

## Featured Abstracts – Innovative Coronary Techniques

Saturday, June 22, 2002, 8:00 a.m. – 10:00 a.m.

### 23 MIDCAB PROCEDURE IN AWAKE PATIENTS

Tayfun Aybek, Paul Kessler, Selami Dogan, Gerd Neidhart, Mohammad Fawad Khan, Gerhard Wimmer-Greinecker, Anton Moritz

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**OBJECTIVE:** Off pump surgery reduces the trauma of coronary revascularization. Epidural anesthesia may further reduce intraoperative stress and postoperative pain. This technique also allows awake coronary artery bypass grafting (ACAB) completely avoiding the drawbacks of mechanical ventilation and general anesthesia.

**METHODS:** 20 patients underwent MIDCAB with LITA to LAD grafting using partial lower sternotomy. 2 out of 20 patients had sequential revascularization to the diagonal branch and LAD. A thoracic epidural catheter was placed at T 2 – T 3 level one day prior to surgery. Clinical outcome and the postoperative visual analogue scale (VAS) pain score were recorded.

**RESULTS:** 18 patients remained awake throughout the whole procedure. 2 patients required secondary intubation due to incomplete analgesia or pneumothorax. Mean skin incision was  $7.1 \pm 4.2$  cm. Procedure time was  $74 \pm 16$  min. Intermediate care stay was  $4.1 \pm 0.6$  hours. There were no in-hospital death. All grafts except one (stenosis at the LITA) showed good function. Early postoperative pain was recorded and amounted to VAS of  $24 \pm 6$  on the first postoperative day,  $28 \pm 6$  on the second postoperative day, and  $26 \pm 7$  on the third postoperative day.

**CONCLUSIONS:** The present data show feasibility and safety of beating heart surgical revascularisation without general anesthesia. Partial lower sternotomy proved to be a feasible approach for awake coronary artery bypass grafting. Continuation of intraoperative thoracic epidural analgesia for 3 postoperative days provides better pain control and faster mobilisation.

### 25 EXTRATHORACIC MIDCAB APPROACH FOR SINGLE AND MULTIVESSEL GRAFTING

Nilesh U. Patel, John C. McCabe, James D. Fonger, Mark W. Connolly, Didier F. Loulmet, Valavanur A. Subramanian

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**OBJECTIVE:** To achieve single and multivessel coronary revascularization using single transabdominal minimal access incision

**METHODS:** Three inch epigastric incision with partial division of recti and release of costo-diaphragmatic attachments supplemented with thoracic cage lifting allowed direct harvesting of IMAs up to 2nd space. Differential pericardial dislocating sutures facilitated exposure of all coronary target sites. Mechanical stabilizer was routinely used.

**RESULTS:** Between March 1998 and September 2001, 117 patients underwent transabdominal MIDCAB (75 males, age 54-84). Preoperative risk factors were reoperation (71); 51 one, 12 two, and 2 three previous surgeries; instant re-stenosis (58), CHF (61), COPD (13), calcified aorta (17), CRF (8), cerebrovascular disease 16 (8 CVA), and EF < 30% (20). Seventy-seven patients had single, 37 double and 1 triple grafts with 1.3 grafts per patient. Grafts were LIMA (26), RIMA (25) and RGEA (79) with (9) composite grafts with either SVG or Radial artery. Target vessels were RCA (47), LAD (37), PDA (55), acute marginal (2) and the PLA branch of the circumflex (13). There were 2 (1.7%) conversion to sternotomy and CPB with full recovery. There was no perioperative mortality, stroke and renal failure. Morbidities were wound infection (4) and re-operation for bleeding (1). Mean length of stay was  $2.9 \pm 1.1$  days. All initial 17 consecutive patients who had routine angiography (< 48 hours) had patent grafts. During the mean follow-up of  $20.1 \pm 4$  months, 96% patients had event free survival (PTCA, reoperation, MI, and death).

**CONCLUSIONS:** Transabdominal MIDCAB is technically feasible approach for single and multi-vessel bypass grafting with good in-hospital and midterm clinical outcome.

### 24 PRIMARY OPCAB AS STRATEGY FOR ACUTE CORONARY SYNDROME - PROSPECTIVE TRIAL

Marek Gemel, Stanisław Woźniak, Adam Szafranek, Marek Jasiński, Piotr Olszówka, Dariusz Szurlej, Kazimierz Widenka, Ryszard Bachowski, Wojciech Ceglarek

2nd Department of Cardiac Surgery, Silesian Medical Academy, Katowice, Poland

**OBJECTIVE:** Conventional CABG using cardiopulmonary bypass (CPB) carries higher mortality and morbidity for patients operated upon acute coronary syndrome (ACS). Aim of this retrospective study was to evaluate potential benefits of avoiding CPB (OPCAB) during operation in ACS.

**METHODS:** Among 624 patients who underwent OPCAB between January 1999 and June 2001, one hundred forty three (143) were operated in acute coronary syndrome (ACS). In ACS patients, 66 were operated during evolving myocardial infarct, and 77 in unstable angina classified as class IV according to Braunwald classification.

**RESULTS:** Overall 30-day mortality was 4.9% (n = 7) for ACS group and 0.83% (n = 4) for Elective CAD group. (p<0.0001) Differences between groups were found in terms of use of inotropes, IABP and conversion OPCAB to CPB subsequently p<0.0001, p<0.01, p<0.03 as well as blood transfusion p<0.0003. Multivariate logistic regression analysis for 641 patients revealed acute coronary syndrome (p<0.015), acute myocardial infarction (p<0.019), renal failure (p<0.017) and left ventricle aneurysm (p<0.028) as independent risk factors for 30-day mortality.

**CONCLUSIONS:** OPCAB is a valuable approach in acute coronary syndrome, however it carries significant mortality and morbidity within one week. Careful preselection and timing of intervention is required in order to fully benefit from OPCAB strategy.

### 26 PROSPECTIVE RANDOMIZED COMPARISON OF POSTOPERATIVE PAIN AND PULMONARY FUNCTION AFTER OFF-PUMP VERSUS CONVENTIONAL CORONARY ARTERY BYPASS GRAFTING

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**OBJECTIVE:** Impairment of pulmonary function and its interaction with postoperative pain is common after conventional coronary artery bypass grafting (CABG). The early and intermediate benefits of the off-pump coronary artery bypass grafting (OPCAB) have been well documented but there are no reports whether OPCAB results less postoperative pain and improved pulmonary function.

**METHODS:** Eighty patients with a body-mass index of 40-50 kg/m<sup>2</sup> were randomly assigned to undergo OPCAB (n = 42) and conventional CABG (n = 38). There were no major preoperative differences concerning age, gender, NYHA class, ejection fraction, body mass index, pulmonary history, baseline pulmonary function. Number of grafts and chest tubes were also similar between these two groups. Pulmonary function studies were performed preoperatively and on 2 and 5 postoperative day. Oxygen saturation and chest radiographs were performed on both groups preoperatively and on 1 postoperative day and at discharge. Postoperative pain was evaluated using a visual analog scale and the amount of analgetics consumed was recorded. Data are presented as mean  $\pm$  standard deviation.

**RESULTS:** Intraoperative time was significantly shorter in OPCAB group (p<0.05). Analgesic requirement (p<0.001) and visual analog scale pain scores at rest and during mobilization were lower after OPCAB than after conventional CABG (p<0.05). OPCAB patients had significantly less impairment of pulmonary function on both postoperative days (p<0.05). The incidence of mild and marked pleural effusions and segmental atelectasis was higher in the conventional CABG group (p = 0.003).

**CONCLUSIONS:** OPCAB resulted in less postoperative suppression of pulmonary function, decreased pain, improved oxygenation, less pleural effusions and atelectasis than conventional CABG. This can be attributed to the reduced intraoperative time and to the absence of extensive chest retraction and generalized inflammatory response associated with the use of cardiopulmonary bypass.

**28 MODIFICATION OF SURGICAL TECHNIQUE FOR ASCENDING AORTIC ATHEROSCLEROSIS CAN REDUCE STROKES IN CABG**

Johannes Bonatti, Georg Nagele, Herbert Hangler, Ludwig Mueller, Michael Danzmayr, Elfriede Ruttman, Guenther Laufer

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**OBJECTIVE:** Use of epiaortic scanning (EAS) in coronary artery bypass grafting (CABG) is still a matter of debate. It is not really clear whether the findings obtained by EAS can lead to effective changes in surgical technique which improve stroke rates.

**METHODS:** We applied EAS in 352 patients undergoing CABG. EAS was performed before opening of the pericardium using a 7.5 MHz ultrasonic probe packed in a sterile plastic bag. In the presence of moderate atherosclerosis (maximum aortic wall thickness of 3 to 5 mm) primarily single aortic cross-clamping was carried out. In cases of severe ascending aortic atherosclerosis (maximum aortic wall thickness above 5 mm) either single cross-clamping or aortic no touch techniques on the beating heart were used.

**RESULTS:** The degree of ascending aortic atherosclerosis was mild in 151 patients (42.9%), moderate in 167 patients (47.4%), and severe in 34 patients (9.7%). The operative technique was modified in 31.1% of patients with moderate ascending aortic disease and in 91.2% of patients with severe disease. Perioperative mortality was 0.0% (mild disease), 3.0% (moderate disease), and 8.8% (severe disease) respectively ( $p = 0.005$ ). Corresponding stroke rates reached 2.0%, 2.4%, and 2.9% ( $p = NS$ ). Stepwise logistic regression showed that ascending aortic atherosclerosis was not an independent predictor for stroke, perioperative mortality, or perioperative myocardial infarction.

**CONCLUSIONS:** We conclude that intraoperative screening of CABG patients by EAS can reveal useful information concerning the patient's operative risk and can influence the surgical decision making process in a way that strokes can be prevented.

**29 CORONARY ENDARTERECTOMY ON BEATING HEART: IS IT SAFE?**

Naresh Trehan, Rajneesh Malhotra, Vijay Kohli, Zile Singh Meharwal, Yugal Mishra, Yatin Mehta

Escorts Heart Institute and Research Centre, New Delhi, India

**OBJECTIVE:** Patients with extensive coronary artery disease require coronary endarterectomy. Coronary endarterectomy has been conventionally being performed on arrested heart. Aim of this study is to evaluate the end results of Coronary endarterectomies performed off pump with the same procedure done on conventional cardiopulmonary bypass and arrested heart.

**METHODS:** Since January 1997, 119 patients have undergone Coronary endarterectomy on beating heart (Group-A), similar number of patients are compared with patients who had coronary endarterectomy on arrested heart (Group-B).

**RESULTS:** Demographic data matched in both groups. Mean ejection fraction in group-A was 0.42 and in group-B was 0.38. Average number of grafts in group-A was 2.8 and in group-B was 2.6. Manual core extraction technique was adopted in both the groups. Endarterectomy of LAD, RCA and obtuse marginals were performed. Incidence of perioperative myocardial infarction evaluated by post operative ECG, CPK, CPK-MB, Troponin - T. Perioperative myocardial infarction occurred in 4 patients in group-A and in 9 patients in group-B. Six patients in group-A required IABP support and 8 patients in group-B required IABP support. Coronary angiography was performed after six months of procedure in 68 patients in group A and 62 patients in group-B. There was 96% patency of endarterectomised vessels in group-A where as it was 94.2% in group-B. There were 2 in-hospital deaths in group-A and 3 in group-B.

**CONCLUSIONS:** Results of this study show that Coronary endarterectomy can be done safely on beating heart and results are comparable to conventional arrested heart CABG.



## Featured Abstracts – Valve and Aortic Surgery

Saturday, June 22, 2002, 10:15 a.m. – 11:30 a.m.

### 30 MINISTERNOTOMY IMPROVES OUTCOME IN AORTIC VALVE SURGERY: A PROSPECTIVE RANDOMIZED STUDY

Guido Sani, Edvin Prifti, Giacomo Frati, Gabriele Giunti, Massimo Bonacchi  
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**OBJECTIVE:** Ministernotomy for AVR has been employed so far but the influence in postoperative outcome is unclear. The aim of this perspective randomized study was to compare the results obtained in patients undergoing elective AVR, either through ministernotomy or conventional sternotomy.

**METHODS:** Between January 1999 and January 2002, 120 consecutive patients, undergoing elective AV replacement, were randomly divided in two groups: Group I (n = 60 patients), undergoing ministernotomy approach (reverted-C or L, Figure 1) and Group II (n = 60), undergoing conventional sternotomy.

**RESULTS:** The length of skin incision was significantly shorter in I (7.8±1.1 cm vs 24.1±2.8 cm, p<0.001). There were not significant differences in associated procedure, CPB and ACC times. Total operating time was longer in Group I (3.7 ±0.32 versus 3.3±0.7 hours). Similar incidence of cardiac, neurological, and renal complications between the groups was found. The mean mediastinal drainage and the mean blood transfusion per patient resulted greater in Group II (p<0.004 and p<0.001 respectively). Thirty-nine (65%) in II versus 17 (28.3%) patients in I required postoperative blood transfusion (p = 0.02). Mechanical ventilation time resulted significantly higher in Group II (7.4±2.3 hours vs 4.3±0.1 hours, p = 0.003). At 5 days after the surgical procedure the spirometric data analysis demonstrated a significantly lower total lung capacity, maximum inspiratory and expiratory pressures in II versus I, p = 0.002, p = 0.005 and p<0.001 respectively.

**CONCLUSIONS:** According to our results, ministernotomy has not only important cosmetic advantage but also beneficial effects in blood loss and transfusion, postoperative pain and in sternal stability. Besides, it improves respiratory functional status recovery, allows earlier extubation and hospital discharge.

### 32 IMMEDIATE VERSUS DELAYED ENDOVASCULAR TREATMENT OF POST-TRAUMATIC AORTIC PSEUDOANEURYSM AND TYPE B DISSECTIONS: RETROSPECTIVE ANALYSIS PREMISES TO THE UPCOMING EUROPEAN TRIAL

Tommaso Fiore, Vito Paradiso, Stefano Schena, Michele Sciascia, Donato D'Agostino, Emanuela De Cillis, Giuseppe Mannatrzio, Alessandro Santo Bortone, Luigi de Luca Tupputi Schinosa

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**OBJECTIVE:** We retrospectively analyzed our data regarding the endovascular management of post-traumatic aortic pseudoaneurysms (PAP) and type B dissections (TBD) in order to verify whether an immediate stent-graft deployment offers clinical advantages over a delayed approach.

**METHODS:** Patients admitted with diagnosis of either PAP (n = 10; 33.4±9.2ys) or TBD (n = 20; 55.8±7.7ys) were respectively divided in two groups according to time of treatment, following the traumatic or pathologic event: immediate (>2weeks; PAP = 5 and TBD = 8) and delayed (>2weeks; PAP = 5 and TBD = 12). Excluder®-Gore (9 in PAP and 6 in TBD) and Talent®-Medtronic (1 in PAP and 5 in TBD) endovascular stent-grafts have been used. Follow-up was performed at 3,6 months and 1year and based on lab tests, chest angio-CTscans and echocardiography.

**RESULTS:** The endovascular procedure resulted uneventful in all PAP patients undergone either immediate or delayed treatment. All immediately treated TBD cases were also successful. However, in 9 over 12 delayed TBD patients, a stent-graft deployment was not possible due to complicate progression of the false lumen; one case benefited fenestrations of the false lumen while 8 underwent medical therapy. All patients treated with endovascular stent-grafts were discharged in good overall conditions within 5 days.

**CONCLUSIONS:** An immediate endovascular management of PAP and TBD offers some important advantages like avoidance of high-risk surgical procedures and post-operative complications with short hospital stay. Moreover it has been observed that an immediate endovascular treatment allows a safe management of all cases. These preliminary data are helpful for the beginning of a randomized European trial about the immediate endovascular management of descending thoracic aorta diseases.

### 31 BEATING-HEART VALVE SURGERY

Seljko Sutlić, Igor Rude, Bojan Biočina, Davor Bariać, Daniel Uniać  
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**OBJECTIVE:** : Wishing to minimize bad effects of cardiopulmonary bypass in valve surgery, and accepting the principals of beating-heart coronary surgery, the authors have developed a method of normothermic beating-heart valve surgery using the technique of retrograde oxygenated coronary sinus perfusion.

**METHODS:** From January 1996 till December 2001 a total number of 62 patients were operated on in our institution using beating-heart technique for different valvular procedures. These patients were case-matched with patients operated in normothermia using cardioplegic arrest. Selection criteria were: gender, LVEF, preoperative AF, hypertension, pulmonary hypertension, and diabetes.

**RESULTS:** There was statistically significant difference between the groups regarding duration of cardiopulmonary-bypass (69,35±13,52 min versus 93,59±28,54 min; p<0,001) and aortic cross-clamp time (46,5±8,95 min versus 61,5±18,34 min; p<0,001) in favour of the beating-heart group. There were no statistically differences observed regarding need for inotropic support, postoperative bleeding, CK, CK-MB, LDH, or complications: sternal infection, atrial fibrillation, neurologic events, and death.

**CONCLUSIONS:** This technique is as safe as the conventional ones. Its major advantages are lower cardiopulmonary bypass- and aortic cross-clamp time, continuous perfusion of the myocardium thus avoiding reperfusion injury. Beating-heart valve surgery can particularly be recommended for patients at high risk and those with low ejection fraction.

### 33 EMERGENT ENDOVASCULAR INTERVENTIONS FOR RUPTURED THORACIC AORTIC ANEURYSMS

Mirko Doss, Anton Moritz, Joern Balzer, Sven Martens, Thomas Vogl, Hans Gerd Fieguth, Gerhard Wimmer-Greinecker

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**OBJECTIVE:** The purpose of our study was to demonstrate the effectiveness of endovascular stent grafts in the treatment of acutely ruptured thoracic aortic aneurysms and Typ B dissections as an alternative to the conventional surgical approach, in an emergency setting.

**METHODS:** From Januar 2001 to October 2001, we deployed 11 emergent endovascular stent grafts, into the thoracic aorta. We treated 7 ruptured aortic aneurysms and 4 acutely perforated Typ B Dissections. Aortic rupture was confirmed pre-operatively by spiral-computed tomography. In all cases hemothorax was present. The average interval from onset of symptoms to treatment was 28.5 hours. We used commercially manufactured stent grafts: 10 Talent (Medtronic) and 1 Excluder (Gore).

**RESULTS:** Deployment of the stent grafts was successful in 9 cases. There were 2 cases of access failure due to small caliber of iliac arteries and one of these patients died shortly after the procedure was abandoned. Perioperatively and at follow up there were no cases of paraplegia, stent migration or endoleaks. There was however, 1 temporary renal failure and 2 patients required mechanical ventilation for more than 48 hours.

**CONCLUSIONS:** Our experiences with emergency endovascular stent-grafting show that the procedure is technically feasible, with less morbidity and mortality than conventional open surgery, in selected patients.

## Forum Abstracts – Basic Science

Saturday, June 22, 2002, 1:30 p.m. – 2:30 p.m.

### 34 CHANGES IN PLATELET FUNCTION AFTER OFF-PUMP CORONARY BYPASS

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**OBJECTIVE:** Off pump coronary artery bypass (OPCAB) has many potential advantages compared with on pump surgery utilizing cardiopulmonary bypass (CPB). These include diminution of the whole body inflammatory response and its resultant effects on haemostasis. Platelet dysfunction is almost universal after CPB, increasing bleeding risk. Little is known of the effects on platelet function during OPCAB. This study was conducted to determine if there was any change in platelet function using a point of care analyser.

**METHODS:** Patients undergoing OPCAB had blood taken for platelet function analysis (hemoSTATUS™, Medtronic Inc, Minneapolis, MN USA) after induction of anaesthesia but prior to systemic heparinization. After internal thoracic artery harvesting, porcine heparin was given (200 IU /kgm body wt) and partly reversed following completion of all grafts. Further platelet function was assessed at 30 minutes following heparin reversal. Platelet counts and blood loss were recorded. Data were analysed with paired t test.

**RESULTS:** Data were collected from 10 male patients. Mean age was 60 ( $\pm 6.9$ ) yrs, no of grafts 3.2 ( $\pm 1.2$ ). Platelet function (Ch 6) increased from 77.5 ( $\pm 22.9$ )% to 89.1 ( $\pm 8.7$ )% ( $p = 0.016$ ). Platelet count fell from  $244 \times 10^9/l$  to  $187 \times 10^9/l$ . Mean blood loss was 598 ml and 1 patient received blood products.

**CONCLUSIONS:** This small study shows platelet function is increased after OPCAB. This may explain reports of increased graft occlusion. It has implications for the early commencement of anti-platelet agents after OPCAB. Further work is needed in this area.

### 36 NEUTROPHIL ACTIVATION IN PATIENTS UNDERGOING OFF-PUMP CORONARY ARTERY BYPASS SURGERY: A PROSPECTIVE RANDOMIZED STUDY

Sharif Al-Ruzzeh, Ginette Hoare, Nandor Marczin, George Asimakopoulos, Shane George, Kenneth Taylor, Mohamed Amrani

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**OBJECTIVE:** Cardiac surgery is associated with systemic inflammation. Activation of neutrophils is a crucial step in inflammation resulting in neutrophil sequestration within the tissues. One of the potential advantages of performing Off-Pump Coronary Artery Bypass (OPCAB) surgery is the attenuation of the systemic inflammatory response. This prospective randomised trial compares neutrophil activation in patients undergoing OPCAB versus Coronary Artery Bypass Grafting (CABG) with Cardiopulmonary Bypass (CPB).

**METHODS:** Sixty patients, undergoing primary isolated CABG, were randomised prospectively into two groups: One group underwent CABG with CPB while the other group underwent OPCAB. Central venous blood samples were obtained before skin incision and 15 minutes, 60 minutes, 2 hours, 5 hours and 24 hours following initiation of CPB or application of the stabilisation device. Differential white cell counts were measured using routine laboratory techniques. CD11b surface expression on neutrophils was measured by flow cytometry. Interleukin-8, myeloperoxidase and lactoferrin plasma levels were measured by enzyme-linked immunoassays.

**RESULTS:** The two groups were well matched with regards to preoperative characteristics. White cell and neutrophil counts rose significantly in both groups following the operation but were significantly higher in the OPCAB group at 5 hours ( $p < 0.001$  and  $p = 0.002$ ) respectively. Interleukin-8 concentration was significantly higher in the CPB group at 5 hours following initiation of CPB ( $p = 0.034$ ). CD11b was significantly raised in the CPB group at 60 minutes ( $p = 0.002$ ). Myeloperoxidase remained undetectable in both groups. Lactoferrin increased in both groups without showing any significant difference between them.

**CONCLUSIONS:** This prospective randomised study demonstrates characteristic changes in the number of circulating neutrophils and their activation following CABG surgery with and without CPB. While OPCAB is associated with significantly higher leukocytosis, these neutrophils exhibit less activation markers. The lower postoperative neutrophil counts occurring in the CPB group could be explained by the activation and consequent sequestration of the neutrophils in the CPB circuit and tissues.

### 35 METABOLISM OF MYOCARDIUM DURING CORONARY ARTERY BYPASS GRAFTING WITH THE USE OF EXTRACORPOREAL CIRCULATION (CCAB) AND ON BEATING-HEART (OPCAB)

Marek Jemielny, Bartłomiej Perek, Pawel Kwinecki, Wojciech Stachowiak, Wojciech Dyszkiewicz

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**OBJECTIVE:** During CABG with the use of CPB myocardium is exposed to ischemia and reperfusion injury. It results in excessive lactates production, pH decrease (acidosis) and ATP degradation. The aim of study was to assess if avoiding CPB in OPCAB procedures influences positively on cardiac metabolism.

**METHODS:** One hundred thirty six (116 male and 20 female) consecutive patients (pts) who underwent CCAB ( $n = 74$ ) or OPCAB ( $n = 62$ ) were examined. Blood was withdrawn simultaneously from radial artery and coronary sinus, in group CCAB before CPB institution (I), then 1 min (II), 5 min (III) and 15 min (IV) after the aortic clamp was released, whereas in group OPCAB before the first distal anastomosis (I), then 1 min (II), 5 min (III) and 15 min (IV) after the last one. Both lactate and phosphates concentration and pH were evaluated.

**RESULTS:** Baseline values of all parameters did not differ between groups. Lactates production, ATP degradation were significantly higher in CCAB pts (table). The highest phosphates release was observed 1 min after declamping of the aorta, while lactates 4 min later. #  $p < 0,05$ ; \*  $p < 0,001$  (OPCAB vs. CCAB); \*\*arterial/coronary difference

	Lactates**		Phosphates **		pH **	
	OPCAB	CCAB	OPCAB	CCAB	OPCAB	CCAB
I	-0,06 $\pm$ 0,04	0,03 $\pm$ 0,02	0,01 $\pm$ 0,07	0,03 $\pm$ 0,01	-0,03 $\pm$ 0,01	-0,03 $\pm$ 0,01
II	0,1 $\pm$ 0,24	0,70 $\pm$ 0,88#	0,03 $\pm$ 0,01	0,13 $\pm$ 0,02#	-0,03 $\pm$ 0,01	-0,13 $\pm$ 0,01*
III	0,04 $\pm$ 0,13	0,66 $\pm$ 0,83*	0,01 $\pm$ 0,01	0,03 $\pm$ 0,07	-0,03 $\pm$ 0,02	-0,13 $\pm$ 0,05*
IV	-0,03 $\pm$ 0,17	0,04 $\pm$ 0,60	0,01 $\pm$ 0,05	0,03 $\pm$ 0,08	-0,03 $\pm$ 0,01	-0,11 $\pm$ 0,04*

**CONCLUSIONS:** During OPCAB procedures metabolism of myocardium is more stable, less lactates is produced and less phosphates is released.

### 37 QUANTITATIVE ASSESSMENT OF MYOCARDIAL PERFUSION DURING GRADED CORONARY ARTERY STENOSES BY FLUORESCENCE ANGIOGRAPHY

Christian Detter, Detlef Russ, Sabine Wipper, Lars Burdorf, Andre Iffland, Hermann Reichenspurner, Bruno Reichart

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**OBJECTIVE:** The purpose of this study was to examine whether the consequence of coronary stenoses of variable severity on myocardial perfusion can be quantitatively assessed by analysis of fluorescence angiography (FA) using the dye indocyanine green (ICG).

**METHODS:** Eleven domestic pigs (28-40 kg) underwent FA of the left anterior descending coronary artery (LAD). Graded stenoses (25, 50, 75%) and total vessel occlusion were created by a screw occluder on the proximal segment of the LAD. Coronary artery flow was measured with a transit-time flowmeter during baseline, graded stenoses, and total vessel occlusion. ICG and fluorescent microspheres were injected at each intervention for determination of regional myocardial blood flow. During FA the heart was illuminated with near-infrared light. The fluorescence emission was detected by an adapted CCD camera system. The images were displayed in real-time and analyzed using a computer system and software (LLS GmbH, Ulm, Germany).

**RESULTS:** All stenoses resulted in an impairment of the myocardial perfusion visualized by FA. Occlusion of the LAD resulted in a total perfusion defect of the corresponding anterior myocardial wall. During graded stenoses and total vessel occlusion dynamic of fluorescence and peak intensity changed significantly. Both peak intensity of myocardial perfusion and blood flow identified graded stenoses and total vessel occlusion of the LAD area. Correlation between FA and fluorescent microspheres in detection of regional myocardial perfusion was excellent.

**CONCLUSIONS:** The impairment of the myocardial perfusion during graded coronary stenoses and total vessel occlusion can be quantitatively assessed by FA compared to fluorescent microspheres.

**38 ACTIVE CORONARY PERFUSION DURING OPCAB IMPROVES MYOCARDIAL PROTECTION AND PERFORMANCE**

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**OBJECTIVE:** A variety of methods are being employed to perform off pump coronary artery bypass (OPCAB) grafting. This study was performed to determine whether one OPCAB method was superior over the others with respect to myocardial protection and performance during and immediately after the operation.

**METHODS:** Over 11 months, 151 consecutive patients underwent elective first-time OPCAB grafting by sternotomy performed by a single surgeon. Patients were prospectively randomized to one of three OPCAB methods: NCP (No Coronary Perfusion), employing no graft perfusion until all the proximal anastomoses were completed, PCP (Passive Coronary Perfusion), providing graft perfusion after each distal anastomosis by means of a cannula from the aorta or ACP (Active Coronary Perfusion), providing graft perfusion assistance by means of an in-line pump (PADCAB). Hemodynamic and biochemical data was recorded to disc continuously throughout the operation and post-operatively.

**RESULTS:** With no statistically significant differences in the three treatment groups with respect to age, left ventricular systolic or diastolic function, extent and distribution of coronary disease or grafts performed, cardiac performance postoperatively was superior in the ACP patients compared to the PCP and NCP patients (p<0.05)FIGURE. Additionally, troponin I levels were lower in the coronary perfusion groups (PCP and ACP)(p<0.05)TABLE.

	ACP (Active)	PCP (Passive)	NCP (None)
Troponin I (ng/ml)	0.18	0.26	0.51

**CONCLUSIONS:** Providing active coronary perfusion (ACP) after each distal anastomosis by using an in-line pump resulted in superior myocardial protection and performance during OPCAB surgery when compared to no coronary perfusion (NCP) or passive coronary perfusion (PCP).

**39 MYOCARDIAL CONTRACTILE PERFORMANCE, PRSW RELATIONSHIPS AND HISTOMORPHOMETRIC CHANGES FOLLOWING LEFT INTERNAL THORACIC ARTERY TO LAD OFF-/ON-PUMP CORONARY REVASCLARIZATION.**

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**OBJECTIVE:** Surgical single vessel left internal thoracic artery (LITA) to LAD revascularization is regaining popularity due to the wider spread application of endoscopically assisted, cardiopulmonary bypass (CPB) avoided coronary bypass grafting (CABG) and hybrid procedures. Many studies documented preserved end-organ function (blood, hepato-renal, pulmonary, brain) post-operatively when CPB is avoided. However, the immediate effects of beating-heart off-pump CABG (OPCABG) on myocardial contractile performance and anastomotic intima responses are not well established.

**METHODS:** Therefore, a canine coronary artery syndrome and myocardial ischemia injury model (60 min LAD occlusion, n = 30, 27-35 kg) was used to quantify post-CABG regional left ventricular dysfunction. The hearts were instrumented with ultrasonic microcrystals, micromanometers, and ultrasonic flow probes to measure load-independently stroke work relationships during temporary bicaval occlusion (preload-recruitable stroke work, PRSW). All animals underwent median sternotomy. The anastomotic quality (light/electron microscopy) of LITA to LAD in off-pump/on-pump CABG with ante-grade/retrograde cold blood cardioplegic arrest (CPB-time 58 min ±2; cross clamp time 28 min ±3) was investigated 14 days after CABG.

**RESULTS:** (ANOVA, t-test, \* = p<0.05 vs. baseline) LAD occlusion resulted in infarction (CK-MB on-pump/off-pump vs. baseline 17.5 ±1.4\*/19.5 ±1.8\* µg/L vs. 1.5 ±0.3/2.1\*0.4). Revascularization led to re-establishment of myocardial function to baseline (on-pump/off-pump 57-196 erg · cm<sup>-2</sup> · 103, mean 127 ±25/81-98, mean 90 ±15) (Figure 1). All anastomoses were widely patent 14 days post CABG. There was a significantly increased intimal thickening at the 8-0 monofilament suture line in the off-pump LITA to LAD anastomoses with no differences at hood, floor, heel, or toe (224 µm ±208 vs. 114 µm ±59).

**CONCLUSIONS:** There are no significant differences in myocardial function and stroke work relationships following single vessel off-and on-pump coronary revascularization. OPCABG provides myocardial protective properties and contractile function is equally preserved. The significantly increased intimal thickening in the off-pump single vessel LITA to LAD revascularization is worrisome and deserves further investigations and leucocyte adhesion molecule analysis.

## Forum Abstracts – Arrhythmia

Saturday, June 22, 2002, 2:30 p.m. – 3:25 p.m.

### 40 FEASIBILITY OF EPICARDIUM-BASED LINEAR LEFT ATRIAL ABLATION IN THE BEATING HEART

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**OBJECTIVE:** Current data suggests that surgical, anatomy-based ablation in the left atrium (LA) reduces atrial fibrillation burden. Most data is the result of endocardial ablation, performed during cardiopulmonary bypass. Epicardium-based LA ablation performed on the beating heart would simplify the procedure, likely reducing morbidity and broadening applicability.

**METHODS:** Six large healthy adult pigs (30-45 kg; LA myocardial thickness 2-6 mm) were studied. Access to the LA was achieved via median sternotomy. Exposure of the atrial body was assisted by a suction positioner and appendectomy performed utilizing a commercial stapling device. Ablation lesions were applied using radiofrequency energy delivered via 2 different irrigated electrode designs: 1. clamp hand piece (anode and cathode on separate arms of a malleable surgical clamp); 2. Octomaze (cathode is married to a set of suction pods, arranged linearly; pods provide active fixation of the ablation electrode to the epicardium during energy application; anode is a distant cutaneous adhesive patch). Using these two tools, a lesion pattern similar to the LA component of the maze III procedure was deployed. Translesion conduction was assessed and histological analysis performed after staining with tetrazolium. Lesion success was defined as translesion conduction block associated with transmuralty.

**RESULTS:** Complete lesion success was achieved in all animals. The clamp hand piece resulted to be ideal for pulmonary veins encirclement while Octomaze enabled the deployment of the connecting lines.

**CONCLUSIONS:** Epicardium-based linear LA ablation in the beating heart is feasible. Our data supports progress towards a clinical trial.

### 43 OFF-PUMP EPICARDIAL ABLATION FOR ATRIAL FIBRILLATION: COMPARISON OF MICROWAVE AND RADIOFREQUENCY TECHNIQUES

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**OBJECTIVE:** Methods commonly pursued for surgical treatment of atrial fibrillation (AF) can be time consuming and difficult to perform. Peri- and post-operative results were retrospectively evaluated for two groups of patients undergoing simplified left atrial epicardial ablation for AF using microwave (MW) and radiofrequency (RF) energy, respectively.

**METHODS:** Twenty patients underwent epicardial ablation via sternotomy using a lesion pattern consisting of bilateral pulmonary vein isolation, two left atrial connecting lesions and excision of the left atrial appendage. RF ablation was carried out using a non-shielded 7-coil probe with current setting of 80° to 90° C for 3 minutes. MW energy ablation was performed using a shielded 4 cm flexible antenna set at 65 watts for 90 seconds. Pulmonary vein (PV) isolation was confirmed in situ with epicardial pre- and post-ablation electrocardiograms.

**RESULTS:** There were no operative deaths or ablation related complications. MW ablation was performed off-pump in 7/12 (58.3%) patients; all patients undergoing RF ablation required cardiopulmonary bypass ( $p < 0.010$ ). Ablation treatment times were  $19.6 \pm 5.8$  minutes for MW and  $29.8 \pm 6.7$  for RF ( $p < 0.002$ ). At mean follow-up of 24.6 weeks, 90% of patients (7/8 RF and 11/12 MW) were free of AF or atrial flutter ( $p = NS$ ).

**CONCLUSIONS:** Epicardial ablation for treating AF using a left atrial approach with either MW or RF was safe and effective. Capability of MW for achieving successful surgical ablation in an epicardial, off-pump approach maximizes opportunities for treating a variety of AF patient subsets.

### 41 WITHDRAWN

### 42 MICROWAVE ABLATION FOR CURATIVE TREATMENT OF PATIENTS WITH CHRONIC ATRIAL FIBRILLATION AND CONCOMITANT CARDIOSURGICAL PROCEDURE - HIGH EFFICIENCY IN COMPARISON TO ISOLATED CARDIOSURGICAL PROCEDURES

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**OBJECTIVE:** Microwave ablation (MW) has been established as efficient treatment of chronic AF (cAF). Restoring of sinus rhythm (SR) is of major importance due to morbidity associated with cAF. Spontaneous follow-up of rhythm after isolated cardiosurgical intervention is of major interest in patients (pts) with cAF. We compared the follow-up of pts with cAF and cardiosurgical procedure with pts receiving MW as a concomitant procedure to cardiosurgical intervention.

**METHODS:** Group A included 62 pts (30 male, 32 female, age  $72 \pm 9$  years, from 36 – 87 years, left atrial diameter  $53 \pm 9$  mm, from 43 – 66 mm) suffering from mitral valve disease ( $n = 11$ ), CAD ( $n = 35$ ), or aortic valve disease ( $n = 16$ ) with cAF documented for  $6.9 \pm 5.5$  years. Cardiosurgical therapy included valve intervention or CABG. Group B included 91 pts (40 male, 48 female, age  $67 \pm 4$  years from 26 - 83 years, left atrial diameter  $52 \pm 6$  mm, from 42 - 84 mm) with documented cAF for  $6.4 \pm 4$  years suffering from mitral valve disease ( $n = 49$ ), CAD ( $n = 30$ ), or aortic valve disease ( $n = 12$ ). MW was performed as concomitant procedure.

**RESULTS:** In the one year-follow-up in group A 15% of pts with mitral valve disease, 11% with CAD and 0% of pts with aortic valve disease were SR. In group B 67% of pts with mitral valve disease, 72% with CAD, and 83% of pts with aortic valve disease were in SR.

**CONCLUSIONS:** Our results illustrate high efficiency of MW in pts with cAF and different concomitant cardiosurgical procedures based on different cardiac diseases in comparison to isolated cardiosurgical procedures.

### 44 A TOTALLY ENDOSCOPIC, BEATING-HEART APPROACH TO PULMONARY VEIN ISOLATION FOR THE TREATMENT OF ATRIAL FIBRILLATION

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**OBJECTIVE:** Recent studies suggest that atrial fibrillation (AF) may be triggered by discrete foci located within the pulmonary veins, and that this arrhythmia may be eliminated by electrically isolating the pulmonary veins (PV). We have previously reported a minimally invasive technique of PV isolation, using a novel microwave energy source through a minithoracotomy. This report describes a totally endoscopic, beating heart operation for AF, using robotic assistance.

**METHODS:** Pulmonary vein isolation and resection of the left atrial appendage (LAA) was performed in 6 dogs. The surgical approach utilized a 3 left and 3 right thoracoscopy ports, using robotic assistance (DaVinci, Intuitive Surgical, Inc.). All pulmonary veins were encircled and electrically isolated by one contiguous myocardial lesion created by the epicardial application of microwave energy at 75 Watts for 120 seconds (Flex-10 probe, AFx, Inc.). The left atrial appendage was resected with a standard thoracoscopic stapling device.

**RESULTS:** In all cases, the cardiac dissection required for exposure of the left atrium, as well as accurate probe positioning, was effected completely endoscopically. There were no bleeding complications, and the Flex-10 probe effected atrial ablation without collateral cardiac damage.

**CONCLUSIONS:** Electrical isolation of the pulmonary veins and resection of the left atrial appendage can be effected via a minimally invasive, beating heart approach, utilizing robotic techniques and a novel microwave energy source