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Original Research Article

FREQUENCY OF POST-OPERATIVE DEEP STERNAL WOUND INFECTION IN DIABETIC PATIENTS USING PEDICLE HARVESTING METHOD OF INTERNAL THORACIC ARTERY FOLLOWING CORONARY ARTERY BYPASS GRAFTING SURGERY

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ABSTRACT

Background: *Deep sternal wound infection (DSWI) is a serious postoperative complication following coronary artery bypass grafting (CABG), particularly among diabetic patients. The method of internal thoracic artery (ITA) harvesting has been implicated as a potential factor influencing infection risk, with the pedicled technique possibly predisposing to higher rates of DSWI due to impaired sternal vascularity.* ***Objective:*** *To determine the frequency of postoperative deep sternal wound infection (DSWI) in diabetic patients undergoing CABG using the pedicled internal thoracic artery harvesting method.* ***Study Design:*** *Descriptive study.* ***Setting:*** *Department of Cardic Surgery, Hayatabad Medical Complex, Peshawar, Pakistan.* ***Duration of Study:*** *From 03-February-2025 to 03-June-2025.* ***Methods:*** *A total of 110 diabetic patients who underwent CABG with pedicled ITA harvesting were included using consecutive non-probability sampling. Patients were monitored for 30 postoperative days for evidence of DSWI, defined by sternal instability, fever >38°C, chest pain, purulent mediastinal drainage, and positive microbiological culture from the mediastinum or blood. Data were analyzed using SPSS version 25.* ***Results:*** *The mean age of the study participants was 53.80 ± 13.52 years, with a male predominance (77.3%). Hypertension (71.8%) and dyslipidemia (42.7%) were common comorbidities. The frequency of DSWI was 4.5% (n=5). A significant association was observed between female gender and the occurrence of DSWI.* ***Conclusion:*** *The incidence of deep sternal wound infection in diabetic patients undergoing CABG with pedicled ITA harvesting was 4.5%. Female gender emerged as a notable risk factor for DSWI, highlighting the need for vigilant perioperative care in high-risk patients.*

Keywords: Deep Sternal Wound Infection, Diabetes Mellitus, Coronary Artery Bypass Grafting, Pedicled Internal Thoracic Artery

INTRODUCTION

Coronary artery bypass grafting (CABG) constitutes a critical surgical intervention that entails the diversion of blood flow around blocked coronary arteries due to atheromatous lesions, using harvested venous grafts. The bypass surgery restores blood flow to ischaemic myocardium, thus enhancing function, viability, and decreasing angina symptoms. Roughly 400,000 CABG interventions are performed each year, which makes it the most commonly carried out major surgical procedure. Additionally, there has been a reduction in surgical trends attributed to increasing adoption of nonsurgical options such as PCI (1-3).

The individual population undergoing CABG exhibits complicated CAD alongside several comorbid conditions. The internal thoracic artery (ITA) is the most common conduit, especially advantageous for diabetic patients due to its greater patency rate as well as reduced occurrence of postoperative cardiac complications. 2 Post-CABG surgery, sternal infection constitutes a critical issue, as it can increase individual mortality rates. The application of ITA provides significant benefits; however, documented data indicate that sternal infections can develop post-application, particularly among diabetic patients, and are linked to impaired blood flow in the sternum. The likelihood of infection within sternal wounds in post-CABG patients can be affected by the method employed for harvesting ITA (4-7).

The pedicled harvesting procedure involves the careful extraction of ITA, making sure its blood supply remains intact through perforating branches connecting the artery to the subclavian artery (8, 9). This method ensures the ongoing viability of the artery throughout the entire procedure. This method contrasts with the free harvesting strategy, where the artery is entirely detached from its blood supply, resulting in the artery lacking its inherent perfusion supply. The pedicled approach assures the viability of ITA for bypass grafting, resulting in enhanced graft function as well as a reduced risk of ischaemia when compared to fully freed grafts (10, 11). A study showed that the incidence of post-operative deep sternal wound infection was 3.64% within diabetic patients who underwent CABG surgery using a pedicled harvesting approach of the internal thoracic artery (12).

The pedicled harvesting technique for the ITA in CABG surgery is frequently regarded as a superior approach. This method preserves the artery's blood supply, resulting in improved graft patency and a reduced risk of ischemia. The objective of this study is to assess the frequency of post-operative deep sternal wound infection in diabetic patients who underwent coronary artery bypass grafting surgery utilizing the pedicled harvesting method of the internal thoracic artery, given the limited local literature on this topic. The results of this study will assist medical professionals in improving their understanding of the complex interactions between diabetes, surgical techniques, and post-operative complications.

METHODOLOGY

This descriptive study was carried out in the department of Cardiac Surgery, Hayatabad Medical Complex, Peshawar. The duration of the study was from 03 February 2025 to 03 June 2025. Ethical approval was obtained from the hospital before starting the survey. The sample of 110 patients was calculated using a frequency of 3.64% (12) for postop DSWI, with an absolute precision of 3.5% and a confidence

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level set at 95%. Patient selection was carried out using a consecutive non-probability sampling technique.

We admitted patients of both genders, aged 30 to 75 years, presenting with diabetes mellitus, and were scheduled to undergo coronary artery bypass grafting surgery. Diabetes mellitus was defined by the presence of polydipsia, polyphagia, and polyuria, along with a fasting blood glucose level measuring 126 mg/dL or higher on two separate occasions, or a confirmed pre-existing history of diabetes managed with anti-diabetic treatment. Patients were excluded from participation if they had presented with any distant extra-thoracic infection before surgery, had a left ventricular ejection fraction documented below 30% or were diagnosed with chronic liver, renal, or kidney disease.

All the patients gave their consent. During the surgical procedure, the left internal thoracic artery was harvested as a pedicled graft, which involved preserving the artery's nerve and blood supply along with its surrounding fascia. Post-operative deep sternal wound infection was assessed within the first 30 days following the surgery. This was defined by the presence of sternal instability, fever exceeding 38°C, chest pain (VAS > 3), mediastinal purulent drainage, and the detection of an organism from cultures taken from the mediastinum or the blood. A consultant cardiac surgeon supervised the entire process with at least five years of post-fellowship experience. A pre-structured proforma was used for documenting all patient information.

SPSS 25 was used for analysis. Gender, DSWI, dyslipidemia, hypertension, three-vessel CAD, diathermy used, anterior mediastinal drain, pleural drain, and chlorhexidine usage were evaluated using frequency and percentages. Age, duration of hospital stays, and body mass index were calculated using mean and standard deviation. Demographic and clinical variables were stratified with DSWI using the chi-square test. P-value ≤ 0.05 was selected for significance.

RESULTS

In our study, 110 patients were included. Our cohort had a mean age of 53.80 ± 13.52 years and a mean body mass index of 25.52 ± 2.55 kg/m². The mean hospital stay for the patients was 10.74 ± 2.23 days. The demographic profile consisted of the majority of male patients, with 85 males (77.3%) and 25 females (22.7%). Hypertension was present in 79 patients (71.8%), and dyslipidemia was present in 47 patients (42.7%). Three-vessel coronary artery disease was found in 99 patients (90.0%) (Table 1).

Deep sternal wound infection was observed in 5 patients (4.5%) (Table 2). A higher frequency of patients who developed the infection was female. Although not significant, a vast majority of patients who developed DWSI had a BMI > 25 kg/m² (Table 3).

Table 1: Commodities and clinical characteristics

Commodities and clinical characteristics		n	%
Hypertension	Yes	79	71.8%
	No	31	28.2%
Dyslipidemia	Yes	47	42.7%
	No	63	57.3%
Diathermy used	Yes	110	100.0%
	No	0	0.0%
Anterior mediastinal drain	Yes	110	100.0%
	No	0	0.0%
Chlorhexidine usage	Yes	110	100.0%
	No	0	0.0%
Three-vessel CAD	Yes	99	90.0%
	No	11	10.0%

Table 2: Frequency of postoperative DSWI

DSWI	n	%
Yes	5	4.5%
No	105	95.5%

Table 3: Association of DSWI with demographics and clinical characteristics

Demographics and clinical characteristics		DSWI				P value
		Yes		No		
		n	%	n	%	
Age distribution (Years)	30 to 45	1	20.0%	36	34.3%	P > 0.05
	46 to 60	2	40.0%	27	25.7%	
	> 60	2	40.0%	42	40.0%	
Gender	Male	2	40.0%	83	79.0%	P < 0.05
	Female	3	60.0%	22	21.0%	
Hypertension	Yes	4	80.0%	75	71.4%	P > 0.05
	No	1	20.0%	30	28.6%	
Dyslipidemia	Yes	4	80.0%	43	41.0%	P > 0.05
	No	1	20.0%	62	59.0%	
Three-vessel CAD	Yes	5	100.0%	94	89.5%	P > 0.05
	No	0	0.0%	11	10.5%	
Hospital stay (Days)	7 to 10	2	40.0%	45	42.9%	P > 0.05
	> 10	3	60.0%	60	57.1%	

DISCUSSION

Our findings indicate that DSWI occurred in 4.5% of the studied cohort. This result aligns with the broader surgical literature, which reports a variable but consistent incidence of this severe complication. Tanveer et al. documented a closely related frequency of 3.64% in a similar patient population utilizing the pedicled approach (12). Another study by Soliman et al. reported a higher rate of 10%. This disparity can be attributed to differing patient demographics or perioperative management protocols (13). The meta-analysis by Deo et al., which consolidated data from over 120,000 diabetic patients, found that pedicled bilateral internal thoracic artery harvesting was associated with a 3.1% incidence of deep sternal wound infection, further affirming our finding (14). This convergence of data underscores that despite advances in surgical care, deep sternal wound infection remains a tangible and clinically significant threat in diabetic patients undergoing pedicled ITA harvest.

An exciting finding from our analysis was the association between female gender and the development of deep sternal wound infection. Although females constituted only 22.7% of our study, they represented 60% of the infection cases. This observation is documented in research by Bonacchi et al., which involved a large

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cohort of patients receiving bilateral ITA grafts. Female sex was identified as a prominent risk factor, with a notably higher percentage of females in their infection group (15). Lazar, in a comprehensive review, also highlighted female gender as a key demographic variable that elevates the risk for mediastinitis, often intersecting with other comorbidities like diabetes and obesity to create a high-risk profile (16). The underlying pathophysiology is thought to be multifactorial, involving differences in subcutaneous tissue distribution, sternal bone density, and mammary gland anatomy, which may compromise sternal vascularity and healing capacity post-harvest.

In our study, other common comorbidities, such as hypertension, were present in 71.8% of our patients, and dyslipidemia was found in 42.7%; they did not demonstrate a statistically notable association with the development of DSWI. This aligns with the results reported by Bonacchi et al., who found that neither hypertension nor dyslipidemia was an independent predictor of sternal infection in their multivariate analysis (15). Similarly, three-vessel coronary artery disease (90% of our cohort) was not a significant predictor of infection, a finding consistent with the study above, which also found no link between the extent of coronary disease and sternal wound complications. This suggests that while these factors are critical markers of overall cardiovascular disease burden, their direct causative role in impairing sternal healing may be limited compared to other, more potent risk factors.

Lazar et al. emphasize the importance of pre-operative chlorhexidine bathing to reduce skin bacterial load (16). Furthermore, the consistent use of diathermy for hemostasis during harvesting, while a practical necessity, has been a point of discussion in the literature. The skeletonized harvesting technique, which often employs more precise instruments like the harmonic scalpel, has been proposed to cause less thermal damage to the sternal collateral vessels and surrounding tissues. Boodhwani et al. demonstrated that skeletonization could better preserve sternal blood flow compared to pedicled harvesting, which relies heavily on electrocautery (17). This may be one mechanistic explanation for the generally lower rates of deep sternal wound infection associated with the skeletonized technique, as reported in studies by Deo et al (14).

The strong association of female gender with deep sternal wound infection in our diabetic cohort suggests that this subgroup requires meticulous pre-operative planning and post-operative vigilance, for female diabetic patients, or any patient identified with multiple risk factors such as obesity or COPD, a deliberate institutional policy to favor the skeletonized harvesting technique should be considered (14, 16).

CONCLUSION

In conclusion, our study found that the frequency of postop DSWI in diabetic patients using the pedicled harvesting method of ITA for CABG was 4.5%. Our analysis found a notable association with DSWI and female gender.

DECLARATIONS

Data Availability Statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned. (IRB-Approval#2468)

Consent for publication

Approved

Funding

Not applicable

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

ATIQ UR REHMAN (Trainee Medical Officer)
Conception of Study, Data Collecction, Manuscript drafting, Review of manuscript, and final approval of manuscript.
MUHAMMAD AASIM (Assistant Professor)
Supervision, Critical input, Study design, and final approval of manuscript
FAREEHA KHALID (Trainee Medical Officer)
Literature search

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