Endoscopic Vein Harvest: Early Results of a Prospective Trial with Open Vein Harvest

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ABSTRACT

Background: Conventional open long saphenous vein harvest (OVH) is often associated with significant wound pain and serious morbidity in some patients with a resultant extended treatment period. Endoscopic vein harvest (EVH) in theory should alleviate wound pain, be less predisposed towards leg wound infection and lead to greater patient satisfaction. This study aims to compare the two techniques on this basis and determine whether EVH is a viable technique within normal operative time.

Methods: During September and December 2000, 60 saphenous vein harvests were prospectively randomised to EVH (n=30) and OVH (n=30); all performed by one surgeon with the Clearglide® endoscopic vein harvest system (Ethicon Inc). End points were impaired wound healing (ASEPSIS score) and postoperative pain (Visual analogue scale) and operative variables. Statistical analysis done using Fisher s exact test and Mann-Whitney *U* test as appropriate.

Results: The groups were well matched demographically. Patients in the EVH group had significantly lower ASEPSIS scores ($p<0.001$) and postoperative pain ($p<0.001$). The vein was harvested at 0.96cm/min (0.43-1.5±0.33) in the OVH group compared to 0.81cm/min (0.41-1.13±0.19) in the EVH group ($p=0.09$). The new procedure did not prolong the overall operative time ($p=0.53$). Two patients needed to be converted to open technique. There was no difference found in the vein quality by histological analysis.

Conclusions: These data clearly demonstrate that endoscopic vein harvest results in significantly reduced post-operative pain, better impaired wound healing, allows earlier ambulation and does not prolong the operative time significantly with no compromise in vein quality.

INTRODUCTION

Vein harvesting is a long under appreciated component of CABG and is associated with higher prevalence of wound complications and pain compared to median sternotomy [DeLaria 1981]]. Considering the fact that saphenous vein harvest is classified as a clean surgical procedure without contamination, which ideally should carry an infection risk less than 1-2%[Horan 1992, Mangram 1999], the operative technique of vein harvesting has not been improved significantly since the advent of coronary revascularization.

Harvesting of the saphenous vein through one or two small, minimal incisions with the aid of an endoscope and special instruments are termed as endoscopic vein harvesting. Lumsden and colleagues first reported it in 1996[Lumsden 1996], and recent technical improvements have increased the applicability of this new technique. Shorter, smaller incisions have been shown to improve patient comfort and post-operative recovery in various laparoscopic procedures[Scriven 1994]. The technique is aimed to reduce both post-operative pain, and scarring with improved aesthetics, reduced risk of wound complications.

The ASEPSIS (Additional treatment, Serous discharge, Erythema, Purulent exudate, Separation of deep tissues, Isolation of bacteria, Stay duration as inpatient) scoring system can be used to quantitate postoperative wound infections. It was initially designed for evaluating the effectiveness of antibiotic prophylaxis prior to cardiac surgery but has been proposed as a method to compare care at different institutions [Wilson 1990, Wilson 1995].

MATERIALS AND METHODS

Hypothesis: Endoscopic vein harvesting is comparable to open vein harvesting in terms of reliability and safety.

Endpoint: Impaired wound healing was considered as an endpoint as estimated by ASEPSIS score.

Study Design: During September to December 2000, 60 saphenous vein harvests were prospectively randomised to EVH (n=30) or OVH (n=30); all performed by one surgeon (PB). Randomisation was done by minimisation method in blocks of 10. All data was analysed on an intent to treat basis. The Research Ethics Committee, Queens University of Belfast, approved the trial.

Inclusion Criteria:

1. All adult cardiac surgical patients who have chronic stable angina or recent unstable angina admitted electively or transferred as urgent case for CABG to the cardiac surgical unit who are hemodynamicly stable.
2. All patients who are scheduled for first time revascularization alone or in combination with single or multiple valve replacement.

Exclusion Criteria:

1. All adult cardiac surgical patients needing an emergency revascularization or with IABP in situ or who are hemodynamicly unstable.
2. Patients who have varicose vein affecting part or the entire lower extremity.
3. Patients who have undergone previous surgical procedure or suffered trauma or had prior saphenectomy so as to preclude the use of the saphenous vein.
4. Previous clinical history of or radiological evidence of deep vein thrombosis.
5. Local factors like dermatitis or infection, which may preclude surgical procedure on the lower extremity.

Preoperative Day:

All the patients enrolled in the study were admitted the day before surgery. Patients meeting the above criteria were counselled, the nature of the study explained, and were given the option to participate. Those patients who enrolled in the study were included in the randomisation between open and endoscopic vein harvesting and a well-informed written consent was obtained. Body hairs were clipped with a disposable clipper the day before surgery and patients had a shower at night and in the morning. Routine

pre medication was administered one hour prior to going to theatre after overnight fasting or from morning depending when the surgery was scheduled.

Operative Day:

All study patients were anaesthetised by similar induction technique and monitoring lines were placed. All patients will receive Cefuroxime 1.5 gm intravenously 30 minutes prior to the skin incision and was continued post operatively for 48 hours (six doses in total). Patients were placed supine with arms by the side and in frog leg position. Whole body scrubbing was done by Betadine® solution. Circumferential scrubbing of leg and sterile leggings to the feet was similar to both procedure groups.

Operative Technique

Open Vein Harvesting:

A small vertical incision was made at the medial malleolus or the groin depending on the length of vein desired and the incision was extended as required till the desired length of vein was obtained. Once superficial subcutaneous tissue was dissected to expose the vein, the side branches were carefully identified and dissected. Throughout the dissection a "no touch" policy was observed. The side branches were clipped on the patient side and the graft side was tied with fine silk sutures and divided in between by sharp scissors. Diathermy was not used during dissection or division of the side branches and was only used sparingly for hemostasis after vein was lifted from the wound.

Endoscopic Vein Harvesting:

The new Clearglide® EVH kit (Ethicon Endosurgery™, Cincinnati, Ohio) was used for all cases randomised for endoscopic vein harvesting. The theatre was altered only by the presence of the monitor and the camera system. An incision on the medial aspect of the leg, just superior to the upper border of the medial condyle of the femur was created. The greater saphenous vein was identified and carefully dissected. When the endoscope and video equipment was properly attached, the endoscope was inserted in to the Clearglide® optical vessel dissector, which was placed into the small incision. The Clearglide® optical vessel dissector was advanced along the anterior surface of the vein, separating the vein from the surrounding tissue. This was performed all the way to the groin, where the greater saphenous vein joins the femoral vein. The Cardiovations™Ultra retractor was used to keep the space open for the rest of the dissection to continue. A continuous carbon dioxide insufflation at a low pressure of 2mm of Hg pressure and flow of 1.5 litres/minute was maintained throughout the procedure. Using the endoscopic scissors the vein was dissected from the remaining surrounding tissue. Throughout the dissection there was no traction applied to the vein by either the optical dissector or the endoloop, this was achieved instead by sharp dissection with the help of endoscopic scissors. Vein branches were identified, clipped (using the Ligaclip® Allport clip applier), and transsected using the endo vein scissors. Only the distal part of the branch was clipped, leaving the proximal vein branch to be double clipped or ligated using fine silk sutures similar to open technique after completion and deliverance of the vein. The use of loop to hook or dissect the vein was actively discouraged and it was only used at the end of the harvest to check if any tributaries are remained. The same process was repeated for harvesting the lower leg vein. The proximal and distal vein was then clipped, transsected, and removed. If needed a second incision was taken below the knee to facilitate the procedure.

Closure of wound:

The leg wound was next checked for hemostasis and subcutaneous layer approximated with continuous 2/0 Dexon® sutures, and subcuticular sutures by Monocryl® to the skin. The leg was wrapped with Parema K plus® bandage preferably

prior to administration of systemic heparin. The technique of closure remained the same for both the techniques.

Preparation of the vein:

The vein was removed and prepared in the standard way after either technique and distended with heparinized blood and any injuries were inspected, recorded and repaired by 7/0 Prolene® sutures.

Postoperative care:

The postoperative care was standardised and was similar to both groups of patients. All the patients returning from theatre remained in the Cardiac surgical intensive care unit (CSICU) and were ventilated till the next morning when the consultant anaesthetist made a decision to extubate the patient. The Specialist Registrar reviewed the patients and decision taken to discharge the patient from the CSICU and to be transferred to the High dependency unit (HDU). The dressing applied in the theatre was removed and the wound examined, and a Mepore® dressing applied. Once the patients arrived in the HDU, chest tubes were removed and morphine infusion stopped and patients ambulated. Non-steroidal anti-inflammatory drugs (NSAID's) were prescribed as required. The next day patients were reviewed and discharged from HDU to the ward where the dressing was removed and wound left open to air. Usually by day three a TED® stocking was applied and on day five haematological, biochemical and radiological investigations were done and patients assessed for discharge. The follow up was done at 6 weeks in the out patients clinic. A postal survey was undertaken with a questionnaire at 6 months regarding morbidity associated with harvest procedure.

Definitions and explanations of variables

Impaired wound healing: Inflammation, separation, cellulitis, hematoma, edema, lymphangitis, drainage, necrosis, or abscess necessitating dressings, antibiotics, or debridement before wound healing with complete epithelisation without eschar formation and without any late development of edema, dermatitis, or neuralgia or limitation of movement at joints.

Current smoker: Smoking till day of surgery or cessation < six weeks prior to scheduled surgery.

Past smoker: Smoking >six weeks or more prior to surgery but has stopped at the time of surgery.

Excessive bleeding: Bleeding encountered during the operative procedure in excess of usual.

Non-standard anatomy: Abnormal branching of the saphenous vein or any anatomical anomaly.

Iatrogenic tears: Injury to the vein caused as a result of instrumentation in the form of <2mm stump of the tributaries, hole in the vein or breach of the vein wall either by avulsion or instrumental trauma.

Amount of blood loss: Blood loss as measured by need of 4cm by 4cm swabs during vein harvest procedure.

Post-operative pain: As estimated by Visual analogue scale from post-operative day one through day five.

Erythema: Redness more than 5mm from the wound edge.

ASEPSIS score: ASEPSIS score = SUM (points from 4 daily wound inspection parameters) + (points for antibiotics) + (points of pus drainage) + (points for wound debridement) + (points for bacterial isolation) + (points for prolonged hospitalisation)[Hall and Hall, 1996, Wilson, et al., 1990]

Interpretation of ASEPSIS score: minimum score=0, maximum score=70

0-10score: Satisfactory healing
11-20score: Disturbance of healing
21-30 score: Minor wound infection
31-40score: Moderate wound infection
> 40score: severe wound infection

Saphenous neuralgia: Altered sensation tested by pinprick and defined as abnormal sensation in the form of anaesthesia, paresthesia or dysesthesia.

Visit to GP: General practitioner (primary care physician) consultation regarding vein harvest site complaints.

District nurse visit: Home visit by the district nurse for dressings to vein harvest wound.

Data Collection

Data was collected at various points during the stay of the patient. Data regarding demographic factors, cardiac related factors, risk factors for wound infection, and co-morbidities were collected on the admission day. Operative data, vein specific data was collected after the operation in the operating theatre. The vein harvest site was inspected on first 5 days after surgery and thereafter till discharge, with the wound scored based on the findings of serous exudate, erythema, purlent exudate and separation of deep tissue. Additional information on wound treatments, culture findings and delayed discharge was then analysed. Postoperative data regarding parameters of impaired wound healing was recorded till the day of discharge and at six weeks review and through a postal questionnaire survey.

Statistics

Statistical analysis on the collected data was done by applying parametric and non-parametric tests (SPSS© software). The primary end-point impaired wound healing was analysed. The primary time-point was considered to be at discharge. Data was summarised by different parameters of impaired wound healing, though the number in each parameters were too small to warrant statistical analysis. For all other endpoints a Fishers Exact test was used for all binary responses. Mann Whitney *U* test was used for continuous variable analysis. Only the parameters defined in the 'Endpoints' section of the study protocol were analysed statistically. All other data was summarised where appropriate. All statistical testing used a 5% two-tailed test.

RESULTS

The groups were well matched demographically and in terms of cardiac morbidity (Table 1 and 2). The operative time, bypass time and cross clamp time was comparable between groups (Table 3). In the OVH group the length of incision was 48cm, range 30-60cm, compared to 4.4cm, range 3 to 5cm ($p<0.0001$). The harvest time was prolonged in the EVH group, 56.5min, range 40 to 110min, compared to OVH group, 44min, range 30 to 70min ($p=0.001$). But the ratio of vein length to harvest time did not reach statistical significance ($p=0.095$), (Table 4). OVH group needed on average 15.5 swabs per harvest, range 10 to 25 swabs compared to EVH group, 1.8 swabs per harvest, range 1 to 9 swabs ($p<0.0001$). Non-standard anatomy was encountered in five patients (OVH, n=3, EVH, n=2). There were six iatrogenic tears in EVH group, which needed to be repaired compared with 3 in OVH group ($p=0.472$), but none of them warranted the vein to be discarded on account of the injury in either groups (Table 5). Two patients needed to be converted to OVH group from EVH group due to non-standard anatomy.

There was more wound separation, hematoma formation, serous discharge, erythema of the edge of wound, necrosis of the wound edge and edema in the OVH group compared to the EVH group reaching statistical significance. Ecchymosis

developed in both groups in all patients. Two patients developed abscess formation needing drainage under local anaesthetics in the OVH group compared to none in the EVH group. Four patients had culture positive, which necessitated antibiotic therapy in the OVH group, and none in EVH group, which did not reach statistical significance (Table 6).

In the OVH group the ASEPSIS score was 15, range 2-38 indicating disturbance of wound healing compared to 2.13, range 1 to 3 in EVH group (p<0.0001). The size of the hematoma was 14cm^{2,} range 0 to 70 cm^2 in OVH group compared to 0.13 cm^2, range 0 to 4 cm^2 in EVH group (p=0.005). The size of indurations in OVH group was 17 cm^2, range 0 to70 cm^2, compared to EVH group of 0.16 cm^2, range 0 to 5 cm^2, (p<0.0001). Ecchymosis was greater in the EVH group 166 cm^2, range 100 to 300 cm^2 compared to OVH 161 cm^2, range 70 to 300 cm^2, but it did not reach statistical significance (Table 7).

The patients in the EVH group were ambulated earlier (p<0.0001). The post-operative pain determined by the visual analogue scale was 5.74, range 4.4 to 7.4 compared to EVH 1.86, range 1.2 to 5.2 on average over the first five post-operative days (p<0.0001). Eight patients in the OVH group developed altered sensations as determined by the pin prick method, while only one patient in EVH group had altered sensation (p=0.026), (Table 8 and 9).

All the patients in either group were discharged on the 6th post-operative day except two patients in the OVH group whose discharge was delayed by a day each due to development of atrial fibrillation. One patient from OVH group needed readmission for drainage of hematoma, the cultures in this particular patient were positive and he needed a short course of antibiotics for five days and was discharged in four days time.

At six-week review five patients still complained of altered sensation on the harvest side in the OVH group. Twelve patients still had edema of the harvested leg in OVH group compared to one patient in the EVH group (p=0.001). Eight patients needed visits to their GPs out of which five needed further antibiotics for suspected wound infection in the OVH group, compared to only one consultation in the EVH group who did not need any antibiotics. District nurse visited 13 patients in the OVH group and one patient in the EVH group for attention to leg harvest wound, a statistical difference was noted between the groups (Table 10).

At 6 months from the data obtained through the postal survey 8 patients in the OVH group indicated that they still have edema of the leg on the harvested side compared to the non-harvested side, while four patients continue to experience some alterations in the sensation on the harvested side. One patient in the OVH group complained of development of dermatitis at the harvest site. Only one patient in the EVH group still experienced edema of the harvested leg (Table 11).

There were no in-hospital or late deaths at 6months in either group. None of the patients developed acute graft failure, intra-operative or peri-operative myocardial infarction. There were no visibly detectable clots in the harvested vein from either technique on table indicating endothelial damage. Hematoxylin and eosin staining was performed on all discarded vein samples and the either ends of the harvested vein and was examined with the aid of light microscope and did not reveal any endothelial damage or any difference between the groups. All patients remain angina free at six months review.

DISCUSSION

Our data clearly shows that the EVH technique leads to less impaired wound healing, reduced post-operative pain, and early ambulation after surgery compared to OVH. There were also advantages in terms of late wound related morbidity in terms of fewer GP consultations and district nurse visits. The new technique did not prolong the operative time significantly and was comparable in terms of vein quality, although the harvest time in the EVH group was significantly prolonged. The blood loss was much less in the EVH group, and this may be related to the fact that it avoids long incisions in the lower extremity.

The reported incidence of leg wound complications varies from 3 to 24% in different studies[DeLaria 1981, Wipke-Tevis 1996] also the incidence is variable in the trials, which earlier compared EVH with OVH[Allen 1998, Hayward 1999, Puskas 1999]. We have tried to avoid confusion in terms of descriptions of wound related complications which is found in different studies by quantifying impaired wound healing as a reproducible score method. It was initially designed for evaluating the effectiveness of antibiotic prophylaxis prior to cardiac surgery [Hall 1996, Wilson 1990, Wilson 1995]. One of the criticisms for the ASEPSIS score is that the objectivity of the index was affected by the assumption its linearity[Byrne, et al., 1988]. A large patient study is proposed to determine if non-linear analysis could improve the accuracy of the index.

In an attempt to reduce the extent of incisions and morbidity related to the wound in conventional harvest, a technique of multiple bridge technique was described either using conventional instruments or some form of vein stripper [Dorsey 1985, Rashid 1984, Tran 1998]. Although it is routinely practised in some centres, it has not found a wide application among the cardiac surgical community due to apprehension about vein trauma. In our centre we have used conventional vein harvest technique for the last 30 years. The technique of endoscopic vein harvest is proposed to harvest the vein with a promise of smaller incisions, less pain, improved cosmesis with comparable vein quality [Allen 1998, Davis 1998, Isgro 1999]. Minimally invasive surgical techniques in other disciplines have reduced dissection and have affected postoperative morbidity [Scriven 1994]. The reduction in patient morbidity must be weighed against a perceived or real compromise in quality of operative procedure. The learning curve that is required by a trainee to achieve an acceptable level of expertise in this new technique of harvesting must be evaluated with an increased damage to the vein. The acceptance of laparoscopic cholecystectomy as a routine procedure did face the initial challenge of increased bile duct injuries[Regoly-Merei 1998]. An attempt to apply minimally invasive technique to cardiac surgical procedures should be scrutinised for heightened morbidity. As with any new surgical procedure, the benefit the new technology might have over the standard therapy, open vein harvesting (OVH), must be proved through scientific methodology before it can be recommended for widespread clinical use. Particularly considering the high investment needed for EVH instruments this is a very important issue. It is very difficult to assess the cost implication of a new procedure like EVH. The operating room cost may not reflect the entire cost burden of a procedure related to vein graft harvesting since many complications of vein harvest are usually treated in the community and only few require re-hospitalisation. The patients referred to the cardiac surgeons' clinic for wound related problems may not reflect all the complications that can be safely dealt by the GP and district nurse in the community and which do not warrant a specialist intervention as demonstrated in this study.

Preservation of the endothelium is an important factor in long-term patency of the saphenous vein grafts. Damage may occur during harvesting process by mechanical trauma as well as thermal injury from cauterisation. In the present study we did not find any early graft failure, clot formation in the harvested vein, increased perioperative or intra-operative myocardial infarction. The histological analysis on the vein by light microscopy did not show any evidence of endothelial damage. Although we admit that

the numbers in the present study are small and a much larger sample size may be needed to detect endothelial damage. Earlier studies have demonstrated that there is no difference in the vein quality by histology, although the samples studied were small [Meyer 2000, Rinia-Feenstra 2000]. The use of carbon dioxide in the endoscopic vein harvest procedure has been shown to be safe [Vitali 2000]. In this trial we used a reduced flow and pressure of carbon dioxide, which we believe does not cause any alteration in the blood gas saturation or the gas exchange[Gayes 1998].

The concern for increased saphenous vein trauma with EVH is an issue that has not been directly addressed. The factors for increased trauma due to EVH technique are related to absence of tactile perception and the two-dimensional picture that is obtained which can hamper vision in presence of bleeding. Prior to the start of this trial, we noticed increased trauma to the vein particularly when the optical dissector is used to dissect the tributaries and when it is used to create space around the vein. As the conical tip of this instrument is quite sharp, we only used it to create space above the vein, which entails passing the instrument only once at the beginning of the procedure. The use of large clips tends to increase the chances of instruments getting entangled and subsequent avulsions; during this trial we only used the medium sized ligaclips. We were quite disappointed by the endo-loop supplied with the EVH kit, which has the potential of shearing and avulsing the vein tributaries, due to its propensity to get caught in the ligaclips. Also it has a potential to apply greater traction on the vein, when it is used to expose the tributaries while clipping them. In addition if used to lift the vein from its bed it tends to avulse the smaller tributaries and tends to create false planes due to the blunt tip. While the entry space in the EVH is limited due the incision length the resulting space is much smaller and tunnel shaped, thus needing heavy traction on the retractor, while trying to maintain the space to continue dissection. This is quite tiring as time progresses and hampers one's ability to use both hands alternatively for delicate dissection around the vein. Fencing of the instruments is an important aspect to consider as the dissection proceeds distally. If more than one instrument is used, there is a potential for shearing on the vein wall when an attempt is made to pass another instrument over or next to each other in a confined space. In this trial we actively discouraged the use of endo-loop for any kind of dissection or use while clipping the side branches, and it was only used at the end of the procedure after all round dissection of the vein was done by endo scissors to identify any remaining tributaries. The use of endo scissors is advantageous due to its precise dissection ability and one can get used to it faster since it simulates open dissection technique with which most surgeons are comfortable.

In the present study we found that the EVH technique takes more time to harvest the vein, although the rate of harvest is comparable in terms of vein harvested per minute. The overall operative time from initial incision to the closure of chest did not differ significantly between the groups. But the set-up of the camera and monitor does take at least 10 to 15 minutes and prior to the start of this trial in the pilot phase we did notice longer times needed to set up the system.

We feel that the new technique is promising but it still needs improvement in terms of better retractors, possibly self-retaining so as to free both hands for dissection, which we hope, will facilitate precise dissection, better visualisation and faster time for harvest. The future may lie in reusable instruments to avoid the prohibitive cost for wider acceptance, since many centres are apprehensive towards the initial investment in the camera and monitoring system in addition to the disposable instruments.

CONCLUSIONS

These data clearly demonstrate that endoscopic vein harvest results in significantly reduced post-operative pain and less impaired wound healing, allows earlier ambulation and does not prolong the operative time significantly with no compromise in

vein quality as quantified by light microscopy. It also results in less late post-operative wound morbidity and interventions.

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Table 1. Demographic details

	OVH (n=30)	**EVH (n=30)**	***p* value**
Age	60.5(51-75)	57.96(50-70)	0.166
Gender (M: F)	24:6	24:6	1.00
BMI	27.41(22.31-31.23)	26.78(24.73-29.59)	0.424
Current smoker	12	9	0.589
Past smoker	21	18	0.589
Diabetes	6	5	1.00
Hypertension	18	12	0.196
COAD	5	6	1.00
PVD	5	6	1.00

(BMI: body mass index, M: F: male: female, COAD: chronic obstructive airway disease, PVD: peripheral vascular disease)

Table 2. Cardiac morbidity

	OVH (n=30)	**EVH (n=30)**
CCS class I	0	3
CCS class II	15	18
CCS class II	12	9
CCS class IV	3	0
NYHA class I	14	12
NYHA class II	13	15
NYHA class III	3	3
Urgent admission	12	10
EURO score	1.9(1-3)	1.53(0-3)

(CCS: Canadian cardiovascular society classification for angina, NYHA: New York heart association.)

Table 3. Operative variables

	OVH (n=30)	**EVH (n=30)**	***p* value**
Number of vein graft	2.1(1-3)	2.0(1-3)	NS
Operative time (min)	255(210-300)	247.5(180-300)	0.538
Bypass time (min)	90.8(30-72)	96.9(60-129)	0.177
Cross clamp time (min)	46.3(30-72)	46.1(30-70)	0.893

Table 4. Vein harvest specific variables (I)

	OVH (n=30)	**EVH (n=30)**	***p* value**
Length of incision (cm)	48(30-60)	4.4(3-5)	<0.0001
Length of vein harvested (cm)	40.2(25-55)	42.8(35-50)	0.195
Harvest time (min)	44(30-70)	56.5(40-110)	0.001
Vein length/harvest time(cm/min)	0.96(0.43-1.50)	0.81(0.41-1.13)	0.095
Closure time (min)	38.5(30-60)	6.3(2-30)	<0.0001

Table 5. Vein harvest specific variables (II)

	OVH (n=30)	**EVH (n=30)**	***p* value**
Excessive bleeding	3	6	0.472
Amount of blood loss	15.5(10-25)	1.8(1-9)	<0.0001
Non-standard anatomy	3	2	1.00
Iatrogenic tears	3	6	0.472

(Blood loss 1Unit = 1 swab, 4cm by 4cm)

Table 6. Wound specific variables

	OVH (n=30)	**EVH (n=30)**	***p* value**
Wound separation	21	1	<0.0001
Haematoma	8	1	0.026
Induration	6	1	0.103
Cellulitis	6	1	0.103
Seroma formation	12	1	0.001
Erythema	27	2	<0.0001
Necrosis of edge	10	1	0.006
Edema of leg	30	3	<0.0001
Ecchymosis	30	30	NS
Abscess formation	2	0	0.492
Positive culture	4	0	0.112
Drainage under LA	2	0	0.492
Antibiotic need	4	0	0.112

Table 7. Wound specific variables (II)

	OVH (n=30)	**EVH (n=30)**	***p* value**
Serous discharge(%)	20.5%(0-50)	0.16%(0-5)	<0.0001
Erythema(%)	29%(0-70)	0.36%(0-6)	<0.0001
Purulent discharge (%)	3%(0-10)	0	0.001
Separation of wound (%)	12.5%(0-30)	0.16%(0-5)	<0.0001
Haematoma (cm^2)	14(0-70)	0.13(0-4)	0.005
Induration(cm^2)	17(0-70)	0.16(0-5)	<0.0001
Ecchymosis(cm^2)	161(70-300)	166(100-300)	0.378
ASEPSIS score	15(2-38)	2.13(1-3)	<0.0001

(%=Percentage of the wound affected)
Interpretation of ASEPSIS score: minimum score=0, maximum score=70
0-10score: Satisfactory healing
11-20score: Disturbance of healing
21-30 score: Minor wound infection
31-40score: Moderate wound infection
> 40score: severe wound infection

Table 8. Mobility

Post op day	**Score**	**OVH (n=30)**	**EVH (n=30)**	***p* value**
Day two	0	9	0	<0.0001
	1	21	3	
	2	0	17	
	3	0	10	
Day three	0	6	0	<0.0001
	1	15	0	
	2	9	9	
	3	0	21	
Day four	1	6	0	<0.0001
	2	18	0	
	3	3	9	
	4	3	21	
Day five	1	3	0	<0.0001
	2	3	0	
	3	12	3	
	4	12	27	

Score:
0. Confined to bed
1. Ambulation with assistance
2. Ambulation with aid but no need of assistance
3. Ambulation < 25 meters without aid/assistance
4. Ambulation > 25 meters independently.

Table 9. Post-operative pain and sensations

	OVH (n=30)	**EVH (n=30)**	***p* value**
Post-operative pain	5.74(4.4-7.4)	1.86(1.2-5.2)	<0.0001
Saphenous neuralgia	8	1	0.026

(Post-operative pain: Visual analogue scale from 0 to 10)

Table 10. Six-week review

	OVH (n=30)	**EVH (n=30)**	***p* value**
Visit to GP	8	1	0.026
Visit by District nurse	13	1	<0.0001
Additional antibiotics after discharge	5	0	0.052
Edema of harvested leg	12	1	0.001
Saphenous neuralgia	5	0	0.026

(GP: General practioner/ Primary care physician)

Table 11. Six-month review

	OVH (n=30)	**EVH (n=30)**	***p* value**
Edema of harvested leg	8	1	0.026
Altered sensations	4	0	0.112
Dermatitis	1	0	NS