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Original Article

Early Postoperative Outcomes of Endoscopic Versus Open Vein Harvesting of Great Saphenous Vein in On-Pump Coronary Artery Bypass Grafting

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ABSTRACT

Objective: To compare early leg wound complications, cosmetic satisfaction, between Endoscopic Vein Harvesting technique (EVH) and open vein Harvesting (OVH) in Coronary Artery Bypass Graft (CABG) surgery patients.

Study Design: Quasi Experimental Design

Place and Duration of Study: Department of Adult Cardiac Surgery, Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi, Jan 2025- Nov 2025.

Methodology: Thirty elective on pump CABG patients with ≥ 18 years regardless of gender were enrolled. Patients were divided into two groups, Group-EVH (n = 15) and Group-OVH (n = 15), non-randomly. Baseline demographics, intraoperative parameters, and post-operative outcomes, including pain at discharge, wound complications (hematoma, edema, drainage, infection, and wound dehiscence), ASEPSIS scores, Euro quality of life and cosmetic satisfaction, were recorded and compared between the groups.

Results: The mean age of the 30 patients was 54.03±10.85 years, with 20(66.7%) males and 10(33.3%) females. Age, BMI, gender, ejection fraction, and number of grafts were comparable between the groups (p>0.05). EVH demonstrated significantly lower post-operative wound complications, ASEPSIS scores, leg pain at discharge (mild pain: 40% versus 0% and severe pain: 33% versus 67%; $p < 0.05$), and improved cosmetic satisfaction (80% versus 26.7%) compared to OVH. EVH had a longer vein harvesting time compared to OVH (40.0 ± 12.47 min versus 20.4 ± 2.66 min; p=0.001 respectively).

Conclusion: EVH is a less invasive, safe, and practical substitute for OVH that offers greater post-operative quality of life, less pain, less wound problems, and enhanced cosmetic pleasure.

Keywords: Coronary artery bypass, pain management, post-operative complications, pain management, saphenous vein, wound healing

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INTRODUCTION

Coronary artery bypass grafting (CABG) commonly utilizes the long saphenous vein conduit for multivessel coronary artery disease.[1] Among available grafts, the left internal mammary artery, radial artery, and saphenous vein the latter remains widely used due to its low risk of spasm and ease of harvesting.[2] Traditionally, the great saphenous vein was harvested through an open lower-limb incision (OVH). Endoscopic vein harvesting (EVH) has since emerged as a less invasive alternative, reducing leg wound morbidity, pain, infection risk, and hospital stay while improving cosmetic outcomes.[3] The REGROUP experiment shown that EVH yields results similar to OVH in terms of wound complications, pain, recuperation, satisfaction, cosmetic outcomes, and long-term graft patency when carried out by skilled practitioners.[4]

The International Society of Minimally Invasive Cardio-Thoracic Surgery (ISMICS) recommends EVH as the standard of care for saphenous vein harvesting. A systematic review and meta-analysis demonstrated that EVH significantly reduces wound infections, complications, hospital stay, and readmission rates.[5] Mubarak *et al.*, reported that EVH is a less invasive technique, with wound complication rates of 2–5%, compared to 3–5% with OVH.[6] In many cardiac surgery centers, endoscopic conduit harvesting has also emerged as the method of choice for radial artery and long saphenous vein procurement. The superiority of EVH in a number of outcomes, including wound infection, cosmetic healing, patient satisfaction, myocardial infarction, and mortality, was further confirmed by a meta-analysis of randomized controlled trials and observational studies.[7] Overall, because of its obvious postoperative benefits, EVH has become much more popular in recent years.[8]

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EVH is a relatively new technique in our setting, and limited local evidence exists comparing it with the traditional OVH approach in terms of leg morbidity, wound healing, cosmetic satisfaction, and quality of life. This gap in regional data underscores the need to evaluate the feasibility and clinical advantages of EVH within the Pakistani healthcare system. Therefore, this study aimed to compare early postoperative outcomes of EVH and OVH for Great saphenous vein (SGV) harvesting during CABG. Generating context-specific evidence may support wider adoption of EVH, improve patient satisfaction and recovery, and reduce the postoperative healthcare burden.

METHODOLOGY

After receiving approval from the Institutional Ethical Review Board (IERB) (ltr #: 9/2/R&D/2024/334; Dated: 12th Dec, 2024), this quasi-experimental study was carried out in the Department of Adult Cardiac Surgery at the Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi, from Jan 2025 to Nov 2025. Patients were selected using non-probability consecutive sampling.

Sample size (n=14; 7 for each study group) was calculated by using open Epi calculator, Based on the Visual Analogue Scale (VAS) score (leg pain) in EVH group versus OVH group (VAS = 1.16± 0.76) and (VAS = 2.50±0.91, respectively).[9] Confidence level was kept at 95% with 80% power and margin of error as 5%. However, 30 patients were recruited: 15 in each group.

Inclusion Criteria: Patients who were above 18 years of age, irrespective of gender and scheduled to undergo elective isolated on-pump CABG and diagnosed with multi-vessel coronary artery disease were enrolled.

Exclusion Criteria: Patients with uncontrolled diabetes mellitus (blood glucose >180 mg/dl) or those diagnosed with peripheral vascular disease, emergency and redo CABG cases, chronic kidney disease, history of cerebrovascular accident, or any immunocompromised condition were also excluded. Additionally, individuals with skin disorders or those undergoing steroid therapy were omitted from the study.

Every patient who fulfilled the requirements for inclusion gave their informed consent. All patients were divided non-randomly into two groups: EVH-Group and OVH- Group. Data were collected from the institutional database using a structured proforma. For in-hospital outcomes, information was extracted from daily progress notes until the patient was discharged. Detail Patient flow is shown in Figure-1.The preoperative assessment included documenting patient characteristics such as age, gender, weight, comorbid conditions, ejection fraction (EF), and the number of grafts. A detailed lower limb examination was performed to assess vascular integrity, supplemented by Doppler studies to evaluate venous patency and rule out peripheral vascular disease. Laboratory investigations, were carried out prior to surgery. Based on these evaluations, patients were allocated to their respective vein-harvesting techniques.

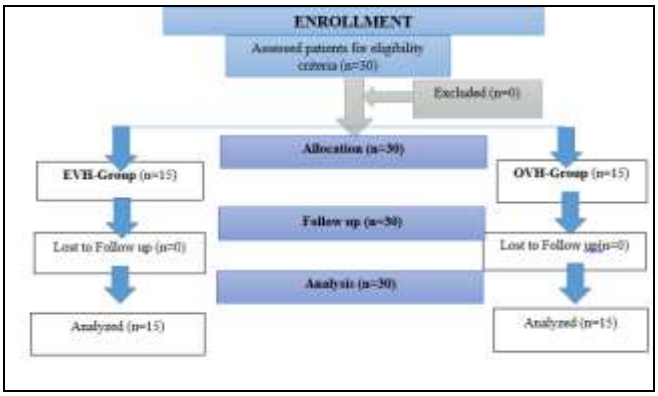

Figure-1 Patient Flow diagram

Endoscopic Vein Harvesting (EVH) was performed using a 2–3 cm incision on the medial knee or above the ankle to access the vein. A trocar and 30° endoscope were introduced, and a balloon dissector was used to create a subcutaneous tunnel under CO_2 insufflation (10–15 mmHg). The saphenous vein was dissected using energy devices such as LigaSure or Harmonic Scalpel, with tributaries coagulated and divided. After administration of 5000 units of heparin, the vein was gently extracted, and its ends were secured with clips or ligatures. The incision was closed in layers, followed by the application of a sterile dressing and compression bandage to minimize edema and support healing. Whereas, open Vein Harvesting (OVH) involved a 10–15 cm longitudinal incision along the medial aspect of the leg, extending from the groin to the ankle to expose the great saphenous vein. After dissecting through the subcutaneous tissue and fascia, tributaries and perforator veins were ligated or clipped to prevent bleeding. The vein was mobilized and extracted with minimal tension to preserve its structural integrity. Heparin (5000 units) was administered during the

procedure to reduce the risk of thrombus formation. The wound was closed in layers, and drains were placed when necessary, followed by sterile dressing and compression bandaging to reduce swelling and promote healing.

Postoperatively, wound healing was assessed daily until discharge using the ASEPSIS score, which quantified infection based on clinical findings (serous discharge, erythema, purulent exudates, tissue separation), microbiological evidence (bacterial isolation), and interventions (antibiotics, drainage, debridement). The Numerical Rating Scale (NRS), which ranges from 0 (no pain) to 10 (worst pain), was used to assess leg pain during hospitalization and up until discharge. Lower limb edema was clinically assessed by looking at swelling or fluid retention in the operated leg, while patient satisfaction with the appearance of the vein harvesting site was evaluated one month after surgery using a 5-point Likert scale (1 = very dissatisfied, 5 = very satisfied), which reflected cosmetic outcomes. The European quality of life [EuroQol (EQ-5D-3L)] questionnaire, which evaluates five domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) each scored at three levels (no problems, some problems, and extreme problems), was used to measure quality of life one month following surgery. A higher frequency of "no problems" indicated better quality of life. The length of ventilation, ICU stay, and overall hospital stay were also noted. Patients were instructed to return for planned clinic visits as directed at release, and follow-up was done over the phone.

The Statistical Package of Social Sciences (SPSS) version 23.0 was used to analyze the data. With the exception of the ASEPSIS score reported as median (IQR), all continuous variable(age, BMI,CPB time, Aortic cross clamp time, Harvesting vein length and harvesting times) were shown as mean ± standard deviation (SD) after being initially examined for normality using the Shapiro-Wilk test. Frequencies and percentages were used to express categorical variables. Independent-t test were applied to find mean difference of continuous variables(age, BMI,CPB time, Aortic cross clamp time, Harvesting vein length and harvesting time) and Man Whitney test was applied for APSEPSIS score between the groups while, the Chi-square test was employed to compare the categorical variable(postoperative outcomes, cosmetic satisfaction and quality of life) across the groups. A *p*-value of 0.05 or below was deemed statistically significant.

RESULTS

A total of thirty patients were recruited, with 15 in the EVH group and 15 in the OVH group. The mean age, BMI, and gender distribution was similar across the groups (p>0.05). Mean EF was 55.33±8.20% vs 50.33±9.30% (p = 0.13), and the number of grafts was similar, except for two grafts which were more frequent in OVH (46.7% vs 80%, p=0.11). Vein harvesting time was significantly longer in EVH (40.00±12.47 vs 20.40±2.66 min, p = 0.001) as shown in Table-I.

Table-I. Comparison Baseline and intraoperative characteristics of patients across study groups (n = 30)

Variables		EVH-Group (n=15)	OVH-Group (n=15)	*p*-value
		Mean± SD		
Demographics				
Age(years)		55.73±9.15	52.33±12.55	0.40
BMI (kgm2)		26.78±4.58	27.81±4.15	0.52
		Frequency (%)		
Gender	Male	10(66.7%)	10(66.7%)	1.00
	Female	5(33.3%)	5(33.3%)	
Preoperative Parameters		Frequency (%)		
Comorbid	Dyslipidemia	3(20.0%)	7(46.7%)	0.29
	HTN	2(13.3%)	-	
	Smoker	6(40.0%)	4(26.7%)	
	None	4(26.7%)	4(26.7%)	
EF (%)		Mean± SD		0.13
		55.33±8.20	50.33±9.30	
Intraoperative Parameters		Frequency (%)		
No of grafts	1	3(20.0%)	0(0.0%)	0.11
	2	7(46.7%)	12(80.0%)	
	3	5(33.3%)	3(20.0%)	
		Mean± SD		
Harvesting vein time (minutes)		40.00±12.47	20.40±2.66	0.001
Harvesting vein length		41.06±6.30	39.06±11.54	0.56
CPB time(minutes)		97.47±27.22	104.53±25.26	0.46
Aortic Cross Clamp time(minutes)		77.80±22.52	73.80±21.28	0.62

HTN = Hypertension; EF = Ejection Fraction; EVH = Endoscopic Vein Harvesting; OVH = Open Vein Harvesting; BMI = Body Mass Index; CPB = Cardiopulmonary Bypass.

All complications were significantly lower in the minimally invasive endoscopic harvesting technique except tenderness (p>0.05) (Figure-2).

Postoperative assessment indicated that serous discharge and erythema were present significantly more in the OVH group than in the EVH group (66.7% vs. 20.0%; p = 0.02). Increased additional antibiotic use and debridement were in OVH patients, although this was not statistically significant. Prolonged hospital stay (>14 days) was seen only in OVH patients (20.0% vs. 0%; p = 0.001), and the ASEPSIS score was

significantly lower in EVH patients (3.00(1.00-10.00) vs. 18.00(13.00-25.00); p = 0.03), indicating better wound healing. Patients in EVH reported higher cosmetic satisfaction after 1 month (80% vs. 26.7%; p=0.009), and quality of life at the EVH OVH was better. (Table-II).

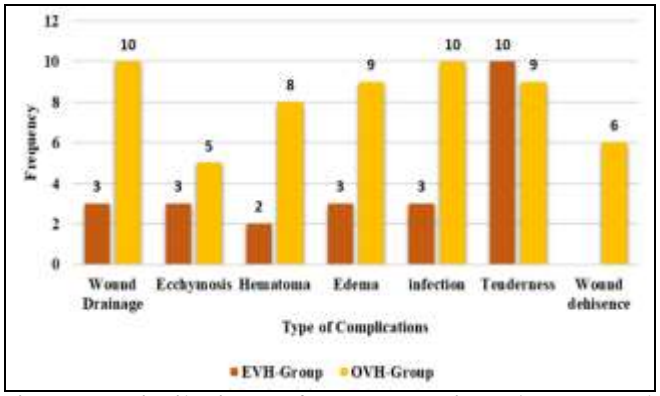

Figure-2 Distribution of Post-operative leg wound complications across study groups (n=30)

There was a statistically significant difference for pain level encountered at discharge between the two groups (p < 0.05). In the EVH group, 6 (40%) reported having mild pain, 4(27%) were in moderate pain, and 5(33%) endured severe pain. On the other hand, the OVH group had no participants with mild pain, 5 (33%) in moderate pain, and 10(67%) in severe pain (p < 0.05) as shown in figure-3.

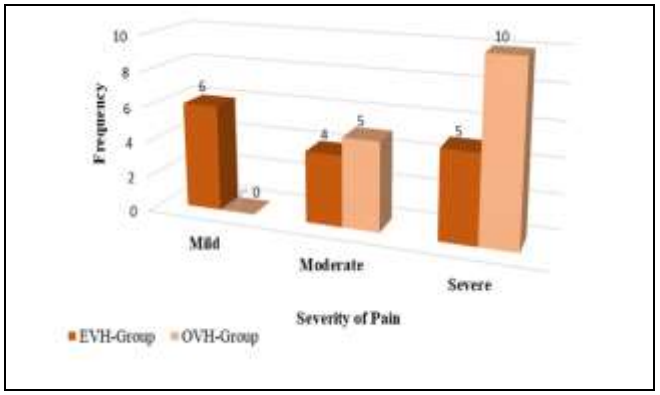

Figure-3 Severity of pain at discharge in EVH and OVH groups (n=30)

DISCUSSION

The study shows that EVH provides better postoperative outcomes than open vein harvesting, with less pain, fewer wound complications, and higher cosmetic satisfaction, despite slightly longer harvesting time. On follow-up, pain and wounds resolved in all patients except occasional edema in the open technique group, suggests EVH enhances recovery and comfort. Leg wound infections, a common complication, were lower with EVH, likely due to its minimally invasive approach that reduces tissue trauma and preserves lymphatic drainage.[6,10,11]

Table-II: Post-operative Parameters, Cosmetic satisfaction and Quality of health related life in EVH versus OVH (n=30)

Variables		EVH-Group (n=15)	OVH-Group (n=15)	p-value
		Frequency (%)		
Additional Treatment Antibiotics	No	11(73.3.0%)	9(60.0%)	0.35
	Yes	4(26.7%)	6(40.0%)	
Debridement	No	10(66.7%)	7(46.7%)	0.43
	Yes	5(33.3%)	8(53.3%)	
Serous Discharge	No	12(80.0%)	5(33.3%)	0.02
	Yes	3(20.0%)	10(66.7%)	
Erythema	No	12(80.0%)	5(33.3%)	0.02
	Yes	3(20.0%)	10(66.7%)	
Purulent Exudates	No	13(86.7%)	9(60.0%)	0.21
	Yes	2(13.3%)	6(40.0%)	
Separation of Tissue	No	15(100%)	11(73.3%)	0.10
	Yes	0	4(26.7%)	
Isolation of Bacteria	No	14(93.3%)	10(66.7%)	0.16
	Yes	1(6.7%)	5(33.3%)	
Prolong Hospital stay>14 days	No	15(100%)	12(80.0%)	0.001
	Yes	0	3(20.0%)	
		Median(IQR)		
Composite ASEPSIS Score		3.00(1.00-10.00)	18.00(13.00-25.00)	0.03
		Mean± SD		
ICU stay (hours)		10.20±5.18	13.87±6.27	0.03
Ventilation time(minutes)		156.67±73.66	155.40±76.8	0.96
Hospital stay(hours)		101.27±13.01	105.27±17.26	0.48
Euro Quality of Life domains		Frequency (%)		
Mobility	No Problem	14 (93.3%)	8(53.3%)	0.04
	Severe Problem	0	2(13.3%)	
	Some Problem	1(6.7%)	5(33.3%)	
Self-Care	No Problem	13(86.7%)	5(33.3%)	0.04
	Severe Problem	0	6(40.0%)	
	Some Problem	2(13.3%)	4(26.7%)	
Usual Activities	No Problem	12(80.0%)	8(53.3%)	0.32
	Severe Problem	2(13.3%)	3(20.0%)	
	Some Problem	1(6.7%)	4(26.7%)	
Pain/Discomfort	No Problem	11(73.3%)	7(46.7%)	0.12
	Severe Problem	0	4(26.7%)	
	Some Problem	4(26.7%)	4(26.7%)	
Anxiety	No Problem	13(86.7%)	9(60.0%)	0.17
	Some Problem	3(20.0%)	3(20.0%)	
	Severe Problem	0	3(20.0%)	
Cosmetic Satisfaction	Satisfied	3(20.0%)	11(73.3%)	0.009
	Very satisfied	12(80.0%)	4(26.7%)	

EVH: Endoscopic Vein Harvesting; OVH: Open Vein Harvesting; ICU: Intensive Care Unit; IQR: Interquartile Range.

Chernyavskiy *et al.,* evaluated lower limb lymphatic drainage in 41 patients (OVH = 18 [43.9%], EVH = 23 [56.1%]), which is somewhat consistent with our results that the EVH group had reduced postoperative drainage (20.0% vs. 66.7%).[12] Our results are consistent with a meta-analysis of eleven randomized controlled trials that found that utilizing an endoscopic method significantly reduced wound infection.[13] In line with our findings, a number of studies have documented enhanced quality of life with EVH, including less postoperative pain, early mobilization, and increased patient satisfaction.[13,14]

Ozgur *et al.,*[15] reported no significant differences in systemic or wound site infections requiring debridement (OVH: 4 [6.1%] vs. EVH: 0; p = 0.061), consistent with our findings, although absolute numbers were slightly higher in our study (EVH: 5 vs. OVH: 8; p = 0.06), likely due to sample size, comorbidities, perioperative care, or surgical technique. Bhargavi *et al.,*[16] also reported a longer harvesting time in the EVH group, which is consistent with our findings. This may be attributed to limited hands-on experience and the infrequent use of the endoscopic technique, with the associated learning curve, meticulous dissection, and careful branch control under endoscopic visualization contributing to the increased harvesting time.

The benefits of EVH were supported by the fact that it was generally linked to a decreased frequency of postoperative complications, especially leg wound infections.[17-20] Previous reports also noted lower hematoma rates in EVH [21,22]. ASEPSIS scores, which are widely used to objectively assess wound healing and the risk of infection, were lower in the EVH group, indicating superior wound integrity and fewer complications compared to the open technique. This finding reflects better postoperative outcomes with EVH, including reduced tissue trauma and preservation of lymphatic drainage.[10] Additionally, postoperative pain was significantly lower in EVH patients in our study, consistent with prior literature.[23,24] This reduction in pain can be attributed to the minimally invasive nature of EVH, smaller incisions, and less disruption of surrounding tissues, which together facilitate faster recovery, earlier mobilization, and higher overall patient comfort.

In summary, this study confirms that EVH is less painful, has fewer complications like infections, hematomas, and wounds, and has a higher patient satisfaction with cosmetic outcomes compared to open vein harvesting, even with slightly longer harvesting time. These benefits improve patient recovery with fewer secondary procedures required, shorter length of hospital stay, and better overall quality of life. The minimally invasive technique that preserves tissue and lymphatic integrity, highlights its importance to incorporate EVH into routine clinical practice as the technique of choice for saphenous vein harvesting for CABG patients.

LIMITATIONS OF STUDY

There are various limitations in this study. Firstly, the number of participants in this study was minimal (n = 30), so the findings may not be applicable to a wider group of people. Secondly, this study was done in one location and the results may be different in other locations with different surgical skills and post-operative care approaches. Thirty, the results examined primarily the short-term post-operative outcomes, and did not look at long-term graft patency, functional recovery, and late complications. Subjective measures, pain and cosmetic satisfaction, can be a factor of patient perception which may cause a bias. More studies with larger sample size, with multiple centers, and longer study durations are needed to confirm and expand on these results.

CONCLUSION

EVH provides many clinical and patient-related advantages when it comes to harvesting the saphenous vein, and is safe and effective. EVH contributes to the enhancement of surgical care, efficient use of resources, and increased patient satisfaction which all support the case for EVH to become a routine practice in CABG.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SMAR & MIA: Data acquisition, data analysis, critical review, approval of the final version to be published.

AMJ & MAK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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