Open Access

Original Article

Comparison of Wound Infection In Below Knee and Above Knee Vein Harvesting In Patients After Coronary Artery Bypass Grafting

Tajamul Hussain Bangash, Muhammad Waseem*, Asif Mahmood Janjua*, Muhammad Hashim Ghouri*, Nasir Ali, Muhammad Usama Akhtar, Tahseen Ahmed*, Yasser Khan**

Department of Cardiac Surgery, Armed Forces Institute of Cardiology / National Institute of Heart Diseases/National University of Medical Sciences (NUMS) Pakistan, *Department of Cardiac Surgery, Army Cardiac Centre Lahore,**Department of Radiology, Combined Military Hospital Lahore/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: To compare rate of wound infection between vein harvesting from thigh and leg among patients undergoing coronary artery bypass graft surgery (CABG).

Study Design: Quasi-experimental study

Place and Duration of Study: Cardiac Surgery Unit, Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi, Pakistan, from Jun 23 to Jan 24.

Methods: Sample size was one hundred and sixty-nine. Patients were assessed for eligibility after informed consent and enrolled using a non-probability consecutive sampling technique. Both males and females above 40 years of age were included. Patients with diabetes, chronic kidney disease, redo cases, patients on steroids, and having any immunocompromised conditions, as well as pregnant women, were excluded. Patients were allocated into two groups i.e., Group-A (vein harvesting from thigh) and Group-B (vein harvesting from leg). After CABG, the wound was assessed using Southampton wound grading system (SWGS).

Results: The study included one hundred and thirteen (66.86%) males and fifty-six (33.14%) females. Age ranged from forty five to seventy six years. Thirty-seven (21.89%) patients were smokers. Seven (4.14%) patients had surgery for single vessel coronary artery disease, twenty-five (14.79%) patients underwent surgery for double vessel coronary artery disease. Patients suffering from lesions of three coronary arteries constituted the highest number, one hundred thirty-seven (81.06%).

Conclusion: Considering management of wound infection and available evidence in view, half-length vein harvesting should be done from leg.

Keywords: Cardiac Surgery, Coronary Artery Bypass, Coronary Artery Disease, Coronary Vessels, Great Saphenous Vein, Post-operative Infection, Surgical Wound Infection, Surgical Site infection, Vein Grafting

How to Cite This Article: *Hussain T, Waseem M, Janjua AM, Ghouri MH, Ali N, Akhtar MU, Ahmed T, Khan Y. Comparison of Wound Infection In Below Knee and Above Knee Vein Harvesting In Patients After Coronary Artery Bypass Grafting. Pak Armed Forces Med J 2025; 76(Suppl-2): S441-S445. DOI: https://doi.org/10.51253/pafmj.v76iSUPPL-2.11935*

INTRODUCTION

Coronary artery disease (CAD) is one of the leading causes of mortality and morbidity and is responsible for around 17.9 million deaths around the world.[1] Coronary Artery Bypass Grafting (CABG) is a commonly used procedure to restore myocardial blood flow.[2] This procedure results in a substantial improvement in the quality of life.[3] In CABG, the stenosed coronary vessels are bypassed using different conduits. Conduits can be arterial or venous. Commonly used arterial conduits include Left Internal Mammary Artery (LIMA) and Radial Artery (RA). In patients where LIMA and RA are not available, a variety of other arterial conduits can be used, namely Gastroepiploic artery (GEA), Ulnar artery, left gastric artery, splenic artery, thoracodorsal artery, left femoral circumflex artery, and inferior epigastric artery.[4] The most common venous conduit is Great Saphenous vein (GSV).5 Apart from GSV, lesser saphenous vein and the upper extremity cephalic veins are used as a second choice. An experimental study including 104 patients used 'no-touch' technique and found that patency of GSV at 18 months was 95% as compared to 89% with conventional method. After 8.[5] years, patency was reduced to 90% with 'no-touch' technique as compared to 76% with the conventional harvesting method.[6]

Complications of CABG include bleeding, respiratory and renal impairment, wound infection, prolonged ventilation and ICU stay, cerebrovascular accident (CVA), and perioperative myocardial infarction.[7] One frequently reported complication among these patients is postoperative wound infection.[8] During healing surgical wound goes

Correspondence: Dr Tajamul Hussain Bangash, Department of Cardiac Surgery, AFIC / NIHD Rawalpindi Pakistan

Received: 05 Jan 2024; revision received: 17 Apr 2024; accepted: 18 Apr 2024

through hemostasis, inflammation, proliferation, and remodeling, which are the four stages of wound healing.[9] Different scoring systems are used for grading wound infection. Southampton Wound Grading System is one of them. It grades wound infection with a score from zero to five in order of increasing severity. This wound system has been found to be significant in scoring the severity of surgical wound infections.[10]

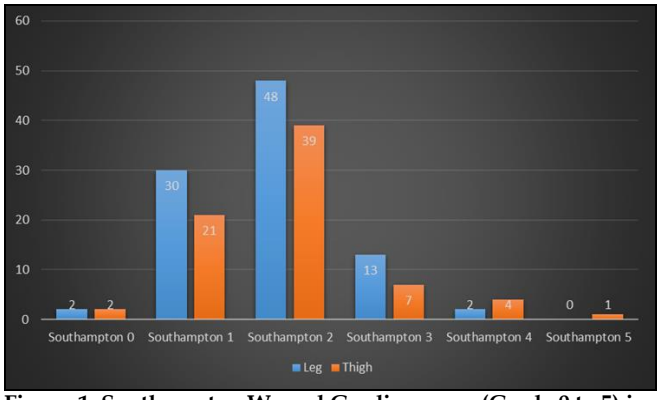

Figure-1: Southampton Wound Grading score (Grade 0 to 5) in Group-A (Thigh) and Group-B (Leg)

Currently, there is scant data available on the choice of site between thigh and leg for GSV harvesting in cases where a half-length vein is required. Surgical wound infection has been observed at both sites after half-length GSV harvesting in CABG patients. However, no clear numbers are currently available to support one site over the other. Therefore, we conducted this study with the intention of measuring the rate of surgical site infection in half-length vein harvesting from the thigh as compared to the half-length vein harvesting from the lower leg among patients undergoing Coronary Artery Bypass Graft (CABG) surgery.

METHODOLOGY

A Quasi-experimental study was conducted at Adult Cardiac Surgery Unit, Armed Forces Institute of Cardiology / National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi, Pakistan, from Jun 23 to Jan 24. The study started after approval from the Institutional Ethical Review Board of AFIC/NIHD vide approval letter number 9/2/R&D/2023/274. For data collection, non-probability consecutive sampling technique was used. A sample size of 169 was calculated, taking the prevalence of leg wound infection after CABG as 12.5%, 95% confidence interval, and 5% margin of error using the WHO calculator.[11]

Inclusion Criteria: Patients of both genders and age ranged from 40 to 80 years undergoing CABG were included in the study.

Exclusion Criteria: Patients having diagnosed diabetes, chronic kidney disease, patients on steroids, those having any immunocompromised conditions (HIV, any type of cancer, or any other condition classified as compromising the immunity of the patient as assessed by the treating surgeon), pregnant women, and redo cases were excluded.

Informed written consent was taken from patients who met inclusion criteria. They were allocated into Group-A (vein harvesting from thigh) and Group-B (vein harvesting from leg) based on surgeon's discretion. After CABG, lower limb wound was assessed at regular intervals using Southampton wound grading system, and patients were followed from 2nd post-operative day till 5th post-operative day. Antibiotics were given as per routine ITC protocols, as per intensivist's advice.

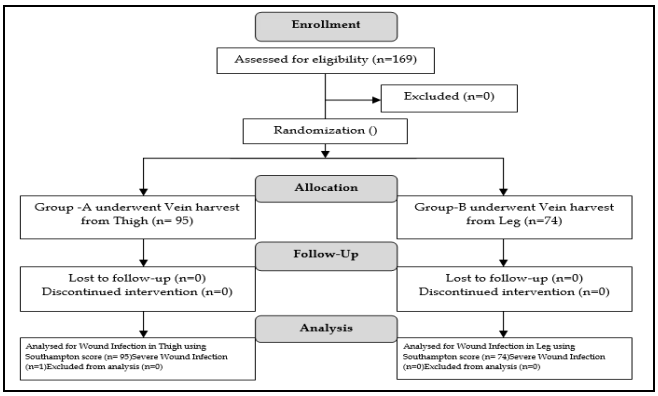

Figure-2: Patient Flow Diagram for evaluating Wound Infection in Vein harvesting sites from Above and Below Knee for CABG

Data analysis was done using IBM Statistical Package for Social Sciences (SPSS) version 21. For quantitative variables, mean and standard deviation were computed. For qualitative variables, percentages and frequencies were reported. In order to compare the effect of two categorical variables (half-length vein harvesting from thigh as compared to the half-length vein harvesting from leg) on wound infection, Chi-square test was applied. The *p*-value of ≤0.05 was considered significant.

RESULTS

A total of one hundred and sixty-nine patients who had coronary artery bypass graft surgery were enrolled in the study. Out of these 113(66.86%) were males and 56(33.14%) were females. Age ranged from 45 to 76 years. A total of 37(21.89%) patients were smokers. According to the number of coronary arteries involved, 7(4.14%) patients had surgery for single vessel coronary artery disease (SVCAD), 25(14.79%) patients underwent surgery for double vessel coronary artery disease (DVCAD). Patients suffering from lesions of three coronary arteries (TVCAD) constituted the highest number 137(81.06%). (Table-I)

Table-I: Descriptive Parameters & Disease wise prevalence (n=169)

Descriptive Variables	n (%)
Gender	
Male	113 (66.86)
Female	56 (33.14)
Smoking	37(21.89)
SVCAD*	7(4.14)
DVCAD**	25(14.79)
TVCAD***	137(81.06)

**Single Vessel Coronary Artery Disease,*
***Double Vessel Coronary Artery Disease,*
****Triple Vessel Coronary Artery Disease*

An overview of the intraoperative parameters exhibited that in 95(56.21%) of patients, great saphenous vein was harvested from leg and in 74(43.79%) of patients the harvest site for great saphenous vein was thigh. Average harvest time was 35.01±7.89 minutes. During surgery, cardiopulmonary bypass time was 75.00±10.86 minutes, and cross-clamp time was 45.02±4.92 minutes. (Table-II)

Table-II: Intraoperative Variables

Operative Parameters	Values
Harvest Site	
Thigh	74 (43.79%)
Leg	95 (56.21%)
Harvest Time (mins)	35.01 ± 7.89
Cardiopulmonary Bypass Time (mins)	75.00 ± 10.86
Cross Clamp Time (mins)	45.02 ± 4.92

Wound infection was graded using the Southampton wound grading system. This system ranges from grade 0 to 5. Grade 3 or higher was considered evidence of infection. Among enrolled patients, 27(15.98%) had infection. Of these, 12(44.44%) had infection in the thigh and 15(55.56%) in the leg. Within the harvest site, 12(16.22%) had infection in the thigh and 15(15.79%) in the leg. The results showed no significant correlation between infection rate and harvest site (*p*-value: 0.106) (Table-III). Normal wound healing, yielding a Southampton score of 0, was observed in 4(2.37%) patients. With respect to the harvest site, 2(2.70%) patients had vein harvested from the thigh and 2(2.10%) from the leg. A total of 51(30.18%) patients had normal wound healing with mild bruising or erythema, yielding a Southampton score of 1. Among these, 21(28.38%) had vein harvested from the thigh and 30(31.58%) from the leg. Erythema with signs of inflammation, yielding a Southampton score of 2, was observed in 87(51.48%) patients. Among these, 39(52.70%) had vein harvested from the thigh and 48(50.53%) from the leg. 20(11.83%) patients developed clear or haemoserous discharge from the wound, with a Southampton wound score of 3. Among these, 7(9.46%) had vein harvested from the thigh and 13(13.68%) from the leg. Major complication with pus discharge, yielding a Southampton score of 4, was found in 6(3.55%) patients. Among these, 4 (5.40%) had vein harvested from the thigh and 2(2.10%) from the leg. Only 1(0.59%) patient had a Southampton score of 5, i.e., deep or severe wound infection with or without tissue breakdown. This patient had vein harvested from the thigh. Within the harvest site, the percentage for this patient was 1(1.35%).

Table-III: Association between Infection Rate and Harvest Site (n=169)

Parameter	Harvest Site		*p*-value
Infection n (%)	Thigh (n=74)	Leg (n=95)	
Yes	12(16.22)	15(15.79)	0.106
No	62(83.78)	80(84.21)	

DISCUSSION

The study found no significant difference in overall surgical wound infection rates between leg and thigh vein harvesting sites. However, a severe infection (Southampton score 5) occurred in one patient after thigh harvesting. Hence, the study confirms that with ease of managing infections at the leg site, half-length vein harvesting from the leg is a preferable option.

Since the first CABG in 1961, cardiac surgery has advanced significantly. The left internal mammary artery (LIMA) is the preferred conduit for CABG due to its superior short- and long-term patency and resistance to atherosclerosis. LIMA has minimal intimal defects, a non-fenestrated internal elastic lamina that prevents hyperplasia, and produces vasodilators such as nitric oxide and prostacyclin,

enhancing its response to post-operative vasodilator drugs.[12] Moreover, the patency rate of LIMA has been observed to be 98% and 91% at 1 and 4 years, respectively, after CABG as per the results concluded by Fron *et al*.[13] Clinical trial by Fron also compared risk of developing post-operative wound infection between patients undergoing vein harvesting using conventional method and endoscopic method. This study concluded that endoscopic method is as safe as classical method for harvesting vein. In addition, endoscopic method provides better wound healing and has better cosmetic outcomes.[13]

In a study conducted by Selcuk *et al,* LIMA was found to have 95% and 88% patency at 10 and 15 years, respectively, after CABG.[14] This retrospective study of 1,900 patients at Sultan Abdulhamid Han Hospital compared post-operative morbidity in CABG patients who underwent vein harvesting from the lower leg (Group-A) versus the thigh (Group-B). The study included patients with various comorbidities. Results showed no significant difference in wound healing between the two groups, aligning with our findings.[14]

A retrospective cohort study conducted by Unossen *et al.,* of 2,188 CABG patients, found that 17.1% received antibiotics and 7.0% underwent revision for leg wound infections (LWI). Independent risk factors included female sex, high BMI, diabetes mellitus, longer operation time, peripheral vascular disease, and direct oral anticoagulants.[15]

The saphenous-vein graft is the most common conduit for coronary-artery bypass grafting (CABG). The influence of the vein-graft harvesting technique on long-term clinical outcomes has not been well characterized.[11] A study by Zenati et al., randomly assigned patients undergoing CABG at 16 Veterans Affairs cardiac surgery centers to either open or endoscopic vein-graft harvesting. The primary outcome was a composite of major adverse cardiac events, including death from any cause, nonfatal myocardial infarction, and repeat revascularization. Leg-wound complications were also evaluated.[16]

A 2024 study by Wang *et al.,* presented an optimized no-touch technique for saphenous vein harvesting in CABG patients that significantly reduces lower limb complications and infections. This approach minimizes electro-cautery, preserves the tunica adventitia, and utilizes specific closure techniques to mitigate the higher infection risks typically associated with traditional no-touch methods.[17] This study included patients with diabetes, including 50% diabetic patients in Group-A and 46% diabetic patients in Group-B. The mean harvest time in our study was 35±19 mins. Mean CPB time in Group-A was 95.2±20.4 mins, and in Group B was 99.7±25.1 mins. The infection rate was higher in patients of Group-A i.e. patients who underwent surgery with an incision extending above the knee.

Salsano *et al.,* conducted a prospective study to determine lower limb wound infection in CABG patients. They divided 175 patients into 3 groups. In Group-A, vein was harvested from above knee. In Group-B great saphenous vein was harvested from the leg with the incision extended till the upper border of the patella. In Group-C, incision was restricted to below the upper border of the patella. The age of patients included in this study ranged from 63.8±9.9. The mean BMI was 28±3.9. This study included 17% diabetic patients and 11% smokers. Our study did not include patients with diabetes, whereas 22% of our patients were current smokers. The study concluded that wound infection was significantly higher in Group-A, which included patients with vein harvesting from above the knee.[18]

There is sparse data available in the literature related to the topic. All the above mentioned studies used ASEPSIS score to measure the infection score. No study has previously employed the Southampton Infection score for measuring clinical infection of harvest site in CABG patients. The studies conducted before also included patients with multiple comorbidities, including diabetes, hypertension, hyperlipidemias, obesity, PAD, hepatic, renal, and endocrine failures. Our study excluded patients with comorbidities and was conducted on non-diabetic patients with normal BMI.

CONCLUSION

In conclusion, no site proved superior over the other in reducing the chances of developing surgical wound infection between leg and thigh. However deep and severe wound infection presenting with tissue breakdown, yielding a Southampton score of 5, was seen in one patient who underwent half-length vein harvesting from the thigh. Keeping the ease of managing surgical wound infection, available evidence, and current data in view, half-length vein harvesting from the leg is a superior choice to thigh harvesting.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

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

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

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

MUA & TA & YK: Conception, data acquisition, drafting the manuscript, 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.

REFERENCES

1. Cardiovascular diseases [Internet]. [cited 2023 Mar 24]. Available from: https://www.who.int/health-topics/cardiovascular-diseases.
2. Borchardt RA, Tzizik D. Update on surgical site infections: The new CDC guidelines. JAAPA 2018; 31(4): 52-54. https://doi:10.1097/01.JAA.0000531052.82007.42.
3. Caliskan E, De Souza DR, Boening A, Liakopoulos OJ, Choi YH, Pepper J, et al. Saphenous vein grafts in contemporary coronary artery bypass graft surgery. Nat Rev Cardiol 2020 Mar; 17(3): 155-169. https://doi.org/10.1038/s41569-019-0249-3.
4. Baig K, Harling L, Papanikitas J, Attaran S, Ashrafian H, Casula R, et al. Does coronary artery bypass grafting improve quality of life in elderly patients? Interact Cardiovasc Thorac Surg 2013; 17(3): 542–553. https://doi.org/10.1093/icvts/ivt220.
5. Cohn LH, Adam DH. Cardiac Surgery in Adults. 3rd ed. New York: McGraw Hill Education/Medical; 2017. p. 494-495.
6. Larsson H, Hälleberg-Nyman M, Friberg Ö, Falk-Brynhildsen K. Perioperative routines and surgical techniques for saphenous vein harvesting in CABG surgery: a national cross-sectional study in Sweden. J Cardiothorac Surg 2020; 15(1): 5. https://doi.org/10.1186/s13019-020-1056-y.
7. Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Healthcare Infection Control Practices Advisory Committee. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg 2017; 152(8): 784-791. https://doi:10.1001/jamasurg.2017.0904.
8. Larsson H, Nyman MH, Brynhildsen KF. Patients' experiences regarding severe leg wound infection associated with coronary artery bypass grafting: A qualitative study. J Vasc Nurs 2023; 41(1): 12-18. https://doi.org/10.1016/j.jvn.2022.12.002.
9. Bryan CS, Yarbrough WM. Preventing Deep Wound Infection after Coronary Artery Bypass Grafting. Tex Heart Inst J 2013; 40(2): 125–139.
10. Tiwari, Shaleen & Chauhan, Mahendra & Shahapurkar, Vinay & Akhtar, Md & Grover, Ankur & Prashad, et al. IMPORTANCE OF SOUTHAMPTON WOUND GRADING SYSTEM IN SURGICAL SITE INFECTION. J Evol Med and Dent Sci 2014; 3(20): 5491-5495. https://doi.org/10.14260/jemds/2014/2618.
11. Siddiqi MS. Saphenous vein harvest wound complications: risk factors, identification, prevention, and management. Chronic Wound Care Management and Research 2016: 147-156. https://doi.org/10.2147/CWCMR.S82601
12. Wallace HA, Basehore BM, Zito PM. Wound Healing Phases. [Updated 2023 Jun 12]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470443/
13. Froń K. Comparison of endoscopic and traditional saphenous vein harvesting used as coronary artery bypass grafting material in patients with increased risk of postoperative infection. Ann Acad Med Siles 2020; 74: 149-156.
14. Selçuk I, Selçuk N, Güven BB. Postoperative morbidity differences between proximal and distal knee saphenous harvesting in coronary artery bypass graft surgery. J Clin Investig Surg 2021; 6(2): 131-135. https://doi.org/10.25083/2559-5555.
15. Unosson H, Nyman MH, Brynhildsen KF, Friberg Ö. Risk factors for infection at the saphenous vein harvest site after coronary artery bypass grafting surgery: a retrospective cohort study. J Cardiothorac Surg 2024; 19(1): 310. https://doi:10.1186/s13019-024-02799-4.
16. Zenati MA, Bhatt DL, Bakaeen FG, Stock EM, Biswas K, Gaziano JM, et al. Randomized Trial of Endoscopic or Open Vein-Graft Harvesting for Coronary-Artery Bypass. N Engl J Med 2019; 380(2): 132-141. https://doi:10.1056/NEJMoa1812390.
17. Wang W, Liu Y, Qi H, Liu Y, Jiang Y, Fan R, et al. Mid-term outcomes of endoscopic vein harvesting in coronary artery bypass grafting: a retrospective cohort study. J Cardiothorac Surg 2024;19(1): 389. https://doi:10.1186/s13019-024-02930-5.
18. Salsano A, Mariscalco G, Santini F. Endoscopic saphenous vein harvesting and surgical site infections after coronary artery bypass surgery. Ann Transl Med 2018; 6(Suppl 1): S37. https://doi:10.21037/atm.2018.09.51.