

# Effect of Endoscopic Versus Open Saphenous Vein Harvesting Technique on Leg Wound Complications

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## Abstract

Background: EVH has become prevalent in recent years due to its reduced morbidity and increased patient satisfaction. We designed and carried out a prospective study of patients undergoing CABG to compare outcomes of open versus endoscopic harvesting technique for great saphenous vein. Two groups of patients who underwent elective Coronary artery bypass grafting at our hospitals between January 2018 and October 2020 were included. Endoscopic vein harvesting group (50 patients) was performed endoscopic technique compared with Open Vein Harvesting group (50 patients) was performed open surgical incision for harvesting. Both groups were demographically similar and received identical management. Leg wound was evaluated at discharge, 2 weeks, and 4 weeks for evidence of complications. Early outcomes were compared included, infection, gaped wound and re-suture, pain, satisfied cosmetically and mobilization. Results: Endoscopic vein harvesting group had increased harvest time and decreased incision closure time when compared with Open Vein Harvesting. The average hospitalization time was  $6.5 \pm 2.2$  days for Endoscopic vein harvesting group and  $9.2 \pm 2.9$  days for Open Vein Harvesting group. In Endoscopic vein harvesting group, no significant hematomas were observed. In Open Vein Harvesting group, hematomas were detected in 2 patients and were surgically evacuated. In Endoscopic vein harvesting group, edema occurred less frequently. Infection of the incision location did not occur in Endoscopic vein harvesting group. Leg wound complications were significantly reduced in Endoscopic vein harvesting group in comparison with Open Vein Harvesting group. Conclusions: Endoscopic vein harvesting decreases leg wound complications and increases patient's satisfaction cosmetically.

## Introduction

SVG remains the most commonly used bypass conduit in CABG because it is usually available at desired length, easily harvested without being time-consuming, technically easy to use due to its wall characteristics and large diameter, supplies a limitless blood flow to the myocardium, and associated with less risk of sternal wound infection[1] .

OVH is associated with long incisions and consequent associated pain and other complications [2] .OVH harvesting includes leg wound complications, prolonged convalescence and poor cosmetic results resulting in patient dissatisfaction. It may prolong a hospital stay or require readmission for debridement, or IV antibiotics. EVH is a less invasive with (2%-5%) morbidity. EVH reduces postoperative pain, the incidence of wound complications and length of hospital stay. EVH also eliminates the need for long leg incisions and increases patient satisfaction [3] . Patients undergoing CABG experience wound complications (3%-30%) related to OVH technique. It requires an extended incision and the associated complications often prove troublesome in the recuperative phase of CABG [4] .

Since 1996, the first clinical report of EVH was published; it has increased in popularity to become the preferred method of SVG harvesting technique [5] . EVH is an atraumatic procedure that harvests SVG without direct manipulation of the vein. It is beneficial in reducing leg wound complications, postoperative pain and morbidity compared with OVH technique [6] . EVH is usually done from the thigh but this conduit

usually short length. The endoscope could be negotiated through the same entry wound at knee level to harvest an additional length from the leg without conversion to open. The use of EVH method reduces the invasiveness of OVH method and its morbidity[4] .

## Methods

The study was approved by our department, and all patients signed a written informed consent. The patients provided written informed consent for publication of the images. A prospective, parallel group trial was undertaken to compare an endoscopically vein harvested technique (EVH) with open vein harvesting technique (OVH) in (100) patients admitted for elective CABG divided into EVH group (50) and OVH group (50) between January 2018 to October 2020. Patients were placed in either group according to surgeon's preference or availability of instrument for EVH. Informed consent was taken in every case. We excluded cases which converted to OVH, and when combined technique is used (both EVH and OVH).

SVG was harvested from the thigh and, if more length needed, the leg using the same entry point incision over the medial epicondyle in (15) cases. GSV was exposed by means of a 2 cm transverse incision along the medial surface of the knee. The vein was dissected free and surrounded by a vessel loop. Subcutaneous tunnels were created distally and proximally. The endoscopic dissecting device VirtuoSaph<sup>2</sup>Plus was then placed in the proximal space (towards groin). A tunnel was created by blunt dissection along the length of the saphenous vein in the thigh. After 3-5 cm of blunt dissection, insufflation was performed by using Carbon dioxide to a pressure of 13 mm of Hg and flow 4 L/min. without an insufflation port to avoid incidence of embolism. Some cases did not given heparin before harvesting and CO2 insufflation to avoid preoperative heparin and excess bleeding during mammary harvesting. Pull the scope and dissection tip back to the incision site and gently slid tip posterior to the vein. The vein was circumferentially dissected and its tributaries were identified. Further dissection of adherent tissue was performed by using a C-ring dissector and bipolar loop scissors (dissector cautery device). Once all tributaries were divided, a 2.5 cm incision was made at the groin and the dissected vein isolated. The proximal portion of the vein was divided. The same procedure was repeated for the distal vein (towards ankle) for more length. Several disposable systems are available, most frequently used is VirtuoSaph by Terumo. Harvested vein was gently distended with heparinized saline and the branches secured with small clips or repaired by 7-0 Prolene sutures if needed. The wound was closed at the end of the procedure after protamination was complete, and drains (Radivac) were used only in (25) cases. Time spent was approximately (45-60min.) in the first, then reduced to (30-35min.). The leg was then wrapped in an elastic bandage for 48 hours. Pain assessment and wound examination was performed daily, 2 weeks, 4 weeks after discharge.

### Figure (1,2,3)

OVH was dissected with Metzenbaum scissor. The vein branches were clipped or tied with 3/0 silk. Once fully dissected, the vein was removed. The wound was closed without Radivac except (2) cases.

### Figure (4)

*Pain* is assessed by Visual Analog Scale (VAS = 1-10) or by comparison of pain in leg incision versus sternotomy. In a questionnaire, patients were asked if their leg pain was less than, equivalent to, or more than the pain from the sternotomy.

*Wound healing* was assessed by recording the presence of postoperative

1. Wound drainage (serous, serosanguinous or purulent)
2. Ecchymosis (haemorrhagic macules in the skin >2 cm)
3. Edema (measured by ankle circumference)
4. Hematoma (localized blood collection)
5. Erythema
6. Infection (superficial and deep)
7. Wound dehiscence (need for wound dressings)
8. Length of hospital stay especially discharge to the home was postponed due to leg wound disturbances

*Cosmetic result* was judged by the patient on the scale graduated:-

(1 unacceptable, 2 not satisfied, 3 satisfied, 4 very satisfied, 5 extremely satisfied).

## Results

This prospective, nonrandomized trial compared early outcomes of GSV harvesting by endoscopic technique versus open surgical technique. We divided them into two groups; EVH group (50) and OVH group (50). Both groups were similar with regard to; age, preoperative risk stratification, and risks for wound complication (diabetes, gender, obesity, preoperative anemia, hypoalbuminemia, low EF <40% and PVD).

### Table (1)

### Table (2)

Extended saphenous vein harvest was possible in 20 patients selected for the study more in EVH group where the harvested segment was long enough to provide 3 conduits and leg had 3 incisions of average size 2.5 cm. The primary location of vein harvested did not influence the incidence of leg wound complications.

### Table (3)

EVH may take longer harvesting time than OVH, but closure time was longer in OVH. The average time needed for EVH was 55min. (40-69 min.). The average length of the harvested vein was 48 cm (39-55 cm). There is no difference between both groups in CPB time, aortic cross clamp time, use of IABP and inotropes. OPCAB is performed in 15 patients of EVH group and 3 patients in OVH group. We use EVH with OPCAB as a step for MIDCAB. The quality of the vein did not appear different between harvest techniques. There was no known acute graft closure in either group and no patient underwent angiography during follow up period. Operating room costs were significantly higher when EVH was used compared to OVH.

### Table (4)

Analysis by multiple logistic regressions demonstrated OVH and uncontrolled DM are risk factors for development of wound complications.

### Table (5)

The average hospitalization time for patients in EVH group was  $5.5 \pm 2.4$  days and that for OVH group was  $9.5 \pm 2.7$  days. In OVH group, hematomas were detected in 5 patients and were surgically evacuated, but in EVH group included one patient with tunnel hematoma which managed conservatively and resolved spontaneously. We used suction drains (Radivac) in 25 cases of EVH without significant difference in result. In EVH group, edema occurred less frequently. Infection of the incision location did not occur in EVH group. There was significantly more wound serous discharge in above ankle incision site of OVH group when compared to the above knee incision site in EVH group. In OVH group, two patients with dehiscence were treated as OPD clinic with daily dressings and oral antibiotics. Nine patients with delayed wound healing treated without antibiotics.

### Table (6)

There was an improvement from discharge to 4 weeks for pain ( $P$  value = 0.001) and for cosmesis ( $P$  value = 0.001). While patients rating of leg pain compared with sternotomy pain tended to be lesser in the EVH group. In EVH group, 99% of patients were very satisfied with leg wound as compared to 25% in OVH group who were just satisfied. Patient's satisfaction with cosmesis, there was a significant difference at time of discharge between the two groups. The incidence of peripheral neuropathy is 0% in EVH group, and 20% in OVH group. Postoperative numbness is not present in EVH group, so better patient mobility after surgery and better patient satisfaction.

**Statistical** analysis of continuous variables was performed using Student's t test. Univariate comparison of categorical variables was done using Fisher's exact test and X2 analysis.

## Discussion

GSV remains the most common conduit for CABG, which is the most common operation in cardiac surgery. Multiple studies in the literature have examined surgical site infection (SSI) after GSV harvested, and these show advantage of EVH (3%-13%) vs. OVH (12%-43%)[7]. The incidence of infection is (20%) in OVH group without any recorded infection in EVH group in our study.

Preoperative risk factors normally associated with leg wound complications include female gender, DM, obesity, hypoalbuminemia, anemia, PVD, chronic ischemia and steroid use. OVH technique has more severe infections involving larger areas of the wound. However, tissue trauma and wound closure methods likely play a role. EVH may minimize the effect of both diabetes and obesity on the incidence of wound complications. The fact that only thigh veins are harvested in EVH group might reduce the wound complications as diabetic vasculopathy being largely a small vessel disease would affect wound healing more below the knees. OVH technique in the thigh was found to be the only risk[3]. The risk factors are similar in both groups of our study. In Our study, EVH is mainly from thigh, however, 10% from leg and 30% extended from the whole lower limb. The site of harvesting did not affect rate of infection. Also, there is high rate of infection in diabetic patients 22% more than non-diabetic 9%.

Compared with OVH, EVH using the back-approach technique was associated with satisfactory short-term results. EVH was associated with lower rates of leg wound complications and a shorter length of hospitalization[8]. Total hospital stay for EVH group was ( $5.5 \pm 2.4$  days) vs. OVH group was ( $9.5 \pm 2.7$  days).

Extended EVH offers significant advantages over OVH and with experience a surgeon can safely perform EVH in shorter time. The results using this technique are superior to OVH or combined (EVH in thigh and OVH in leg) techniques. By avoiding wound complications minimally invasive techniques for vein harvest may reduce postoperative morbidity, and hospital stay [4]. Learning curve of EVH is growing; we started with 70min. until reached 40min. In cases of combined technique or conversion of EVH to OVH, we exclude cases from study. We harvested by extended technique in thigh and leg within reasonable time, and provided long vein graft for multiple conduits in (15) cases.

Traditional OVH may increase post operation wound complications. These wounds and their complications can influence the patient's physical activity and may make limitations of mobility, so it is very harmful in post CABG rehabilitation therapy [9]. As, we know that physiotherapy and early mobilization after CABG is very important for convalescence, EVH has significant early mobilization over OVH (*P value* 0.02)

EVH has been shown to be safe and reproducible with low incidence of leg complications. Patients are satisfied by small incision and absence of leg wound discomfort. As the experience grows, learning curve is required to become familiar with EVH [2]. Postoperative leg pain, mobilization, and overall patient satisfaction were also significantly improved in study EVH group.

There is widespread general acceptance of EVH doubts about its impact on the integrity, quality of the conduit and longterm graft patency[3]. EVH has emerged as minimally invasive technique that reduces wound pain and infection in CABG surgery. In a histological and immunohistochemical evaluation of SVG, EVH showed superiority in endothelial layer preservation when compared to OVH [10]. We take EVH as a step for MIDCAB. We did not perform vein endoscopy after EVH or coronary angiography during follow up period, however, coronary Flowmeter was done in all cases without any difference between both groups.

CABG is a commonly performed open heart surgery worldwide, and GSV is used as a conduit for bypass in over 95% cases. The OVH technique has remained unchanged over the years. However, leg wound complications can be a major source of postoperative morbidity [11]. The best indication for EVH is the patients with increased risk for wound infection and in whom cosmetics is a major concern. EVH should be the standard in all cases of GSV harvesting.

Cost may be an important consideration when choosing an endoscopic approach to harvesting GSV. Each endoscopic procedure has a definite added cost due to the expense of the disposable equipment required along with an initial investment in the non-disposable equipment (monitor, camera, light source, and CO2

insufflator). However, overall savings based on improved wound healing and, therefore, fewer additional treatments may counter balance the added cost of the equipment[12]. The cost of EVH is already more than OVH, however, cost of long time hospital stay, readmissions, needed other surgical procedure and antibiotics have a cost loaded on health system. We needed large number of patients to compare cost effect of both techniques.

Another consideration is the time it takes to learn and master this technique. The time it takes to become fully adept at this technique varies and is operator dependent. By logistic regression analysis, the only significant of impaired wound healing was open vein harvesting[12]. We finished training course until reaching reasonable time of EVH to start the study, so EVH has significant less leg wound complications vs. OVH ( $P$  value 0.03)

EVH reduces the incidence of postoperative leg wound complications, especially leg wound infections. Moreover, there are significant differences in the patients' postoperative mobility, leg pain, and satisfaction, favoring EVH. Therefore, the recommendation is routine use of EVH in CABG [13]. During the last decade, surgery has been moved towards less invasive access and to minimizing length of incision [14]. In EVH group, patients were very satisfied with leg wound (99%), and had significant less pain and more cosmesis ( $P$  value 0.02) vs. OVH group.

### Conclusion

EVH is safe, beneficial, and reliable with better cosmesis, patient's satisfaction and minimal complications facilitate patient compliance and early mobility.

### Abbreviations

OVH: Open Vein Harvesting, EVH: Endoscopic Vein Harvesting, CABG: Coronary Artery Bypass Grafting, OPCAB: Off Pump Coronary Artery Bypass, GSV: Great Saphenous Vein, DM: Diabetes Mellitus, HTN; Hypertension, COPD: Chronic Obstructive Pulmonary Disease, BMI: Body Mass Index, CKD: Chronic Kidney Disease, Hb: Hemoglobin, EF: Ejection Fraction, PVD: Peripheral Vascular Disease, VAS: Visual Analog Scale, SSI: Surgical Site Infection, MIDCAB: Minimal Invasive Direct Coronary Artery Bypass, OPD: Out Patient Discharge.

### References

- 1-Moshkovitz Y, Raanani E.** The art of saphenous vein grafting and patency maintenance. *J Thorac Cardiovasc Surg.* 2016;151:300-2.
- 2-Raghuram AR, John EV, Kumar S, Balamurugan K, Amol D, Murugadoss S, et al.** Early experience of endoscopic vein harvesting for CABG. *Indian J Thorac Cardiovasc Surg.* 2007; 23: 188-91.
- 3-Kalra S, Aiyer P, Bhardwaj M, Grover V, Gupta VK.** A prospective randomized trial of endoscopic versus open saphenous vein harvesting technique for coronary artery bypass graft surgery. *Indian J Thorac Cardiovasc Surg.* 2016; 32(2):113–19.
- 4-Mandiye S, Yadav A, Pathak S, Kanhere VM, Pande H.** Extended length endoscopic harvest of the great saphenous vein for coronary artery bypass grafting. *Indian J Thorac Cardiovasc Surg.* 2007; 23: 125-27.
- 5-Zenati MA, Shroyer AL, Collins JF, Hattler B, Ota T, Almassi GH, et al.** Impact of endoscopic versus open saphenous vein harvest technique on late coronary artery bypass grafting patient outcomes in the ROOBY (Randomized On/Off Bypass) Trial. *J Thorac Cardiovasc Surg.* 2011; 141:338-44.
- 6-Raza S, Chang C, Deo SV, Sabik JF.** Current role of saphenous vein graft in coronary artery bypass grafting. *Indian J Thorac Cardiovasc Surg.* 2018; 34:245-50.
- 7-Liliav B, Yakoub D, Kasabian A.** Case Report; Necrotizing Fasciitis Following Endoscopic Harvesting of the Greater Saphenous Vein for Coronary Artery Bypass Graft. *Journal of the Society of Laparoendoscopic Surgeons.* 2011;15: 90–95.

**8-Tamura K, Maruyama T, Sakurai S.** The back-approach technique of endoscopic saphenous vein harvesting in coronary artery bypass grafting. *Indian J Thorac Cardiovasc Surg.* <https://doi.org/10.1007/s12055-020-01063-3>.

**9-Nezafati MH, Nezafati P, Amoueian S, Attaranzadeh A, Rahimi HR.** Immunohistochemistry comparing endoscopic vein harvesting vs. open vein harvesting on saphenous vein endothelium . *J Cardio-thorac Surg.* 2014; 9:101- 8.

**10-Bouhout I, Ben Ali W, Perrault LP.** The effect of storage solutions on endothelial function and saphenous vein graft patency. *Indian J Thorac Cardiovasc Surg.* 2018; 34 (3):258 – 65.

**11-Siddiqi MS.** Saphenous vein harvest wound complications: risk factors, identification, prevention, and management. *Chronic Wound Care Management and Research* 2016; 3: 147–56.

**12 - Bitondo JM, Daggett WM, Torchiana DF, Akins CW, Hilgenberg AD, Vlahakes GJ, et al.** Endoscopic Versus Open Saphenous Vein Harvest: A Comparison of Postoperative Wound Complications. *Ann Thorac Surg* 2002; 73: 523– 28.

**13-Kiaii B, Moon BC, Massel D, Langlois Y, Austin TW, Willoughby A, et al.** A prospective randomized trial of endoscopic versus conventional harvesting of the saphenous vein in coronary artery bypass surgery. *J Thorac Cardiovasc Surg.* 2002; 123: 204-12.

**14- Raja SG, Sarang Z.** Endoscopic vein harvesting: technique, outcomes, concerns and controversies. *J Thorac Disease.* 2013; 5(6): 630- 37.

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