30° END-TO-SIDE CORONARY ANASTOMOSIS COUPLER

Felix Schoeneich¹, Andreas Boening¹, Michael Brandt¹, Richard Lotti², Jochen Cremer¹

¹Department of Cardiovascular Surgery, University Hospital, Kiel, Germany;

²Converge Medical, Sunnyvale, CA, USA

OBJECTIVE: The purpose of this study is to evaluate the safety and efficacy of a novel coronary anastomotic Coupler (Converge Medical, Inc., Sunnyvale, CA) that facilitates a sutureless vein graft to coronary artery anastomosis.

MATERIAL AND METHODS: The Coupler will be evaluated in a multi-center, non-randomized, open study in up to 35 patients. The Coupler relies on a set of concentric mating frames that clamp vessel tissues together to enable healing. The frames are manufactured from Nitinol, a nickel titanium shape-memory alloy. The Nitinol frames attach the bypass graft to the coronary artery in a 30° end-to-side configuration. A total of 4 patients (3 male, 1 female, mean age 65 years) were admitted for coronary artery re-vascularization and included in the study.

RESULTS: Three patients were successfully treated with Coupler. One patient did not meet the intraoperative exclusion criteria, and was excluded from the study due to small and heavily calcified vessels. There was minor bleeding in one patient, which was corrected by arranging the bypass graft along the axis of the coronary vessel with fibrin glue. Average mean flow through the Couplers was 51 ml/min, compared to an average flow rate of 24.8 ml/min in conventionally sutured grafts, and 34.47 ml/min in IMA bypass grafts. Patients will be angiographically assessed at 8 weeks postoperatively.

CONCLUSION: Initial results indicate that the Converge Coupler can be used to create a safe and effective 30° vein graft to coronary artery anastomosis.

31 NOVADAQ SPY™: IMMEDIATE BYPASS FUNCTION CONTROL IN OFF-PUMP CABG

Oliver Reuthebuch, Achim Häussler, Marko Turina

University Hospital Zurich, Zurich, Switzerland

OBJECTIVES: Off-pump coronary artery bypass grafting (OPCAB) is an emerging technique. However it is technically demanding. To assess quality of anastomoses and quality of grafts the Spy™ imaging system (Novadaq, Canada) was evaluated. Based on fluorescence properties of indocyanine green (ICG) the dye was intravenously injected and area of interest illuminated with a laser. Images were captured with CCD camera, digitally processed, immediately analyzed and finally saved on CD-ROM.

METHODS: Between April 02 and August 02 a total of 37 consecutive patients (25m/12f) with 107 grafts (45 arteries/62 veins) were included in the study. Immediate and fast run-off of dye as well as extended opacification of myocardium was supposed equivalent to good quality of anastomosis and high intravascular ICG-signal for good graft quality respectively. For cross-check flow was measured with doppler flow-probes (Medistim, Norway).

RESULTS: The system is easy to handle and no side-effects of ICG were observed. 4/107 grafts (3.73%) had to be revised (3 anastomotic constrictions, 1 graft dissection). Optical assessment correlated with measured flow. Each image required approximately 1.25-2.5mg ICG. Distinct images were equivalent to angiography without the need for X-rays and catheter insertion. Course of coronaries in redo-cases and obese patients could be detected.

CONCLUSIONS: Optical assessment of graft flow and graft quality is a very advantageous tool not only in OPCAB surgery. Immediate bypass control can lead to immediate corrections with better postoperative results. Future improvements of the system could include a quantitative flow measurement and flow curve analysis.

Featured Abstracts: Atrial Fibrillation

Friday, June 20, 2003, 9:25 AM-10:25 AM

32 A MODIFIED ABLATION LINE CONCEPT IS SUPERIOR TO ORIGINAL MICROWAVE ABLATION FOR CURATIVE TREATMENT OF PERMANENT ATRIAL FIBRILLATION

Michael Knaut, Sems M. Tugtekin, Klaus Matschke, Vassilios Guliemos
Dept. of Cardiac Surgery, Heart Center Dresden University Hospital,
Dresden, Germany

OBJECTIVE: Microwave ablation (MW) has been established as a safe and efficient procedure for the treatment of permanent AF (pAF). For further improvement of clinical results, a new ablation line concept has been introduced. We present the first clinical results using this new concept compared with the results of the previous concept.

METHODS: We compared two groups, including patients (pts) with mitral valve disease (MVD), coronary artery disease (CAD), and aortic valve disease (AVD). Group A included 137 pts, age 67 ± 4 years, ejection fraction 32-80%, left atrial diameter 52 ± 7 mm, suffering from MVD (n=82), CAD (n=60) or AVD (n=18) with pAF for 6.4 ± 4.5 years using the original ablation line concept. In group B including 75 pts, age 68 ± 4 years, ejection fraction 20-83%, left atrial diameter 52 ± 4 mm with pAF for 7.2 ± 8 years suffering from MVD (n=48), CAD (n=30) or AVD (n=31) a modified ablation line concept was used. The new concept includes the circular ablation around the pulmonary veins of both sides.

RESULTS: Survival rate in group A was 98.5 % and 97.3 % in group B. In the 6-month follow-up in group A 62% of pts with MVD, 68% with CAD and 78% of pts with AVD were in sinus rhythm. In group B 88 % of pts with MVD, 78% with CAD and 85% of pts with AVD were in sinus rhythm.

CONCLUSIONS: This modified concept seems to be superior to our previously used concept. Therefore we have established this new concept as standard for MW.

33 BIPOLAR RADIOFREQUENCY CLAMP FOR SURGICAL TREATMENT OF ATRIAL FIBRILLATION

A. Marc Gillinov, Patrick M. McCarthy, Royce Calhoun, Gosta Pettersson, Nassir Marrouche, Andrea Natale, Delos M. Cosgrove, III
Cardiac Surgery, The Cleveland Clinic Foundation, Cleveland, OH, USA

OBJECTIVE: To assess initial clinical results with a bipolar radiofrequency clamp for surgical treatment of atrial fibrillation (AF).

METHODS: From August to December 2002, the Atricure bipolar radiofrequency clamp was used to create a standard left atrial lesion set in 50 patients with AF (22 permanent, 12 persistent, 16 paroxysmal). Mean duration of AF was 44 months (range 1-240 months). Mean patient age was 69 ± 10 years, and 48% were 70 years of age or older. The lesion set included bilateral pulmonary vein isolation, and connecting lesions between the right and left pulmonary veins and between the left atrial appendage and the left pulmonary veins; the atrial appendage was excised or excluded in all patients. Mean procedure time was 16 ± 6 minutes. Concomitant procedures included mitral valve repair or replacement (88%), tricuspid valve repair (32%), coronary artery bypass grafting (32%), and aortic valve replacement (28%).

RESULTS: Rhythm at the conclusion of the procedure was sinus in 64%, junctional in 26%, and AF in 10%. While in hospital, 33 patients (66%) developed perioperative AF; all were treated with antiarrhythmic medications, and 19 had electrical cardioversion. At hospital discharge, rhythm was sinus in 60%, AF in 32%, atrial flutter in 4%, and junctional in 2%.

CONCLUSION: The bipolar radiofrequency clamp can be used to achieve rapid and safe pulmonary vein isolation, extending the possibility of AF ablation to elderly patients and those with complex concomitant cardiac pathology. Early postoperative AF is common, suggesting a role for prophylactic antiarrhythmic therapy.

34 A COMPLETE COX-MAZE PROCEDURE PERFORMED ON THE BEATING HEART WITH BIPOLAR RADIOFREQUENCY ENERGY: OPERATIVE TECHNIQUE AND EARLY RESULTS

Sydney L. Gaynor, Yosuke Ishii, Michael D. Diodato, Sunil M. Prasad, Nicholas R. Damiano, Kara M. Barnett, Richard B. Schuessler, Ralph J. Damiano, Jr.

Cardiothoracic Surgery, Washington University School of Medicine, St. Louis, MO, USA

OBJECTIVE: The most successful surgical treatment for atrial fibrillation (AF) is the Cox-Maze (CM) procedure. Unfortunately, this operation traditionally involves long periods of cardiopulmonary bypass (CPB) and cardioplegia arrest. Our aim interestingly, was to reproduce all CM lesions by utilizing a bipolar radiofrequency (BRF) ablation device to replace all of the surgical incisions without CPB.

METHODS: Six Hanford mini-pigs underwent high resolution MRI to assess atrial function and pulmonary vein anatomy. A median sternotomy was performed. The pulmonary veins were circumferentially dissected and ablated. Electrical isolation was confirmed by pacing. One of the jaws of the BRF device was then introduced into the right and left atria through purse string sutures. The remaining lesions were made by clamping atrial myocardium. After 30 days, the MRI was repeated and re-operation performed. Burst pacing with cholinergic stimulation was used to induce AF. The animals were sacrificed and the heart examined histologically.

RESULTS: All of the CM lesions were successfully created using the BRF devices and there was no mortality. Mean ablation time for each lesion was 8.6 ± 3.1 seconds. The pulmonary veins were isolated in every instance. Comparative MRI studies of each animal revealed no evidence of pulmonary vein occlusion or intra-atrial thrombus. Cholinergic stimulation along with burst pacing failed to produce AF. Histology revealed transmural of all atrial lesions and no evidence of valvular or coronary injury.

CONCLUSION: The Cox-Maze procedure can be performed successfully using bipolar RF energy without CPB. Clinical trials of this less invasive procedure are warranted.

35 INITIAL CLINICAL TRIAL OF PULMONARY VEIN ISOLATION WITH BIPOLAR RADIOFREQUENCY ABLATION FOR THE SURGICAL TREATMENT OF ATRIAL FIBRILLATION

Ralph J. Damiano, Jr., Sydney L. Gaynor, Marc R. Moon, Sunil Prasad, Samuel A. Wickline, Kara M. Barnett, Nicholas R. Damiano, Marci S. Bailey, Rachel L. Herren, Yosuke Ishii, Richard B. Schuessler
Cardiothoracic Surgery, Washington University School of Medicine, St. Louis, MO, USA

OBJECTIVE: The Cox-Maze (CM) procedure remains the gold standard for the surgical treatment of atrial fibrillation (AF). However, the original "cut and sew technique" is time consuming and technically challenging. We have modified the Cox-Maze III procedure by using a bipolar radiofrequency (RF) ablation device to isolate the pulmonary veins (PV) and remove several of the other incisions of the CM procedure. The purpose of this trial was to demonstrate efficacy and safety of bipolar RF in isolating the PV and replacing the surgical incisions of the CM procedure.

METHODS: Beginning 2002, 21 consecutive patients (7 female, 14 male) underwent bipolar RF. Mean age was 60 ± 13 years. Twelve patients had paroxysmal AF while 9 had chronic AF. Electrical isolation of the PV was documented with intraoperative pacing. Atrial function and PV patency were assessed by post-operative MRI at 1 month in ten patients.

RESULTS: The left (LPV) and right (RPV) pulmonary veins were isolated in every instance. The LPV underwent 3.0 ± 1.1 bipolar RF applications while the RPV underwent 2.7 ± 1.0 bipolar RF applications. Ablation times were 24.0 ± 9.1 seconds for the LPV and 24.5 ± 12.4 seconds for the RPV. There were no operative mortalities. Follow-up MRI showed preserved atrial contractility and no evidence of PV stenosis. All patients with 3 and 6-month follow-up were in sinus rhythm.

CONCLUSION: Bipolar RF ablation can be used effectively and safely to isolate the PV, hence replacing the "cut and sew" technique. This technology has the potential to simplify the surgical treatment of AF.

36 ENDOCARDIAL AND EPICARDIAL MICROWAVE ABLATION OF ATRIAL FIBRILLATION DURING CONCOMITANT CARDIAC SURGERY

Donald Thomas, II¹, Todd Guynn², David B. Calandra², Julie D. Porter²
¹Metropolitan Cardiac Surgeons, Clinical Associate University of Chicago, Hinsdale, IL, USA; ²AFX, Inc., Fremont, CA, USA

OBJECTIVE: To report on the surgical management of AF patients using microwave (MW) energy ablation therapy.

METHODS: From December 2001 to November 2002, 22 consecutive patients (mean age 79 ± 5.2 yrs in a range from 50 to 82 yrs), with permanent (10 pts), persistent (7 pts) and paroxysmal (5 pts) AF, underwent a modified left sided maze procedure using the FLEX 4 microwave ablation device (AFx Inc., Fremont CA) prior to concomitant cardiac surgery procedures (MV replacement in 4 pts, MV repair in 6 pts, CABG in 6 pts, AV replacement in 1 pts, and multiple procedures in 5 pts). The ablation was performed epicardially in 11 pts, endocardially in 9 pts and a combined approach in 2 pts. In order to maintain the pts in NSR, electrical cardio version and antiarrhythmic drugs were used as required.

RESULTS: The pump time ranged between 0 and 202 minutes (132.8 ± 54.4 minutes) and the cross-clamp time ranged from 0 to 180 minutes (79 ± 5.2 minutes). Immediately post op all the pts were in a regular paced rhythm or NSR. At the latest follow-up 19/22 (86%) pts were in NSR. There was one death unrelated to the MWV ablation procedure.

CONCLUSIONS: The MWV modified maze procedure can be easily and quickly performed epicardially and/or endocardially with comparable outcomes in terms of SR restoration. All patients with a history of AF undergoing microwave ablation during correction of their concomitant cardiac surgical issues can expect excellent freedom from AF.

Presidential Plenary Session

Friday, June 20, 2003, 11:05 AM-11:55 AM

37 A NOVEL, CUSTOM MADE, LONG SHUNT (CLS) SIMPLIFIES THE PERFORMANCE AND IMPROVES THE RESULTS OF BEATING HEART SURGERY

Donald E. Ross

Cardio-Thoracic Surgery, Royal North Shore Hospital, Sydney, Australia

OBJECTIVE: The occurrence of a snare related stenosis after beating heart surgery prompted the search for an alternative method of haemostasis. Because of the shortcomings of commercial coronary shunts a novel custom-made coronary shunting technique was devised. It involves the use of varying lengths of 1.2 mm Silastic tubing secured with a fine silk "tag" suture. The technique of construction and deployment of the shunts is demonstrated and a retrospective comparison of the two methods is presented.

METHOD: Between June 1998 and December 2000 five hundred opcab cases were done using The Platypus stabilizer and Silastic snares for haemostasis. Since then, three hundred cases were done with the same stabiliser but using CLS shunts instead of snares.

RESULTS: The CLS group had a peri-operative infarction from of 1.5% compared with 4.4% in the snare group. Other measured parameters remained unchanged but there was a profound, but subjective reduction in the incidence of haemodynamic instability in the shunted cases.

CONCLUSION: The best method for control of coronary bleeding during beating heart surgery remains controversial. There is increasing evidence that snares can cause artery damage and spasm. Shunting avoids this problem while enhancing haemodynamic stability and facilitating accurate anastomoses. The case against shunts is based mainly on inconvenience but this has been substantially negated by the introduction of the CLS technique.

38 SUTURELESS MITRAL VALVE REPAIR USING NITINOL CLIP TECHNOLOGY

Lishan Aklog¹, L. Wiley Nifong², Robert F. Hebler³, Timothy A. Galbraith⁴, W. Randolph Chitwood², Fidel Realyvasquez⁵, Renu Virmani⁶

¹Cardiothoracic Surgery, Mount Sinai Medical Center, New York, NY, USA; ²Cardiothoracic Surgery, Brody School of Medicine at East Carolina University, Greenville, NC, USA; ³Cardiothoracic Surgery, Baylor University Medical Center, Houston, TX, USA; ⁴Cardiothoracic Surgery, University of Nebraska Medical Center, Omaha, NE, USA; ⁵Cardiothoracic Surgery, Redding Medical Center, Redding, CA, USA; ⁶Pathology, Armed Forces Institute of Pathology, Washington, DC, USA

OBJECTIVE: Technical challenges remain in minimally-invasive mitral valve repair (MVP). We hypothesized that self-closing nitinol clip (NC) technology could facilitate MVP.

METHODS: MVP was performed in a series of animals using NC's. Anterior leaflet (AL) repair was first performed using NC's or suture in 14 isolated, pressurized porcine hearts. AL repair (n=10) or prosthetic annuloplasty (PA) (13 open, 10 robotic) was then performed in 33 sheep to optimize clip design. Finally, MVP was performed in 7 calves using a stable clip design, including isolated PA (n=2), bileaflet repair (n=2) and combined posterior leaflet repair and PA (n=3). Serial echocardiography was performed followed by sacrifice at 1 (n=7), 3 (n=7) and 6 (n=6) months.

Procedure	N	Clip Utilization	
		No. Clips	Time (min)
Leaflet repair			
Anterior	8	5.5 ± 0.8	5.9 ± 2.4
Annuloplasty			
Mattress (Open)	9	7.3 ± 0.7	17 ± 8
Mattress (Robotic)	10	6.3 ± 0.5	22 ± 3
Simple (Open)	4	14 ± 1	12 ± 1

RESULTS: In bench testing, all clips and repairs remained intact. In vivo sheep data are summarized in Table 1. All repairs were intact and all PA's were securely attached at sacrifice. Leaflet healing and neointimal coverage of prosthetic material was confirmed in all animals. Echocardiography revealed no more than mild central regurgitation.

CONCLUSIONS: Sutureless MVP using NC's can be performed expeditiously with good functional and histologic results. By eliminating knot-tying and suture management, NC's have the potential to facilitate MVP, especially minimally invasive approaches.

39 PREOPERATIVE DEMOGRAPHIC RISK STRATIFICATION FOR SIGNIFICANT ATHEROSCLEROSIS OF THE ASCENDING AORTA

Erez Sharoni¹, Jack Shanewise¹, Howard Song¹, Peggy Duke¹, Kathy Glas¹, James Staples¹, Rebecca Petersen, RN², Robert A. Guyton¹, John D. Puskas¹

¹School of Medicine, Emory University, Atlanta, GA, USA; ²Cardiothoracic Surgery, The Emory Clinic, Atlanta, GA, USA

OBJECTIVE: To evaluate demographic predictors of ascending aortic atherosclerosis (AAA) among cardiac surgical patients and assess whether individualized management, guided by epiaortic ultrasound, can neutralize risk of stroke.

METHODS: 1720 consecutive epiaortic ultrasound examinations were performed at surgeons' discretion, scored on a 5-point scale, and reviewed retrospectively. Preoperative demographics and perioperative stroke rate were compared between patients with AAA Grade 1-2 and Grade 3-5, using univariate and multivariate analyses.

RESULTS: Logistic regression identified age, COPD, renal failure, previous carotid endarterectomy and body mass index as independent predictors of Grade 3-5 AAA. Individualized management of the ascending aorta included OPCAB, alternate cannulation sites, avoidance of aortic clamping, and "no-touch" technique with coronary inflow by internal thoracic artery(ies). These individualized techniques largely neutralized the risk of perioperative stroke, which occurred in 3% of patients with AAA Grade 1-2 and 5% with AAA Grade 3-5 (p=0.075).

CONCLUSIONS: Preoperative demographic characteristics identify patients likely to have AAA Grade 3-5. Epiaortic ultrasound diagnoses AAA and allows individualized management to reduce risk of stroke.

Preoperative Demographic Risk Stratification for AAA

Variable	Grade 1-2 (n=1370)	Grade 3-5 (n= 350)	Univariate P-Value	Multivariate Odds Ratio	CI
Mean Age ± SD	65.5 ± 11.2	69.7 ± 8.9	<0.001	1.026	1.006, 1.046
HTN	1010 (74%)	289 (83%)	<0.001		
Lt. Main >50%	281 (21%)	82 (23%)	0.262		
Prior PV Surgery	60 (4%)	28 (8%)	0.009		
Prior Carotid Endart	59 (4%)	40 (11%)	<0.001	2.630	1.419, 4.874
Diabetic	473 (35%)	114 (33%)	0.532		
COPD	255 (19%)	91 (26%)	0.003	1.805	1.181, 2.758
Renal Failure	123 (9%)	45 (15%)	0.001	2.048	1.215, 3.453
BMI	28.8 ± 5.4	27.3 ± 5.20	0.001	0.962	0.926, 1.001

40 FETAL ROBOTIC CARDIAC MANIPULATION: THE POTENTIAL TO HEAL BEFORE BIRTH

Michael D. Black¹, Darren Lebl¹, Greg Nelson¹, Barry Bagley²

¹Cardiothoracic Surgery, Stanford University, Stanford, CA, USA; ²Computer Motion Inc., Santa Barbara, CA, USA

OBJECTIVE: The current philosophy of fetal extraction, the institution of CPB, and subsequent re-implantation should be questioned. Since the triggers of labor have not been fully elucidated, early and unwanted delivery remains likely. Fetal demise and lack of complete maturation may occur thus making all previous surgical intervention futile. Placenta failure and fetal death are frequent complications of fetal CPB. We propose the introduction of robotic video assisted surgery as a viable alternative to the methods described above.

METHODS: Four pregnant Ewes, 90-112 days, underwent limited laparotomy followed by robotic uterine instrumentation. A 3D visualization system (Storz) with end-instrument micro-wrist articulation (Zeus, Computer Motion Inc.) allowed for direct manipulation of the fetal umbilical chord. Intra-cardiac catheterization was assisted by trans-abdominal ultrasound.

Novel biological glue was applied prior to closure to prevent iatrogenic persistent fetal leak (Cohesion Technologies).

RESULTS: A turbid amniotic environment was overcome by continuous saline uterine irrigation. A learning curve was demonstrated. The ductus venosus was negotiated and the fetal hearts were catheterized via the umbilical vein in 4 sheep allowing for intra-cardiac balloon inflation. The biological glue was effective in preventing amniotic leaks. No sheep were complicated

by spontaneous delivery, maternal or fetal death or uncontrolled bleeding. Fetal heartbeats remained regular throughout the procedure.

CONCLUSIONS: We believe the current philosophy of fetal extraction and reinsertion for the treatment of congenital cardiac conditions remains flawed. Although preliminary, we believe that robotic in-utero manipulation has merit. Chronic/percutaneous fetal survival studies are planned.

Featured Abstracts: Robotics

Friday, June 20, 2003, 3:55 PM-5:35 PM

41 ENDOTHORACIC ASSISTANCE FOR TOTALLY ENDOSCOPIC OFF-PUMP CABG

Selami Dogan¹, Tayfun Aybek¹, Omer Dzemali¹, Stephan Mierdl¹, Hubert Stein², Gerhard Wimmer-Greinecker¹, Anton Moritz¹

¹Department of Thoracic and Cardiovascular Surgery, J.W. Goethe University, Frankfurt, Germany; ²Intuitive Surgical, Sunnyvale, CA, USA

BACKGROUND: Totally endoscopic CABG is complex and demanding due to lack of tactile feedback and counter traction, i.e. endothoracic assistance. Procedural time is prolonged and precision of anastomotic suturing may be impaired. Secondly, the visual field is limited.

METHODS: We have evaluated the second generation of the Da Vinci Surgical System, which provides an additional arm for endothoracic instrumentation and a 3 channel endoscope for wide angle visualization. Seven patients were operated using the additional instrument arm for pericardiotomy and for exposition of the distal ITA during anastomotic suturing.

RESULTS: In 4 patients the left ITA was grafted to the LAD successfully in totally endoscopic fashion. One patient had sequential grafting of the left ITA to LAD and diagonal branch. Mean operative time was 195 ± 58 min. Intra and postoperative course were uneventful including a good result on control angiogram before discharge from the hospital. In two patients a more complex bypass procedure was attempted with bilateral ITA grafting. There was no adverse event due to insertion of the additional robotic arm as a second right instrument.

CONCLUSION: The modifications of the Da Vinci Surgical System had no impact on ITA dissection. Pericardiotomy and anastomotic suturing were performed in a more controlled fashion using the assistant arm for endothoracic assistance. Wide angle visualization improved surgical vision and facilitated transthoracic instrumentation and instrument change. The modifications carry the potential to reduce operative risk and shorten operative time in totally endoscopic CABG.

42 SUCCESSFUL CLOSED-CHEST BEATING-HEART MULTIVESSEL CABG USING A NOVEL DEPLOYABLE ENDO-OCTOPUS AND THE ARTICULATING ENDOSTARFISH CARDIAC POSITIONER

Paul F. Grundeman¹, Ricardo Budde¹, Wim-Jan van Boven², Henricus Mansvelt Beck³, Cornelius Borst¹

¹Exp. Cardiothoracic Surg, HLCU Utrecht, Utrecht, Netherlands; ²Antonius Hospital, HLCU Utrecht, Nieuwegein, Netherlands; ³Mtm, HLCU Utrecht, Utrecht, Netherlands

OBJECTIVE: Endoscopic multivessel CABG on the beating heart was studied employing novel tools for cardiac positioning and for endoscopic immobilization of the coronary vessels.

METHOD: In 12 pigs (80 kg) both mammary arteries (IMA) were harvested. The Da VinciTM system was used for anastomosis constructions (n=16). Five trocar ports were placed (∅12 mm, 2 in left chest, 2 in right chest, one subxiphoidly). For exposure, the Utrecht articulating EndoStarfish cardiac positioner was fixed to the heart using 400 mmHg suction. A novel deployable EndoOctopus tissue stabilizer with an articulating neck was placed by the robot (-400 mmHg). A sky hook was used to hoist the sternum ventrally by 5 cm.

RESULTS: In the displaced heart, obtuse marginal vessels (OM) and Ramus Descending Posterior of the RCA (RPD) became fully exposed with a mean arterial pressure ≥70 mm Hg without accidental detachments. Coronary vessel motion was restrained to ≤1 × 1 mm which facilitated meticulous en precise suturing technique. In 2 cases, 5 sham distal anastomosis were created (grafts sewn to epicardium, jump OM2-3 with left IMA, RDP with right IMA and jump diagonal to LAD with Y graft from left IMA). Ten cases included successfully completed separate constructions of anastomosis to RPD (n=7) and to OM2-3 (n=9) of ∅1.75-2.5 mm (2 jump grafts). Anastomosis construction time ranged from 25-60 min.

CONCLUSION: In the acute pig model, endoscopic exposure with the EndoStarfish cardiac positioner of circumflex vessels enabled endoscopic multivessel bypass surgery on the beating heart using the deployable

Utrecht EndoOctopus tissue stabilizer.

43 OBJECTIVE ASSESSMENT OF PERFORMANCE OF ROBOTIC ASSISTED LIMA TO LAD ANASTOMOSIS ON A BENCH- MODEL

Yaron Munz¹, Aristotelis Dosis¹, Benny Lo², Dorothy A. Wang¹, Krishna Moorthy¹, Vikas Pandey¹, Rex Stanbridge³, Roberto Casula³, Shirley Martin¹, Fernando Bello¹, Guang Z. Yang², Ara W. Darzi¹, Timothy A. Rockall¹

¹Surgical Oncology and Technology, ²Computing, and ³Cardio Thoracic Surgery, Imperial College, London, United Kingdom

OBJECTIVE: Robotic surgery has now the potential to revolutionize minimal invasive cardio thoracic surgery (MICS). The aim of this study was to objectively assess performance of robotic assisted LIMA to LAD anastomosis on a bench model.

METHODS: Two experienced cardio thoracic surgeons performed robotic assisted LIMA to LAD anastomosis using the da Vinci robotic system. They carried out 5 repetitions each on the still and the beating heart model and in addition performed one open-technique anastomosis each. Assessment of performance included retrieval of positional data from the da Vinci's API and its analysis using a custom designed software package (ROVIMAS), examination of the image of the cross-section of the anastomosis by means of pixel analysis and evaluation of the overall performance by means of a global rating scale (OSATS) carried out by 3 independent blinded observers. Statistical analysis included non-parametric tests and P<0.05 was deemed significant.

RESULTS: Significant improvements in range of 20-35% were recorded for both surgeons for all positional parameters (time, number of movements and distance traveled by both hands). Pixel analysis of the anastomosis revealed median improvements in the circumference to area ratio (CAR) in range of 30-40%. Overall performance as judged by the OSATS score followed the same trend and correlated well to the surgeons' self-appraisal.

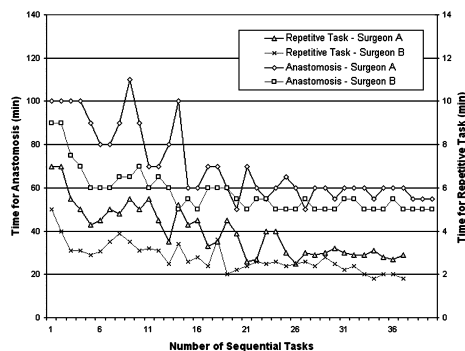
CONCLUSIONS: Robotic assisted LIMA to LAD anastomosis is comparable to the open technique in most parameters measured. Although more demanding, performance on the beating heart is not significantly impaired and quality of final product is acceptable.

44 PREPARING FOR ROBOTICS IN CARDIAC SURGERY

Richard H. Trimlett, Anthony C. DeSouza, Marcus Flather, Douglas West, John Yapp, Richard Kuenzler, John R. Pepper

Cardiothoracic Surgery, The Royal Brompton Hospital, London, UK, London, United Kingdom

OBJECTIVE: Establish a staged introduction to robotic cardiac surgery, allowing development of confidence and skills, and assess the time required to produce safe and reproducible results.



METHODS: Two specialists performed dexterity tasks in the laboratory, replicating those in cardiac surgery. Each performed 40 timed tasks, then 37

cycles of timed anastomoses where coronary anastomoses were formed on pig hearts. The exercise was repeated on live pigs and port placement training was performed at the Royal College of Surgeons using human cadavers. Once confident of achieving a high degree of safety and acceptable times we commenced a clinical series.

RESULTS: 154 timed procedures totalled sixty hours. Mean times for laboratory tasks were 5.8 min., and 7.0 min. for Surgeons A & B respectively. Range 5 to 11 min. Chart 1 clearly shows plateauing and comparing the first and last ten case means we see 8.2 min. and 5.5 min. respectively. ($p < 0.05$). Mean times for anastomoses were 36.9 min. and 25.6 min.. Range 18 to 70 min. Again, first and last ten means were 44.4 min. and 25.7 min. ($p < 0.05$).

CONCLUSIONS: The learning process for robotic cardiac surgery is quick and reproducible, readily translating to patient benefit. Learning time is short, with familiar tasks but, adaptation to different sensing modalities is necessary.

45 ENDOSCOPIC ROBOT-ASSISTED ON-LINE LOCALIZATION AND ASSESSMENT OF THE LAD AND VISUALIZATION OF IMA-LAD ANASTOMOSIS BY EPICARDIAL 13 MHZ ULTRASOUND

Ricardo P. Budde¹, Rudy Meijer¹, Thomas C. Dessing¹, Patricia F. Bakker², Wim-Jan van Boven³, Paul F. Grundeman¹

¹Experimental Cardiology Laboratory and ²Department of Cardio-Thoracic Surgery, University Medical Center Utrecht, Utrecht, Netherlands; ³Department of Cardio-Thoracic Surgery, St. Antonius Hospital, Nieuwegein, Netherlands

OBJECTIVE: In total endoscopic off-pump coronary artery bypass surgery, the LAD may be difficult to localize due to epicardial fat. A novel, high-frequency ultrasound mini-transducer was used endoscopically to evaluate its capacity to localize and assess the LAD and visualize IMA-LAD anastomosis.

METHODS: In 8 pigs (55-85 Kg), a 13 MHz mini-transducer (15 × 6 × 9 mm, Aloka, Japan), introduced via a 15 mm port, was manipulated with the da Vinci telemanipulation system over the unstabilized and stabilized epicardium to identify the LAD and to obtain a scout scan and optimal transverse and longitudinal images. The ultrasound image was displayed real-time picture-in-picture on the master console. The LAD was marked with a clip and identification was verified *ex vivo* by angiography. In 4 additional pigs (60-80 Kg), both RIMA and LIMA were anastomoses to the LAD (n=8) conventionally, subsequently the chest was closed. After stabilization with a novel EndoOctopus cardiac stabilizer, the anastomoses were endoscopically visualized (B-mode and Doppler) with the mini-transducer on the beating heart.

RESULTS: In both unstabilized and stabilized condition, the LAD was located within 30 seconds in all 8 animals, the entire scanning procedure was completed within a median of 3 minutes. Septal perforators and side branches were easily spotted. All IMA-LAD anastomoses were visualized within 1 minute. High quality transverse and longitudinal images were obtained.

CONCLUSIONS: The 13 MHz ultrasound mini-transducer enabled on-line endoscopic localization of the LAD within 30 seconds, and visualization of coronary anastomosis within 1 minute.

46 QUANTIFYING MEDIASTINAL MOVEMENT UNDER CO2-INSUFFLATION-A STEP TOWARD AN ENDOSCOPIC PLANNING AND SIMULATION SYSTEM

Christoph Schmitz¹, Wolfgang Schiller¹, Chris Probst¹, Ron Schwarz², Thomas Berlage², Armin Welz¹

¹Department of Cardiac Surgery, University of Bonn, Bonn, Germany; ²Fraunhofer Institute for Applied Information Technology, Sankt Augustin, Germany

OBJECTIVE: Single lung ventilation and CO₂-insufflation is the preferred method to maximize exposure in endoscopic or robotic cardiac surgery. In order to use preoperative CT or MRI data for planning and simulating endoscopic cardiac interventions it is essential to predict intraoperative thoracic and mediastinal shifts.

METHODS: Between 10/02 and 12/02 5 patients undergoing a robot assisted MIDCAB were included into the study. Preoperatively CT or MRI scans were collected. Intraoperatively a matrix of extra- and intrathoracic targets was scanned with an optical tracking system (NDI Polaris). A stylus with three reflecting markers on its top was positioned onto the targets on the patient's thorax. Tip position was recorded by a double camera system. Positions of mediastinal structures were measured under endoscopic control. Target positions were assessed during inspiration and expiration as well as under CO₂-insufflation at different pressure levels (0-15 mmHg).

RESULTS: Mean target shifts in the midline of the thorax were 1.2 cm, and 2.5 cm at the lateral wall, respectively (CO₂ 0 and 15 mmHg). Mean target shifts of the mediastinum were 1.0 cm at the ascending aorta, and 3 cm at the apex of the heart (CO₂ 0 and 15 mmHg).

CONCLUSIONS: The presented method provides an exact and reproducible measurement of extra- and intrathoracic displacements. CO₂-insufflation and single lung ventilation have a distinct and reproducible effect on thoracic and mediastinal structures. Therefore CO₂-insufflation and single lung ventilation have to be considered in the development of a planning and simulation system for intrathoracic endoscopic or robotic surgery.

47 THE IMPACT OF ROBOTIC TECHNIQUES ON POSTOPERATIVE QUALITY OF LIFE IN PATIENTS UNDERGOING ATRIAL SEPTAL DEFECT REPAIR

Jeffrey A. Morgan, Karen W. Hollingsworth, Nicholas J. Colletti, Takushi Kohmoto, Aftab R. Kherani, Deon W. Vigilance, Faisal H. Cheema, Eric A. Rose, Craig R. Smith, Mehmet C. Oz, Michael Argenziano

Division of Cardiothoracic Surgery, Columbia University, College of Physicians and Surgeons, New York, NY, USA

OBJECTIVE: Although most studies of minimally invasive cardiac surgery have reported morbidity and mortality, few have addressed more subjective outcome measures, such as pain and quality of life (QOL), which was the aim of this study.

METHODS: Over a 15-month period, 17 patients underwent atrial septal defect (ASD) repair by a totally endoscopic robotic (TE-R) approach. These patients were compared to a similar number of patients who underwent repair of their ASD by a mini-thoracotomy (MT) or sternotomy. QOL was assessed on postoperative day 30 by administering the Medical Outcomes Study Short Form Survey (SF-36). QOL endpoints included bodily pain, vitality, mental health, general health, physical function, and social function.

RESULTS: At 30 days, QOL was best for TE-R patients in all 8 categories, most pronounced in bodily pain (BP, $p=0.014$), mental health (MH, $p=0.034$), and vitality (VT, $p=0.036$) (Table). Patients undergoing minithoracotomy, however, did not fare better than those undergoing sternotomy.

CONCLUSION: Repair of an ASD can be performed safely and effectively via a totally endoscopic approach. The totally endoscopic robotic approach resulted in the least postoperative pain and best quality of life despite increased cross clamp and bypass times.

	Sternotomy	MT	TE-R	p
Day 30 BP	42 ± 25	52 ± 11	83 ± 25	.014
Day 30 MH	68 ± 28	56 ± 28	93 ± 10	.034
Day 30 VT	58 ± 21	48 ± 19	80 ± 16	.036
BP time (min)	39 ± 10	47 ± 25	171 ± 73	.002
XCl time (min)	14 ± 5	17 ± 16	39 ± 11	.005

48 ROBOTIC ENHANCED EPICARDIAL LEAD IMPLANTATION FOR BIVENTRICULAR RESYNCHRONIZATION THERAPY

Jean-Luc Jansens¹, Francis Wellens², Anne Ducart³, Eric Stoupe⁴, Didier de Cannière¹

¹Cardiac Surgery, Erasme University Hospital, Brussels, Belgium; ²Cardiac Surgery, OLVZ Aalst, Aalst, Belgium; ³Anaesthesiology, Erasme University Hospital, Brussels, Belgium; ⁴Cardiology, Erasme University Hospital, Brussels, Belgium

OBJECTIVE: Biventricular resynchronization is a therapeutic option in selected chronic heart failure patients. We describe an alternative route of LV lead implantation: robotic enhanced, totally endoscopic.

METHODS: Biventricular resynchronization through robotic thoracoscopy has been performed in 20 patients. After implantation of the endocardial leads in a classical way, the LV lead was sutured on the epicardium with the robotic arms. The leads were then connected to the stimulator, placed in a pectoral position.

RESULTS: Mean duration of the procedure was 2.5 hours (10 pacemakers and 10 AICD). Mean procedural duration for the LV lead implantation was 20 minutes. In the early experience three patients were converted into a small left thoracotomy, all for reasons unrelated to the robotic procedure. After a mean follow up of 8 months, all the devices were well functioning. All the patients improved their functional capacity. No major complications were observed in the early follow-up period.

CONCLUSIONS: Based on this preliminary experience, we do strongly believe that this new approach is a valid procedure for biventricular resynchronization and warrants further investigation on a larger scale basis.

Featured Abstracts: Off-Pump II

Saturday, June 21, 2003, 8:00 AM-9:25 AM

49 AVOIDANCE OF CARDIOPULMONARY BYPASS IMPROVES EARLY SURVIVAL IN MULTI-VESSEL CORONARY ARTERY BYPASS PATIENTS WITH POOR VENTRICULAR FUNCTION

Todd M. Dewey¹, Mitchell J. Magee¹, James R. Edgerton¹, Morley A. Herbert², Syma L. Prince¹, Gregory Trachiotis³, E P. Alexander³, Michael J. Mack¹

¹Cardiopulmonary Research Science and Technology Institute, Dallas, TX, USA; ²Medical City Dallas Hospital, Dallas, TX, USA; ³George Washington University/Veterans Affairs Medical Center, Washington, DC, USA

OBJECTIVE: Patients with diminished ventricular function represent an increasing percentage of candidates for coronary artery bypass grafting (CABG). We reviewed our recent experience in coronary artery bypass grafting in patients with ejection fractions (EF) less than or equal to 30% to identify factors leading to improved outcomes in this high risk group.

METHODS: 990 patients with an EF \leq 30% underwent CABG between January 1997 and September 2002. Univariate and logistic regression analysis was used to compare the data from 204 patients revascularized off-pump, with 715 who underwent grafting with CPB for differences in mortality, morbidity and length of stay (LOS).

RESULTS: Patients with depressed ventricular function revascularized without using CPB had a significantly lower operative mortality (2.9% vs 6.4%; $p=0.05$) than the on-pump cohort, despite a higher predicted risk ($5.4\% \pm 5.5$ vs $4.3\% \pm 3.7$; $p=0.01$) had a significantly lower incidence of reoperation for bleeding (1.0% vs 4.6%; $p=0.03$), blood product usage (39.6% vs 66.5%; $p<0.001$), decreased post-op vent time (11 ± 37 hrs vs 46 ± 156 ; $p<0.001$) and fewer ICU days (2.6 ± 3.8 vs 4.2 ± 6.5 ; $p<0.001$). Logistic regression showed that the use of CPB was an independent risk factor for mortality (odds ratio [OR]=2.34; 95% CI =0.96, 5.68). A trend towards shorter LOS (7.6 days ± 7.8 vs 8.9 ± 9.6 , $p=0.06$) was seen in the off-pump patients.

CONCLUSION: Avoidance of CPB in patients with reduced ventricular function undergoing multivessel bypass improves early survival, decreases reoperation for bleeding, blood product usage and post-op vent time.

50 PRIMARY STENTING VERSUS ATRAUMATIC CORONARY ARTERY BYPASS. COMPARISON OF TWO METHODS OF REVASCULARIZATION IN SINGLE LAD STENOSIS. ONE YEAR FOLLOW-UP

Marek Cisowski¹, Janusz Drzewiecki², Andrzej Jaklik², Agnieszka Drzewiecka-Gerber², Wojciech Kruczak³, Andrzej Bochenek¹

¹First Department of Cardiac Surgery, ²First Department of Cardiology, and ³Department of Cardio-Anesthesiology, Medical University of Silesia, Katowice, Poland

OBJECTIVE: Percutaneous revascularization is well-accepted method of treatment in a single LAD artery stenosis. It has become the treatment of choice for LAD lesion with the introduction of primary stenting. However the introduction of minimally invasive cardiac surgery methods have risen the question whether minimally invasive surgical revascularization would be competitive to percutaneous coronary interventions in a single vessel stenosis.

METHODS: Group of 100 pts with CCS class II-IV, and single critical stenosis of LAD (type A or B), were treated with primary stenting (PS-group I, 50 pts), or with endoscopic atraumatic coronary artery bypass grafting (ACAB-group II, 50 pts).

RESULTS: All pts in a group I, have reached a very good angiographic and clinical early effect. In one-month, 3 pts (6%), and in six-months follow-up 6 pts (12%) developed restenosis of the LAD. In these cases repeated-PCI was performed. In a group II one- and six- month follow-up all pts remained asymptomatic. Critical stenosis of the LITA-LAD anastomosis was angiographically documented in 1 case (2%). Forty-eight pts (96%) from group I, and 49 pts (98%) from group II were included in 12 month-follow up. In group I, one patient expired (2%), 12 pts had recurrence of angina (25%). One patient (2%) experienced MACE.

CONCLUSIONS: PS is less expensive than ACAB, offers the same degree of protection against death and myocardial infarction and is associated with a greater need for repeated revascularization. Both techniques have similar risk of complications.

51 THE USE OF CARDIO-PULMONARY BYPASS FOR MULTI VESSEL CORONARY ARTERY BYPASS SURGERY IS AN INDEPENDENT PREDICTOR OF OPERATIVE MORTALITY IN PATIENTS WITH ISCHAEMIC LEFT VENTRICULAR DYSFUNCTION

Sharif Al-Ruzzeh¹, Thanos Athanasiou², Brian Glenville², Anthony DeSouza³, John Pepper³, Mohamed Amrani¹

¹Harefield Hospital, London, United Kingdom; ²St Mary's Hospital, London, United Kingdom; ³Royal Brompton Hospital, London, United Kingdom

OBJECTIVE: CABG for patients with ischaemic left ventricular dysfunction (ILVD) remains superior to medical therapy in terms of long-term survival. Recently, OPCAB surgery achieved favourable operative mortality in this challenging group of patients. The aim of this study was to assess the risk factors responsible for operative mortality in this group of patients.

METHODS: The records of 305 consecutive ILVD patients, who underwent primary isolated CABG for multi-vessel disease at The National Heart and Lung Institute, between January 1999 and January 2002, were reviewed. Patients were considered to have ILVD if they had a LVEF \leq 30. 106 patients were operated on using the OPCAB technique while 199 patients were operated on with CPB.

RESULTS: 7 (6.6%) patients died in the OPCAB group, while 28 (14.1%) patients died in the CPB group, $p=0.05$. By univariate analysis, the potential predictors of mortality included: symptom status (stable/unstable), COAD, dyspnoea grade III and IV on NYHA classification, IV nitrates, preoperative use of IABP, VT/VF, BSA) <2 and CPB. CPB was proved to act as an independent predictor of mortality in this group of ILVD patients with odds ratio 1.96 (95% CI: 0.745-5.168).

CONCLUSION: This study showed that using CPB for multi-vessel CABG in patients with ILVD was associated with almost two-fold increase in the odds of operative mortality.

52 COMBINED CAROTID ENDARTERECTOMY AND CORONARY ARTERY SURGERY: ANALYSIS OF ON PUMP AND OFF PUMP TECHNIQUES

Yugal K. Mishra¹, Harpreet Wasir¹, Vijay Kohli¹, Zile S. Meharwal¹, Yatin Mehta², Naresh Trehan¹

¹Ctvs, Escorts Heart Institute and Research Centre, Okhla Road, New Delhi, India; ²Anesthesia, Escorts Heart Institute and Research Centre, Okhla Road, New Delhi, India

OBJECTIVE: Controversy still remains regarding the optimal surgical management of patients with coexisting significant carotid and coronary artery disease. Patients with concomitant involvement of carotid and coronary arteries pose a high risk of perioperative stroke and myocardial infarction. Included in the various approaches to this situation is combined one stage procedure of carotid endarterectomy and coronary artery surgery done either on pump or off pump (OPCAB). We analysed our results of one stage off pump versus on pump coronary artery bypass surgery with concomitant carotid endarterectomy.

METHODS: Between January 1996 and June 2002, 358 patients in all underwent combined one stage CABG and CEA. Of these, 166 patients underwent off pump CABG with CEA (OPCAB-CEA group) while in 192 patients CABG was performed on pump (CCAB-CEA group). The preoperative demographic profile, including severity of carotid stenosis, neurological symptomatology and cardiac functions were comparable between OPCAB-CEA and CCAB-CEA group.

RESULTS: There was 1 stroke in CCAB-CEA group while there was no incidence of stroke in OPCAB-CEA group. Two patients in OPCAB-CEA group and two patients in CCAB-CEA group had perioperative myocardial infarction. The incidence of transient neurological deficit (1 v/s 4) and neck hematoma (1 v/s 4) were not significantly different between two groups. There were two mortalities in OPCAB-CEA group and three mortalities in CCAB-CEA group.

CONCLUSION: One stage CABG and carotid endarterectomy can be performed safely and effectively using both off pump and on pump coronary revascularization techniques with equally good comparable results.

53 OFF-PUMP CORONARY ARTERY BYPASS WITH EXCLUSIVE USE OF SKELETONIZED IN-SITU ARTERIAL GRAFTS

Tohru Asai, Shoichiro Shiraiishi, Ryuji Higashita, Takao Nishi

Department of Surgery, Shiga University of Medical Science, Otsu, Japan

OBJECTIVE: Conventional internal mammary artery (IMA) harvesting, especially bilateral, has shown sternal devascularization and increased risk of mediastinitis. With Harmonic Scalpel (HS), an ultrasonic device, we have harvested skeletonized IMA and developed skeletonized right gastroepiploic artery (RGEA) method. We present our early clinical results of off-pump coronary artery bypass (OPCAB) exclusively with these skeletonized in-situ grafts.

METHODS: From January 2002 to December 2002, 82 consecutive patients underwent isolated coronary artery bypass. They were performed off-pump in 100%. Among them, 50 patients (61.0%) underwent OPCAB exclusively with skeletonized in-situ arteries. IMAs were harvested with dissecting hook of HS and RGEAs were harvested with coagulating shears of HS. Exposure of coronary vessels was facilitated with deep pericardial sutures. Contraindication to use GEA were previous laparotomy, less than 90% stenosis in the right coronary artery and unstable hemodynamics.

RESULTS: The approach was sternotomy in 46 (92%), thoracotomy in 3 (6%) and transdiaphragm in 1 (2%). A total of 153 anastomoses were constructed with a mean of 3.06 per patient (1 to 5). No routine composite grafting was employed. There were 63 distal anastomoses with LIMA, 38 with RIMA and 52 with RGEA. Hospital mortality was 0%, perioperative myocardial infarction occurred in 1 (2%). perioperative neurologic complication and mediastinitis were absent. The early angiographic patency were 98.3%(59/60), 100%(36/36) and 100%(49/49) in LIMA, RIMA and RGEA respectively.

CONCLUSIONS: Our data suggest that OPCAB exclusively with skeletonized in-situ grafts can be performed with excellent early outcome. OPCAB with these conduits may be the ultimate minimally invasive procedure via median sternotomy.

54 PERCUTANEOUS CORONARY INTERVENTION VERSUS MINIMALLY INVASIVE DIRECT CORONARY ARTERY BYPASS FOR THE TREATMENT OF ISOLATED PROXIMAL LEFT ANTERIOR DESCENDING ARTERY DISEASE

Munir Boodhwani, Fraser D. Rubens, Marc Ruel, Thierry Mesana

Cardiac Surgery, University of Ottawa Heart Institute, Ottawa, On, Canada.

OBJECTIVE: With technological advances in percutaneous interventions (PCI), single vessel coronary disease is primarily treated with angioplasty and stents. Proximal LAD lesions represent a particularly high risk subset for PCI and can also be treated effectively with minimally invasive left internal thoracic artery to LAD bypass (MIDCAB).

METHODS: Chart review, objective angiographic grading, and telephone follow-up were conducted to compare the clinical outcomes of 52 patients who underwent MIDCAB and 51 randomly selected patients who underwent PCI for isolated proximal LAD disease from October 1998 to December 2001 at our institution. The primary endpoint was a composite outcome of 30-day mortality, myocardial infarction, stroke, and target vessel revascularization.

RESULTS: MIDCAB patients had a higher proportion of class C lesions compared to PCI patients (65% vs. 27%, p = 0.001) and a higher LAD jeopardy score (8.6 ± 3.9 vs. 6.4 ± 2.8, p = 0.01). The table below summarizes the clinical outcomes of each group.

CONCLUSION: Within context limitations related to evolving stent technology and surgical technique, patients undergoing PCI for the treatment of isolated proximal LAD disease have a significantly higher rate of myocardial infarction and target vessel revascularization than MIDCAB patients.

Patient Outcomes	PCI (n = 51)	MIDCAB (n = 52)	p
30-day mortality	1 (2%)	0	ns
MI	5 (10%)	0	0.05
Stroke	0	0	ns
Target vessel revascularization	12 (24%)	4 (8%)	0.05
Total number of events	24 (47%)	4 (8%)	<0.001
Composite outcome	12 (24%)	4 (8%)	0.05

55 ANGIOGRAPHIC GRAFT PATENCY AND CLINICAL OUTCOMES AMONG DIABETIC PATIENTS AFTER OFF-PUMP VERSUS CONVENTIONAL CORONARY ARTERY BYPASS GRAFTING: RESULTS OF A PROSPECTIVE RANDOMIZED TRIAL

John D. Puskas¹, Erez Sharoni¹, Rebecca Petersen, RN², Susan McCall, RN², Willis Williams¹, Peggy Duke¹, Robert A. Guyton¹

¹School of Medicine, Emory University, Atlanta, GA, USA; ²Cardiothoracic Surgery, The Emory Clinic, Atlanta, GA, USA

OBJECTIVE: Conventional coronary artery bypass surgery (CABG/CPB) is superior to angioplasty/stenting in diabetic patients, preserving referral of diabetic patients to surgery. The resurgence of OPCAB mandates comparison of graft patency and outcomes after OPCAB versus CABG/CPB.

METHODS: 200 patients referred for elective primary CABG were randomized to OPCAB or CABG/CPB. There was no exclusion on basis of coronary anatomy, ventricular function or other comorbidities. Management followed strict, unbiased protocols. Angiographic graft patency and outcomes among diabetic patients were compared between groups. Costs were calculated from UB92 data.

RESULTS: 29 of 32 diabetic OPCAB and 29 of 33 diabetic CABG/CPB patients completed postoperative cardiac catheterization. Number of grafts per patient, index of completeness of revascularization (ICOR = # grafts performed/# grafts intended) and graft patency were similar, as were thirty-day mortality and stroke. Postoperative serum measures of myocardial enzymes and coagulopathy were significantly lower in OPCAB. More OPCAB patients were extubated within 4 hours. Hospital stay tended to be shorter and costs were significantly lower for the OPCAB group.

CONCLUSIONS: Among this surgically important subgroup of diabetic patients randomized to OPCAB versus CABG/CPB, OPCAB achieved similar completeness of revascularization and graft patency, less myocardial injury, earlier extubation and significantly lower total cost.

Variable	Diabetic		P Value
	OPCAB (n = 29)	CABG/CPB (n = 28)	
Age (mean ± SD), y	61 ± 10.6	61 ± 7.5	0.812
No. female	10 (34%)	10 (36%)	1.000
Mean no. grafts	3.3 ± 1.1	3.4 ± 1.1	0.785
ICOR	0.96 ± 0.97	0.98 ± 1.03	0.879
PO length of stay (mean ± SD) day	5.2 ± 7.4	6.3 ± 7	0.592
PO Troponin I (24 hrs postop)	0.13 ± 0.18	0.27 ± 0.23	0.014
Thromboelastogram Index (means ± SD) postop	3.27 ± 1.9	-0.1 ± 4.9	0.044
Patients extubated within 4 hrs	23 (79%)	15 (53%)	0.052
Patency		1 missing	
FitzgibbonA	96	93	0.246
FitzGibbonB	0	2	0.497
FitzGibbonO	0	1	1.00

Featured Abstracts: Congenital

Saturday, June 21, 2003, 1:10 PM-2:10 PM

56 CLOSURE OF PATENT DUCTUS ARTERIOSUS BY VIDEO-ASSISTED THORACOSCOPIC SURGERY; MINIMALLY INVASIVE, MAXIMALLY EFFECTIVE: REPORT OF 600 CASES

Mohammad H. Nezafati

Cardiac Surgery, Imam Reza Hospital, Mashhad, Iran (Islamic Republic of)

OBJECTIVE: In the last decade, increasing interest has focused on different applications and various aspects of minimally invasive surgery. To further determine the safety and efficacy of video-assisted thoracoscopic surgical (VATS) closure of Patent Ductus Arteriosus (PDA), we prospectively studied 550 patients treated by this new method.

METHODS: From June 1997 to November 2002, 600 consecutive patients diagnosed as PDA (mean age: 6 years old), were referred to us; all of them met our inclusion criteria eligible for VATS procedure. Recently, we have made some minor alterations in our routine methodology, which will be discussed in more detail later. After complete closure of PDA by two titanium clips the extubated patient leaves the Operating Room without a chest tube.

RESULTS: There were two cases of chylothorax, which were successfully treated by thoracotomy and ligation of the small lymphatic ducts, after one week of close observation. The procedure was changed to thoracotomy in four adult patients due to inappropriately dilated canal (greater than 9 mm), meanwhile, four additional patients developed transient recurrent laryngeal nerve dysfunction. All cases were re-assessed immediately after the procedure, and followed for more than 5 years by control echocardiography. No significant complication and residual shunt was recorded during the follow-up period. Mean procedure time was about 15 ± 2 minutes. All patients were discharged shortly after the procedure (~20 hours).

CONCLUSIONS: Video-assisted thoracoscopic surgery is superior to other techniques of ductal closure; it is also simple, rapid, cost-effective, and more comfortable for the patients, in addition offering cosmetic benefits.

57 HYBRID CONGENITAL CARDIAC SURGERY: NEW THERAPEUTIC AVENUES

Emile Bacha, Joanne Starr, David Waight, Qi-Ling Cao, Peter Koenig, Ziyad Hijazi

Cardiac Surgery, the University of Chicago, Chicago, IL, USA

OBJECTIVE: Expanding minimally invasive strategies by combining surgical and interventional techniques.

METHODS: Prospective study of all pediatric patients who have undergone hybrid cardiac surgery at the University of Chicago Children's Hospital. A hybrid procedure was defined as combined catheter-based and surgical interventions either in one setting or in a planned sequential fashion within 24 hrs.

RESULTS: Between January 2000 and December 2002, 18 patients were treated with hybrid approaches. Eleven patients with muscular VSDs (mVSD) (mean age 4 months; range 2 weeks-4 years) underwent either Amplatzer device closure in the catheterization laboratory followed by surgical completion (closure of other VSDs 5, right ventricular outflow enlargement 5, tricuspid valvuloplasty 3, bi-directional Glenn I, Maze I, retrieval embolized device 1) (n=8) or more recently one-stage intra-operative off-pump VSD device closure (n=3) with repair of concomitant heart lesions (DORV/pulmonary stenosis 1, arch hypoplasia 1). Seven patients with branch PA stenoses underwent intra-operative PA stenting along with Fontan completion in 3, RV-PA conduit change in 2, main PA plasty in 2, and Maze procedure, mitral valvuloplasty, and Damus-Kaye-Stanzel in 1, respectively. All patients survived hospitalization. One patient had embolization of an Amplatzer VSD device during catheterization, and one had intraoperative coronary compression from a PA stent. At a mean follow-up of 14 months (2-26 months), one fontan patient required a heart transplant and one mVSD patient died suddenly 5 months after discharge. All other patients are doing well.

CONCLUSIONS: Combined catheter interventions and surgery are safe and reduce the magnitude of either procedure alone.

58 VIDEO-ENHANCED REPAIR OF SINUS VENOSUS ATRIAL DEFECTS: WITH/WITHOUT ANOMALOUS PULMONARY VENOUS DRAINAGE

Michael D. Black¹, Nancy Pike¹, Nikola Tede², Robert Popper²

¹Cardiothoracic Surgery, Stanford University, Stanford, CA, USA; ²Pediatrics, California Pacific Medical Center, San Francisco, CA, USA

OBJECTIVE: A minimally invasive surgical approach is frequently dismissed for the repair of anomalous pulmonary venous drainage (APVR) in association with a Sinus Venosus atrial communication (SVasd).

METHODS: Since 03/99, 15 patients (age 4 mo-27 yrs) underwent repair of SVasd with/without APVR. Pulmonary drainage patterns were: partial anomalous (n=3), mixed total anomalous (n=1) total right lung anomalous (n=7) and normal (n=4). Those with Scimitar Syndrome without ASD were excluded (n=2).

RESULTS: There was no mortality. Children (1 exception - temporary 2nd degree heart block) and adults were discharged in 2 and 3 days, respectively. The average weight was 29.9kg (8.6-65.5). The morphological types included: superior location (n=5) [partial APVR (n=2), total right APVR (n=3)], inferior location (n=6) [partial APVR (n=1), total right APVR (n=1), normal pattern (n=4)], and complete absence of the posterior septum (n=4) [total right APVR (n=5), mixed total APVR (n=1)]. A neo-superior vena cava (N-svc) was required in 3, patch closure in 12 and concomitant superior venoplasty in 1. Bilateral SVC was present in 2.

CONCLUSIONS: The identification of a malalignment type of atrial septal defect should raise suspicions with regards to APVR. Complex repairs are frequently required when the venous drainage remains distant from the cavo-atrial junction frequently requiring the creation of a N-svc. Video-enhanced repairs with/without robotics have allowed for a minimally invasive repair in all patients, allowing for rapid discharge, improved cosmesis and reduced tissue trauma regardless of age or weight.

59 MINIMALLY INVASIVE SURGERY FOR PATIENTS WITH STROKE, PATENT FORAMEN OVALE AND ATRIAL SEPTAL ANEURYSM

James A. Magovern¹, Jon Brillman²

¹Cardiothoracic Surgery and ²Neurology, Allegheny General Hospital, Pittsburgh, PA, USA

OBJECTIVE: Patients with previous stroke, a patent foramen ovale and atrial septal aneurysm (PFO/ASA) require chronic anticoagulation or closure of the defect. A minimally invasive surgical technique has been developed for this patient group as an alternative to anticoagulation or percutaneous closure.

METHODS: In a 42-month period, 35 patients have undergone surgical closure via a 3-inch right thoracotomy. A beating heart technique with cardiopulmonary bypass (CPB) was used. Access was from the femoral vein, superior vena cava and ascending aorta. The mean age was 42 years (range 20-80), 63% were female and most patients were otherwise healthy.

RESULTS: The PFO/ASA was directly sutured during an average CPB time of 35 minutes. Intraoperative transesophageal echocardiography showed complete closure in all patients. There were no deaths and no major complications. Seven patients (7/35, 20%) received red cell transfusions, but no platelets or plasma were transfused. Mean hospital stay was 4 days (range 3-7 days). At a mean follow-up of two years, all patients are alive with no recurrent strokes.

CONCLUSION: Minimally invasive surgery is a safe therapy for patients with PFO/ASA and previous stroke, and provides an effective alternative to life-long anticoagulation. Comparison of this procedure to percutaneous closure needs to be done.

60 TOTALLY ENDOSCOPIC INTRACARDIAC REPAIRS ON A BEATING HEART

Giovanni Speziali¹, Charles J. Bruce², Gregory Gilman², Donald D. Potter³, Richard C. Daly¹

¹Div. of Cardiovascular Surgery, ²Dept. of Cardiology, and ³Dept. of General Surgery, Mayo Clinic and Foundation, Rochester, MN, USA

OBJECTIVE: A totally endoscopic, intracardiac repair on a beating heart without the need for CPB represents a significant step forward in the concept of minimally invasive surgery.

METHODS: In anesthetized, intubated and fully heparinized calves, video-assisted thoracoscopic techniques were utilized to insert the tip of a non-valved (12 mm diam.) modified thoracoscopic introducer into the right or the left atrium percutaneously. A novel suture device, inserted through the introducer under trans-esophageal and intracardiac echocardiographic guidance, was utilized to place stitches on specific intracardiac structures. This device permits secure grasping of a structure or tissue margin (valve leaflet, ASD etc), and retrograde passing of a stitch and smooth retrieval of the needle/suture. Suture placement was confirmed using real-time intracardiac visualization with an endoscopic camera. Procedural safety was assessed by monitoring the following parameters: hemodynamic stability; intraoperative blood loss; incidence/severity of cardiac arrhythmias; incidence/severity of carotid air embolism.

RESULTS: Feasibility of the following procedures was confirmed: (1) Patch closure of an ostium secundum-type atrial septal defect (after creation of the same by surgical excision of the fossa ovalis). (2) Tricuspid and mitral valve leaflet and commissure approximation. Transesophageal and intravascular echocardiography and direct intracardiac visualization using an endoscopic camera allowed precise stitch placement. All experiments were completed without intraoperative mortality. After sacrifice, direct examination of the intracardiac repairs correlated with the procedural imaging findings.

CONCLUSIONS: A specially designed suturing device and integrated use of intracardiac visualization techniques permits intracardiac procedures to be performed endoscopically on a beating heart.

Moderated Poster Session

Saturday, June 21, 2003, 3:10 PM-4:30 PM

61 IMPLANTATION OF HEARTMATE, THORATEC AND ABIOMED LEFT VENTRICULAR ASSIST DEVICES WITHOUT CARDIOPULMONARY BYPASS: OFF-PUMP LVAD

Valentino Piacentino, III, Janice Jones, Dipin Gupta, Carol A. Fisher, Theresa Hollander, Arun K. Singhal, Mahender Macha, James B. McClurken, Satoshi Furukawa.

Division of Cardiac and Thoracic Surgery, Temple University School of Medicine, Philadelphia, PA, USA

OBJECTIVE: Left ventricular assist devices (LVAD) have been successfully used as a bridge to cardiac transplantation, recovery of the failing heart, and destination therapy in patients with decompensated heart failure (HF). Although results of the R.E.M.A.T.C.H. Trial are promising, early mortality remains high, and improvement of implantation techniques and post-operative management are critical for LVADs to realize their true potential as life-saving devices. Implantation of LVADs requires cardiopulmonary bypass (CPB), which may exacerbate multi-organ dysfunction and RV failure. Our goal was to (1) determine whether LVADs could be safely implanted without CPB support; and (2) assess intraoperative blood product requirements [packed red blood cells (PRBC) and non-PRBC (fresh frozen plasma and/or platelets)].

METHODS: Eleven patients between the ages of 45-77 (mean age, 60 years, 9 male) received a Thoratec, Heartmate or Abiomed LVAD with [LVAD-OnPump, (n=5)] or without [LVAD-OffPump, (n=6)] intraoperative CPB. All patients were inotrope-dependent in end-stage HF.

RESULTS: There were no intraoperative deaths. Intraoperative blood product requirements were significantly greater ($p < 0.05$) for LVAD-OnPump than LVAD-OffPump (mean \pm S.E.M., 4.6 ± 0.9 vs. 2.3 ± 0.6 units PRBC and 9.2 ± 2.3 vs. 2.2 ± 1.1 units non-PRBC).

CONCLUSIONS: These results suggest that implantation of LVADs in the absence of CPB (1) is feasible and (2) requires less intraoperative blood product replacement. Improved organ function and decreased levels of pre-reactive antibodies may be particularly advantageous to those patients receiving a LVAD as a bridge to cardiac transplantation. Furthermore, this refinement in implantation technique may further broaden the successful application of LVADs to older and sicker patients with HF.

62 A COST COMPARISON OF ROBOTIC VERSUS CONVENTIONAL CARDIAC SURGERY

Jeffrey A. Morgan, Barbara A. Thornton, Karen W. Hollingsworth, Takushi Kohmoto, Aftab R. Kherani, Deon W. Vigilance, Faisal H. Cheema, Eric A. Rose, Craig R. Smith, Mehmet C. Oz, Michael Argenziano

Surgery, Division of Cardiothoracic Surgery, Columbia University, College of Physicians and Surgeons, New York, NY, USA

OBJECTIVE: While potential benefits of robotically assisted cardiac surgery include decreased morbidity and improved recovery, some have suggested a prohibitively high cost. This study compares actual hospital costs of open and robotically assisted cardiac procedures.

METHODS: Clinical and financial data were obtained from our hospital database for patients undergoing atrial septal defect (ASD) or mitral valve repair (MVR). Procedures were performed by sternotomy or minithoracotomy (OPEN, n=68), or with robotic assistance (ROBO, n=30) using the Da Vinci system (Intuitive Surgical, Mountain View, CA). Total cost included direct and indirect costs and was further subdivided into operative and post-operative costs.

RESULTS: Intraoperative cost was higher for robotic ASD ($p=0.064$) and robotic MVR ($p=0.025$) as compared to open. However, there was no significant difference in total cost of robotic versus open procedures (Table).

CONCLUSIONS: Beyond the initial capital investment associated with robotic technology, robotic surgery does not increase total hospital cost. While intraoperative costs are higher for robotic procedures, they are offset by a less costly postoperative course. This may be secondary to a trend toward decreased ICU and hospital stay for robotic patients. Thus, the benefits of minimally invasive surgery may justify investment in this technology.

	Direct Cost	Indirect Cost	Total Cost	Operative Cost	Postoperative Cost
ASD OPEN	13958 \pm 7409	14667 \pm 8517	28625 \pm 15694	12444 \pm 5747	12367 \pm 8571
ASD ROBO	13829 \pm 4939	13571 \pm 5361	27400 \pm 10221	16264 \pm 5780	10358 \pm 6430
p	0.954	0.665	0.794	0.064	0.707
MVr OPEN	18595 \pm 10885	18758 \pm 11387	37351 \pm 22066	16611 \pm 5540	13019 \pm 6818
MVr ROBO	17284 \pm 5313	17516 \pm 7223	34800 \pm 12313	20549 \pm 4079	11539 \pm 10619
p	0.663	0.704	0.681	0.025	0.594

63 NON-INVASIVE EVALUATION OF CORONARY FLOW RESERVE IN Y-GRAFTED INTERNAL THORACIC ARTERY-DOES STEAL PHENOMENON OCCUR IN LAD?

Junjiro Kobayashi¹, Osamu Tagusari, Ko Bando, Kazuo Niwaya, Hiroyuki Nakajima, Michiko Ishida, Soichiro Kitamura, Norio Tanaka, Satoshi Nakatomi

Department of Cardiovascular Surgery National Cardiovascular Center, Suita, Osaka, Japan

OBJECTIVE: It is still controversial whether the left internal thoracic artery (LITA) with radial arterial (RA) Y composite graft provides sufficient blood flow to the left anterior descending artery (LAD) without steal phenomenon. We evaluated the coronary flow reserve (CFR) of LAD in patients with LITA to LAD bypass with or without RA Y composite graft.

METHODS: In selected 26 patients, who underwent complete off-pump arterial revascularization with only ITA and composite RA grafts including LITA to LAD bypass, CFR of the LAD was measured at maximum coronary hyperemia induced by intravenous adenosine infusion within 3 weeks after surgery using the trans-thoracic color Doppler echocardiography. Postoperative angiographic study revealed no stenosis at any anastomosis sites or in LITA in all patients. Patients were divided into 3 groups. Group I was composed of 6 patients who had bilateral ITA use without LITA and RA Y composite graft. Group II was composed of 6 patients who had bilateral ITA use with LITA and Y composite graft. Group III was composed of 14 patients who had total coronary revascularization with LITA and Y composite graft.

RESULTS: During adenosine infusion, heart rate and diastolic velocity increased from 66 beats/min and 34 cm/sec to 71 beats/min and 67 cm/sec, respectively. There was no significant difference among three groups in CFR of LAD (Group I: 2.17 ± 0.73 , Group II: 2.02 ± 1.01 , Group III: 2.24 ± 0.32).

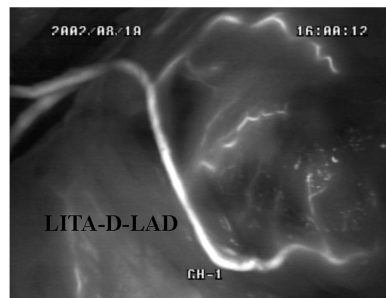
CONCLUSION: The CFR of the LAD is adequate even if the LITA was used as the single blood source for total coronary revascularization.

64 THE FIRST ASIAN EXPERIENCES USING INNOVATIVE SPY INTRA-OPERATIVE IMAGING SYSTEM

Masao Takahashi

Cardiovascular Surgery, Hiratsuka Kyosai Hospital, Hiratsuka, Japan

OBJECTIVE: Off Pump CABG has been rapidly increased, because of its less invasiveness with low complications. However, graft patency rate highly depends on operators' capability due to technical difficulties.



METHODS: SPY System is an innovative device developed for getting 100% graft patency. After low dose of ICG (Indocyanine Green) is injected via the central venous line, real time image movie of the graft and coronary artery can be observed immediately during surgery. Catheter insertion, X-rays and iodine contrast media are never needed. Side-effect rate of ICG is lower (0.17%) than iodine contrast media (1.6-4.0%).

RESULTS: Vivid and fantastic SPY images could be obtained in all 137 grafts of 34 OPCAB cases. In a radial sequential graft from aorta to high lateral and obtuse marginal branch, only SPY system could detect no blood flow of the graft, although transit-time flow meter showed diastolic dominant pattern. After reanastomosis, excellent flow image could be obtained by SPY system.

CONCLUSIONS: OPCAB using SPY Intra-operative validation may become a golden standard surgical management in the near future.

65 LESS INVASIVE CORONARY ARTERY RECONSTRUCTION VERSUS CORONARY ENDARTERECTOMY, IN THE TREATMENT OF DIFFUSE CORONARY ARTERY DISEASE. A COMPARATIVE ANALYSIS OF SURVIVAL AND GRAFT PATENCY

Mirko Doss, Jeffrey P. Wood, Sven Martens, Anton Moritz

Department of Thoracic and Cardiovascular Surgery, J.W. Goethe University, Frankfurt, Germany

OBJECTIVE: In the treatment of diffuse coronary artery disease, we have selectively applied the technique of reconstructing the diseased vessel by extending the arteriotomy over the lesion and simply performing a plaque-bridging anastomosis. The purpose of this study is to compare our results of coronary artery reconstruction with coronary endarterectomy, with regards to midterm graft patency and survival.

METHODS: Between May 1995 and December 1998, 174 consecutive patients either received coronary artery reconstruction (n=104) or coronary endarterectomy (n=70) in an effort to treat their diffuse coronary artery disease. The length of the arteriotomies ranged from 14 mm to 40 mm. We retrospectively analysed the bypass graft patency rates by coronary angiography or multidetector computed tomography.

RESULTS: Perioperative mortality was 3.8% (4/104) in the reconstruction group and 1.4% (1/70) in the endarterectomy group. Late mortality was 3.8% (4/104) in the reconstruction group and 4.2% (3/70) in the endarterectomy group. See Table for occlusion rates.

CONCLUSION: Less invasive coronary artery reconstruction is a valuable tool in the management of diffuse coronary artery disease. Overall graft patency rates were superior in the reconstruction group, whereas associated mortality rates were comparable between the groups.

Occlusion Rates

	Endarterectomy	Long Arteriotomies
LIMA-LAD	30% (3/10)	5.2% (1/19)
SVG-RCX	20% (1/5)	33% (3/9)
SVG-RCA	34% (13/38)	20.5% (8/39)

66 MINIMALLY INVASIVE SAPHENECTOMY USING THE SAPHLITE® RETRACTOR SYSTEM

Tobias Deuse, Sonja Schrepfer, Hendrik Treede, Christian Detter, Hermann Reichenspurner

Department of Cardiovascular Surgery, University Hospital Hamburg-Eppendorf, Hamburg, Germany

OBJECTIVE: Minimally invasive saphenous vein harvesting is supposed to improve the cosmetic result and to reduce postoperative complications. The aim of this study was to test feasibility of the SaphLITE® retractor system for saphenectomy and to compare postoperative complication rates with the open surgical technique.

METHODS: One hundred patients were included in this prospective, non-randomized trial. Saphenous vein harvesting was performed by minimally-invasive technique with the Genzyme SaphLITE® retractor system (group 1) or conventionally by open surgery (group 2) in 50 patients each. There were no significant differences in patient demographics according to age, sex, body mass index and comorbidities (diabetes mellitus, peripheral vascular disease and varicosis) between groups (p=n.s.).

RESULTS: Mean harvest time for 1cm of vein graft was 1.5 ± 0.8 and 1.4 ± 0.6 min. in group 1 and 2, respectively, and did not differ between the groups

(p=0.72). Mean incision length for 1 cm of vein graft was 0.3 ± 0.1 and 0.9 ± 0.3 cm, respectively and thus was significantly reduced with the SaphLITE® system (p<0.001). A mean of 2.7 incisions was performed in group 1 and device handling was excellent in all cases.

There were no differences in postoperative wound infection rates (p=0.12) between groups, but there was significantly less pain (p=0.005), patient discomfort (p=0.04), hematoma development (p<0.001), and a significantly increased patient satisfaction with the SaphLITE® system (p<0.001).

CONCLUSIONS: Minimally invasive saphenous vein harvesting using the SaphLITE® retractor system can be performed with superior cosmetic result, increased patient satisfaction and lower postoperative complication rates. Harvesting time is not prolonged with the SaphLITE® system.

67 DOES CORONARY ARTERY BYPASS IMPROVE SURVIVAL IN PATIENTS WITH END STAGE RENAL DISEASE (ESRD)?

Todd M. Dewey¹, Mitchell J. Magee¹, Morley A. Herbert², Syma L. Prince¹, James R. Edgerton¹, Christina M. Worley¹, Allison E. Leonard¹, Michael J. Mack¹

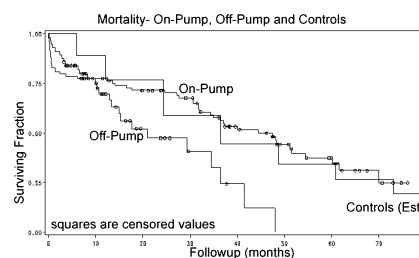
¹Cardiopulmonary Research Science and Technology Institute, Dallas, TX, USA; ²Medical City Dallas Hospital, Dallas, TX, USA

OBJECTIVE: Cardiovascular disease remains the most frequent cause of mortality for patients with ESRD. To determine the benefits from revascularization in this high-risk population, we reviewed our CABG patients with ESRD.

METHODS: From January 1995 through May 2002, 145 ESRD dialysis patients, underwent CABG: 55 patients (37.9%) off-pump, and 90 patients (62.1%) done using cardiopulmonary bypass (CPB). Preoperative risk factors and operative results were reviewed, along with longitudinal survival data.

RESULTS: Mean follow-up time was 37 months (range 0-76), with a mean survival of 36.4 months. Patients revascularized off-pump had an operative mortality of 3.6% while patients grafted using CPB had an operative mortality of 16.7% (p=0.02). The off-pump predicted risk of mortality ($9.28\% \pm 7.56$) was not statistically different from the on-pump risk ($8.51\% \pm 6.89$). Logistic regression analysis indicates that CPB use was an independent predictor of mortality p=0.02 (Odds Ratio =5.3, 95% CI: 1.2, 24.2).

CONCLUSION: Coronary revascularization in ESRD does not improve survival when compared to the historic mortality of 23 % per year in dialysis patients (United States Renal Data System). Initially, off-pump bypass grafting improves short-term mortality when compared with conventional revascularization, but this benefit is lost after one year.



68 CONVERSION OF ENDOSCOPIC, ROBOTICALLY ASSISTED CORONARY BYPASS: INCIDENCE, RISK FACTORS, AND OUTCOME

Thomas A. Vassiliades, James L. Nielsen, James L. Lonquist

Pensacola Heart Institute, Pensacola, FL, USA

OBJECTIVE: The clinical and financial consequences of conversion from endoscopic (robotically-assisted) atraumatic coronary artery bypass (EndoACAB) to conventional CAB (ConvCAB) have not been previously reported. This study sought to identify the incidence, causes, predictive factors and adverse consequences.

METHODS: Between July 1996 and December 2002, 468 patients underwent endoscopic atraumatic coronary artery bypass (EndoACAB) with an additional 19 patients converted to conventional CAB (ConvCAB). These groups were retrospectively compared using univariate and multivariate regression analysis. The converted ConvCAB group was then computer matched to a cohort of patients who underwent planned ConvCAB.

RESULTS: The overall rate of conversion was 3.9% (19/487). Causes were: inability to expose the target vessel(s) (8), unsuitable internal mammary artery (7), intra-thoracic bleeding (2), and hemodynamic instability (2)

(Table). There were no statistical differences in mortality or major morbidity between converted ConvCAB patients versus the planned computer matched ConvCAB patients ($p = NS$). Hospital costs for the converted ConvCAB patients were higher than the endoACAB patients, but not higher than the computer matched ConvCAB patients.

CONCLUSIONS: The incidence of conversion of EndoACAB patients to ConvCAB was low and often occurred under non-emergent circumstances. The clinical and economic consequences of conversion were minimal.

Factors Predictive of Conversion	p-value	Odds Ratio (95% CI)
Intra-myocardial LAD	0.01	2.3 (1.1-4.2)
IMA size < 1.5 mm or flow <20 cc/min	0.03	2.0 (1.1-3.5)
Clopidogrel therapy within 5 days of operation	0.005	2.7 (1.2-4.9)

69 A PROSPECTIVE LONG TERM FOLLOW-UP STUDY IN 200 CONSECUTIVE PATIENTS AFTER ENDOSCOPIC ATRAUMATIC CORONARY ARTERY BYPASS

Marek Cisowski¹, Agnieszka Drzewiecka-Gerber², Rafik Abu Samra¹, Andrzej Jaklik², Wojciech Kruczak³, Krzysztof Toczek³, Rafal Ulczok¹, Maria Trusz-Gluza², Andrzej Bochenek¹

¹First Department of Cardiac Surgery, ²First Department of Cardiology, and ³Department of Cardio-Anesthesiology, Medical University of Silesia, Katowice, Poland

OBJECTIVE: Atraumatic Coronary Artery Bypass technique consists of endoscopic IMA harvesting followed by an atraumatic chest incision through which a direct-vision anastomosis is performed.

METHODS: Between June 1998 and February 2002, we performed 247 ACAB procedures. In all the cases the endoscopic IMA harvest was employed. A total of 200 pts from this group, with anginal symptoms of CCS 2.57 + 0.7 were included to prospective follow-up study.

RESULTS: Mean follow-up period was 2.5 years. There were one early and two late deaths. MACE were observed in 6 pts (3%) and included: myocardial infarction (2 pts, 1%), aggravation of anginal status (4 pts, 2%). ECG exercise test was negative in 172 pts (86%). Eight pts (4%) were not able to perform stress test due to skeletal-muscular disorders. Quality of life was very good and good in 196 pts (98%). In 157 pts control coronary angiography was performed (78.5%). Angiographic studies showed patent LITA-LAD graft in 154 pts (98.1%). Three pts (1.9%) had totally occluded grafts. CAD progression was observed in 14 pts (8.9%).

CONCLUSIONS: The endo-ACAB is the safe and effective method of treatment proximal LAD lesions thus it may be the treatment of choice in patients with a high risk of stent restenosis. We believe that endo-ACAB approach will have a major impact on the management of coronary patient with type B or C lesion of LAD.

70 SUCTION DEVICE VERSUS PERICARDIAL RETRACTION SUTURES-COMPARISON OF HEMODYNAMICS USING DIFFERENT EXPOSURE SYSTEMS IN BEATING HEART CORONARY SURGERY

Jan F. Gummert¹, Joerg Raumann², Torsten Bossert¹, Markus Richter¹, Markus J. Barten¹, Volkmar Falk¹, Nico Doll¹, Thomas Walther¹, Friedrich W. Mohr¹

¹Cardiac Surgery and ²Anesthesia, HeartCenter Leipzig, Leipzig, Germany

OBJECTIVES: To investigate hemodynamics during OPCAB surgery comparing the Xpose™ suction device (XS) versus simple pericardial stitches (PS) exposing the backwall of the heart.

METHODS: 27 consecutive coronary patients (4 female) with 3-vessel disease were prospectively evaluated. Mean age was 70 ± 8 years and mean EF was 55 ± 18%. 2.9 ± 0.7 anastomosis were done per patient. Hemodynamics were measured using PICCO online cardiac output, Swan Ganz catheter and transthoracic echo. 18 expositions for grafting the inferior and 21 expositions for grafting the lateral wall were done with XS and PS in the same position / patient allowing the heart to recover to baseline hemodynamics between measurements.

RESULTS: All procedures were completed as OPCAB without any perioperative complications. The CI (l/min/m²) / MAP (mmHg) after opening the pericardium was 2.8 ± 0.5/87 ± 11, dropping to 2.4 ± 0.4/75 ± 12 exposing the LAD. Exposing the lateral wall CI / MAP dropped from 2.7 ± 0.3/93 ± 10 to 1.8 ± 0.6/67 ± 12 using XS and to 1.9 ± 0.6/68 ± 12 using PS ($p = n.s.$). Exposing the inferior wall CI / MAP dropped from 2.8 ± 0.4/88 ± 12 to 2.1 ± 0.4/69 ± 12 using XS and to 1.9 ± 0.4/68 ± 13 using PS ($p = n.s.$). Furthermore no

significant differences were seen on all other parameters (HVM, HR, ITBVI, TEE) as well.

CONCLUSIONS: The exposition of the backwall of the beating heart can be achieved with PS or the XS allowing a stable hemodynamic. On average the use of XS does not offer an additional hemodynamic benefit. However, in individual patients the use of XS may be favorable allowing a more stable hemodynamic.

71 USE OF BILATERAL SKELETONIZED ITA'S IN OPCAB SURGERY IS NOT ASSOCIATED WITH STERNAL WOUND COMPLICATIONS (SWC)

Vassilios Kotsis¹, John Panagiotopoulos¹, Alexandros Sidiropoulos¹, Dimitrios Protogeris¹, Fotini Danou², Sotirios Prapas¹

¹Cardiac Surgery Department and ²Anesthesiology Department, Henry Dunant Hospital, Athens, Greece

OBJECTIVE: Use of bilateral ITA's in classical coronary surgery is associated with high incidence (3-6%) of sternal wound complications. In our practice we routinely use bilateral skeletonized ITA's in OPCAB surgery. In order to evaluate the incidence of SWC we analyze the results.

METHODS: Within a period of 20 months we operated on 590 patients with isolated coronary artery disease. LITA alone was used in 53 cases and therefore these patients were excluded from the study. In the remaining 533 cases (86.6% males and overall mean age of 64.9 ± 7.6y) bilateral skeletonized ITA's were harvested. Risk factors included Diabetes in 166 patients, history of COPD in 51 patients and renal failure in 44 cases. 175 patients had preoperative LVEF <35% and 40 cases were reoperations. Sternal closure technique was based on alternative placement of figure of eight (3 in total) and single sternal wires.

RESULTS: Only one patient (82 y.o, male) underwent re-exploration of his sternal wound for superficial infection with good overall outcome. This case was a reoperation following preoperative long stay in ICU for unstable angina. Three patients reopened for bleeding and one for low cardiac output syndrome without any further complications. Mean ICU stay was 1.7 ± 0.9 days with early mortality rate of 1%.

CONCLUSION: The routine use of bilateral ITA's in skeletonized fashion in OPCAB surgery is not associated with sternal wound complications despite the presence of considerable risk factors.

72 MORBIDITY AND MORTALITY RATES IN PATIENTS UNDERGOING OFF-PUMP CORONARY SURGERY WITHOUT AORTIC MANIPULATIONS

Sotirios Prapas¹, Vassilios Kotsis¹, Alexandros Sidiropoulos¹, John Panagiotopoulos¹, Poli Stratigi², Spiros Mentzelopoulos², Konstantinos Rellos³, Argirios Michalopoulos³

¹Cardiac Surgery Department, ²Anesthesiology Department, and ³ICU Department, Henry Dunant Hospital, Athens, Greece

OBJECTIVE: To determine morbidity and mortality in patients undergoing off-pump coronary surgery without aortic manipulations.

METHODS: We prospectively recorded all perioperative complications and adverse outcomes in all patients who underwent off-pump CABG surgery within a period of 20 months. The surgical technique included diversion of bilateral internal mammary artery flow through preconstructed conduits with radial or saphenous vein graft, to the diseased coronary vessels. Composite grafts in the shape of T, Y and II, sequential anastomoses and right internal mammary artery extension with radial artery were used. Aorta non-touch technique was applied in all cases and total arterial revascularization in 92% of patients.

RESULTS: Five hundred and ninety patients were consecutively enrolled (511 males, 86.6%) of overall mean age of 64.9 ± 7.6 years. 194 patients had a preoperative LVEF (%) <35%, 57 and 49 patients had a history of COPD and chronic renal failure, respectively, and 184 were diabetics. Ascending aorta was atheromatous in 87 pts. Mean ICU length of stay was 1.7 ± 0.9 days. Perioperatively, two patients developed nosocomial infection (0.3%), 3 postoperative bleeding requiring re-exploration, 2 low cardiac output syndrome and 2 myocardial infarction. Postoperative atrial fibrillation amounted to 15%, whereas stroke did not occur in any case. Observed mortality was 1%.

CONCLUSIONS: OPCAB surgery without aortic manipulations is associated with a very low incidence of postoperative complications and/or adverse outcomes, despite the presence of considerable comorbidity. The method abolishes the possibility of stroke even in patients with atheromatic aorta.

73 OPCAB WITH A REUSABLE STABILIZER USING ALL ARTERIAL GRAFTS AND NO AORTIC MANIPULATION VIA A STERNOTOMY WITH SHORTENED SKIN INCISION. AS GOOD AS IT GETS?

Donald E. Ross

RNSH, Vaucluse, Australia

INTRODUCTION: The promise of reduced cerebral complications if the cross clamp and cardio-pulmonary bypass are avoided by using off pump techniques has been largely realised but the use of the ascending aorta for graft inflow in off pump surgery can have serious consequences. The partial clamp can initiate fatal aortic dissection and stroke producing athero-embolism. Clamp less connectors only use vein and have been associated with thrombosis and catastrophic haemorrhage. Hypercoagulability is an issue for off pump coronary surgery and has been implicated in graft thrombosis (particularly vein), and pulmonary embolism. The use of aspirin, arterial conduit and prophylaxis for deep venous thrombosis has largely solved these problems.

METHOD: Using a short skin incision, sternotomy, and a reusable stabilizer, 540 cases were done off pump, avoiding aortic manipulation by using one or both internal thoracic arteries for inflow with usually the radial artery added when necessary.

RESULTS: Of 820 off pump cases performed since July '99, 545 were done without aortic manipulation. 89% had all arterial grafts. Mean age: 68.5. Grafts per patient: 2.6. Redo: 10% Single graft: 178. Bilateral ITA harvested: 179. The rest involved skip, composite and T grafts. Mortality: 0.5%. Infarct 2.1%. Stroke: 0%. Mediastinitis: 0%.

CONCLUSION: It is possible, using the techniques described, to perform, off pump, full arterial revascularization safely and economically in most coronary bypass candidates.

74 IS RADIOGRAPHIC CARDIOMEGALYA NEGATIVE IMPACT FOR OFF-PUMP CORONARY ARTERY BYPASS GRAFTING?

Osamu Tagusari, Junjiro Kobayashi, Hiroaki Sakamoto, Ko Bando, Kazuo Niwaya, Hiroyuki Nakajima, Michiko Ishida, Takeshi Nakatani, Toshikatsu Yagihara, Soichiro Kitamura

Cardiovascular Surgery, National Cardiovascular Center, Osaka, Japan

OBJECTIVE: In off-pump coronary artery bypass grafting (OPCAB), exposure and stabilization of target coronary artery, which located on the back of the heart, is one of the key concern. The purpose of this study is to determine whether radiographic cardiomegaly (CTR > 0.6) is a negative impact or not for OPCAB.

METHOD: From March 2000 to July 2002, a total of 386 pts underwent OPCAB (320 male, mean age 67). Of these pts, cardiothoracic ratio (CTR) was over 60% in 29 pts (group I). These patients were compared with remaining 357 pts whose CTR were less than 60% (group II).

RESULT: Average number of distal anastomosis was 2.93 in group I and 3.20 in group II (p=0.13). Complete revascularization was performed in 93% of group I and in 95% of group II (p=0.57). Hemodynamic instability (hypotension, arrhythmia, increasing pulmonary pressure) during operation occurred in 2 pts of group I and in 10 pts of group II (p=0.21). There was 1 hospital death in group I and 3 in group II (p=0.27). Postoperative angiography was performed in 344 pts (96%). Graft patency was 97% (58/60) in group I and 97% (937/970) in group II (p>0.99).

CONCLUSION: OPCAB provides good early clinical and angiographic outcomes even in the pts with radiographic cardiomegaly. These results suggests that radiographic cardiomegaly is not a negative impact for off-pump coronary artery bypass grafting.

75 ROBOTICALLY SUTURED LIMA GRAFTS-INTRAOPERATIVE QUALITY CONTROL USING GRAFT ANGIOGRAPHY

Johannes Bonatti¹, Thomas Schachner¹, Nikolaos Bonaros¹, Michael Danzmayr¹, Guy Friedrich², Otmar Pachinger², Guenther Laufer¹

¹Cardiac Surgery and ²Cardiology, Innsbruck University Hospital, Innsbruck, Austria

OBJECTIVE: Totally endoscopic coronary artery bypass grafting is dependent on robotic technology. Little is reported on the quality of the anastomoses which are sutured using robotic techniques. The aim of this study was to investigate the immediate quality of robotically sutured LIMA grafts by intraoperative angiography.

METHODS: LIMA grafts to the LAD system were investigated in 23 patients. All anastomoses were sutured on the arrested heart using the daVinciTM (Intuitive Surgical) telemanipulation system. Suturing was carried out in a running fashion with 7/0 PronovaTM. 11 anastomoses were performed via sternotomy, 12 others were performed endoscopically.

RESULTS: All anastomoses were patent on first inspection. Target vessel spasm was noted in 18 cases (78%) but spasm resolved after intraluminal injection of nitroglycerine in all of these. Extravasation of contrast agent led to the diagnosis of one anastomotic leak (4%) and of one bleeding LIMA side branch (4%). In both cases surgical repair was performed on table. A local dissection of the LIMA caused by electrocautery was found in two cases (8%) and resulted in on table revision. No perioperative myocardial ischemia occurred and there was no hospital mortality.

CONCLUSION: LIMA grafts can be sutured with satisfying quality using robotic techniques. Suturing of the anastomoses on the arrested heart frequently leads to target vessel spasm but anastomotic patency seems to be adequate. Bleeding from the anastomosis or graft as well as local graft dissection may be problems which can be detected by intraoperative angiography and repaired immediately.

Poster Session

PO1 VETTATH'S PROXIMAL ANASTAMOTIC OBTURATOR

Murali P. Vettath, Dr. Sheen, Dr. Baburaj, Dr. Vamab, Dr. Kannan
Cardiac Surgery, Malabar Institute of Medical Sciences, Kozhikode, India

OBJECTIVE: All top ends of the vein grafts in coronary surgery are anastomosed on the aorta using a side clamp. As this can cause calcific embolisation to the brain we have been using this device where the anastomosis is performed without using the clamp.

MATERIALS AND METHODS: We have fabricated this simple device to perform the proximal anastomosis in 78 of the 90 OPCAB'S performed during the last five months.

RESULTS: We have made this obturator in different sizes, according to the sizes of the Aortic punch. Once the punch hole is made on the aorta, the obturator is introduced. The vein graft is then anastomosed on to the aorta as usual, leaving the sutures loose in the beginning. Once the suturing is complete, the Obturator is removed and the sutures tightened, and knotted. We sometimes use a purse string to prevent bleeding.

DISCUSSION: Using this device we have been successful in performing all our proximal anastomosis, and in turn avoiding any neurological complications. Another important point is that we need not have to reduce the arterial blood pressure, which we have to, if we need to side clamp the aorta. This device is also reusable as it is made of steel, and could be used even if we have a small island of normal normal aorta on a calcific aorta.

PO2 A FACILITATED SUTURE-LESS CORONARY ANASTOMOSIS THAT IS RAPID, REPRODUCIBLE AND GEOMETRICALLY OPTIMIZED

James A. Magovern¹, Eric E. Solien², Dale M. Groth², James G. Whayne³, Sidney D. Fleischman³, Charles S. Love³

¹Cardiothoracic Surgery, Allegheny General Hospital, Pittsburgh, PA, USA; ²River Valley Farms, Inc., Osceola, WI, USA; ³Converge Medical, Inc., Sunnyvale, CA, USA

OBJECTIVE: A rapid and reliable means for creating a coronary artery anastomosis may improve beating heart bypass procedures by reducing ischemic time and ensuring optimal anastomotic geometry.

METHODS: The Converge (Sunnyvale, CA) Anastomotic Coupler system relies on a set of mating Nitinol frames to clamp vessel tissues into a 30° end-to-side anastomosis. Concentric frames are attached to the bypass graft and are deflected with a specialized deployment tool for insertion into a standard arteriotomy. In vitro testing confirmed a minimally disruptive blood flow path, and excellent fatigue resistance. A total of 21 sheep were implanted with the Coupler. An autologous carotid artery was used as the bypass graft to a ligated circumflex coronary artery to establish a flow dependant model. Animals were electively sacrificed at 7 days, 90 days, and 1 year.

RESULTS: Coronary anastomoses could be reliably completed within 3 minutes. There were 4 early animal deaths due to surgical issues, but no intermediate or late deaths. Angiography and intravascular ultrasound showed 100% patency in all surviving animals at 3, 6 and 12 months. Pathologic examinations showed a widely patent anastomosis in all cases with no intimal hyperplasia and no anastomotic stenosis. The coupler frames were covered with a thin layer of endothelium-lined neointima.

CONCLUSION: These results demonstrate the feasibility of mating Nitinol frames to create a rapid and precise coronary anastomosis.

PO3 DOES USE OF PROXIMAL AORTIC CONNECTORS REDUCE INCIDENCE OF POSTOPERATIVE NEUROLOGICAL DEFICIT DURING OFF PUMP CORONARY SURGERY?

Nirav C. Patel, Nilesh U. Patel, Milan Patel, Sheila Sahani, Disha Patel, V A. Subramanian

Cardiovascular and Thoracic Surgery, Lenox Hill Hospital, New York, NY, USA

BACKGROUND: Proximal aortic connectors are increasingly used to perform proximal anastomoses on the aorta during off-pump CABG (OPCAB) as it avoids partial clamping of the aorta and reduces embolic load. We decided to study the effect of use of proximal aortic connectors on post-operative stroke in OPCAB patients.

METHODS: From June 2001 to July 2002, 250 patients underwent OPCAB using vein grafts at our institution. We used Symmetry Bypass System Aor-

tic Connector (St. Jude Medical) for proximal anastomoses in the connector group and side-biting aortic clamp for the no-connector group.

RESULTS: Seventy-one patients had aortic connectors used and 179 patients had partial aortic clamping for proximal anastomoses. The preoperative variables in each group are shown in the table. The incidence of post-operative stroke was 2.8% (n=2) in connector group and 1.7% (n=3) in no connector group (P=0.62). Even comparing patients in both groups with preoperative high preoperative stroke predictors there was no difference in post-operative stroke. (1 out of 33 in connector group and 1 out of 80 in no-connector group: 3% vs 1.3%; p=0.5.)

CONCLUSION: In comparing OPCAB performed at a single institution during same time frame with and without aortic connectors did not show difference in incidence of postoperative stroke.

Variable	Connector Group (n=70)	No-connector Group (n=70)	P value
Preoperative stroke	8.45% (n=6)	12.2% (n=22)	NS
Carotid/cerebrovascular disease	16.9% (n=12)	7.82% (n=14)	0.04
Aortoiliac disease	8.45% (n=6)	2.23% (n=4)	0.03
Femoral/popliteal	16.90% (n=12)	15.64% (n=28)	NS
COPD	7% (n=5)	1.7% (n=3)	0.04
Extensively calcified aorta	9.9% (n=7)	7.2% (n=13)	NS
Diabetes-on medication	43.7% (n=31)	44.4% (n=80)	NS
Renal failure	8.4% (n=6)	10.5% (n=19)	NS
EF<30%	22.5% (n=16)	15.0% (n=27)	NS

PO4 NEUROLOGICAL OUTCOME IN PATIENTS AGE 70 YEARS AND OLDER UNDERGOING OPCAB WITH USE OF SYMMETRY DEVICE

Kushagra Katariya, Pierluca Lombardi, Hassan Tehrani, Saeed Yassin, Saqib Masroor, Hooshang Bolooki, Tomas A. Salerno

Cardiothoracic Surgery, University of Miami/Jackson Memorial Hospital, Miami, FL, USA

OBJECTIVE: To compare neurological outcomes in patients age 70 and older undergoing off pump coronary artery bypass grafting (OPCAB) using the Symmetry aortic connector (St. Jude Inc.) with those in whom the aorta was partially clamped.

METHODS: From November 15, 2001, to October 1, 2002, 52 patients, age 70 years and older, underwent clampless OPCAB using the Symmetry aortic connector at the University of Miami (Group A). During the same period, 144 patients in the same age group underwent OPCAB surgery at the same institutions using partial occlusion of the aorta to perform proximal anastomoses (Group B). The demographic characteristics and comorbidities of patients in the two groups were similar. Retrospective analysis of medical records was done to assess for any new postoperative neurological deficits during the patients' hospital stay.

RESULTS: No new neurological deficits were noticed in patients from Group A (0%). Eight patients from Group B had new postoperative neurological deficits (5.5%) (p value < 0.01) of which 6 patients had a transient ischemic attack (TIA) and 2 patients had a stroke. Length of stay in the ICU and hospital length of stay was a mean of 1.3 days and 5.2 days in group A and 1.8 and 6.9 days in group B respectively.

CONCLUSION: There was a significant reduction in postoperative neurological events in patients in whom the proximal anastomosis was completed using the Symmetry aortic connector device as compared to using a partial occlusion clamp on the aorta.

PO5 PATENCY AND HEALING OF A VASCULAR ANASTOMOSIS CREATED WITHOUT INTIMAL APPPOSITION USING A NOVEL DEVICE AND CATHETER-BASED DELIVERY SYSTEM

Mitchell J. Magee¹, Michael J. Mack¹, Hani Shennib², Zhan Mitrev³

¹CRSTI, Dallas, TX, USA; ²Cardiothoracic Surgery, Montreal General Hospital, Montreal, PQ, Canada; ³Cardiothoracic Surgery, Phillip II, Skopje, The former Yugoslav Republic of Macedonia

OBJECTIVE: A novel concept of anastomosis using passive sealing achieved via pliable non-metal flanges connected by a flow channel is being evaluated for feasibility, healing, and patency.

METHODS: Fourteen vascular anastomoses were performed with devices delivered either by surgical technique (n=6) or proprietary catheter system (n=8) in 12 animals (6 sheep, 6 swine). In 8 control animals, a standard sutured anastomosis was also constructed with 5-0 or 6-0 polypropylene suture. Anti-platelet therapy was given and Doppler ultrasound and angiography assessments were performed throughout the survival period.

RESULTS: Hemostasis was achieved in all anastomoses delivered via delivery system (8/8). There were no incidences of post-operative leaking or device displacement. Histopathology demonstrates a prolonged phase of healing with neointimal formation and complete healing by 90 days.

CONCLUSION: The Vasconnect anastomosis system demonstrates that neointimal formation and healing occurs without intimal apposition or tissue ingrowth. The system is now undergoing evaluation in humans.

Patency without Control

Survival	45 d	90 d
Patent/Total	6/6 (100%)	4/4 (100%)

Patency with Controls

	14 d	45 d	90 d
Devices patent/total	7/8 (88%)	4/5 (80%)	3/3 (100%)
Controls patent/total	6/8 (75%)	4/5 (80%)	3/3 (100%)

P06 ULTRAFAST-TRACK ANESTHESIA IN MITRAL VALVE SURGERY

Peter J. Brucek¹, Jean-Paul Couetil², Zbynek Straka¹, Tomas Vanek¹

¹Cardiac Surgery, Univ.Hosp.Kralovske Vinohrady, Prague, Czech Republic;

²Cardiac Surgery, Groupe Hospitalier Bichat-Claude Bernard, Paris, France

OBJECTIVE: Ultrafast-track anesthesia is part of modern cardiac surgery. This study analyzes the impact of ultrafast-track anesthesia without thoracic epidural analgesia on the clinical outcome in patients undergoing mitral valve surgery (repair/replacement).

METHODS: Ultrafast-track anesthesia using short acting opiate remifentanyl, without epidural catheter insertion, was tested in 30 patients undergoing elective mitral valve surgery, i.e. mitral valve replacement, n = 17, mitral valve repair, n = 8, and mitral valve + aortic valve replacement, n = 5. Mean age of patients was 66 years (27-75); their mean preoperative ejection fraction was 54 % (25-70). Mean mean time of extracorporeal circuit was 77 minutes (41-119), mean cross clamp time was 59 minutes (31-101). Successful early extubation and its impact on the postoperative outcome were the study endpoints.

RESULTS: Twenty-seven (90%) of the study patients were extubated within 10 minutes after skin closure. None of the patients needed reintubation. One of the patients died. The mean ICU stay was 77 hours (40-336), mean administration of inotropic drugs was 52 hours (0-288). Mean hospital stay was 12 days (7-34). None of the patients developed any serious surgery-related complications. Episodes of atrial fibrillation occurred in 20% of the patients.

CONCLUSION: The results demonstrate that this ultrafast-track technique of cardiac anesthesia is also highly relevant in mitral valve surgery, typically coupled with long use of cross clamp and extracorporeal circuit.

P07 MANAGEMENT OF COMPLICATIONS OF EMERGENCY STENT-GRAFTING FOR ACUTE THORACIC AORTIC RUPTURES. EXPERIENCE AND LESSONS LEARNED

Mirko Doss¹, Joern Balzer², Sven Martens¹, Jeffrey P. Wood¹, Gerhard Wimmer-Greinecker¹, Thomas J. Vogl², Hans G. Fieguth¹, Anton Moritz¹

¹Department of Thoracic and Cardiovascular Surgery and ²Department of Diagnostic and Interventional Radiology, J.W. Goethe University, Frankfurt, Germany

BACKGROUND: The emergency endovascular treatment of acute ruptures of the thoracic aorta is associated with a higher risk for the patient than stent-grafting in an elective setting. Compromises in preoperative workup and stent-graft size have to be made, to keep the interval between onset of symptoms to treatment short. Therefore, not only the nature of the aortic pathology but also the nature of the procedure under these circumstances gives rise to complications. In this study we summarize our experiences and strategies in the management of complications of acute thoracic aortic stent-grafting.

METHODS: During the last three years emergency stent-grafting of the thoracic aorta was performed in 26 patients (18 ruptured thoracic aneurysms and 8 perforated acute type B dissections). After a mean follow up of 2 years, causes and outcomes of deployment related complications were evaluated.

RESULTS: See Table.

CONCLUSIONS: Emergency stent-grafting of the descending thoracic aorta is associated with predictable complications that can be reduced to a minimum if adequate management strategies are employed.

Complication		Management
Short time interval	n=26	Quick screening + readily available stents
Hemodynamic instability	n= 9	Intensive resuscitation protocol
Access failure	n=2	Preop scan + balloon dilatation of vessels
Iliac artery dissection	n=1	Additional iliac stents
Common iliac artery rupture	n=1	Endoballoon seal
Endoleaks	n=2	Oversizing by 3-5 mm
Hemothorax	n=26	Chest drain, thoracotomy

P08 HYBRID SURGICAL AND ENDOVASCULAR MODIFIED ELEPHANT TRUNK TECHNIQUE FOR THORACIC AORTA REPAIR: PROSPECTIVE STUDY

Alessandro S. Bortone¹, Donato D'Agostino¹, Emanuela De Cillis¹, Marco Aiello², Mauro Rinaldi², Mario Viganò², Luigi de Luca Tuppiti Schinosa¹

¹Cardiac Surgery, University of Bari, Bari, Italy; ²Cardiac Surgery, University of Pavia, Pavia, Italy

OBJECTIVE: We report our experience about stent-graft completion of elephant trunk technique in order to evaluate whether this new hybrid approach is not only safe and less invasive but also more effective if compared to the standard surgical procedure in high-risk patients.

METHODS: From March 2000, three patients (2M,1F) underwent this hybrid procedure, within 4 weeks, one affected by giant aortic aneurysm while the other two with acute type A dissection. In the last two patients elephant trunk was followed, by using Talent™ Medtronic devices, advanced in one patient via right common femoral artery, while in the other a retro-peritoneal right common iliac artery approach was chosen. In the patient with giant aneurysm elephant trunk was followed by endovascular completion through the right subclavian artery, by using Excluder® Gore system, to avoid the reflexion of distal prosthesis. Follow-up (range 1-33 months) was performed at 72 hours, 3 and 6 months and once a year, based on angio CT-scan.

RESULTS: Post-operative clinical course was uneventful and patients left the hospital within 5 days. CT-scan performed within 72 hours showed complete exclusion of the aneurysm and partial thrombosis of the aortic false lumen that became complete in 3 months. No case of paraplegia was observed neither dislodgement of the stent-graft.

CONCLUSIONS: The hybrid stent-graft repair seems to be safe, effective and less invasive option for thoracic aorta diseases. Furthermore, the short hospital stay and the absence of mortality, suggest the opportunity to study a larger group with longer follow-up.

P09 BENEFICIAL EFFECTS OF MAGNESIUM SULFATE ON REDUCING ATRIAL FIBRILLATION POST-OFF PUMP CORONARY BYPASS SURGERY

Fernando M. Jara, Jean M. Kalush, III

Cardiac Surgery, McLaren Regional Medical Center, Flint, MI, USA

OBJECTIVE: Post-operative atrial fibrillation adversely affects the recovery of post-coronary artery bypass graft patients, off pump appear to have reduce the severity of this complication although not eliminated. This study was conducted to evaluate the use of magnesium sulfate to prevent atrial fibrillation in the off-pump coronary bypass patient.

METHODS: Eighty five consecutive patients who underwent off-pump coronary bypass surgery received magnesium sulfate according with the following protocol: weight under 200 lbs received magnesium sulfate 2 gm, one hour prior to surgery and daily for 3 days and on patients over 200 lbs magnesium sulfate 3 gm was used; this group of patients was compared with eighty-five consecutive patients that received no magnesium sulfate.

RESULTS: On the control group twenty patients developed atrial fibrillation during their present hospitalization for an incidence of 23.5%, on the group that received magnesium sulfate ten patients developed atrial fibrillation for an incidence of 11.7%.

CONCLUSION: Atrial fibrillation is the most common complication following coronary artery bypass graft resulting in increase hospitalization. This study demonstrates significant reduction of atrial fibrillation with the use of magnesium sulfate without any deleterious effects. Further evaluation of this protocol appears to be warranted.

P11 SURGICAL TREATMENT OF CHRONICAL ATRIAL FIBRILLATION WITH RADIOFREQUENCY ABLATION DURING MITRAL VALVE REPAIR

Friedrich-Christian Riess, Hanns-York Helmold, Ralf Bader, Lorenz Hansen, Stephan Winkel, Niels Bleese

Cardiac Surgery, Albertinen Hospital, Hamburg, Germany

OBJECTIVE: New techniques are under investigation for the surgical treatment of atrial fibrillation (AF) as alternative to the Maze procedure. We present our approach of left atrial ablation during concomitant cardiac surgery using radiofrequency (RF).

METHODS: The video shows a mitral valve repair with partial resection of the posterior leaflet and annuloplasty. Chronical AF is treated by a modified Maze procedure consisting of a standard left atrial endocardial ablation using a Saline Irrigated Cooled Tip Radiofrequency Ablation (SICTRA) (Cardioblate, Medtronic, Minneapolis, MN, USA). A sponge behind the left atrium protects structures of the posterior mediastinum. While performing the ablation line between the left pulmonary veins and the mitral annulus, cold modified blood cardioplegia is administered in order to prevent damage to the circumflex artery. Between 7/2001 and 12/2002 a total of 34 patients (21 male/13 female), mean age 64.2 ± 9.5 years (32 to 82 years) suffering from chronic AF and additional cardiac diseases were treated with SICTRA by 5 different surgeons.

RESULTS: All operations were performed without complications. Until now in 26 (77%) patients the 6-months follow-up was carried out. 15 patients (57.7%) are in stable sinus rhythm, while the remaining 11 (42.3%) patients demonstrate AF.

CONCLUSIONS: Left atrial SICTRA offers a safe and easy-to-perform surgical method for the treatment of chronic AF. Considering the learning curve of several surgeons we expect our results to improve in the future with growing case numbers.

P12 FRUCTOSE-1,6-DIPHOSPHATE ADMINISTRATION ATTENUATES POST-ISCHEMIC VENTRICULAR DYSFUNCTION

Y. Joseph Woo¹, Jeffrey E. Cohen¹, Matthew D. Taylor¹, Mark F. Berry¹, Todd Grand¹, Jeffrey W. Burdick¹, H. Lee Sweeney²

¹Department of Surgery and ²Department of Physiology, University of Pennsylvania, Philadelphia, PA, USA

OBJECTIVE: Cardiomyocyte energy production during ischemia is dependent upon anaerobic glycolysis inefficiently yielding two ATP per glucose. Substrate augmentation with fructose-1,6-diphosphate(FDP) would bypass the ATP consuming steps of glucokinase and phosphofructokinase thus yielding four ATP per FDP. FDP is also a positive allosteric stimulator of phosphofructokinase and pyruvate kinase. This study sought to evaluate the impact of FDP administration on myocardial function after ischemia.

METHODS: Male Wistar rats, 250-300 g, underwent 30 minute occlusion of the left anterior descending coronary artery followed by 30-minute reperfusion. Immediately prior to both ischemia and reperfusion, animals received an intravenous bolus of fructose-1,6-diphosphate in Ringer's solution or Ringer's solution alone as a control. After 30min reperfusion, myocardial function was evaluated with a left ventricular intracavitary pressure/volume conductance microcatheter.

RESULTS: See Table. Compared to controls, FDP-treated animals demonstrated significantly improved maximal pressure generated (Pmax), rate of pressure generation (dP/dt), and ejection fraction.

CONCLUSIONS: The administration of the natural glycolytic intermediate substrate, FDP, by simple intravenous injection, resulted in significantly improved myocardial function after ischemia. Studies of histopathology and bioenergetic state are in progress.

Parameter	Control	FDP	p value
N	8	8	-
Pmax (mmHg)	69.1 ± 1.9	100.5 ± 5.4	0.0005
dP/dt (mmHg/sec)	2940 ± 175	5296 ± 531	0.0028
Ejection Fraction (%)	20.4 ± 1.4	29.1 ± 1.7	0.0017

P13 PRECONDITIONING WITH NITRIC OXIDE INFLUENCES LUNG DAMAGE AFTER NORMOTHERMIC ISCHEMIA IN AN IN VIVO PIG MODEL

Thomas Waldow¹, Konstantin Alexiou¹, Florian Wagner², Utz Kappert¹, Klaus Matschke¹, Michael Knaut¹, Vassilios Guliemos¹

¹Dept. of Cardiac Surgery, Heart Center Dresden University Hospital, Dresden, Germany; ²Dept. of Cardiac Surgery, University Hospital Eppendorf, Hamburg, Germany

OBJECTIVE: Using an *in vivo* pig model of warm lung ischemia, NO inhalation as preconditioning was used. Lung function, serum levels of reactive oxygen species (ROS), interleukins 1β and 6 (IL 1β, IL 6) and pulmonary epithelial and endothelial integrity were analyzed.

METHODS: After left lateral thoracotomy normothermic lung ischemia was maintained for 90 min, followed by a 5 h reperfusion period (group I, n=7). In group II (n=6) NO inhalation (10 min, 15 ppm) preceded ischemia. Group III (n=7) underwent sham surgery. Hemodynamics and lung function parameters were measured over time. ROS were determined by chemiluminescence. Interleukins were analyzed using enzyme immunoassays. Immunohistochemical markers for epithelial and endothelial cell integrity were as followed: Type I pneumocyte-specific Lycopodium esculentum agglutinin (LEA) and the capillary endothelium-specific Bauhinia purpurea agglutinin (BPA). Lung tissue was harvested after preparation of pulmonary hilum (H1) and after reperfusion (H2).

RESULTS: Animals in group I developed significant signs of pulmonary reperfusion injury. Application of NO attenuated pulmonary hypertension, while pO₂ levels from left-side pulmonary venous blood, levels of ROS and IL 1β, and integrity of pulmonary epithelium showed no significant differences compared to controls.

CONCLUSIONS: NO inhalation before lung ischemia improves lung function of the ischemic organ combined with decreased levels of ROS and IL 1β, and a protection of the alveolar epithelium. IL 6 response seems to be an IL 1β-independent phenomenon.

P14 EXPOSING EFFECT OF ATRIAL SEPTUM THROUGH MINOR THORACIC APPROACH

Wenlin Wang, Sr.¹, Kaican Cai²

¹Cardiac Surgery, Guangzhou General Military Hospital, Guangzhou, China; ²Cardiac Surgery, Nanfang Hospital, Guangzhou, China

OBJECTIVE: To evaluate the exposing effect of atrial septum through minor thoracic approaches.

METHODS: Superior partial median sternotomy, inferior partial median sternotomy, right parasternal approach, left parasternal approach, right anterolateral minor thoracotomy, left anterolateral minor thoracotomy, and minor median thoracotomy were imitated on twelve adult cadavers. In these thoracic approaches, the exposing effect of atrial septum was observed through the incision on right atrium.

RESULTS: In superior partial median sternotomy, its inferior end should be made at least to the third intercostal level, otherwise the atrial septum would not be exposed well. In inferior partial median sternotomy, its superior end should be made at least to the third intercostal level. The right parasternal approaches in the second and third, or third and fourth intercostal level could both expose the atrial septum well, but the latter was the better one. The right anterolateral minor thoracotomy in both third and fourth intercostal level could expose the atrial septum well. In minor median thoracotomy, the approaches in the third and fourth intercostal level could have satisfactory exposing effect. Both left parasternal approach and left anterolateral minor thoracotomy were not suitable for the exposing of atrial septum.

CONCLUSION: The minimally invasive approaches in the median or right part of thoracic wall could expose atrial septum well, but it was necessary to choose the suitable position and length of the approaches. Meanwhile, the establishment of cardiopulmonary bypass should also be considered carefully.

P15 POSSIBILITY FOR IMMUNOSUPPRESSIVETHERAPY AFTER LUNG TRANSPLANTATION USING PHOSPHODIESTERASE 4-INHIBITORS-AN EXPERIMENTAL STUDY

Ina Schade¹, Sylke Roth-Eichhorn¹, Katrin Plötze¹, Michael Kasper², Michael Knaut¹, Klaus Matschke¹, Vassilios Guliemos¹

¹Dept. of Cardiac Surgery, Heart Center and ²Institute for Anatomy, Dresden University Hospital, Dresden, Germany

OBJECTIVE: After lung transplantation the long-term survival is mostly limited by bronchiolitis obliterans syndrome (BOS). There is an evidence that epithelium damage and proliferation of fibroblasts are the important causes in developing BOS. Recent advances in understanding of immunomodulation by phosphodiesterase(PDE)4-inhibitors recommend these drugs for immunosuppression. The immunosuppressive potency of different PDE4-inhibitors was tested using an established model of heterotopic tracheal transplantation.

METHODS: Six groups of allogenic transplanted rats were compared at d5, d7, d28 (n=4-7) treated with: Rolipram (10 mg/kg/d), Ariflo™ (30 mg/kg/d), Roflumilast (2 mg/kg/d), CsA (10 mg/kg/d), CsA+Rolipram, untreated. The grafts were analyzed immunochemically for proliferating cells, epithelial cell markers, and obliteration. The staining was quantified by a digital morphometric system.

RESULTS: Differences in the acute (d5, d7) and chronic phases (d28) are shown in the table.

CONCLUSIONS: Positive effects could be evaluated for the chronic phase, in respect to the density of proliferating cells. The obliteration is probably related to epithelial disturbance in the early phase which could be not influenced by PDE4-inhibitors. An adjunct treatment affects the chronic phase by the combination of covering the epithelium and minimizing the proliferation of fibroblast. A combined treatment with CsA and PDE4-inhibitors could play an important role in the treatment of chronic airway obliteration after lung transplantation.

Results of Different PDE 4-Inhibitor Treatments

Treatment	Proliferating cells (cells/mm ²) [d5/d28]	% epithelium (respiratory/attenuated) [d7/d28]	% luminal obliteration [d7/d28]
Untreated	600/330	13/73/0/0	26/100
Rolipram	460/160	22/48/0/0	16/84
Ariflo	150/70	15/61/0/0	20/74
Roflumilast	300/50	26/64/0/0	20/100
CsA	270/370	88/12/16/25	17/31
CsA+ Rolipram	260/70	23/75/0/94	18/15

P16 RIGHT ATRIAL SURGERY WITHOUT CAVAL SNARING: ANIMAL MODEL

Reddy Dandolu¹, Douglas Eaton¹, Aras Ali², Nannette Schwann², Andrew Wechsler¹

¹Cardiothoracic Surgery and ²Cardiac Anesthesia, Drexel University, Hahnemann Hospital, Philadelphia, PA, USA

OBJECTIVE: An incidental clinical observation that right atrium can be opened without caval snaring was tested on an animal model.

METHODS: Two patients underwent right atrial surgery using percutaneous cannulation and no air was entrained without caval snaring. This principle was tested in an animal model using two pigs weighing 80 kg each. Percutaneous cannulae were placed under echo guidance with their tips 2.5 cm from the right atrium. A "collapsible bag with air drainage system" was devised to quantify air return from SVC and IVC. Two types of percutaneous cannulae with and without proximal side holes were tested.

RESULTS: In the animal model upon opening the right atrium air was entrained from the SVC cannula at 60 ml/min with no air from the IVC. There was no difference in the amount of air between two cannulae. Pressures measured at this time were +5 cm of water in IVC and -20 SVC. Partial clamping of SVC cannula reduced the amount of air to 60 ml/min and placing a straight clamp eliminated it. No air was ever noted in IVC cannula.

CONCLUSION: Inferior vena caval drainage by percutaneous cannula does not entrain air using either type of cannula and no snaring. This might be explained by competent Eustachian valve. Minimal air in SVC could be managed after its partial clamping or completely avoided by placing a small straight clamp.

P17 DIFFUSE ST SEGMENT ELEVATION: A COMMON FEATURE FOLLOWING MINIMALLY INVASIVE ASD CLOSURE

Nancy A. Pike¹, Luca A. Vricella², Rosewyn L. Ford², Michael A. Coady², Ana Carolina Coll³, Michael D. Black²

¹Cardiothoracic Surgery, International Heart Institute of Palm Springs, Palm Springs, CA, USA; ²Cardiothoracic Surgery and ³Pediatric Cardiology, Lucile Packard Children's Hospital at Stanford, Stanford, CA, USA

OBJECTIVE: Diffuse ST segment elevation has been well described following minimally invasive heart surgery. We investigated the role of acute pericarditis as the cause of diffuse ST segment elevation following atrial septal defect (ASD) repair in children.

METHOD: Between 1999 and 2001, 55 children underwent a minimally invasive repair of an isolated ASD. Mean age and weight of the 23 boys and 32 girls at operation was 5.9 ± 5.0 years (range: 6 mo-19 yr) and 24.4 ± 18.5 (range: 5.1-92 kg), respectively. The routine postoperative monitoring of ST segment elevation was performed by surface electrocardiography with regional wall motion abnormalities and inspection of possible pericardial effusions by echocardiography. ST segments were evaluated for regression at discharge.

RESULTS: Forty-two (76%) of the children had a secundum ASD, while 13 (24%) had a sinus venosus defect. Mean CPB time was 57.5 ± 27.2 minutes. An aortic cross clamp was applied in 15 children (27%) and fibrillation utilized in 40 (73%), mean 22.6 ± 12.2 minutes. ST segment elevations were noted in 41% (75%) patients with a mean of 6.7 ± 2.4 hours after surgery and remained independent from onset of fever. Twenty-five (45%) children had a postoperative insignificant pericardial effusion upon discharge. No regional wall motion abnormalities were detected. Fifty-eight percent of the ST segment elevations returned to baseline prior to discharge.

CONCLUSION: The incidence of ST segment elevation after minimally invasive ASD closure is consistent with a diffuse and limited acute pericarditis and not myocardial ischemia.

P18 A MODIFIED TWIN HOLE AORTIC CANNULA FACILITATING OPEN HEART SURGERY THROUGH A 5-CM MINI STERNOTOMY

Kıvanç S. Metin¹, Öztekin Oto²

¹Cardiovascular Surgery, Ege Sağlık Hosp., Izmir, Turkey; ²Cardiovascular Surgery, Dokuz Eylül Üniversitesi Tıp Fakültesi, Izmir, Turkey

OBJECTIVES: Lower mini sternotomy is an alternative approach for many cardiac operations. We prefer this technique for closure of atrial septal defects either primum or secundum type with additional anomalies such as cleft mitral valve, especially in pediatric group.

METHODS: Complete excision of thymus gland is essential for this method and aortic cannulation can be performed with the help of a clamp. In our initial experience, we have observed that arterial line pressure exceeds acceptable values due to hyperangulation of the tip of the conventional aortic cannula under the sternum. To solve this problem, we have modified the aortic cannulas. A hole in similar size of the original opening of the cannula tip was created beyond the curve of the cannula tip with a dentist's drill.

RESULTS: The result was satisfying with normal arterial line pressure levels throughout the operation without any additional technical difficulty, cost or morbidity.

CONCLUSIONS: We prefer those easy-to-produce cannulas are useful in many of the minimally invasive cardiac operations.



P19 THOROSCOPIC TRANS-ATRIAL LEAD PLACEMENT: A NOVEL PACING PARADIGM FOR PATIENTS WITH COMPLEX CONGENITAL HEART DISEASE

Michael D. Black¹, Robert Popper²

¹Cardiothoracic Surgery, Stanford University, Stanford, CA, USA; ²Pediatrics, California Pacific Medical Center, San Francisco, CA, USA

OBJECTIVE: Thrombosis of the superior vena cava may significantly limit the route(s) of access to the cardiac chambers for those in need of chronic car-

diac pacing. Although epicardial pacing remains a viable alternative, a minimally invasive thorascopic technique with the aid of fluoroscopy can be used to circumvent both pacing failure secondary to progressive epicardial fibrosis and the inherent risks of multiple redo-sternotomy incisions.

METHODS: A 34 year-old female with Trisomy 21 had previously undergone repair of her complete atrio-ventricular septal defect as a child. She was initially palliated with a pulmonary arterial band. She remains in complete heart block and has subsequently developed atrial flutter (AF) complicated by a reversible cerebral vascular accident. She since remains chronically anticoagulated. Impending battery failure, lead fracture and increasing thresholds were indications for pacemaker/lead placement. Additional diagnosis included, sleep apnea and significantly superior vena cava thrombosis.

RESULTS: A trans-atrial technique was devised which allowed for manipulation of the atria under direct thorascopic visualization allowing for the placement of right atrial purse strings. Under fluoroscopic guidance, both ventricular and atrial leads were successfully placed. Additionally, atrial flutter was converted to normal sinus rhythm using a rapid atrial burst technique. Excellent thresholds were ultimately achieved. The patient was discharged from hospital the following morning in normal sinus rhythm with predominant atrial pacing.

CONCLUSIONS: A novel minimally invasive thorascopic pacing paradigm can negate the dangers of redo-sternotomy and achieve results of more conventional trans-venous pacing technique in those with complex pediatric and adult congenital heart disease.

P20 THE HEARTSTRING: A NEW TOOL TO AVOID AORTIC SIDE CLAMPING

Piergiorgio Tozzi, Antonio Francesco Corno, Didier Locca, Ludwig Karl von Segesser

CardioVascular Surgery Dpt, Centre Hospitalier Universitaire Vaudois-CHUV, Lausanne, Switzerland

BACKGROUND: Aortic side clamping (ASC) is necessary for the construction of the proximal anastomosis with the suture technique when the heart is beating increasing the incidence of embolic cerebral lesions and neurocognitive deterioration in patients undergoing CABGs. A new anastomotic assist device is now available to avoid the ASC. This study analyzes its technical, ergonomic and functional aspects in an animal model.

METHODS: The Heartstring (Guidant, CA) consists of polyurethane suture fashioned in a spiral structure, inserted into the anastomotic hole providing a clampless hemostatic seal. It has been used to assist the construction of 5 proximal anastomoses in 3 sheep (65 ± 5 kg) undergoing off-pump CABGs. Aortotomy was done using a dedicated 4.5-mm puncher. The following parameters have been considered: quality of aortotomy; sealing off property measuring the blood volume loosed during the anastomosis construction at different blood pressures (120 and 200 mmHg); aortic intimal lesions; device ergonomic (handling, suture impairment, device removing); technical failure.

RESULTS: No intimal flaps were noted. Device insertion was easy. Leakage was 3 ± 0.5 ml/min with a blood pressure (BP) of 120/65 mmHg and 9 ± 1.5 ml/min with a BP of 200/95 mmHg. Any significant suture impairment and technical failure occurred. Pathology showed no alteration of the aortic intima up to 10 mm far from the anastomotic site.

CONCLUSIONS: Even if the amount of blood loss is small, a constant suction is needed to clean the operative field. The device is easy to handle and does not impair the anastomosis construction and does not cause endothelial lesions.

P21 END-STAGE ISCHEMIC HEART FAILURE: SURGICAL TREATMENT

Zan K. Mitrev, Jr., Tanja N. Anguseva, Anica Vasileva, Vlado Petrovski, Josevska Slagana, Vilma H. Ampova

Spec. Hospital for Cardiosurgery, Skopje, Macau

OBJECTIVE: Patients with medically refractory heart failure in time are listed for transplantation. Long waiting list and lack of organ donors have forced surgical alternative of left ventricle (LV) mass reducing combined with total myocardial revascularisation (TMR). The aim of this study was to determine survival and outcome in group of patients with terminal ischemic disease (IHD), after surgical treatment.

METHODS: From 03/2000 to 02/2002, 89 pts with IHD (NYHA class IV) underwent TMR combined with LV reconstruction. Three techniques for LV reconstruction have been utilized, (depending of dilatation dominant localization): direct circular repair for antero-apical aneurysm (DCR) (group I; n=66

pts), Batista procedure for posterior aneurysm (group II; n=9 pts) and DCR+Bat. for antero-apico-posterior aneurysm (group III; n=14 pts). We compared preoperative and postoperative echocardiographic, radioisotopic ventriculography, haemodynamic data and NYHA class, at intervals of zero and 12 months postoperatively.

RESULTS: Survival was 92.5%/98.5 in group I, 77%/100% in group II, and 71.5%/91.7% in group III at zero/12 months interval. Postoperative echocardiographia demonstrated reduction of EDV and ESV with increasing of EF in all 3 groups at zero/12 months (decrease of EDV was 37.3%/40% with group I, 41.2%/40% with group II and 47.4%/52% with group III, EF increased from 25 on 35% I, 25 on 30 II and from 15 on 30 group III). Survivors enjoyed better clinical outcome according to NYHA functional class (preoperative NYHA I vs NYHA II 12 months later; in all 3 groups).

CONCLUSION: Extensive and targeted resection of ischemically thinned myocardium in patients with end-stage IHD improves left ventricular function and forwards these procedures as an alternative in spectrum of surgical treatment of heart failure.

P22 NOVEL REAL-TIME AND CONTINUOUS MONITORING OF LEFT VENTRICULAR FUNCTION USING TRANSESOPHAGEAL ECHODOPPLER (ED) ALLOWS WEANING OF EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO)

Jens Garbade, Markus J. Barten, Thomas Walther, Ralf Krakor, Jan F. Gummert, Friedrich W. Mohr

Heart surgery, Herzzentrum Leipzig, University Leipzig, Germany

OBJECTIVE: Prolonged cardiogenic shock requiring temporary mechanical support following cardiac surgery occurs in approximately 1%. So far no method of real-time and continuously hemodynamic monitoring has been described to wean patients from ECMO.

The purpose of this study was to show practicability of ED compared with the established method of thermodilution (TD).

METHODS: Four consecutive patients with ECMO due to low cardiac output were monitored with ED (HemoSonic™100 Arrow, USA) and pulmonary catheter (PA7.5F, Baxter). Cardiac output (CO) and changes in echographic hemodynamic parameters under weaning from ECMO were assessed. ED measures blood velocity (5 MHz Doppler) and aortic diameter (10 MHz M-Mode) to calculate cardiac output (CCO). Further parameters like stroke volume (SV), acceleration (Acc) and systemic vascular resistance (SVR) were continuously observed with ED.

RESULTS: A total of 150 data pairs with TD and ED were obtained under 4 different ECMO flow-rates (T1: 4.5 ± 0.5 l/min, T2: 4.0 ± 0.4 l/min, T3: 2.8 ± 0.5 l/min, T4: without ECMO). CO measured by TD (1.9 to 6.0 l/min) and CO measured by ED (2.1 to 5.7 l/min) correlated highly (R=0.91). Among the ED parameters SVR decreased in the same time as SV and Acc increased (R= -0.97-0.99).

CONCLUSION: For the first time the ED provides a real-time continuously monitoring of CO with high correlation to TD method. New hemodynamic profile like Acc, SV and SVR were helpful to assess early alterations of left ventricular function. Further studies are needed to show the value of ED in patients with mechanical device.

P24 ACAB VS DIFFERENTLY MINIMALLY INVASIVE CARDIAC SURGERY TECHNIQUES

Tayfun Aybek¹, Selami Dogan¹, Paul Kessler², Mohammed Fawad Khan¹, Gerhard Wimmer-Greinecker¹, Anton Moritz¹

¹Department of Cardiovascular Surgery and ²Department of Anesthesiology, Intensive Care and Pain Therapy, University of Johann Wolfgang Goethe Frankfurt/Main, Germany

To evaluate the effect of different MIDCAB techniques on postoperative pain, mobilisation and pulmonary function we investigated patients with single revascularization of the left anterior descending artery. 25 patients had partial lower sternotomy (PLS) in the awake setting (ACAB, group A). 24 patients had PLS (group B), and 18 patients had LAST using general anesthesia (group C). Preoperative and postoperative (day 3) pulmonary function, activities of daily life, and visual analog scale (VAS) for postoperative pain were assessed. Total operation time was 78 ± 16 (group A), 88 ± 26 (group B), and 118 ± 32 min (group C) (A vs B ns, A vs C p<0.0001). In group A, no patient needed postoperative ventilation. Duration of ventilation amounted to 3.6 ± 2.3 in group B and 4.6 ± 1.8 h in group C (B vs C ns). Pulmonary function was comparable between group B and C on postoper-

ative day 3, whereas vital capacity was significantly greater in group A (74.4% vs 60.2% in group B [p<0.001] and 58.7% in group C [p<0.001]). VAS was significantly lower in group A (31 ± 4 mm) than in group B (52 ± 7 mm, p<0.0001) and in group C (61 ± 6 mm, p<0.0001). 18 patients in group A, 7 in group B and 5 in group C resumed activities of daily life on the day of surgery. ACAB leads to better preservation of pulmonary function, better pain control as well as faster postoperative recovery compared with conventional standard MIDCAB procedures.

P26 COMPLETE REVASCLARIZATION STRATEGIES UTILIZING TMR: CAREFUL PATIENT SELECTION MAY YIELD IMPROVED SURVIVAL

Douglas Schuch

Sutter Memorial Hospital, Sacramento, CA, USA

OBJECTIVE: To determine if improved patient selection can yield superior operative mortality when utilizing TMR as a hybrid or stand-alone surgical revascularization technique in patients suffering from severe refractory angina. **METHODS:** 109 consecutively treated TMR patients were followed for mortality from June 1999 through April 2002. TMR was used as a hybrid surgical technique, with 89 patients receiving CABG plus TMR and 4 patients receiving CABG+AVR with TMR. Patient selection required moderate to large areas of viable myocardium, an EF>30%, and one or more moderate to large unypassable vessels. 16 patients received stand-alone TMR revascularization via left anterior thoracotomy. These patients were required to have one or more areas of viable myocardium that were untreatable by CABG or PCI. Patients were required to be in NYHA angina Class III or IV pre TMR.

RESULTS: 100% follow-up was achieved. 30-day operative mortality was 1.08% when utilizing TMR for hybrid revascularization (CABG+TMR) and 0% when using TMR as a stand-alone therapy. Via STS Risk Stratification Analysis, the predicted operative mortality for the TMR hybrid revascularization group was 1.74%. Risk analysis yielded an observed/expected mortality ratio for CABG patients of 0.65% compared to a superior 0.62% (1.08/1.74) observed/expected mortality ratio for TMR as a hybrid technique.

CONCLUSIONS: TMR is safe and, in this experience, showed improvement in the observed/expected operative mortality ratio, when used as a hybrid technique, over standard CABG alone.

P27 CABG PLUS TMR HYBRID REVASCLARIZATION TECHNIQUE IMPROVES IN-HOSPITAL OUTCOMES

Kurt Wehberg, J S. Julian, James Todd, Nicholas Ogburn, Edward Klopp, Michael Buchness

Peninsula Regional Medical Center, Salisbury, MD, USA

OBJECTIVE: Transmyocardial Revascularization (TMR) has been recently used to treat patients with angina for whom angioplasty/stenting and/or coronary artery bypass grafting (CABG) is no longer an option.

METHODS: Minimally invasive TMR in combination with CABG was used in 52 patients with a mean angina score of 3.4 (CCSAS). Inclusion criteria were EF ≥ 30%, no identifiable surgical targets on anterior or lateral wall and documented reversible ischemia. Exclusion criteria were unstable angina, congestive heart failure, or recent MI. In-hospital (up to 30 day) outcomes were compared to matched CABG alone patients (n=219). Age (65.4 vs. 65.2 years) and Ejection Fraction (50.5 vs. 48.5%) were similar.

RESULTS: In this experience, hybrid TMR patients yielded encouraging in-hospital results, for mortality, readmit rates, and length of stay, as compared to CABG patients.

CONCLUSION: TMR, as a hybrid revascularization technique, is an effective and safe treatment for angina in selected patients with limited options.

Outcome	CABG Alone	CABG + TMR
Number of grafts	3.1	2.9
OR time, m	276.7	272.3
ICU time, d	2.1	1.7
Length of stay (ER→discharge)	9.4	7.3
Re-operative bleeding %	0.85	0
Renal Failure %	1.7	0
Respiratory Failure %	2.8	0
Neurologic Complications %	1.2	1.9
Re-admit 30 d %	7.8	1.9
Mortality %	2.12	0

P28 LIMA SEGMENTATION: A NEW TECHNIQUE FOR MAMMARY GRAFTING

Ramzi Ramadan, Nawwar Al Attar, Richard Raffoul, Francisco Nappi, Patrick R. Nataf

Cardiac Surgery, CCN, Saint Denis, France

OBJECTIVE: The left internal mammary artery (LIMA) is the preferred graft in CABG. With the technique of skeletonization, an excess of length of the LIMA should be considered as having the potential for more than 1 bypass in the presence of favourable coronary anatomy.

METHODS: To maximize the use of the IMAs, we describe a technique of grafting 2 distant coronary arteries with the LIMA, using its distal part segmented to construct a Y graft with either the in-situ LIMA or RIMA. Since December 2001 we applied this technique in 51 patients. Mean age was 62.5 years. (43-85); 14 patients had previous myocardial infarction. There were 35 diabetics. Mean EF was 59.5 % (24-79).

RESULTS: The number of grafts per patient was 3.18 (2-5). Four configurations were crafted:

1. LIMA-distal LIMA Y graft for LAD and ramus intermedius (20 pts) or diagonal (9 pts) arteries CABG
2. LIMA-distal LIMA Y graft for LAD or proximal marginal artery CABG (16 pts)
3. RIMA-distal LIMA Y graft for distal marginal arteries CABG (4 pts)
4. RIMA-distal LIMA Y graft for PDA and artery CABG (2 pts)

One patient with preoperative cardiogenic shock died from multi-organ failure 10 days after surgery without MI. There was no recurrence of angina. Angiographic control in 10 patients showed 100% patency.

CONCLUSIONS: In conclusion, this technique allows greater use of IMA-revascularization. By avoiding side to side anastomoses with the IMA, it facilitates total arterial OPCAB. Furthermore, manipulation of the aorta is obviated.

P29 RESTORATION OF MYOCARDIAL FUNCTION WITH COMBINATION ANGIOGENESIS THERAPY

Keith A. Horvath¹, John Doukas², Noam Belkind¹, Barbara A. Sosnowski², Rodney Greene¹, David A. Fullerton¹

¹Division of Cardiothoracic Surgery, Northwestern University Medical School, Chicago, IL, USA; ²Selective Genetics, Inc., San Diego, CA, USA

OBJECTIVES: The angiogenic response to gene therapy or transmyocardial laser revascularization (TMR) has been shown. We investigated whether a novel FGF2 gene formulation, providing a sustained release of adenoviral vector from a collagen-based matrix, in combination with CO2 TMR would lead to enhanced angiogenic response and improved function.

METHODS: Using a model of chronic myocardial ischemia, animals were randomized into 4 groups. Group 1: ischemic area treated with CO2 TMR (20 channels, n=5); Group 2: treatment with intramyocardial AdFGF2 in a collagen-based matrix (20 injections, n=8); Group 3: combination treatment of matrix AdFGF2 and CO2 TMR (n=10); Group 4: identical injections with aqueous AdFGF2 (no matrix, n=7). Left ventricular function was assessed by echocardiography and cine MRIs pretreatment and six weeks post. Angiogenesis was assessed by quantifying arterioles using anti-α-actin immunohistochemistry.

RESULTS: Matrix AdFGF2 + TMR treated areas had a 105% increase in arteriolar development vs. either treatment alone (p<0.05) and a 390% increase compared to aqueous AdFGF2 treatment alone (p<0.05). Contractility significantly improved in matrix AdFGF2 + TMR treated areas as measured by myocardial wall thickening (.61 ± .09cm pretreatment vs. 1.33 ± .11cm post-treatment, p<0.05). This functional improvement was confirmed by cine MRI, in which a 90% increase in the contractility of the treated segments was demonstrated. The other treatments provided significantly less restoration of myocardial function.

CONCLUSIONS: The increase in angiogenesis and concomitant improvement in myocardial function as a result of matrix AdFGF2 gene therapy in combination with CO2 TMR is greater than either therapy alone.

P30 ROBOTIC SKELETONIZING OF THE INTERNAL THORACIC ARTERY: IS IT SAFE?

Gil Bolotin, Walter W. Scott, Jr., Trevor C. Austin, Patrick J. Charland, Alan P. Kypson, L W. Nifong, Clifton C. Reade, Walter R. Chitwood, Jr.

Surgery, East Carolina University, Greenville, NC, USA

OBJECTIVE: The advantages of internal thoracic artery (ITA) skeletonization (SK) include early high blood flow, a longer conduit, and less bleeding than

pedical (P) ITA grafts. Longer conduits are needed for complete endoscopic arterial revascularization. Thus, this study was designed to determine the feasibility and safety of ITA skeletonizing using the da Vinci™ robotic system.

METHODS: Eight dogs underwent bilateral robotic ITA harvesting through three ports placed in the left chest. In each dog one ITA was harvested as a P; while the other was SK. ITA blood flow and pressure were monitored before, during, and after each harvesting. At the end Free ITA flow was measured in each graft. Comparative endothelial histological studies were done in all ITA grafts. Data are mean ± SEM.

RESULTS: All 16 ITAs were harvested successfully. SK-ITA harvesting required more time (48.0 ± 1.8) than P-ITA harvests (39.0 ± 1.4 min; p < 0.05). ITA flows during the final intervals were similar (SK = 30.0 ± 2.4 vs. P = 31.5 ± 1.8; p=0.9). Free ITA bleeding flow was similar in both groups (SK = 162.0 ± 3.0 ml/min vs. P = 189.0 ± 2.4 ml/min; p=0.4). Histologically both groups were similar with minimal endothelial damage.

CONCLUSIONS: Robotic skeletonized ITA harvesting is safe but requires more operative time. Despite muted tactile feedback with robotics, neither technique was associated histological or functional ITA damage. These encouraging results may represent an advantage for complete arterial revascularization in robotic coronary bypass patients.

P31 DIRECT LASER ANGIOGRAPHY FOR QUALITY ASSESSMENT OF BYPASS GRAFTS

Utz Kappert, Klaus Matschke, Jens Schneider, Michael Knaut, Vassilios Gulielmos

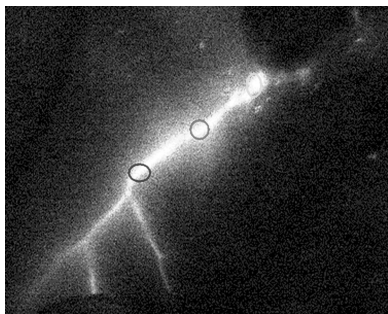
Dept. of Cardiac Surgery, Heart Center Dresden University Hospital, Dresden, Germany

OBJECTIVE: So far, no intraoperative digital method for an instant quality assessment has been proposed to judge the patency of bypass grafts in coronary artery surgery. Coronary angiography is always correlated to certain risks and is not always at hand. A noninvasive direct method of fluorescence laser angiography for the quality control of coronary anastomoses with a minimal OR setup is presented.

METHODS: We used an established method from plastic surgery for the measurement of blood flow and changed the procedure so that the contrast medium could be applied directly to the coronary artery grafts. Our protocol is based on the intraoperative application of an albumin adhering substance, which can be measured by means of its fluorescing nature via a digitally laser enhanced camera.

RESULTS: A first series of 5 patients suffering from coronary artery disease was operated on-pump in order to evaluate the efficacy of this new method. Graft patency, run-off and further lesions can be judged with direct laser angiography (DLA).

CONCLUSIONS: The results are positive and represent first steps in the development of an intraoperative quality assessment of bypass grafts by DLA and are aiming at establishing a safety standard for OPCAB surgery in addition to flow-measurement.



P32 CHANGE MANAGEMENT: BRINGING NEW TECHNOLOGY INTO CLINICAL PRACTICE

Francis D. Ferdinand, Candace Trace, Francis P. Sutter, Scott M. Goldman

Cardiothoracic Surgery, Lankenau Hospital and Institute for Medical Research/Main Line Health Heart Center, Wynnewood, PA, USA

OBJECTIVES: Multivessel beating heart surgical revascularization (OPCAB) may prove less invasive and provide more optimal outcomes. We introduced

this technology and procedure to our practice utilizing a process improvement system.

METHODS: A multidisciplinary team evaluated and implemented all aspects of the surgical procedure and protocols during hospitalization. All patient data are prospectively entered into our CV Database. Groups were defined as Pre OPCAB (Jan-Aug 2000) at the Introduction of OPCAB (Sept-Dec 2000), during the Adoption phase (Jan-Dec 2001) and finally, Acceptance (Jan-June 2002).

RESULTS: We progressed from utilizing OPCAB on 55.7% of patients during the Introduction phase to 92.2% OPCAB at present. Patient groups are not significantly different and outcomes have been stable during this transition as illustrated in the Table.

CONCLUSIONS: By utilizing a process improvement system we have been able to introduce a new and potentially better methodology for revascularization to all of the surgeons in our practice while maintaining stable clinical outcomes.

Transition to OPCAB	Pre OPCAB	Introduction	Adoption	Acceptance
n	191	149	474	204
OPCAB (%)	15.3	55.7	90.3	92.2
Distals (n)	3.67	2.92	3.38	3.31
Arterial (n)	2.01	1.85	1.95	1.92
OR Extubation (%)	14	30	60	75
Mortality (%)	3.14	2.40	1.40	1.06
STS Pred Risk (%)	2.16	2.53	2.83	4.01

P33 EFFECT OF OFF-PUMP CORONARY SURGERY ON GASTROINTESTINAL COMPLICATIONS

Nirav C. Patel, Nilesh U. Patel, Georgia Panagopoulos, John Mc Cabe, Didier Loulmet, V A. Subramanian

Cardiovascular and Thoracic Surgery, Lenox Hill Hospital, New York, NY, USA

OBJECTIVE: Gastrointestinal (GI) complications following CABG carry a high mortality rate. Off-pump revascularization(OPCAB) might reduce GI complications. However there are concerns about reduced splanchnic blood flow during cardiac manipulation for OPCAB. The purpose of this study is to determine the independent effect of OPCAB on GI complications during CABG.

METHODS: A total of 2143 consecutive cases undergoing isolated CABG between July 1997 to June 2002 were identified from our database. The GI complications recorded for this study included gastrointestinal bleeding, gastrointestinal perforation and ischemic bowel. We performed a multivariate logistic regression analysis to identify the risk factors for development of post-operative GI complications.

RESULTS: OPCAB was performed on 1490 patients and CABG on CPB was performed on 653 patients. The incidence of GI complications was 2.29% (n=15) in the on pump group and 1.2% (n=19) for the OPCAB group (p=0.06). The in-hospital mortality was significantly higher 41.2 % (n=14) in the patients who had a GI complication compared to patients who did not have GI complications 1.5% (n=32) (p<0.0001). The results of the multivariate logistic regression analysis are shown in the Table.

CONCLUSION: GI complications after CABG are associated with very high mortality. Patients receiving OPCAB are less likely to develop GI complications.

Logistic regression analysis for GI complications			
Predictor	Odds Ratio	95% CI	P value
Age	1.10	1.05-1.14	0.0001
Use of IABP	5.05	2.06-12.38	0.0001
Preop Dialysis	7.56	1.03-55.30	0.04
Preop Stroke	3.19	1.19-8.55	0.02
OPCAB	0.383	0.17-0.84	0.01

P34 INFLAMMATORY RESPONSE FOLLOWING OFF-PUMP AND ON-PUMP CORONARY ARTERY BYPASS GRAFTING

Marek M. Jemielity¹, Bartłomiej Perek¹, Piotr Buczkowski¹, Kinga Lesniewska², Krzysztof Wiktorowicz², Wojciech Dyszkiewicz¹

¹Department of Cardiac Surgery and ²Department of Biology and Environmental Research, Academy of Medical Sciences, Poznan, Poland

OBJECTIVE: The aim of our study was to assess if coronary artery bypass grafting (CABG) on beating heart can reduce systemic inflammatory reaction.

METHODS: Fifty patients undergoing CABG were randomly assigned to one of two groups. In the first group (23 males and 2 females) all the procedures were

performed on the beating heart (OPCAB group), in the second (20 males and 5 females) with the use of cardiopulmonary bypass (CCAB group). Serum concentrations of cytokines (cachectin [TNF- α], interleukin-6 [IL-6]) and acute phase proteins (C-reactive protein [CRP], α_1 -acid glycoprotein [AGP], α_1 -antichymotrypsin [α_1 -ACT], α_1 -antitrypsin [AT], ceruloplasmin [Cp], haptoglobin [Hp], transferrin [Tf] and α_2 -macroglobulin [α_2 -M]) were measured before sternotomy, then 1.5 h, 4 h, 12 h, 24 h, 48 h and 72 h postoperatively.

RESULTS: Il-6 serum concentration increased in both groups, but the peak level was significantly lower in OPCAB group (106.8 ± 60.9 pg/ml vs 276.2 ± 161.0 pg/ml; $p < 0.05$). The concentration of the CRP was significantly higher in CCAB group at 24 h (66.6 ± 35.5 mg/l vs 41.0 ± 22.8 mg/l; $p < 0.01$) and at 48 h (105.7 ± 57.0 mg/l vs 63.4 ± 33.5 mg/l; $p < 0.05$) postoperatively. In both groups the significant and comparable increase of AGP, α_1 -ACT, AT, Cp and Hp was found. In first 72 postoperative hours the levels of TNF- α , Tf and α_2 -M remained without any signs of increasing in both groups.

CONCLUSIONS: The inflammatory systemic response is more pronounced in patients undergoing on-pump revascularization. Elimination of CPB reduces but not completely inhibits acute phase reaction.

P35 DIABETICS UNDERGOING BEATING HEART SURGERY HAVE BETTER OUTCOMES COMPARED WITH CONVENTIONAL CORONARY ARTERY BYPASS SURGERY

Alex Zapolski, Laurel Mengarelli, Michael B. Pliam, Richard E. Shaw

San Francisco Heart Institute, Seton Medical Center, Daly City, CA, USA

OBJECTIVE: Prior research has demonstrated that coronary artery bypass surgery (CABG) done without cardiopulmonary bypass (CPB) results in a lower rate of cerebrovascular stroke (CVA) and reduced need for blood transfusions. The purpose of this study was to determine if diabetic patients undergoing CABG without CPB (OPCAB) experience benefits in addition to those previously reported for OPCAB patients.

METHODS: Between January of 1996 and September of 2002, 4,313 consecutive patients had isolated CABG. Of these, 549 were done OPCAB. In this sample, 1251 patients presented with a history of diabetes. Of these, 1109 (86.6%) had CABG with CPB and 142 (11.3%) had OPCAB. The STS expected probability of mortality was calculated for each group and found to be nearly identical (0.0361 vs. 0.0365, OPCAB vs. CPB), allowing for unbiased comparison of the groups. Data were extracted from a standard cardiac database.

RESULTS: OPCAB diabetic patients had lower in-hospital (0.7% vs. 2.3%) and 30-day mortality (0.7% vs. 3.7%; $p < 0.05$) compared with CPB patients. Although not statistically different, OPCAB diabetic patients had a lower rate of CVA (1.4% vs. 2.9%), post-operative renal failure (1.4% vs. 2.8%) and pneumonia (0.0% vs. 1.2%). Significantly fewer OPCAB diabetic patients required blood transfusions (40.8% vs. 50.0%; $p < 0.05$) and had a shorter time to extubation (11.5 hours vs. 17.5 hours; $p < 0.001$).

CONCLUSIONS: There are beneficial outcomes associated with using OPCAB in the treatment of diabetic patients with coronary disease. This approach should be considered to improve the overall management of the diabetic patient with coronary disease.

P36 IS ROUTINE MULTIVESSEL OFF PUMP CORONARY BYPASS BENEFICIAL IN WOMEN? IN HOSPITAL OUTCOMES IN 131 CONSECUTIVE FEMALE PATIENTS

Husam H. Balkhy, Curtis C. Quinn, Kathryn H. Lois, Carol M. Munsch

Department of Cardiac Surgery, St. Joseph Regional Medical Center, Milwaukee, WI, USA

OBJECTIVE: Female gender is identified as a significant risk factor for increased morbidity and mortality of coronary bypass surgery. Retrospective studies have shown early benefits of off-pump coronary bypass (OPCABG) when compared to on-pump surgery. Only a few have addressed its benefits in the female population. We reviewed our experience with OPCABG in women to evaluate safety and potential benefits.

METHODS: We analyzed 550 consecutive patients undergoing isolated OPCABG at our institution between 1999-2001. There were 131 female patients. They were compared to 130 female patients operated on with CPB prior to adapting routine OPCABG, as well as to a cohort of 419 male OPCABG patients.

RESULTS: Multivariate logistic regression, showed that CPB in women was a risk factor for major morbidity (odds ratio 3.1, $p = .014$), and prolonged hos-

pital stay (odds ratio 4.6, $p = .022$). Compared to the OPCABG cohort of men, OPCABG women had similar mortality and major morbidity despite having a higher predicted mortality ($p < .05$).

CONCLUSION: Multivessel off-pump coronary bypass is a safe procedure in women, and despite their higher risk profile, morbidity and mortality rates are comparable to men. In female patients off-pump bypass was associated with significantly reduced early morbidity compared to on-pump surgery.

In-Hospital Outcomes: OPCAB Women vs On-Pump Women, and OPCAB Women vs OPCAB Men

	Off-Pump Women (131)	On-Pump Women (130)	p value Women: Off Pump (131) vs On Pump (130)	Off-Pump Men (419)	p value Off-Pump: Women (131) vs Men (419)
Mortality	1 (0.8%)	5 (3.9%)	.097	11 (2.6%)	.310
Post-op stay	6.2	7.9	.004	5.9	.416
CVA	1 (0.8%)	4 (3.1%)	.173	4 (1.0%)	1.000
Postoperative IABP	0	5 (3.8%)	.029	4 (1.0%)	.577
Mean Number Grafts	3.4	3.6	.091	3.8	.001
Blood Products	76 (58%)	89 (69%)	.093	137 (33%)	.000
Atrial Fibrillation	25 (19%)	40 (31%)	.032	71 (17%)	.598
Renal Failure	1 (0.8%)	12 (7.2%)	.001	12 (2.9%)	.319
Prolonged Ventilator	4 (3.1%)	20 (15.4%)	.001	16 (3.8%)	.795

P37 RATIONALE OF OFF-PUMP CORONARY REVASCULARIZATION TO SMALL BRANCHES-ANGIOGRAPHIC STUDY IN 1283 ANASTOMOSES IN 408 PATIENTS

Kaoru Matsuura, Junjiro Kobayashi, Osamu Tagusari, Ko Bando, Kazuo Niwaya, Hiroyuki Nakajima, Soichiro Kitamura

Cardiovascular Surgery, National Cardiovascular Center, Suita, Japan

OBJECTIVE: Off-pump coronary artery bypass grafting (OPCAB) has been widely applied with the development of stabilizer and techniques. However, OPCAB to small branches is technically demanding and still controversial. In this present study, we evaluated the graft patency of anastomoses to small coronary arteries by early postoperative angiography.

METHODS: Between March 2000 and September 2002, a total of 1283 anastomosed sites to coronary branches were studied angiographically in 408 patients. The size of coronary artery branches were divided into large (≥ 1.5 mm) (Group L: 1035 anastomoses sites) and small (< 1.5 mm) (Group S: 248 sites) by intraoperative measurement.

RESULTS: Graft patency and stenosis free rates in Group S (95.9% and 91.9%) were as good as those in Group L (99.0% and 98.1%). In Group S, graft patency and stenosis free rate of SV grafts (66.7% and 50.0%) were significantly lower than those of ITA grafts (100% and 97%) ($p = 0.001$ and $p = 0.001$) and RA grafts (95.8% and 92.1%) ($p = 0.001$ and $p = 0.001$). Graft patency and stenosis free rate of bypass to OM (88.2% and 82.3%) were slightly lower than those to other implantation sites in Group S. There was no significant difference in patency and stenosis free rates according to anastomosis method (side-to-side: 97.7% and 96.0% vs end-to-side 95.0% and 89.9%) in Group S.

CONCLUSION: OPCAB to small coronary artery branches with arterial grafts provided satisfactory graft patency and stenosis free rate. Saphenous vein should not be used for OPCAB to small coronary branches. OPCAB to small OM branches may be technically demanding.

P38 THE IMPACT OF OFF-PUMP VERSUS ON-PUMP TECHNIQUES INCORONARY ARTERY BYPASS SURGERY ON POSTOPERATIVE MECHANICAL VENTILATION TIMES IN PATIENTS WITH DEPRESSED LEFT VENTRICULAR FUNCTION

Robert A. Lancey¹, Mo A. Hedeshian², Christian T. Campos²

¹Cardiac Surgery, Bassett Hospital, Cooperstown, NY, USA; ²Cardiac Surgery, University of Massachusetts Medical School, Worcester, MA, USA

OBJECTIVES: Depressed left ventricular function (LVF) has been associated with prolonged time on mechanical ventilation (MVT) after coronary bypass surgery (CABG). Off-pump techniques (OPCAB) have been found to lead to shortened MVT versus conventional (on-pump) coronary artery bypass procedures (CCABG).

METHODS: Data was gathered prospectively on 1551 consecutive patients who underwent CABG (OPCAB, n=1125; CCABG, n=426), followed by a standard extubation protocol. Mechanical ventilation times were calculated based on ejection fraction (EF) both as a dichotomous variable ($> 40\%$;

<40%) and as a continuous variable divided in quintiles (>30%, 30-40%, 41-50%, 51-60%, <60%) with data analyzed using analysis of variance.

RESULTS: Groups A and B were similar in age, mean EF, incidence of chronic lung disease, and preoperative risk scores. There was also no significant difference in reintubation rates, complications, or mortality. OPCAB patients required shorter MVT and ICU LOS. For CCAB patients, lower EF was associated with prolonged MVT, which did not hold true for OPCAB patients.

CONCLUSIONS: The use of off-pump techniques appears to limit the use of hospital resources which are scarce and costly without sacrificing clinical outcomes. OPCAB thus appears the preferred method of performing surgical coronary revascularization in those with poor LVF.

CCABG (n=1125)						p-value (ANOVA)
Ejection Fraction (%)	<30	30-40	40-50	50-60	>60	
Ventilation Time (hours)	52.9 ± 65.6	30.7 ± 54.9	25.3 ± 50.9	24.8 ± 56.6	22.2 ± 45.2	<0.001
ICU Length of Stay (days)	4.2 ± 3.9	2.9 ± 3.5	2.3 ± 2.8	2.5 ± 3.3	2.5 ± 3.7	<0.001

OPCAB (n=426)						p-value (ANOVA)
Ejection Fraction (%)	<30	30-40	40-50	50-60	>60	
Ventilation Time (hours)	12.6 ± 9.7	16.1 ± 27.8	8.9 ± 19.7	12.0 ± 23.2	11.0 ± 13.8	0.26
ICU Length of Stay (days)	2.1 ± 1.5	2.5 ± 3.2	2.1 ± 2.7	2.1 ± 2.0	1.9 ± 1.4	0.51

P39 AN ALTERNATIVE APPROACH FOR THE TREATMENT OF ACUTE MYOCARDIAL INFARCTION-OPCAB

Heiko Sahre¹, Utz Kappert¹, Markus Eller¹, Joachim Nicolai², Nicolaus Hartmann², Michael Knaut¹, Klaus Matschke¹, Vassilios Guliemos¹

¹Dept. of Cardiac Surgery and ²Dept. of Cardiac Anesthesiology, Heart Center Dresden University Hospital, Dresden, Germany

OBJECTIVE: Acute myocardial revascularization after myocardial infarction is associated with high morbidity and mortality. Myocardial revascularization without cardiopulmonary bypass has been proposed as an alternative technique to decrease the operative risk. We present a retrospective analysis of patients receiving OPCAB surgery at our institution while in acute infarction.

METHODS: From 01/2000 to 10/2002 among 582 patients which underwent OPCAB (off pump coronary artery bypass) surgery, 37 patients (6.4%, age 67 ± 9 years; LVEF 50 ± 14%) were operated on during an ongoing acute myocardial infarction. 27 patients (73%) were admitted to surgery for acute revascularization, 10 patients (27%) received a re-do procedure after conventional CABG, and 3 patients (8%) out of the series were operated in cardiogenic shock. All patients received surgery after a mean time of 16 ± 37 hours (min 1 h, max. 114 h).

RESULTS: Mortality rate was 13.5%, mean number of grafts per patient was 2.2 ± 1.0. Five patients (13.5%) received an IABP preoperatively and 4 patients (11%) postoperatively. Twelve patients (32%) had additional inotropic drug support. All perioperative data were recorded and analyzed.

CONCLUSIONS: The presented results suggest that OPCAB procedures in acute myocardial infarction present more than a reasonable alternative to CPB procedures if patients are not operated in cardiogenic shock.

P40 OPCAB, AORTA NON-TOUCH, TOTAL ARTERIAL REVASCLARIZATION IN REDO CASES

Alexandros Sidiropoulos¹, Vassilios Kotsis¹, Ioannis Panagiotopoulos¹, Dimitrios Protogeros¹, Eleni Kouri², Sotirios Prapas¹

¹Cardiac Surgery Department and ²Anesthesiology Department, Henry Dunant Hospital, Athens, Greece

OBJECTIVE: OPCAB has grown due to the fact that it avoids the negative physiological effects of cardiopulmonary bypass. The favorable results of total arterial myocardial revascularization led us in the development of a method which combines OPCAB with the use of preconstructed conduits based on the two skeletonised mammaries in order to avoid any manipulations on the aorta. We report our experience of applying this method in Redo cases.

METHODS: From 06/2001 until 11/2002 38 patients (pts) were reoperated in our institution with the intention of OPCAB-surgery. Age ranged from 47 to 82 years. According to Euroscore analysis 32 pts were at high (84%) and 6 pts at medium risk. The flow resource based on one ITA in 19 pts, on both

ITAs in 16 and on ITAs and ascending aorta in 3 pts. Total distal anastomoses number was 75 (1.95 per patient). Left radial was used in 16 pts, both radials in 4 and vein grafts in 3.

RESULTS: One case had to be converted to cardiopulmonary bypass. Aorta non touch technique was possible in 34 cases (89%). Total arterial revascularization was achieved in 35 pts. (92%). Early mortality (30 days) was zero. One pt. was supported with intraaortic balloon, another one was reopened for bleeding and 9 cases suffered postoperative atrial fibrillation.

CONCLUSIONS: OPCAB surgery can be safely performed in Redo cases in combination with no aortic manipulations using all the available arterial conduits. This method is the procedure of choice in our practice and associated with a low morbidity.

P41 IS PRIMARY OFF-PUMP CABG AN OPTION IN ACUTE MYOCARDIAL INFARCTION?

Stanislaw Wos, Marek J. Jasinski, Ryszard Bachowski, Wojciech Ceglarek, Kazimierz Widenka, Marek Deja, Marek Gemel, Wojciech Domaradzki, Piotr Olszowka, Adam Szafrank, Dariusz Szurlej

2nd Dept. of Cardiac Surgery, Katowice, Poland

OBJECTIVE: Aim of this prospective study was to evaluate risk factors for off-pump CABG (OPCAB) in ACS and AMI.

METHODS: 165 consecutive urgent and emergency CABG patients due to AMI referred to one surgeon were operated without CPB. All of those 165 ACS were troponine positive (by definition); among them there were 46 AMI operated during first 72 hours - group named "AMI early." Sixteen preoperative and operative discrete variables (age, sex, ejection fraction, myocardial infarction, acute myocardial infarct (<1 week), myocardial infarct (>1 week), acute coronary syndrome, CCS class, NYHA class, hypertension, diabetes mellitus, renal failure, chronic obstructive pulmonary disease, redo, atheroscleromathosis, LV aneurysm) were tested, with end-points being 30-day hospital mortality.

RESULTS: Overall 30-day mortality was 4.24% (n=7) for ACS group and 10.9% (n=5) for "AMI early" group. Univariate analysis revealed operation in AMI <72 hours ("AMI early") as only predictor (p=0.022, OR- 7.07, CI- 1.3- 37.5). Multivariate logistic regression analysis for overall 165 patients revealed "AMI early" (p=0.03, OR-8.6), female gender (p=0.01, OR-15.7), LV aneurysm (p=0.03, OR-13.8), perioperative IABP (p=0.03, OR-12) and renal failure (p=0.05, OR-2) as independent risk factors for 30-day mortality. In "AMI early" group female gender (p=0.001, OR- 32.5), perioperative IABP (p=0.03, OR- 12.1) and diabetes (p=0.05, OR-2.1) appeared to be the risk factors.

CONCLUSIONS: OPCAB is a valuable approach in AMI; however it carries significant mortality and morbidity when performed within 72 hours of myocardial infarction. Careful preselection, early preoperative IABP support and timing of intervention warrant optimal results.

P42 A COMPARISON OF ON AND OFF PUMP RE-DO CORONARY ARTERY BYPASS SURGERY

Farah Bhatti, Joel Desmond, Suzanne Chaisty, Danny Keenan

Manchester Heart Centre, Manchester Royal Infirmary, Manchester, United Kingdom

OBJECTIVE: Off pump coronary artery bypass (OPCAB) surgery has become an accepted option in patients requiring surgical revascularisation. We wished to examine the role of OPCAB surgery in the re-do patient population.

METHODS: We retrospectively reviewed a single surgeon's practice of re-do coronary artery surgery between April 1997 to August 2002. We compared the on pump (ON) and off pump (OPCAB) groups for outcomes including mortality and major morbidity. We also reviewed the management of any patent left internal mammary arteries (LIMA). Fisher's Exact test was used for categorical variables and the Mann Whitney U test for rank variables and non-parametric continuous variables.

RESULTS: There were no significant differences between the two groups in terms of morbidity and mortality. Two LIMAs required repair in the ON group, while none were damaged in the OPCAB group.

CONCLUSIONS: Off pump coronary artery surgery in the re-do setting carries an acceptable morbidity and mortality. In addition, there is a trend towards a shorter ICU and hospital stay and a lower incidence of atrial fibrillation. Technically, OPCAB offers additional options, especially in the increasing group of patients having repeat coronary artery surgery who have a patent pedicled left internal mammary graft.

Comparison of on and off pump surgery in re-do coronary artery surgery

	ON (n=57)	OPCAB (n=27)	p-value
Parsonnet score	10.1	9.3	0.5
Death	1.75%	0%	1
ICU stay	2.56 days	1.15 days	0.27
Hospital Stay	9.2 days	8.3 days	0.23
Atrial Fibrillation	17.5%	11%	0.53
Bleeding	0%	4%	0.32
Sternal Wound infection	0%	0%	
Stroke	0%	0%	

P43 PERFUSION FLOW ASSESSMENT OF CORONARY SHUNT DURING OPCAB

Hirokuni Arai, Akira Kozakai, Susumu Manabe, Satoru Kawaguchi, Masato Shimizu, Koso Egi, Noriyuki Tabuchi, Hiroyuki Tanaka, Makoto Sunamori
Cardiothoracic Surgery, Tokyo Medical & Dental University, Tokyo, Japan

OBJECTIVE: To prevent myocardial ischemia during OPCAB, coronary shunt is widely utilized. Although its clinical effectiveness has been reported, the actual perfusion flow has not been well assessed. The purpose of this study is to evaluate actual shunt flow and its pattern during passive coronary perfusion in clinical OPCAB

METHODS: In 9 OPCAB cases, the coronary perfusion flow of the external shunt during anastomosis and the free flow of the shunt were measured using in-line electro-magnetic flow probe. The perfused coronary was either LAD or RCA and the inflow of the external shunt was either femoral artery (FA) or ascending aorta (AA).

RESULTS: Passive perfusion flow was 15 ± 5 ml/min for LAD irrespective of inflow site or shunt size, and 22 ± 14 ml/min for RCA. Those were sufficient to prevent myocardial ischemia during anastomosis. Diastolic/systolic flow ratio was larger when shunt was perfused from FA.

CONCLUSIONS: Although the difference of the inflow site showed no effect on net flow of the shunt, more physiological flow pattern was obtained when shunt was perfused from femoral artery. The perfusion flow of shunt may be regulated depending on the resistance of the distal coronary artery provided that the free flow is sufficient.

Shunt size (mm)	2.0	1.7	1.7	1.4
Coronary	RCA	LAD	LAD	LAD
Inflow	FA	FA	AA	AA
Free flow (ml/min)	49	38	39	19
Perfusion flow (ml/min)	22	15	14	14
Diastolic/systolic flow ratio	1.43	1.72	0.55	0.71

P44 INFLUENCE OF INNOVATIVE TECHNIQUES ON MID-TERM RESULTS IN PATIENTS WITH OPCAB AND MIDCAB SURGERY

Ioannis K. Toumpoulis¹, Constantine E. Anagnostopoulos², Hani Shennib³, Joseph DeRose, Jr.², Daniel Swistel²

¹Cardiac Surgery, University Hospital of Ioannina, Ioannina, Greece; ²Cardiac Surgery, St. Luke's/Roosevelt Hospital Center at Columbia University, New York, NY, USA; ³Cardiac Surgery, McGill University, Montreal, PQ, Canada

OBJECTIVE: There is need for documentation of mid-term OPCAB and MIDCAB results.

	OPCAB	CABG	P-value	OPCAB	CABG	P-value
	1992-1997	1992-1997		1998-2002	1998-2002	
EuroSCORE	11.5 ± 1.8	11.4 ± 0.3	0.949	13.2 ± 1.5	13.3 ± 0.4	0.946
Complications %	11.5	16.6	0.333	10.1	12.6	0.502
Risk adjusted 30-day mortality	1.2%	0.7%	0.524	0.5%	0.7%	0.641
LOS	13 ± 1.5	11.7 ± 0.3	0.489	7.2 ± 0.6	9.6 ± 0.3	0.019*
Kaplan-Meier avg survival, mo	82.1 ± 0.9	94.5 ± 0.9	0.023**	47 ± 2	46.4 ± 0.6	0.534

Statistically significant: *t-test, **log-rank.

METHODS: 3670 coronary artery bypass patients were risk stratified by EuroSCORE. 52 OPCAB and MIDCAB between 1992 and 1997 were compared with 1796 on pump patients (CABG) of similar EuroSCORE. 89 OPCAB and MIDCAB between 1998 and 2002 (employing "innovative tech-

niques") were compared with 796 CABG patients. National Death Index assessed mortality and Kaplan-Meier curves were constructed. Arterial grafts, number of anastomoses, complications and length of stay (LOS) were noted. **RESULTS:** See Table.

CONCLUSIONS: The advent of innovative surgery significantly improved LOS and "equalized" survival to five years in OPCAB and MIDCAB patients when compared to similar risk "on pump" CABG patients.

P45 OFF-PUMP CORONARY ARTERY BYPASS GRAFTING DECREASES MORTALITY AND MORBIDITY IN HIGH-RISK PATIENTS

Saed Jazayeri¹, Etienne Tatou¹, Marie Carmen Gomez Bielefeld², Montejab Saleh¹, Olivier Bouchot¹, Roger Brenot¹, Michel David¹

¹Department of Cardiovascular Surgery and ²Department of Cardiology, Dijon University Hospital, Dijon, France

OBJECTIVE: Coronary artery bypass grafting in high-risk patients carries substantial morbidity and mortality. In high-risk surgical patients avoiding cardiopulmonary bypass (CPB), cardioplegic arrest and cross clamping may reduce these complications. The aim of this study was to compare the operative morbidity and mortality between two groups of consecutive high-risk patients, using cardiopulmonary bypass and cardioplegic arrest versus off-pump coronary artery bypass grafting (OPCABG).

METHODS: From January 1997 to December 2001, clinical data for consecutive patients undergoing coronary artery revascularization were prospectively collected. Utilizing a Parsonnet risk stratification model we analyzed from 1523 patients who were operated for CABG in our institution the data of a group of high-risk patients. High-risk patients were defined as those with a Parsonnet score of 20 or greater.

RESULTS: The study group comprised 234 consecutive high-risk patients, 80 (34%) of whom underwent an OPCABG. The 2 groups were identical for all different risk factors except for chronic renal insufficiency and renal dialysis. More chronic renal insufficiency and renal dialysis were noted between the patients in OPCABG group ($P < 0.05$). An average of 3.02 ± 0.88 grafts/patient for on-pump patients versus 1.95 ± 0.88 grafts/patient were performed ($P < 0.05$). The mortality rate was higher in on-pump patients: 7.1% versus 1.25% in OPCABG patients ($P < 0.05$). Neurologic disorders (TIA, confusion and coma) blood transfusion and duration of intubation were significantly higher in on-pump patients ($P < 0.05$).

CONCLUSIONS: Off-pump coronary artery bypass grafting is safe, effective, and associated with reduced morbidity and mortality in high-risk patients compared with conventional coronary artery revascularization.

P46 MYOCARDIAL REVASCUARIZATION WITH AND WITHOUT CARDIOPULMONARY BYPASS IN LOW EJECTION FRACTION (<35%) PATIENTS-RESULTS OF SURGICAL PROCEDURE

Jerzy K. Pacholewicz, Tomasz Hrapkiewicz, Arkadiusz I. Farmas, Jacek Kaperczak, Roman Przybylski, Jan Borzymowski, Boguslaw Ryfinski, Marcin Maruszewski, Bartłomiej Zych, Pawel Nadziakiewicz, Robert Kalis, Marian Zembala

Department of Cardiac Surgery and Transplantology, Silesian Center for Heart Disease, Zabrze, Poland

OBJECTIVE: Introduction of off-pump (OPCAB) technique has brought a new solution for patients with low ejection fraction. The aim of our study was to evaluate the outcome, complications after surgery with and without cardiopulmonary bypass (CPB).

METHODS: There were analyzed 287 patients who underwent direct myocardial revascularization with (232 pts) and without (55 pts) CPB in the period from January 2001 to September 2002. The EUROSCORE predict risk stratification table was used in the different groups: low, medium and high risk patients to evaluate the outcome after surgery. The groups of patients with regard to EUROSCORE scale were comparable-the differences were not significant-(for OPCAB and CABG consequently): 18% (10/55) vs. 12% (28/232) in low risk; 45% (25/55) vs. 36% (84/232) in medium risk and 37% (20/55) vs. 52% (120/232) in high risk group.

RESULTS: The global mortality rate was 7.3% (4/55 and 17/232) for both groups. The incidence of complications was lower in OPCAB group; with significant difference in myocardial infarctions as 0% (0/55) vs. 6.5% (15/232), $p < 0.05$ in CABG group, and non-significant in case of IABP application 3.6% (2/55) vs. 9% (21/232) as well as neurological complications which occurred in 3.6% (2/55) vs. 3.9% (9/232).

CONCLUSION: The myocardial revascularization in patients with impaired left ventricle function with and without CPB has similar mortality rate. Beating heart coronary surgery compared to conventional bypass surgery is a safe alternative method for myocardial revascularization with lower rate of complications, as myocardial infarction in patients with ejection fraction less than <35%.

P47 COMPARISON OF STERNOTOMY AND ENDO-ACAB FOR OFF-PUMP ITA-LAD BYPASS

Douglas G. West, John R. Pepper, Anthony C. De Souza
Cardiac Surgery, Royal Brompton Hospital, London, United Kingdom

OBJECTIVE: Internal Thoracic Artery to Left Anterior Descending (ITA-LAD) grafting is the established treatment for LAD disease. Debate remains about the optimal incision for single vessel ITA-LAD off pump surgery. We investigated the early impact of the endo A-CAB approach in a prospective case control series.
METHODS: Between 1999 and 2002 26 patients successfully underwent endo A-CAB ITA-LAD grafting. Control pairs (26 controls in total) were obtained from the 80 off pump sternotomy ITA-LAD procedures performed in the same period. Urgent cases, redo patients and those with impaired left ventricular function were excluded. Controls were matched for age and sex. Student's paired T-test was used to determine statistical significance.
RESULTS: Three patients in the sternotomy group and 1 A-CAB patient underwent blood transfusion, 1 patient in each group underwent re-exploration for excessive bleeding (3.85%), the A-CAB patient via re-thoracoscopy. See Table
CONCLUSIONS: Endo A-CAB surgery is associated with less blood loss and shorter hospital stay. In this series, difference in transfusion requirement and time ventilated did not achieve significance.

Group Characteristics	Sternotomy		P value
	Endo A-CAB	OPCAB	
Percentage Male (no. male)	88.4% (23)	92.3% (24)	
Mean Age	60.3 (8.7)	59.6 (8.4)	
Results			
Mediastinal drainage first 12 post-operative hours (ml)	406.8 (220.1)	620.4(392.7)	0.029
Time until extubation after leaving theatre (hours)	5.8 (5.3)	8.8 (5.8)	0.062
Nights spent in hospital following operation	5.1 (1.5)	6.0 (1.7)	0.045
Mean blood transfused per patient (units)	0.15 (0.38)	0.38 (1.09)	0.387
Change in Haemoglobin from pre-op to discharge (g/dl)	-2.31 (2.57)	-2.85 (1.42)	0.36

Figures in parentheses are Standard Deviations.

P49 INTRAORTIC FILTRATION IN OFF-PUMP CORONARY ARTERY BYPASS GRAFTING

Christoph Schmitz¹, Irena Oengoeren¹, Susanne Weinreich¹, Christoph Pohl², Armin Welz¹

¹Department of Cardiac Surgery, University of Bonn, Bonn, Germany, ²Department of Neurology, University of Bonn, Bonn, Germany

OBJECTIVE: Neurologic injury is a rare but disastrous complication in off-pump coronary artery bypass surgery (OPCAB). Intraaortic filtration has been shown to be effective in standard on-pump coronary artery bypass surgery. This study was set up to test the efficacy of intraaortic filtration in OPCAB surgery.
METHODS: Between 08/02 and 12/02 40 patients scheduled for OPCAB surgery were randomized into two groups. One group received intraaortic filtration during sewing of the central anastomoses to the ascending aorta. The second group served as control. Mean number of central aortic anastomoses was 1.8 in the filter; and 1.7 in the control group. Filters were sent to a core lab for histologic assessment. In both groups neurologic examinations and neurocognitive tests were performed pre- and postoperatively.
RESULTS: Microscopic debris was found in 80 % of the filters. In no group an intraoperative stroke or a TIA was observed. Both groups showed no differences regarding delirium or memory deficit. The filter group performed slightly better in the neurocognitive test battery.
CONCLUSIONS: Even in OPCAB surgery surgically debris can be filtered out of the ascending aorta. So far the study population was too small to draw final conclusions. The high percentage of filter with debris might lead to the conclusion that intraaortic filtration is indicated in all operations where the ascending aorta is manipulated, even when performed without cardio-pulmonary bypass.

P50 COMPARISON OF THE QUALITY OF LIFE AFTER CONVENTIONAL VERSUS OFF PUMP CORONARY ARTERY BYPASS SURGERY

Emmanouil I. Kapetanakis, Kathleen R. Petro, Sotiris S. Stamou, Ammar S. Bafi, Mercedes K. Dullum, Steven W. Boyce, Paul J. Corso

Section of Cardiac Surgery/Department of Surgery, Washington Heart/Washington Hospital Center, Washington, DC, USA

OBJECTIVE: Off pump coronary artery bypass surgery (OPCAB) has become widely utilized and accepted. While numerous studies have concentrated on its decreased morbidity and mortality, few looked at its effect on patients' quality of life. This study sought to compare postoperative quality of life in patients who had undergone conventional versus off pump CABG.
METHODS: From January 2000 through June 2000, 201 prospectively enrolled CABG patients at the Section of Cardiac Surgery, Washington Hospital Center filled a preoperative and a six-month follow-up SF 36 general health survey. Study groups consisted of 121 (60.2%) OPCAB patients, and 80 (39.8%) on pump CABG patients. There were 60 (75%) male and 20 (25%) female OPCAB patients versus 95 (78.5%) male and 26 (21.5%) female on pump patients (p=0.61). Preoperative Parsonnet's risk scores showed no significant differences between the two groups [13.4 ± 8.1 versus 12.0 ± 7.6 (p=0.25)]. Average score change for each category was compared, as was category averages for physical, emotional and overall function.
RESULTS: See Table.
CONCLUSION: Numerous studies have demonstrated lower morbidity and mortality rates with off pump CABG surgery but this prospective study reveals there is no statistical significant difference in the patient's postoperative quality of life with either surgical approach.

	On Pump [N=80 (39.8%)]			Off Pump [N=121 (60.2%)]			p-value
	Worse N (%)	No Change N (%)	Improve N (%)	Worse N (%)	No Change N (%)	Improve N (%)	
SF36-Physical Average	7 (8.8%)	12 (15.0%)	61 (76.3%)	14 (11.6%)	28 (23.1%)	79 (65.3%)	0.155
SF36-Emotional Average	10 (12.5%)	17 (21.3%)	53 (66.3%)	19 (15.7%)	25 (20.7%)	77 (63.6%)	0.583
SF36-Total Function	9 (11.3%)	11 (13.8%)	60 (75.0%)	13 (10.7%)	31 (25.6%)	77 (63.6%)	0.269

P51 REDUCTION OF MYOCARDIAL DAMAGE AND INFLAMMATORY RESPONSE AFTER BEATING HEART REVASCLARIZATION OF THE POSTERIOR WALL

Helmut Mair¹, Calin Vicol¹, Peter Fraunberger², Sabine Däbritz¹, Bruno Reichart¹

¹Dept of Cardiac Surgery and ²Institute of Clinical Chemistry, Grobhadern Medical Center, University of Munich, Munich, Germany

OBJECTIVE: We aimed to evaluate operative stress during OPCAB of the posterior wall comparing this procedure with OPCAB of the anterior wall and revascularization on-pump.
METHODS: 94 patients were assigned to either control-group treated on-pump (group A; n=30), or OPCAB without posterior wall involvement using only Octopus-stabilizer (group B; n=31) or multivessel-OPCAB (group C; n=33) using Octopus and starfish-heart-positioner (Medtronic Inc.). Demographics and EuroScore (4.4 ± 3.2) were same in all groups. Troponin I, CKMB, Interleukin 6, tumor-necrosis-factor-α (TNF-α), TNF-α-receptors p55 and p75 were measured at baseline, 0.5, 2, 4, 6, 12, 24, 48 and 120 hours after bypass-anastomoses were completed.

Peak-levels: *significantly different from group B, °significantly different from group A

	Group A (on-pump)	Group B (Octopus)	Group C (Starfish)
Troponin I (ng/ml)	21.7 ± 28.3 [°]	10.9 ± 14.8 [*]	15.7 ± 29.2
CKMB (ng/ml)	20.3 ± 11.1 [°]	6.7 ± 7.3 [*]	12.6 ± 12.8
TNFα-p55 (ng/ml)	6.7 ± 3.4 [°]	4.1 ± 1.3 [*]	4.2 ± 1.4
TNFα-p75 (ng/ml)	8.8 ± 1.9 [°]	7.4 ± 2.2 [*]	7.8 ± 2.2

RESULTS: In-hospital mortality (one death in group A and one in C), postoperative infarction (3.4%) and low-output (one IABP in group A and one in B) didn't differ. Postoperative infection rates were significantly higher in group A compared to group B or C (p<0.05). Grafts completed: 3.0 ± 0.8 in group A, 1.3 ± 0.5 in group B and 2.7 ± 0.9 in group C. Group A had signifi-

cant increased Troponin I, CKMB and TNF-a-receptors compared to group B and C (p<0.05).

CONCLUSIONS: Using positioning-devices like the starfish, multivessel OPCAB presented similar less myocardial damage, inflammatory reaction and postoperative infections like OPCAB without posterior wall involvement when compared to on-pump procedures.

P52 OFF-PUMP CORONARY BYPASS GRAFTING WITH RIGHT HEART SUPPORT IS EQUALLY EFFECTIVE FOR HEMODYNAMIC SUPPORT IN PATIENTS WITH HIGHER OR LOWER RISK VARIABLES

Dwight C. Lundell¹, John D. Crouch²

¹Cardiac Care Center, L.L.C., Mesa, AZ, USA; ²St. Luke's Medical Center, Milwaukee, WI, USA

OBJECTIVE: A potential problem with OPCAB is maintaining hemodynamic stability while positioning the heart for anastomotic access. Studies show right heart support (RHS) augments left ventricle preload and provides stability, especially for lateral and posterior target vessels. The present study evaluated the effectiveness of RHS in lower risk versus higher risk patients.

METHODS: In a prospective study of forty-five patients undergoing multivessel OPCAB with RHS (A-Med Systems, Inc., West Sacramento, CA), cardiac output (CO), stroke volume (SV), cardiac index (CI), and mean arterial pressure (MAP) were obtained at baseline (5.0 L/M ± 1.8, 67.4 ml ± 23.6, 2.5 ± 0.8, 67.9 mmHg ± 11.3, respectively), during each anastomosis (heart optimally positioned), and when RHS was temporarily interrupted prior to heart release. Patients were divided into risk groups for age (70), ejection fraction (EF) (≥45) (=45), mean pulmonary artery pressure (MPAP) (≤25 mmHg or >25 mmHg), NYHA class (I/II or III/IV), preoperative status (elective or urgent/emergent), and the presence of arrhythmia or prior MI. There were 157 distal anastomoses.

RESULTS: All measures markedly improved with RHS. There were no deaths, adverse events, or intraoperative IABP placements, and one conversion to CPB.

CONCLUSIONS: In patients with higher or lower risk variables, RHS was equally effective in maintaining hemodynamics during OPCAB.

% Decrease With RHS Temporarily Off

Risk Variable	CO	SV	MAP	CI
Age ≤70/>70	17.9/19.0	17.0/19.3	12.0/13.5	17.8/19.2
EF <45%/≥45%	17.4/20.0	16.3/21.0	10.6/15.4	17.5/20.1
MPAP ≤25mmHg/>25mmHG	19.2/16.2	19.6/15.0	13.0/12.3	19.2/16.4
NYHA I or II/III or IV	20.5/17.7	20.0/17.7	15.7/12.2	21.0/17.8
Elective/Urgent or Emergent	19.9/17.6	19.5/17.5	14.7/12.1	20.0/17.7
Arrhythmia Not Present/Present	17.8/20.7	17.6/20.3	13.1/11.5	17.9/20.8
No Prior MI/Prior MI	16.5/19.8	17.1/18.8	12.5/12.7	16.4/20.1

P53 ANALYSIS OF SELECTIVE AND NON-SELECTIVE APPROACHES TOWARDS ON-PUMP/ OFF-PUMP CABG FOR MULTI VESSEL CORONARY ARTERY DISEASE

Kunal Sarkar, Atanu Saha, Karunakaran Padhy, Emmanuel Rupert, Asutosh Raghuvanshi

Cardiac Surgery, RTIICS, Kolkata, India, Calcutta, India

OBJECTIVE: Off pump surgery (OPCAB) has emerged as an alternative technique in coronary artery bypass surgery. Concerns have been expressed regarding the safety and efficacy of OFCAB to achieve complete revascularisation in triple vessel coronary artery disease(TVD).

METHOD: We analysed retrospectively the results of adopting a selective and non-selective approach regarding OPCAB and On -pump techniques of CABG. 609 patients undergoing CABG for TVD in a 18 month period were grouped as: Gr A (n=152) where primarily off pump technique was used (OPCAB) , and Group B (n= 457) wherein patients were selected for on-pump or off-pump CABG. In Group B 280 patients underwent off pump CABG and 177 patients were operated on pump.

RESULTS: Results were analysed in terms of completeness of revascularisation (based on: *Revascularisation Index (RI)* = Ratio of grafts performed to grafts intended), intra operative haemodynamic crisis (IHC), peri-operative infarction and mortality. Revascularisation was deemed to be superior in group B (RI: GrA:0.717; Gr B:0.923; P<0.05). Occurrence of IHC was significantly higher in Gr.A (GrA: 12/152 Gr B 6/280 P<0.05) ,so was mortality

(Gr A:4/152; Gr B:4/457) and perioperative infarction (Gr A:15/152; Gr B:12/457). Six of the 18 patients who had developed IHC died.

CONCLUSIONS: We advocate selective adoption of OPCAB / On-pump techniques to achieve complete and safe revascularisation.

P54 OPCAB IN PATIENTS WITH MALIGNANT NEOPLASMS

Toshiya Ohtsuka, Noboru Motomura, Yoshihiro Suematsu, Shinichi Takamoto

Cardiothoracic Surgery, Tokyo University Hospital, Tokyo, Japan

OBJECTIVE: Off-pump coronary artery bypass (OPCAB) was used in patients with coexisting malignant neoplasms. The results were reviewed, and preoperative cellular immuno-activity was compared with patients on whom conventional on-pump coronary artery bypass (CCAB) was performed.

METHODS: Since July 1997, OPCAB was performed in twenty consecutive patients (thirteen men, seven women, 68 ± 9.5 years old) with coexistent malignant disease of the lung (6), stomach (3), breast (2), sigmoid-colon (2), liver (2), prostate (1), pancreas (1), thymus (1), and metastatic skin tumor of unknown origin (1). Perioperative cellular immuno-activity (leukocyte counts, percentages of lymphocytes, CD4, CD8, and natural killer cells activity) assessed preoperatively and 1,2, and 7 days after surgery was compared in seven consecutive OPCAB and seven consecutive CCAB cases.

RESULTS: Six pulmonary resections and one thymectomy were performed concomitantly with OPCAB. Surgical resections in eleven non-thoracic cases and chemotherapy in one hepatoma case were performed 8.8 ± 1.9 days after OPCAB. The mean follow-up period was 3.1 ± 1.9 years, and all patients except four were alive without recurrence of malignancy: one sigmoid-colon cancer patient died of stroke, and one liver, pancreas, and bile-duct cancer patient each died of metastases 3, 1, and 2 years after OPCAB, respectively. The percentage of lymphocytes, CD4, and natural killer cell activity on postoperative day 1 was significantly higher in the OPCAB cases than in the CCAB cases (24.5 ± 6.5 vs 9.8 ± 7.7%, p=0.0092; 33.3 ± 8.1 vs 18.5 ± 9.5%, p=0.011; 36.3 ± 9.1 vs 14.2 ± 5.8%, p=0.010).

CONCLUSION: Oncological treatment can be performed concomitantly or very soon after OPCAB with well-maintained postoperative cellular immuno-activity.

P55 RESULTS OF MYOCARDIAL REVASCLARIZATION IN PATIENTS WITH LEFT MAIN STENOSIS (LM) WITH AND WITHOUT CARDIOPULMONARY BYPASS

Arkadiusz I. Farmas, Jerzy K. Pacholewicz, Jacek Kaperczak, Roman Przybylski, Jan Borzymowski, Boguslaw Ryfinski, Bartlomiej Zych, Pawel Nadziakiewicz, Robert Kalis, Marcin Maruszewski, Marian Zembala

Department of Cardiac Surgery and Transplantology, Silesian Center for Heart Disease, Zabrze, Poland

OBJECTIVE: Patients with ≥50% stenosis of LMCA are qualified to surgery treatment, because the long-term follow-up studies have shown that prognosis in patients with medical therapy is poor. The left main coronary artery provides blood supply to approximately 80% of LV, and maneuvers during beating heart grafting could destabilize heart with lesion in LMCA. This concern about ability to tolerate revascularization without of CPB was the reason why pts with LM stenosis were excluded from OPCAB techniques.

METHOD: We collected 129 consecutive pts with LMCAD from 2001-01-01 to 2002-02-28. 95 pts underwent bypass grafting with the aid of CPB, and 34 were revascularized without of CPB.

CONCLUSION: OPCAB in pts with LMCAD is safe and effective method.

	ON-PUMP	OFF-PUMP
AGE	62.1	61.6
LM-stenosis (%)	78	78.8
CCS	3.0	3.11
EuroSCORE	5.4	4.86
EF LV(%)	45.15	45.62
BY-PASS GRAFTS	3.2	2.4
IABP	13 (13.4%)	4(11.4%)
TRANSFUSION	75 (80%)	7 (20%)
INOTROPIC AGENTS	79 (84%)	6 (27%)

RESULT: There were 2 deaths (5.8%) in OPCAB group as compared with hospital mortality 6 pts (6.3%) on-pump group. The majority of pts had 2 grafts or greater performed at time of operation. The comparison of two methods surgical treatment of LMCAD-off-pump vs on-pump shows two data which are statistically significant. There was significantly less pts (OPCAB -group) who need blood transfusion (20% vs 80%, $p < 0.001$). The pts revascularized off pump also were significantly less require postoperative inotropic agents than pts on-pump (17% vs 84% , $p < 0.001$).

P56 EFFECTS OF INTRACORONARY SHUNTS ON CORONARY ENDOTHELIAL COATING IN THE HUMAN BEATING HEART

Herbert B. Hangler¹, Kristian Pfaller², Daniel Hofer¹, Thomas Schachner¹, Karin Dunst¹, Guenther Laufer¹, Herwig Antretter¹

¹Cardiac Surgery and ²Department of Histology, Innsbruck University, Innsbruck, Austria

OBJECTIVE: Manipulating coronary arteries during off-pump surgery with hemostatic devices impairs endothelial integrity and function. In this study we hypothesized that intracoronary shunting could be less harmful to human coronary artery endothelial coating.

METHODS: The left anterior descending coronary artery and/or the right coronary artery of patients undergoing orthotopic heart transplantation for dilative cardiomyopathy (Group I, DCMP) (n=4) and ischemic coronary heart disease (Group II, ICHD) (n=3) were occluded with elastic silicone loops or incised and intracoronary shunts placed into the coronary artery after cannulation before cardiopulmonary bypass was started and left in place for a period of 10 minutes. When necessary, cardiopulmonary bypass was started but without fully unloading the heart to keep a pulsatile flow. Uninstrumented segments adjacent to the occlusion/shunt site of the same coronary artery served as controls. Integrity of coronary endothelial lining was evaluated by scanning electron microscopy.

RESULTS: In the control samples endothelial lining was regular without areas of local denudation. Coronary artery samples that were manipulated with intracoronary shunts or elastic silicon loops exhibited a significant higher endothelial injury ($p < 0.001$) than controls.

CONCLUSION: Manipulating coronary arteries during off-pump surgery leads to disruption of human coronary artery coating.

P57 WHICH ANASTOMOSIS TO DO FIRST-OBTUSE MARGINALS OR LEFT ANTERIOR DESCENDING ARTERY:SEQUENCE OF DISTAL ANASTOMOSIS IN OPCAB SURGERY

Naresh Trehan¹, **Rajneesh Malhotra**¹, Vivek Gupta, Iv¹, Yugal Mishra¹, Vijay Kohli¹, Zile Meharwal¹, Ramesh Bapna¹, Yatin Mehta²

¹Cardiac Surgery, and ²Cardiac Anaesthesia, Escorts Heart Institute and Research Centre, New Delhi, India

OBJECTIVE: The aim of this study was to answer: which vessel to bypass-first left anterior descending (LAD) artery or obtuse marginals (OM) in OPCAB? Left internal mammary artery (LIMA) grafted to LAD can become stretched while doing distal anastomosis of OM and can cause significant hemodynamic and ECG changes.

METHODS: Data were collected from 100 consecutive patients. Patients were randomised into two groups: Group A in which LIMA to LAD anastomosis was done first followed by OM's anastomosis, Group B in which OM's were done first followed by LIMA to LAD. There were 50 patients in each group. Patients were evaluated for perioperative hemodynamic parameters, ECG changes, regional wall motion changes on transesophageal echocardiography (TEE), cardiac enzymes and clinical outcome.

RESULTS: There was no difference in hemodynamic parameters in both the groups statistically. Perioperatively there were statistically significant ECG changes in anterior leads and regional wall motion abnormalities on TEE in terms of hypokinesia of left ventricular anterior wall and interventricular septum in patients in whom the LAD anastomosis was done first (Group A) as compared with patients in whom the OM were anastomosed first (Group B) especially in patients in whom LIMA length was short or the site of anastomosis of LAD was quiet distal. Cardiac enzymes were higher in group A as compared with group B. Clinical outcome were comparable in both the groups.

CONCLUSIONS: Significant perioperative myocardial ischemia occurs in patients in whom LIMA to LAD anastomosis is done first especially when length of LIMA is short or site of anastomosis of LAD is distal.

P58 CARDIAC ANGIO-CT SCAN FOR PLANNING MIDCAB

Philippe-Primo R. Caimmi¹, Rita Fossaceca², Marco Lanfranchi¹, Carlo De Gasperi¹, Alessandro Carriero

¹Cardiac Surgery, Ospedale Maggiore di Novara, Novara, Italy; ²Radiology, University of East Piedmont "A. Avogadro", Novara, Italy

OBJECTIVE: Precise evaluation of cardiac and thoracic anatomy of the patient is mandatory for planning safe MIDCAB. Here we report our preliminary experience with cardiac angio-CT scan as a new method to verify the feasibility of minimally invasive approach in every patient scheduled for MIDCAB.

METHODS: By mean of a cardiac angio-CT scan 3D images, 10 patients have been evaluated in order to obtain an accurate definition of the intra-thoracic surgical anatomy. The feasibility of the direct exposure of the anatomical structures involved in the surgical procedures has been checked. Particularly, morphological parameters of the anterior descending coronary artery as well as artery diameter, presence of wall calcification, and its intramycardial position has all been possible to be precisely defined with this method. The following scanning protocol has been used: 4x1-mm collimation (simultaneous acquisition of four 1-mm-thick sections per rotation); pitch of 1.5-2.0; 500-msec rotation time; 120 kV and 300 mA, which corresponds to an effective radiation dose estimate of 5 mSv.

RESULTS: After cardiac angio-CT scan evaluation, only 4 of the ten Pts were selected for MIDCAB, according to the morphological criteria above mentioned. All selected Patients underwent MIDCAB without complications, no Pt required reversal to standard surgical approach.

CONCLUSIONS: Angio-CT scan has shown high sensitivity and specificity and it has been effective either in selecting Pts for MIDCAB or in avoiding possible surgical complications as well as the necessity to reverse to standard surgical approach.

P59 RISK FACTORS AND OUTCOMES ASSOCIATED WITH FAILED WEAN FROM CARDIOPULMONARY BYPASS

Jacob DeLaRosa¹, Faraz Kerendi¹, Rebecca Petersen², Robert A. Guyton¹, John D. Puskas¹

¹School of Medicine, Emory University, Atlanta, GA, USA, ²Cardiothoracic Surgery, The Emory Clinic, Atlanta, GA, USA

OBJECTIVES: This study was to determine risk factors and evaluate postoperative outcomes for patients who required a return to CPB (RCPB) after failed wean.

METHODS: A consecutive series of 9701 patients who underwent a cardiac surgical procedure with CPB at a single academic institution between January 1996 and June 2001 was retrospectively reviewed. Univariate chi-square analysis and multivariate logistic regression were performed to identify possible risk factors contributing to RCPB and associated mortality.

RESULTS: 404 (4%) patients required RCPB, of whom 348 (86%) had elective, 16 (4%) urgent, 40 (10%) emergent and 106 (26%) redo operations. Intraoperative and in-hospital mortality in the RCPB group were 5% and 22.5%, respectively, versus 0.2% and 3.0% for the group that did not require RCPB ($p = 0.001$). Univariate risk factors positively associated with RCPB were redo operation ($p < 0.001$), age > 65 years ($p = 0.004$), and female gender ($p = 0.021$). Multivariate predictors for RCPB included redo operation (OR 3.0), age (OR 1.3) and female (OR 1.4). Univariate risk factors for death were RCPB ($p = 0.001$), urgent/emergent status ($p = 0.001$), redo operation ($p = 0.001$), age > 65 years ($p = 0.001$), female gender ($p = 0.001$), renal failure ($p > 0.001$) and COPD ($p = 0.029$). Multivariate predictors of death, in addition to RCPB (OR 8.8) included surgical priority (OR 4.0), renal failure (OR 3.3), age (OR 3.2), reoperation (OR 2.8) and female gender (OR 1.7).

CONCLUSIONS: Return to CPB is a powerful independent predictor of hospital mortality. Surgical priority, reoperation, age, gender, renal failure and COPD are risk factors for RCPB and/or death.

P60 A NOVEL ELASTIC WALL VENOUS CANNULA FOR AUGMENTED VENOUS RETURN

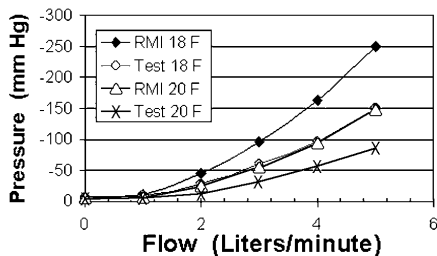
Jennifer K. White, James S. Titus, David F. Torchiana, Arvind K. Agnihotri
Surgery, Massachusetts General Hospital, Boston, MA, USA

OBJECTIVE: Augmentation of venous return by regulated suction has been increasingly applied to overcome the resistance imposed by longer and narrower minimally invasive cannulae. A new cannula with a self-stenting wall is investigated for use during kinetic-assisted venous drainage.

METHODS: Specialized funneled intravascular tip femoral venous cannulae designed for low profile insertion were constructed using self-expanding stent material. Kinetic-assisted saline flow through the cannula was compared to standard femoral venous return cannula.

RESULTS: The test cannulae demonstrated a significant increase in fluid flow, with a larger difference at higher negative pressures, as compared to standard cannula of similar insertion diameters.

CONCLUSIONS: The unique ability of the new cannula to maintain a low profile insertion and radially expand in the endovascular space, may reduce the risk of complications associated with augmented venous return.



P61 TRANSIENT TIME ASSESSMENT OF COMPOSITE VERSUS FREE ARTERIAL GRAFTS IN OPCAB

Marek J. Jasinski, Maciej Kolowca, Piotr Olszówka, Ryszard Bachowski, Kazimierz Widenka, Marek Deja, Dariusz Szurlej, Stanislaw Wos

2nd Dept. of Cardiac Surgery, Katowice, Poland

OBJECTIVE: To avoid cerebral vascular accidents (CVA) arterial revascularization with composite graft has been applied for off-pump CABG. Our study is looking at clinical, angiographic and perioperative flow measurement data. Results were compared to control group having free radial artery (RA) or free ITA graft performed.

METHODS: 88 patients were prospectively recruited to the study. There were two groups: 53 patients with composite arterial grafts (composite group) and 35 with free arterial grafts (free group). Mean ages at operation were 61.4 ± 6.6 vs 57.2 ± 9.2 , average number of grafts: 2.4 ± 0.7 vs 2.6 ± 0.8 in composite and free graft groups respectively. 20 preselected patients with intention to perform two grafts to LAD and Cx territories were randomly assigned to either of groups and were followed with Transient Time Flow (TTF) and Pulsatile index (PI) measurements perioperatively.

RESULTS: There was no mortality in either of groups. Postoperative complications for overall group included three IABP insertions (3.4%), three conversions to CPB (3.4%), four respiratory complications (4.52%), two wound infections (2.3%). TTF studies revealed for composite vs free group respectively: LITA flow value of 14.6 vs 15.6 ($p=ns$), PI: 2.7 vs 2.1 ($p=ns$); RA flow value 17.6 vs 10.0 ($p=ns$) with PI 2.1 vs 2.7 ($p=ns$). Angiographic studies showed patent grafts in both groups.

CONCLUSIONS: Arterial revascularization in off-pump CABG can be achieved with composite grafts, with satisfactory clinical outcome. Flow parameters detected by Transient Time modification of ultrasound method is showing comparable results between composite and free grafts.

P62 ACUTE CORONARY ANGIOGRAPHY AFTER CABG-NECESSITY AND CONSEQUENCES

Markus Eller, Georgios Tagarakis, Heiko Sahre, Beate Boden, Christian Georgi, Klaus Matschke, Michael Knaut, Vassilios Guliemos

Dept. of Cardiac Surgery, Heart Center Dresden University Hospital, Dresden, Germany

OBJECTIVE: Current standard of quality assessment of CABG is coronary angiography, but often the question arises when to perform angiography and with what consequences.

METHODS: We retrospectively analyzed 43 patients receiving acute coronary angiography from 01/2001 to 08/2002 after CABG. Seventeen patients (group 1) had CKMB/CK higher than 10%, 9 patients (group 2) received angiography due to new ischemia signs on ECG, 15 patients (group 3) due to both, and 2 patients (group 4) due to ventricular fibrillation.

RESULTS: In group 1 fourteen patients (88%), in group 2 seven patients (78

%) and in group 3 fourteen patients (88%) had anastomotic problems. In group 4 angiography revealed good patent grafts. Ten patients received subsequently additional operation and 2 patients (20%) died being already in cardiogenic shock. Nine patients received acute PTCA and/or stenting and 1 patient (11%) died. The remaining 16 patients with anastomotic complications underwent conservative therapy and 1 patient (6.3%) died.

CONCLUSIONS: Equal sensitive criteria for detection of anastomotic failures after CABG are the combination of increase of cardiac enzymes plus ECG ischemia signs or isolated increased cardiac enzymes. Reoperation during acute stadium offers best outcome unless patients are in cardiogenic shock.

P63 USING FEM-FEM BYPASS WITH BALLOON ENDO-CLAMP TECHNIQUE, ON PATIENTS WITH SUSPECTED AORTIC RUPTURE

Amihay Shinfeld, Erez Kachel, Yoav Paz, Aram Smolinsky

Cardiac Surgery, Sheba, Tel-Aviv, Israel

OBJECTIVE: Mid-sternotomy presents a critical risk in certain circumstances, specifically when performing redo operations of the aorta, or aortic aneurysm with adhesion to the sternum.

METHODS: We used CBP via the femoral-femoral route, and then cross-clamped the aorta with an endo-clamp, gave antegrade cardioplegia, used aortic route venting and total circulatory arrest. Only then did we open the chest. We applied this technique to 4 patients during 2000-2002: a 50-year-old with a pseudoaneurysm 8 cm in diameter, 5 months after composite AVR for root abscess; a 36-year-old, noticeably thin, with an infected graft implanted 16 years before due to congenital AS; a 57-year-old with huge valvular sinuses; and a 54-year-old patient with a huge aneurysm of the RCA and presumed adhesion to the sternum.

RESULT: The 4 patients were operated on successfully using the above method, and recovered successfully, with no complications.

CONCLUSION: When facing a high risk of damaging the aorta, and only when the normal condition of the distal ascending aortic is clearly evident, the described method seems to be a safe, reliable and low-risk technique for patients who, otherwise, would be considered a major surgical risk.

P64 IS ROUTINE USE OF TEMPORARY EPICARDIAL PACING WIRES NECESSARY AFTER EITHER OPCAB OR CONVENTIONAL CABG/CPB?

John D. Puskas¹, Erez Sharoni¹, Willis Williams¹, Rebecca Petersen, RN², Peggy Duke¹, Robert A. Guyton¹

¹School of Medicine, Emory University, Atlanta, GA, USA; ²Cardiothoracic Surgery, The Emory Clinic, Atlanta, GA, USA

OBJECTIVES: Placement of temporary epicardial pacing wires (PWs) after CABG is routine in many centers, despite infrequent but significant complications, including hemorrhage, tamponade and death. The resurgence of OPCAB prompted a re-examination of this practice.

METHODS: Two-hundred (200) unselected coronary patients were prospectively randomized to have either OPCAB or conventional coronary artery bypass grafting on cardiopulmonary bypass (CABG/CPB). Three patients were excluded after randomization. Management, including placement or avoidance of PWs, followed unbiased, criteria-driven protocols. Patients requiring pacing immediately prior to chest closure (bradycardia with cardiac output <2.2 L/min/m², nodal or junctional arrhythmias, atrioventricular block) received PWs. All others avoided PWs. Duration of pacing and complications related to PW placement or avoidance were recorded.

RESULTS: PWs were placed in 33/197 (17%) patients, 23 of whom were paced after arrival in the ICU and 10 were never paced. 12 OPCAB vs 21 CABG/CPB patients had PWs ($p=0.08$). Patients with PWs were older, more commonly female, had more COPD and longer length of stay than those not requiring PWs. Preoperative beta blocker use, coronary anatomy and number of grafts performed were not correlated with need for PWs. No patient without PWs required postoperative pacing by any means or suffered any complication attributable to avoidance of PWs.

CONCLUSIONS: Need for pacing immediately prior to chest closure accurately and safely identifies coronary patients who will require postoperative pacing after OPCAB or CABG/CPB. Routine use of PWs is unnecessary. OPCAB may be associated with a reduced requirement for PWs.

P65 A PROSPECTIVE RANDOMIZED ANGIOGRAPHIC STUDY OF OPEN VERSUS ENDOSCOPIC SAPHENECTOMY FOR CABG

Louis P. Perrault, Luc Bilodeau, Hugues Jeanmart, Jacques Lespérance, Jean-François Tanguay, Denis Bouchard, Pierre Pagé, Michel Carrier
Montreal Heart Institute, Montréal, PQ, Canada

OBJECTIVE: Although endoscopic saphenectomy for coronary artery bypass grafting surgery (CABG) is associated with a decreased incidence of wound complications and has shown no increased incidence of histological trauma or endothelial dysfunction, a concern remains about the angiographic results of saphenous vein grafts (SVG) harvested with this technique in regard to the development of intimal hyperplasia in the body of the graft due to bipolar cauterisation of side branches. The purpose of this study was to compare the angiographic appearance of SVG harvested with the open versus endoscopic technique after CABG.

METHODS: Forty patients undergoing primary CABG surgery with at least one internal mammary artery (IMA) and one SVG were randomized preoperatively to open versus endoscopic saphenectomy using the Guidant Vasoview system with bipolar cauterisation of side branches. Quantitative coronary angiography was performed (mean 3 months) after CABG.

RESULTS: There were no significant differences between preoperative variables between both groups. There was no statistically significant difference in the patency rates of IMA grafts and in the patency rate of SVG (85.2% vs 84.4% respectively) ($P < 0.05$) between the two groups and no difference in graft stenosis in the body of the SVG between both groups ($P < 0.05$).

CONCLUSION: The angiographic appearance and patency rate of SVG harvested for CABG by the endoscopic technique with bipolar cauterisation are similar to those harvested with the open technique. These results support use of endoscopic saphenectomy for CABG because of the lower incidence of wound and infectious complications and superior functional results.

P66 SYSTOLIC MYOCARDIAL FUNCTION DURING MIDCAB AND TECAB PROCEDURES QUANTIFIED BY PULSED WAVE TISSUE DOPPLER

Stephan E. Mierdl¹, Gerhard Wimmer-Greinecker², Selami Dogan², Peter Küppers¹, Paul Kessler¹

¹Dpt. of Anesthesiology, Intensive Care Medicine and Pain Therapy and ²Dpt. of Cardiothoracic Surgery, J.W.-Goethe-University Hospital, Frankfurt, Germany

INTRODUCTION: The study sought to quantify perioperative systolic myocardial function by pulsed wave tissue doppler (PWTD) during MIDCAB and TECAB procedures.

METHOD: 33 patients undergoing MIDCAB (n=16) or TECAB (n=17) were studied. PWTD-loops of the posterior (PW) and the anterior myocardial wall (AW) of the both ventricles (RV/LV) were recorded. Data was assessed prior to SLV (DLV_{base}) 30, 90 and 120 min. after initiation of SLV (SLV_{+30, +90, +120}) - and CO₂-insufflation prior to the institution of CPB in TECAB procedures - as well as 20 minutes after reinstatement of DLV and (TECAB only) weaning from CPB (DLV_{end}). An offline analysis of the velocities of isovolumic contraction (V_{IVC}), duration of IVC (D_{IVC}), velocity of systolic contraction (V_S) and duration of systolic contraction (D_S) was performed. To assess biventricular myocardial synchronicity, the indices of V_{IVCPW/AW}, D_{IVCPW/AW}, V_{SPW/AW} and D_{SPW/AW} were calculated. $P < 0.05$ was considered statistically significant.

RESULTS: In the MIDCAB group D_{IVCPW/AW} in the LV showed an increase at SLV₊₉₀ and D_{SPW/AW} an increase at SLV₊₁₂₀. In the TECAB group, an increase was noted for V_S at SLV₊₃₀ and for V_{IVC} at SLV₊₃₀ and SLV₊₉₀ in the LVPW. Significant higher values for D_{SPW/AW} were found in the RV of MIDCAB patients at SLV₊₃₀ and SLV₊₁₂₀.

CONCLUSION: LV and RV of patients undergoing MIDCAB were more affected by significant changes in the duration of systolic action than in TECAB patients, indicating that the MIDCAB technique leads to significant RV myocardial asynchronicity during prolonged SLV in comparison to the TECAB technique.

P67 TOTALLY ENDOSCOPIC ROBOTIC ASSISTED AORTIC VALVE REPLACEMENT: INITIAL TECHNICAL FEASIBILITY STUDIES

William P. Sweezer, Jr.¹, Bea Colburn RN¹, Russell Woo²

¹Thoracic & Cardiovascular Surgery, Mt. Diablo Medical Center, Concord, CA, USA; ²Surgery, Stanford University, Palo Alto, CA, USA

OBJECTIVE: Evolving clinical strategies to reduce the surgical trauma of access for Aortic valve replacement (AVR) have yielded partial sternotomy,

right parasternal and right thoracotomy as useful alternatives to conventional median sternotomy. We report herein initial technical feasibility studies directed towards developing a robotic-assisted totally endoscopic approach to AVR.

METHODS: Phase I of this study was carried out utilizing 4 closed-chest fresh human cadavers. The steps included: (1) Insertion of the "da Vinci" Intuitive Surgical 3D camera and two robotic instrument arms into ports in the right hemithorax, (2) Insertion of accessory ports for introducing the prosthetic valve and ancillary endoscopic instrumentation, (3) Pericardiotomy, (4) Aortotomy, (5) Valve excision, (6) Placement of annular sutures, (7) Valve seating, (8) Closure of aortotomy. Phase II of this study explored an alternative method of attaching the prosthetic valve to the aortic annulus using pledgetted and non pledgetted nitinol wire clips in isolated cadaveric porcine heart model. Accuracy of suture placement, valve seating, duration of procedure and tissue trauma were examined post-implantation.

RESULTS: Optimal port placement for excellent visualization and manipulation of the aortic valve and related structures was established which lead to successful closed-chest AVR in all 4 human cadavers. Suture placement was precise and secure with minimal tissue trauma. Nitinol valve clips in porcine hearts eliminated the time required for tying sutures.

CONCLUSIONS: We conclude that totally endoscopic robotic-assisted access to the aortic valve in these cadaveric models for AVR is feasible and warrants further studies and refinement for possible clinical application.

P68 PROGRAM DEVELOPMENT AND LEARNING CURVE ISSUES IN ROBOTIC TOTALLY ENDOSCOPIC CORONARY ARTERY BYPASS GRAFTING

Johannes Bonatti¹, Thomas Schachner¹, Nikolaos Bonaros¹, Oliver Bernecker¹, Harald Ott¹, Guy Friedrich², Franz Weidinger², Guenther Laufer¹

¹Cardiac Surgery and ²Cardiology, Innsbruck University Hospital, Innsbruck, Austria

OBJECTIVE: Introduction of new procedures in heart surgery is a critical phase which includes learning curves and sometimes increased mortality or morbidity. Totally endoscopic coronary artery bypass grafting (TECAB) using robotic techniques represents such an innovative procedure. The aim of this report is to demonstrate the safe introduction of TECAB using a stepwise and modular approach.

METHODS: From June 2001 to December 2002, 49 procedures were performed using the da Vinci[®] telemanipulation system. The following procedure modules were carried out in a stepwise manner: robotically assisted endoscopic left internal mammary artery (LIMA) harvesting and completion of the procedure as conventional CABG, MIDCAB, or OPCAB (n=19), robotically assisted suturing of LIMA anastomoses during conventional CABG (n=14), TECAB on the arrested heart using port access CPB (n=15). One patient was excluded intraoperatively for pleural adhesions.

RESULTS: A significant learning curve was observed for LIMA take down time (62 [35-300] min), and total operative time in TECAB (420 [270-690] min), but not for LIMA to target vessel anastomotic time (34 [23-50] min). There were 2 conversions to sternotomy and 3 on table revisions for bleeding in the 15 TECAB patients. Postoperative ventilation time and ICU stay for the whole patient series were 13 (0-278) h and 24 (12-282) h respectively. There was no hospital mortality.

CONCLUSION: We conclude that totally endoscopic coronary artery bypass grafting can be safely implemented into a heart surgery program. Learning curves are steep for LIMA harvesting time and operative time in TECAB but less pronounced for anastomotic time.

P69 AXILLARY ARTERY PERFUSION MAKES MINIMALLY INVASIVE CARDIAC SURGERY SIMPLER AND SAFER

Alan H. Markowitz¹, Ray Graber², Michelle Capdeville²

¹Department of Cardiothoracic Surgery and ²Department of Anesthesia, Case Western Reserve Univ Hospitals of Cleveland, Cleveland, OH, USA

OBJECTIVE: Right axillary artery cannulation (RAC) for cardiopulmonary bypass avoids need for extensive ascending aortic exposure and simplifies minimally invasive cardiac surgery (MICS). Extensive clinical experience with RAC since 1995, led us to incorporate this approach into MICS.

METHODS: 42 patients underwent aortic, mitral, tricuspid, or atrial surgery supported by direct RAC and percutaneous right femoral venous cannulation at CWRU Hospitals from 2000-2002. Aortic valve exposure was

achieved through a lower mini-sternotomy T'd into the third intercostal space; mitral, tricuspid and atria were exposed through a 6-cm thoracotomy overlying the fourth rib in men and through the submammary crease in women. This approach allowed for either direct aortic cross-clamping or retrograde insertion of a balloon occluder through the axillary cannula sidearm (Heartport) with echo-corroborated positioning. LV vent was placed in all aortic and mitral valve procedures, supplemented with aortic needle vent prior to unclamping. CO₂ insufflation was not employed.

RESULTS: There was no mortality or neurologic morbidity. One patient was re-explored for bleeding from a left atrial suture line and atrial fibrillation occurred in eight patients. Average length of stay was significantly reduced for each cohort.

CONCLUSIONS: RAC: Facilitates minimally invasive exposure of aortic, mitral, and tricuspid valves and atria, provides antegrade flow and avoids groin incision, allows either internal balloon occlusion through the sidearm or direct aortic cross-clamping, avoids need for CO₂ insufflation, and produces no upper extremity morbidity despite temporary occlusion of the axillary artery by the proximally-directed cannula.

P70 MID-TERM RESULTS IN MINIMALLY INVASIVE MITRAL VALVE REPAIR

Lucia Torracca, Andrea G. Quarti, Giuseppe Crescenzi, Alessandro Castiglioni, Alessandro Caldarola, Ottavio Alfieri

Cardiac Surgery, San Raffaele Hospital, Milano, Italy

OBJECTIVE: Surgical treatment of mitral valve disease has changed in the last years. Introduction of minimally invasive cardiac surgery (MICS) offers reduced discomfort and reduction in recovery time. In this study we review our mid-term results in minimally invasive mitral valve repair.

METHODS: From October 1999 to November 2002, 51 consecutive patients (mean age 39.4 y, 23 female) underwent mitral valve surgery through right anterolateral minithoracotomy, with peripheral cardiopulmonary bypass.

RESULTS: Thirty-four patients had an edge to edge repair to correct anterior or bileaflet prolapse, 9 patients had a quadrangular resection of the posterior leaflet. Eight patients with mitral stenosis were treated by commissurotomy. In all cases but 6 we implanted a prosthetic ring. Mean CPB and cross clamp time were 97 min and 66 min respectively. Median mechanical ventilation and ICU stay time were 6 hours and 13 hours respectively. Hospital mortality, conversion to sternotomy and neurological complications were 0%. At a mean 24.1 months follow-up, one patient (1.9%) had mitral repair failure. Freedom from reoperation was 98%, and survival rate was 100%. All patients but one are in NYHA class I and none of them is actually on medical therapy.

CONCLUSIONS: MICS offers the patient the possibility to avoid the sternotomy trauma providing excellent results also in challenging lesions. Mid-term results are encouraging and MICS has now become the standard approach for mitral valve disease in young people, in our institution. The marked advantages of minimally invasive approach should be considered for a wider application.

P71 MITRAL VALVE REPAIR WITHOUT CARDIOPULMONARY BYPASS OR ATRIOTOMY USING THE COAPSYS DEVICE: DEVICE DESIGN AND IMPLANTATION PROCEDURE

Masahiro Inoue¹, Zoran B. Popovic², Kazuyoshi Doi¹, Soren Schenk¹, Hassan Nemeh¹, Ootaki Yoshio¹, Michael W. Kopcak, Jr.¹, Raymond Dessoify¹, James D. Thomas², Patrick M. McCarthy³, Kiyotaka Fukamachi¹

¹Biomedical Engineering, ²Cardiovascular Medicine, and ³Thoracic and Cardiovascular Surgery, The Cleveland Clinic Foundation, Cleveland, OH, USA

BACKGROUND: Functional mitral regurgitation (MR) results from annular dilatation and/or displacement of the papillary muscles in ventricles as they become progressively dysfunctional. This study evaluated the feasibility of utilizing a novel device, the Myocor Coapsys, to perform mitral valve repair without cardiopulmonary bypass (CPB).

METHODS: The device was tested in a pacing induced canine model of heart failure with MR. The Coapsys device, which consists of anterior and posterior epicardial pads connected by a sub-valvular chord, was surgically implanted. It was located with the aid of echocardiographic imaging and delivered via a vacuum stabilized instrument. Once the device was positioned such that the posterior pad was in transmural alignment with the valve annulus, it was sized by drawing the posterior leaflet and annulus toward the anterior leaflet. This reduction in annular dimension and stabi-

lization of the posterior aspect restored leaflet apposition and valve competency. Final device size was selected when MR was minimized or eliminated as assessed by color flow Doppler echocardiography.

RESULTS: In all cases (n = 6), we successfully implanted the Coapsys device without CPB or atriotomy. MR was reduced by an average of 2 grades to or less than 1. No adverse events such as hemodynamic compromise or structural valve damage were noted.

CONCLUSIONS: The Coapsys device implantation was feasible, safe, and repeatable on a beating canine heart. The Coapsys device consistently and significantly reduced or eliminated functional MR acutely without negative consequence to hemodynamics or valve function.

P72 MIDTERM OUTCOMES AFTER AORTIC VALVE DECALCIFICATION FOR PATIENTS WITH ASYMPTOMATIC MODERATE AORTIC STENOSIS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

Gilles D. Touati, Faouzi Trojette, Doron Carmi, Amar Benamar, Alphonse Nzomvuama

Cardiac Surgery Department, Hopital Sud, Amiens, France

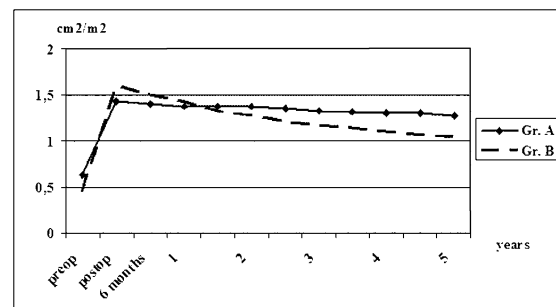
BACKGROUND: We performed manual decalcification of the aortic valve in a prospective series of patients with moderate aortic stenosis undergoing coronary artery bypass graft (CABG) surgery.

METHODS: 22 adult patients with moderate aortic stenosis underwent concomitant surgical repair of the aortic valve during CABG. Manual valve debridement with restoration of cusp mobility was attempted with myocardial revascularization.

RESULTS: After surgery, mean aortic valve area index (AVAI) improved from 0.57 cm²/m² to 1.56 cm²/m². Two groups of patients were identified: Group A "slow restenosers" (n = 16) and Group B "rapid restenosers" (n = 6); meanwhile, in Group B, over a period of 5 years, postoperative AVAI was twice than preoperative, without reoperation (Figure).

Population with the slowest recalcification rates were patients in whom the preoperative AVAI was greater than 0.55 cm²/m².

CONCLUSIONS: Manual aortic valve debridement for moderate aortic stenosis is a good option when surgery must be performed for coronary disease; the best results were obtained in patients with senile stenosis of a tricuspid aortic valve with an AVAI between 0.55 and 0.9 cm²/m².



P73 MINIMALLY INVASIVE MITRAL VALVE SURGERY IN HIGH-RISK PATIENTS

Aram K. Smolinsky, Amihay Shinfeld, Leonid Sternik, Erez Kachel, Jacob Lavee

Cardiac Surgery, Chaim Sheba MC, Tel-Hashomer, Ramat-Gan, Israel

OBJECTIVE: The advantages of the minimally invasive mitral valve surgery in high-risk redo patients is presented. Since its introduction in Israel, 42 patients were operated employing the Heartport system. 8 were AVR. Of the rest, 30 were mitral surgery. Nine patients of these 30 were of very high risk: 2 had two to four previous valvular operations. Seven had one to three previous CABP. Two were on IACPB support, one was in cardiogenic shock. All had LV dysfunction. Six were either urgent or emergent.

METHODS: Small RT thoracotomy through 4th intercostal space. Arterial cannulation in the ascending aorta via a separate stab wound in 6/9, others femoral. Venous via long femoral cannulae. Operations done with no aortic clamp, on fibrillating heart. Six had repairs, three replacement.

RESULTS: No perioperative mortality occurred. One patient with preoperative cardiogenic shock continued with low cardiac output, and died two months later. One patient with pre-op hemiparesis, had worsening of the paresis. Intra and post-operative TEE revealed excellent functional results.

CONCLUSION: Thoroscopic assisted minimally invasive mitral surgery is a viable option for the very high risk group of Redo mitral operations.

P74 REPAIR OF ACUTE MITRAL REGURGITATION ON A PORCINE BEATING HEART

Curtis E. Bower, Clifton C. Reade, Victor F. Chu, You Su Sun, L. Wiley Nifong, W. Randolph Chitwood, Jr.

Department of Surgery, East Carolina University, Greenville, NC, USA

OBJECTIVE: There is increasing interest in minimally invasive cardiac surgery. There has also been interest in decreasing or eliminating cardiopulmonary bypass (CPB). A porcine model of acute mitral regurgitation (MR) was created to demonstrate the feasibility of performing a mitral chordal repair on a beating heart.

METHODS: After institutional approval, 20 pigs underwent a left thoracotomy and placement of monitoring lines. A cutting snare was inserted transmyocardially and was used to rupture mitral valve chords. Hemodynamic parameters collected included heart rate (HR), left atrial pressure (LAP), left ventricular end diastolic pressure (LVEDP), pulmonary arterial pressure (PAP), and cardiac output (CO). Successful MR was noted by hemodynamic changes. A beating heart chordal repair was performed without CPB by passing a needle through the flail leaflet transmyocardially.

RESULTS: Five repairs are reported. Post-rupture, LAP, LVEDP, and CO significantly ($P < 0.05$) changed compared to Pre-rupture. Similarly, post repair, LAP, LVEDP, and CO significantly improved compared to post-rupture (Table).

CONCLUSIONS: Our data supports the possibility of repairing MR on a beating heart and warrants further investigation. Echocardiography during the procedure will likely improve results and ease. We believe a mitral valve repair using this method could substantially reduce the inflammatory response and complications associated with CPB.

	Pre-rupture	Post-rupture	Post-repair
HR	94.2 ± 16.4	84.4 ± 17.7	103.0 ± 20.0
LAP	10.0 ± 2.7	21.0 ± 7.0*	13.8 ± 3.7†
LVEDP	13.0 ± 5.7	24.4 ± 9.9*	14.0 ± 2.3†
ABP	58.4 ± 8.0	49.2 ± 8.9	52.8 ± 2.0
PAP	24.4 ± 4.1	27.0 ± 4.4	26.2 ± 7.8
CO	3.15 ± 0.50	2.44 ± 0.3*	2.92 ± 0.3†

* $P < 0.05$ vs. pre-rupture; † $P < 0.05$ vs. post-rupture.

P75 NEWLY DESIGNED STENTLESS MITRAL VALVES-IMPLANTATION TECHNIQUES AND IN VIVO VALVE PERFORMANCE

Jose L. Navia¹, Kazuyoshi Doi², Mario G. Garcia³, Kiyotaka Fukamachi², Michael W. Kopcak, Jr.², Pablo Ruda Vega¹, Eugene H. Blackstone¹, Patrick M. McCarthy¹, Delos M. Cosgrove, III¹

¹Thoracic and Cardiovascular Surgery, ²Biomedical Engineering, and ³Cardiology, The Cleveland Clinic Foundation, Cleveland, OH, USA

OBJECTIVE: The purpose of this study is to evaluate the implantation procedures and valve performance of newly designed stentless mitral valves (SMVs) in an acute animal study.

METHODS: A bovine pericardial bileaflet SMV without chordae (Bileaflet) and with chordae (Bileaflet-C) were implanted in 7 and 6 sheep, respectively, through a left thoracotomy. For Bileaflet prosthesis, the clear zone of the leaflets was excised, and the rough zone with primary and secondary chordae was preserved to keep the subvalvular apparatus intact. The free edges of the leaflets of the SMV were sutured to those of the native leaflets. The inflow orifice of the SMV was sutured to the mitral annulus (MA). For Bileaflet-C, the native mitral leaflets and chordae were excised, and the chordae of the SMV were sutured to the heads of the papillary muscles (PM). The inflow orifice of the SMV was sutured to the native MA. After weaning from CPB, valve performance was evaluated by epicardial echocardiography in the acute phase.

RESULTS: Postoperative echocardiography showed neither leaflet's restriction nor prolapse, and large effective orifice areas. Trivial and 1+ mitral regurgitation were found in 6 and 1 case in Bileaflet, and no to trivial MR was in 4 and 2 cases in Bileaflet-C, respectively. Transvalvular pressure gradient at rest and dobutamine stimulation were 2.3 ± 1.6 and 2.5 ± 2.2 mmHg in Bileaflet, and 1.8 ± 1.1 and 2.3 ± 1.2 mmHg in Bileaflet-C.

CONCLUSIONS: Both implantation techniques were simple and feasible, and maintained physiologic MA-PM continuity. These new bileaflet SMVs demonstrated excellent valvular performance.

P76 DEVELOPMENT OF A NOVEL DEVICE TO TREAT MITRAL REGURGITATION OFF-PUMP: AN EX VIVO STUDY ON EXCISED RECIPIENTS' HEARTS

Kiyotaka Fukamachi¹, Masahiro Inoue¹, Kazuyoshi Doi¹, Soren Schenk¹, Yoshio Ootaki¹, Raymond Dessoiffy¹, Hassan Neme², Cristiano Faber², Michael W. Kopcak, Jr.¹, Robert M. Vidlund³, Richard F. Schroeder³, Patrick M. McCarthy²

¹Biomedical Engineering and ²Thoracic and Cardiovascular Surgery, The Cleveland Clinic Foundation, Cleveland, OH, USA; ³Myocor, Inc., Maple Grove, MN, USA

OBJECTIVE: Current surgical treatments of mitral regurgitation (MR) require atriotomy and cardiopulmonary bypass. The purpose of this study was to develop and evaluate a novel device to treat functional MR without cardiopulmonary bypass.

METHODS: The device consists of anterior and posterior epicardial pads connected by a sub-valvular chord, which draws the posterior leaflet and annulus toward the anterior leaflet. In this *ex vivo* experimental study, we used 7 excised hearts from patients who underwent cardiac transplantation. All patients had functional MR of grade 2 or greater associated with idiopathic dilated cardiomyopathy (n=3) or ischemic cardiomyopathy (n=4). After the aortic valve was removed, the left ventricle was pressurized from the aorta with saline at a constant pressure. The degree of MR was then visually graded from the opened left atrium using a scale similar to that used for *in vivo* MR evaluation (0=none, 4=severe). The last three studies included volumetric measurements of MR.

RESULTS: In all hearts, there was a substantial decrease in MR. Mean MR grade was reduced from 3.1 ± 0.9 , pre tightening to 1.1 ± 0.4 , post tightening ($p < 0.001$). In the quantitative analysis of the last three cases mean regurgitation volume was reduced from 1108 ± 1134 ml/min to 236 ± 89 ml/min.

CONCLUSIONS: A device developed to treat MR off-pump has successfully demonstrated the ability to reduce MR in human hearts *ex vivo*. Further study will be required to evaluate the effects of the device on MR and hemodynamics in the *in vivo* setting.

P78 CABG USING A NEW SIMPLIFIED BYPASS SYSTEM WITH THE DELTASTREAM ERBP

Stefan Brose¹, Monica Aranda-Carrero¹, Wolfgang Buhre², Steffen Rex², Helmut Reul³, Stefan H. Christiansen¹, Rüdiger Autschbach¹

¹Cardiothoracic Surgery, ²Anesthesiology, and ³Institute for Biomedical Engineering, University of Aachen, Aachen, Germany

OBJECTIVES: More and more multimorbid patients undergo coronary artery bypass grafting (CABG). In order to reduce the operative risk, a simplified bypass system (SBS) with the Deltastream® extracorporeal rotary blood pump (ERBP) was developed. The priming volume of the Deltastream® ERBP is reduced to 35 mL, of the whole SBS (tubes, oxygenator and Deltastream® ERBP) to 600 mL, respectively. We report on our first clinical experiences with this device.

METHODS: 20 patients (16m/4f, mean age 65.5 years) with high grade two or three vessel disease had CABG on the beating heart with support of this SBS. Mean preoperative ejection fraction and CCS class were 0.3 (0.15-0.5) and 3.2 (2-4).

RESULTS: Mean number of distal anastomoses was 2.2 (2-3) and duration of extracorporeal circulation was 92 (52-136) minutes. Overall drainage blood loss was 644 mL (300-1300) requiring transfusion of 0.4 (0-3) packed red blood cells, 0.8 (0-4) fresh frozen plasma and no platelets. Comparing pre- and postoperative platelet counts as well as hemoglobin values, there was only a slight decrease of 30% and 18%, respectively. All patients had an uneventful postoperative course with normal hospital stay (7-13 days).

CONCLUSION: These results indicate that this SBS with the DeltaStream ERBP is useful in severely ill patients undergoing CABG.

P79 AORTIC VALVE REPAIR WITH THE VALSALVA GRAFT: COMBINING THE BENEFITS OF THE REIMPLANTATION WITH THE REMODELLING

Aram K. Smolinsky

Cardiac Surgery, Chaim Sheba MC, Tel- Hashomer, Ramat-Gan, Israel

BACKGROUND: While the aortic valve and root repair with the reimplanation technique (David I) gives excellent support to the valve and root elements, its flow patterns differ from normal. The remodeling technique (David II, Yacoub) gives normal like flow patterns and leaflets motion but less support. The new Sulzer Vascutek Valsalva graft is supposed to combine the benefits of the two techniques. We present our experience with seven consecutive patients.

METHODS: From Aug 2001 to Dec 2002 seven patients who underwent various aortic operations, which included valve and root repair, had the procedure done employing the Valsalva graft. Six had tricuspid valve, one bicuspid. One acute dissection, six elective. Valve repair included high resuspension of the commissures in the new STJ with separate pledgeted sutures, subcommissural annuloplasty (in two), raphe resection (in the bicuspid patient) and 7:0 Gortex suture support of the free leaflet margin in one.

RESULTS: There was no mortality. Excellent functional result in post-op TEE. The new root had a normal appearing look, with new artificial sinuses and leaflet motion that does not approach contact with the graft. The short-term follow-up is good-no functional deterioration or re-op, but the longest F/U is 15 months only.

CONCLUSION: In the short term follow-up, the Valsalva graft seems to fulfill its promise of better support combined with favorable functional anatomy.

P80 EXTENSIVE REVASCLARIZATION ON THE BEATING HEART: EARLY RESULTS IN PATIENTS RECEIVING FOUR TO SEVEN BYPASS GRAFTS

Alex Zapolanski¹, Michael B. Pliam¹, Laurel Mengarelli¹, Jill Ley², Richard E. Shaw¹

¹San Francisco Heart Institute, Seton Medical Center, Daly City, CA, USA;

²Department of Cardiac Surgery, California Pacific Medical Center, San Francisco, CA, USA

OBJECTIVE: Advances in Percutaneous Coronary Intervention have resulted in the referral of patients with more extensive disease for coronary artery bypass graft (CABG) surgery. There is concern that extensive revascularization is not consistently achievable using beating heart surgery. To evaluate this, we analyzed our experience in isolated CABG utilizing 4 or more grafts.

METHODS: Between January of 1996 and April of 2002, 3,905 consecutive patients had isolated CABG. Of these, 527 were done off-pump (OFFP). In 169 cases, 4 to 7 grafts were placed. These patients were compared with a matched, risk-adjusted sample taken from 1,406 patients who had 4 or more grafts placed using cardiopulmonary bypass (CPS). Matching was based on the STS expected probability of mortality. Data were extracted from a standard cardiac database.

RESULTS: Comparison of the two groups demonstrated that they were similar in age, gender, risk factor history, LV ejection fraction and acuity of surgery. In the OFFP group, the graft distribution was: 123 had 4, 40 had 5, 5 had 6 and 1 patient had 7 grafts placed. In-hospital results were: Mortality (OFFP=0.6% vs. CPS=1.5%; p=n.s.), stroke (OFFP=1.2% vs. CPS=2.4%; p=n.s.), renal failure (OFFP=0.0% vs. CPS=1.8%; p<0.05) and blood use (OFFP=32% vs. CPS=44%; p<0.05). OFFP patients were extubated quicker (mean 10 hrs. vs 22 hrs.; p<0.01) and required less blood when transfused (2 vs. 5 units; p<0.01).

CONCLUSIONS: Off-pump coronary bypass surgery requiring placement of 4 or more grafts can be performed safely and effectively in selected patients without compromising the completeness of revascularization.

P81 THE POTENTIAL ADVANTAGE OF "NO-TOUCH" AORTIC TECHNIQUE IN OFF-PUMP COMPLETE ARTERIAL REVASCLARIZATION

Gil Bolotin¹, Yuval Shapira², Yakov Gotler², Inna V. Frolkis², Alan P. Kypson¹, Nahum Neshet³, W R. Chitwood, Jr.¹, Gideon Uretzky²

¹Surgery, East Carolina University, Greenville, NC, USA; ²Cardiothoracic Surgery and ³Surgery, Tel Aviv Medical Center, Tel Aviv, Israel

OBJECTIVES: Off-pump coronary artery bypass grafting (OPCAB) and complete arterial revascularization without proximal anastomosis to the aorta may decrease neurological events after open-heart surgery. Few reports exist regarding the combination of OPCAB and complete arterial revascularization exploring the theoretical advantage of avoiding manipulation of the aorta. We review our results in 183 patients who underwent off-pump complete arterial revascularization.

METHODS: Between September 2000 and August 2001, 258 patients underwent complete arterial coronary artery bypass, 183 (71.0%) were OPCAB. Pre-operative renal failure was 12.6% (n=23) as compared to 5.8% (n=13, p=0.018) in our on-pump CABG population (n=223) and 14.8% (n=27) of the patients were octogenarians as compared to 4.5% (n=10, p<0.001) in our on pump CABG population.

RESULTS: Of 183 patients, 74 (40%) were single graft to LAD. The mean number of grafts per patient undergoing multiple OPCAB complete arterial revascularization was 2.3, as compared to 3.0 in our on-pump CABG population (p<0.05). The mortality rate was 3.28% as compared to 2.69% (NS) in our on-pump CABG population. The incidence of CVA was 0% as compared to 2.24% (p=0.04) in our on-pump CABG population.

CONCLUSIONS: Complete arterial OPCAB revascularization without manipulation of the aorta in high-risk patients can be performed with short-term similar results to conventional CABG and very low neurological complications.

P82 EFFICACY OF OFF-PUMP CABG ON CHRONIC DIALYSIS PATIENTS

Susumu Manabe, Hirokuni Arai, Masato Shimizu, Koso Egi, Noriyuki Tabuchi, Hiroyuki Tanaka, Makoto Sunamori

Cardiothoracic Surgery, Tokyo Medical and Dental University, Tokyo, Japan

OBJECTIVE: Although chronic dialysis (HD) patients frequently suffer from ischemic heart disease, the operative mortality of on-pump CABG in HD patients has been reported as high as 7-10%. The purpose of this study is to determine the impact of off-pump CABG in HD patients.

METHODS: In consecutive 26 HD patients, isolated CABG of either off pump (n=15) or on pump (n=11) was performed. Early postoperative respiratory function and hemodynamics were compared between these two groups.

RESULTS: Preoperative patient backgrounds (age, gender distribution, LV function and respiratory function) were similar in both groups. There was no operative death in both groups. Two major postoperative complications (pneumonia and sustained VT) were observed in on pump group. Mean AaDO₂ during first postoperative 12 hours was significantly lower in off pump group (73.1 ± 25.6 vs. 136.0 ± 82.4 mmHg, p=0.01). Postoperative respiratory support time tended to be shorter in off pump group (19.2 ± 12.3 vs 25.6 ± 10.6 hrs, p=0.21), but the difference was not significant. During first postoperative 36 hours, mean RA and PAW pressure were significantly lower in off group (RA 5.6 ± 1.8 vs 7.4 ± 2.0 mmHg, p=0.04, PAW 8.1 ± 1.9 vs. 11.0 ± 1.5 mmHg, p=0.001). Cardiac index was similar in both groups (3.4 ± 0.7 vs. 3.4 ± 0.4 l/min/m², p=1.00).

CONCLUSION: Off-pump CABG in HD patient had favorable effects on postoperative respiratory function and hemodynamics, and was considered to be a less invasive procedure.

P83 TOTAL ARTERIAL OFF-PUMP CORONARY ARTERY BYPASS FOR MULTIVESSEL CORONARY ARTERY DISEASE

Derek von Haag, Peter D. Wearden, Gianluca Bonanomi, Larry Shears, Marco A. Zenati

Cardiothoracic Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA, USA

OBJECTIVE: The technical complexity and potential risk of off-pump coronary artery bypass surgery (OPCAB) for multivessel coronary artery disease (CAD) are both increased by the use of all arterial conduits. We hypothesize that total arterial off-pump coronary artery bypass (TAOPCAB) for multi-vessel CAD is a technically feasible and safe operation.

METHODS: Retrospective analysis was performed on our database of all patients who underwent coronary artery bypass grafting via median sternotomy where neither cardiopulmonary bypass nor venous conduits were used from September 1999-May 2002 at two major hospitals.

RESULTS: Eighty-seven patients underwent TAOPCAB. The average age was 62 ± 11 years. Comorbidities included diabetes mellitus (40%), chronic renal insufficiency/failure (28%), Cerebrovascular disease (22%), peripheral vascular disease (21%), chronic lung disease (19%), morbid obesity (15%), myocardial infarction (MI) within one week (15%), and ejection fraction

<30% (4%). The average number of bypasses was 2.5 ± 0.6 (Range = 2-4). At least one internal mammary artery (IMA) was used in 98% of patients. The radial artery was used in 62% of patients with one of these patients having both radial arteries used. The gastroepiploic artery was utilized in 18% of patients. There were two perioperative deaths resulting in a 2.4% mortality. One patient (1.2%) had a postoperative CVA. Three patients (3.5%) developed mediastinal wound infections. There were no 30-day readmissions for angina or MI.

CONCLUSIONS: Total arterial OPCAB can be performed safely in patients with multivessel coronary artery disease and concomitant comorbidities.

P84 HEMODYNAMIC COLLAPSE DURING OFF-PUMP CORONARY ARTERY BYPASS AND A REVIEW OF SOME CONTROVERSIAL ADVERSE OUTCOMES

Avdesh N. Mathur

Cardiac Surgery, Sudbury Regional Hospital, Sudbury, ON, Canada

OBJECTIVE: To examine controversial issues of intra-operative hemodynamic crisis, adverse effects of acute on-pump conversion, other morbidity and effectiveness (post-op angiography) following off-pump coronary artery bypass (OPCAB).

SETTING: A small northern Ontario community hospital where surgical assistance, nursing familiarity with OPCAB and even anesthesiologist comfort with the procedure varied.

DESIGN: Prospective collection of data with incremental audit of results and retrospective analysis of alarming and controversial issues.

PATIENTS: 124 consecutive patients were operated by a surgeon with long-standing experience between April 1996 and June 2002. Patients were selected on basis of coronary anatomy. With time more complex multi-vessel revascularization, including posterior wall, was undertaken but not "all comers". Every attempt was made not to compromise use of arterial conduits, quality of anastomoses or completeness of revascularization. This represents our "learning curve".

MAIN RESULTS: Hemodynamic crisis requiring acute on-pump conversion (5.6%) had adverse outcomes. In our experience, increased blood transfusion, operative time, mortality (2.8%), poorer angiographic graft patency and unpredictability of these outcomes following complex multi-vessel OPCAB surgery led to a more cautious strategy including selection of patients.

CONCLUSION: "Simple" OPCAB on easily accessible coronary arteries had excellent early outcomes. "Complex" multi-vessel OPCAB for triple vessel disease involving difficult to access coronaries was more demanding with

higher peri-operative adverse effects and unpredictable effectiveness. Our early enthusiasm for complex multi-vessel OPCAB has been gradually replaced with a more conservative approach based on the trauma and chaos of acute on-pump conversion, evidence of poorer anastomotic quality, increased operating time and blood utilization.

P85 CONVERSIONS IN OFF PUMP CORONARY SURGERY- EXPERIENCE FROM A NEW CENTER IN BOSNIA

Emir Mujanovic, Emir Kabil, Mehdi Hadziselimovic, Muniba Softic, Azur Azabagic, Jacob Bergsland

Cardiovascular Clinic, University Hospital Tuzla, Tuzla, Bosnia and Herzegovina

OBJECTIVE: This study investigated outcomes in patients undergoing OPCAB converted to CPB.

METHODS: 784 CABG procedures were performed in a new center. MID-CAB and robotic procedures were done as OPCAB. For multivessel CABG selection criteria were arbitrary.

RESULTS: 391 procedures were ONCAB, 357 OPCAB and 36 converted from OPCAB to ONCAB. Patients started as OPCAB and later placed on CPB were considered conversions (9.16%). Reasons for conversions: hemodynamic instability-21 (58.3%); graft revision-8 (22.2%), ventricular fibrillation-5 (13.8%) and poor native vessel-2 (5.6%). Surgical results are summarized in the table. Patients converted with mild hemodynamic compromise or for graft revision had no complications. In 9 patients emergently converted due to cardiac arrest or VF, 3 patients had stroke and 3 myocardial ischemia requiring IAPB.

CONCLUSION: Conversion of OPCAB patients during the surgical procedure must be performed prior to cardiac arrest or severe hemodynamic instability. Careful monitoring and treatment of ischaemia is essential in OPCAB surgery. Emergency conversion after cardiac arrest is serious, frequently causing major ischaemic complications.

	ONCPB	OPCPB	CONV
Number	391	357	36
Mean age	56.15	57.09	57.38
Mean EF	51.86%	52.42%	51.38%
Grafts per patient	3.09	1.98	2.75
Morbidity			
Stroke	8 (1.87%)	4 (1.12%)	3 (8.33%)
IABP	3 (0.70%)	0 (0.00%)	3 (8.33%)
Mortality	11 (2.57%)	2 (0.56%)	0 (0.00%)