Below -Knee Vein Harvesting Versus Above Knee Vein Harvesting Wound Healing In CABG Patients Using ASEPSIS Score

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Background: Lower limb vein harvesting wound is a significant source of morbidity in CABG patients. The aim of that study was to evaluate wound healing following harvesting of the long saphenous vein from the lower limb below and above knee in patients undergoing coronary artery bypass surgery. Using the ASEPSIS score system.

Methods: From January 2011 till February 2012, a total of 120 patients undergone CABG procedure using internal thoracic artery as a graft for LAD in all the cases, in addition to long saphenous vein grafts for the rest of coronary target vessels. Patients were divided into 2 groups: Group(A) include 60 patient undergone CABG with harvesting of the long saphenous vein entirely from one leg with extension of the leg incision above the knee. Group(B) also included 60 patients undergone CABG with harvesting of the long saphenous vein from both legs without extension of the leg incision above the knee. Our limit was the upper border of the patella.

Results: The Leg wounds were assessed daily using the ASEPSIS scoring system. The mean ASEPSIS score was significantly lower in group B than groups A. In group A 25% of patients had an ASEPSIS score > 10 (satisfactory wound healing), compared to 5% of patients group B. Conclusion: The ASEPSIS score was reduced when the saphenous vein harvesting was restricted to below the level of the knee.

Abbreviations: LSV=long saphenous vein, CABG=coronary artery bypass grafting, CPB= cardiopulmonary bypass, SSIS=surgical site infections score, MIVH=minimally invasive vein harvesting, CVH=conventional vein harvesting

Keywords: saphenous vein, wound infection, CABG

Modern management of CABG patients emphasizes early return to normal activities. In this regard, early mobilization after surgery has an important role in improving the recovery of the patients. Although there have been many enthusiasms toward the use of arterial conduits, still saphenous vein remains the most common conduit used in most of cardiac surgery centers worldwide. Hence any reduction in the morbidity from saphenous vein harvesting will promote early mobilization and enhance the speed of rehabilitation. (1)

Harvesting of the great saphenous vein for CABG has traditionally been undertaken using a ‘conventional’ vein harvest (CVH) technique, with a continuous skin incision along the medial aspect of the lower limb. More recently, advances in surgical instrument technology, cameras, light sources and endoscopic instrumentation have led to the development of minimally invasive (endoscopic and non-endoscopic) techniques. These operations are performed through a limited number of smaller skin incisions, and therefore aim to reduce the wound related morbidity that these patients face in the postoperative period. (2)

The long saphenous vein may be harvested from one or both lower limbs depending on the length of vein required, and on the operating surgeon’s preference. Vein dissection from the thigh involves working closer to the perineum and requires more tissue dissection as the vein is less superficial, and it may be of a larger caliber;
Alternatively, dissecting the LSV below the knee involves less tissue dissection and less incidence of infection (3)

The complications associated with varicose vein surgery are well documented in general surgery literature. Few studies, however, have addressed the issue in regard to coronary revascularization surgery, where the wounds are usually longer, and the focus of this part of the operation is obtaining a good conduit and not cosmetic, and often undertaken by a less experienced member of the surgical team.(4)

A reduction in wound healing disturbances has the potential to reduce wound-related morbidity, post-operative pain, length of hospital stay, and re-admission rate. This in turn has an implication not only on the time and cost of post-operative care that these patients receive, but their satisfaction with the operation, and therefore quality of life following. (2)

Patients and Methods

That study was approved by the ethical committee of our institute, informed consent was obtained from the patients. All patients undergone CABG surgery in Kasr ElAini hospitals, Cairo university, and in Banha university hospital in the period between January 2011 till February 2012. Patient’s data were collected prospectively, and the follow-up of lower limb wounds was done on daily basis.

Inclusion criteria

Patients indicated for CABG operation that needed 3 length grafts or more to be harvested from the great saphenous vein.

Exclusion criteria

Patients who had total arterial revascularization for CABG operation were excluded. Patients had preoperative lower limbs inflammatory conditions, evidence of varicose vein, previous deep venous thrombosis or with history of lower limb ischemic vascular lesion were also excluded.

Surgical techniques

120 CABG patients were divided non randomly into 2 groups:

Group (A): Included 60 patients undergone CABG operations, receiving LIMA to LAD, and rest of grafts were done with venous grafts. Harvesting of the long saphenous vein was done from one lower limb with extension of the leg incision above the knee.

Group (B): Included 60 patients undergone CABG operation, receiving LIMA to LAD, and rest of grafts were done with venous grafts. Harvesting of the long saphenous vein was done from both legs without extension of the leg incision above the knee. Our limit was the upper border of the patella.

Routine pre-operative preparation was done for all patients. Legs were shaved the night before surgery, followed by a shower with Chlorhexidine antiseptic. The legs were painted with iodine-based antiseptic at the time of surgery and the groins were excluded with drapes. All the patients in both group received antibiotic prophylaxis 3rd generation cephalosporin routinely before surgery, which is continued for 5 days after surgery.

In both groups, vein harvesting was done by the full open ‘conventional’ technique. Harvesting of the vein was performed by the second assistant while sternotomy and LIMA harvesting were done concomitantly by the first assistant. A linear incision was made 1.5 cm above and anterior to the medial malleolus. The saphenous vein was dissected using sharp dissection. The incision was then continued upwards, staying over the vein and up to the length required. The vein was harvested without any subcutaneous tissue, taking care not to damage the saphenous nerve. The side branches were tied or clipped. The wound was closed in single or two layers depending on surgeon preference. A suction drain was placed if necessary.

Data collection

We carried out a prospective observational study comparing leg wound healing, and infection rates between both groups. In both groups dressings were left in place until the third post-operative day, when they were removed and the wounds left open to air. All leg wounds were assessed daily during the postoperative period. Wounds were scored until the day of discharge. Wounds were graded using the ASEPSIS system score. The name is an acronym for the variables assessed: A, additional treatment required; S, deep tissue separation; E, erythema; P, purulence; S, serous exudate; I, isolation of bacteria; S, prolonged hospital stay. The observer assigned a point score (0–10), based on the proportion of the wound exhibiting the characteristics of Asepsis SCORE greater than 5 mm. For example, scores of 0, 1, 2, 3, 4 and 5 were given for proportions of 0, 20, 20–39, 40–59, 60–79 and >80% of the wound affected by each variable. The final ASEPSIS score was generated by adding the daily wound characteristic scores to the additional points. Table (1).

The final wounds score were then categorized: 0–10 satisfactory wound healing, 11–20 altered wound healing, 21–30 mild infection, 31–40 moderate infection, and >40 severe infection.

Additional points were scored for surgical debriement, prolonged hospital stay, isolation of bacteria, and antibiotic treatment. Cultures were done in those how showed evidence of wound discharge. All the patients were treated conservatively, only one patient in group (A) needed wound drainage and debridement. (5)
The statistical methods

Data were statistically described in terms of mean ± standard deviation (± SD), or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using Student $t$ test for independent samples.

For comparing categorical data, Chi square ($\chi^2$) test was performed. Exact test was used instead when the expected frequency is less than 5. $p$ values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

Results

Preoperative data

Preoperative data included, age, gender, diabetic status and body mass index (BMI) which is defined as the measurement of body fat based on height and weight that applies to adult men and women on admission. The two groups were similar in regard to preoperative demographics. There was no significant statistical difference between both groups regarding the age, gender, the prevalence of diabetes, as well as the body mass index. Table (2).

<table>
<thead>
<tr>
<th>Wound characteristic</th>
<th>0%</th>
<th>&lt;20%</th>
<th>20–39%</th>
<th>40–59%</th>
<th>60–79%</th>
<th>&gt;80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serous exudates</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Erythema</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Purulent exudates</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Separation of deep tissues</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

*Table 1. Points scale for the daily wound inspection*

Intra operative data

There was no significant difference between both groups with regards to the intra operative parameters as, the length of time to harvest the vein, aortic cross clamp time, cardiopulmonary bypass time, and total duration of the operation. Table (3).

<table>
<thead>
<tr>
<th></th>
<th>Group A</th>
<th>Group B</th>
<th>$p$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>60</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Time for vein harvest (min)</td>
<td>± 39.8</td>
<td>±31.8</td>
<td>(0.1)</td>
</tr>
<tr>
<td>Aortic cross clamp time (min)</td>
<td>76.4</td>
<td>81.4</td>
<td>(0.4)</td>
</tr>
<tr>
<td>CPB time (min)</td>
<td>±20.4</td>
<td>±25.1</td>
<td>(0.5)</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>±40.8</td>
<td>±51</td>
<td>(0.27)</td>
</tr>
</tbody>
</table>

*Table (3). Intra operative Data*

Postoperative data

Patients in group (A) had a significantly higher mean ASEPSIS score than those patients in group (B). (6.5 ±3.23 vs. 1.7 ± 3.66, $p = 0.04$). There was also significant statistical difference between both groups as regards number of patients with ASEPSIS score > 10 (satisfactory wound healing). (Fifteen patients (25%) in group (A), compared to 3 patients (5%) in group (B) , $p$ value 0.009). No patient had ASEPSIS score > 40 in both groups. Patients in group A were more likely to have a suction drain used at the wound site (some patient with obese thigh needed surgical drains in the thigh). Total Hospital stay was more in group (A) 12.2±3.6 day, compared to group (B) 9.4±2.5 day with no statistical significance between both groups ($p$ value 0.06). Table (4).
Cardiovascular Group (A) | Group (B) | \( p \) Value
--- | --- | ---
No of patients | 60 | 60 | 
Mean ASEPSIS score | 6.5±3.23 | 1.7±3.66 | SIGN (0.04)
ASEPSIS score >10 | 15 (25%) | 3 (5%) | SIGN (0.009)
Hospital stay | 12.2±3.6 | 9.4±2.5 | NS (0.06)

Table (4). Postoperative Data

Discussion

Impaired leg wound healing has been reported to occur from 1% to 25% of CABG patients. Intra-operative and postoperative complications as hematoma formation, saphenous neuropathy, infection, and cellulites can prolong recovery, and require frequent wound dressing, leading to difficulty in mobilization which can impair patient’s quality of life.

Efforts must be paid to prevent complications of LSV harvesting wound. This efforts include intraoperative minimal dissection, careful homeostasis, and closure in layers. Wide excision and direct closure are necessary postoperatively in cases of development of skin slough, infection and tissue necrosis, to reduce the requirement for skin grafting. (6)

Surgical site infection is associated with poor cosmetic outcome. Patients who have wound infection, experience emotional distress and may have longer hospitalization and delayed return to work with its economic implications. In the vast majority of cases, surgical site infection heals on conservative management, but the impact can be quit devastating. (7)

Wound infection is aggraded phenomenon. At the earliest stages, patients may have just tissue edema and cellulites. At the worst, they may have a frank wound abscess that requires opening up for drainage and/or debridement. The ASEPSIS score is a very helpful scoring system in assessment and follow up of wound postoperatively, but still other system can be employed as the CDC classification. (8)

In our study there was no significant difference in time spent in harvesting the saphenous vein between the two groups of patients, unlike the study which was conducted by Enoch et al. that documented significant longer time in the group of patients in which vein harvesting was extended above the knee. Interestingly, the seniority of the surgeon harvesting the LSV vein did not appear to have an effect on the ASEPSIS score. Possibly, the incidence of altered wound healing in this study might have been changed if a greater proportion of grafts were harvested by a more skilled trainee. (9)

In this prospective study, patients in whom the saphenous vein was harvested from the leg with extension of the wound to the thigh had a significantly higher ASEPSIS score than those in whom the incision was limited to the leg below the level of the knee. This finding may be due to the close proximity of the wound to the groin, the greater dissection required for harvesting the vein. The study conducted by Blak et al. demonstrated not only extended harvesting of the saphenous vein from the thigh increases the incidence of in hospital wound infection, but also contributes to higher rate of delayed wound infection. (10)

This study concentrated on in hospital wound infection, but it is well recognized that late infections occurring after hospital discharge may also be a significant cause of morbidity after CABG. Nevertheless, this study suggested that LSV harvesting should be limited to sites below the knee as much as possible.

In a study conducted by Garland et al. (4), Female gender, peripheral vascular disease, and postoperative intra-aortic balloon pump use were identified as significant independent predictors of major leg wound complications. Unlike the multiple logistic analysis, performed by Crouch et al which showed that open harvesting (\( p \leq 0.0007 \)) and diabetes (\( p \leq 0.0001 \)) were independent risk factors for wound infection. (1)

Wilson documented many factors he believed to be the most important in the pathology of wound infection. Among these factors from the patient side: age, nutritional status, obesity and altered immune response. Other operative factors as: duration of surgery, skin antiseptic/shaving, instrument sterilization and antimicrobial prophylaxis. Wilson suggested another procedure which may add another dimension to surgical prophylaxis, a new method of delivering topical antibiotics in the wound and the use of antiseptic-impregnated suture. (8)

Other risk factors identified for wound infection in lower limb include female gender, chronic steroid therapy, and diabetes mellitus, and malnutrition, post-operative use of blood products, lymph leak, post-operative edema, low pre-operative hematocrit, high pre-operative urea, and low serum albumin. Recent evidence suggested that two-thirds of wound infections occur in clean wounds following discharge and that these infections are not predicted by the recognized risk factors. (5)

In contrast, minimally invasive LSV harvesting techniques, which involve minimal tissue dissection, have been shown to reduce leg wound infection and postoperative pain.
The concerns with endoscopic harvest included: increased harvest time, additional expense and the potential for vein trauma. A number of prospective randomized trials and retrospective cohort studies have shown less leg wound complications, with the MIVH technique, however, speed of harvest was significantly slower. The quality of the veins harvested, appeared to be excellent. The difficulty with the endoscopic technique was the learning curve and cost of change; however, in the long term the technique may well prove to be superior.(3)

In a meta-analysis of randomized trials comparing leg wound infection rates between the MIVH and CVH techniques, a significant reduction in post-operative wound infection occurred with MIVH technique.

This may be because the MIVH technique involved tunneling rather than cutting through the layers of tissue covering the vein, and therefore resulted in a more localized inflammatory response for wound healing. But the incidence of hematoma was higher in the MIVH technique, as one of the advantages of CVH was that homeostasis was possible under direct vision before closing the wound. In that respect, endoscopic MIVH had the added benefit over non-endoscopic MIVH in that ligation of the branches of the great saphenous vein could be done under direct vision and the wound tunnel could be inspected more easily.(2)

We did not study the incidence of the various wound complications in regard to how the wounds were closed. However, a number of studies have examined the role of either two layer (with subcutaneous layer) compared with single-layer closure or staples. Overall, the findings support a single-layer closure or staples. Overall, the findings support a single-layer closure as the most favorable technique for lower limb wound closure.(5)

Limitation of the study

The major limitation of this study is the numbers of patients. However, the groups were matched in terms of demographic characteristics, in particular, body mass index. However, there is a need for a large prospective study.

Another limitation was the use of drains in the wound which was used more frequently in group (A). This may serve as a foreign material that’s invite more infection as has been claimed by some authors. Our experience was that suction drainage actually decreased the ASEPSIS score due to a decrease in the presence of serous exudates.

Conclusion

The ASEPSIS score is reduced when the saphenous vein harvesting is restricted to below knee level, compared to extending the incision to above knee. With increasing number of older and sicker patients referred for CAGB, eliminating wound infection and pain would significantly reduce complications and hence the expenses of health care.

References

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