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Original Article

Comparison between Single Layer Interrupted and Double Layer Continuous Closure of Leg Wound after Great Saphenous Vein Harvest in Coronary Artery Bypass Grafting

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Keywords: *Coronary artery bypass surgery, Great saphenous vein, wound infection.*

Abstract:

Background: *Great saphenous vein is a popular conduit for coronary artery bypass graft. But the harvest site wound infection increases morbidity and prolong hospital stay. Closing techniques of saphenectony wound may contribute to early post operative outcome of the patient. The purpose of this study was to compare outcomes of the different closing techniques of saphenectomy wound.*

Methods: *This comparative cross-sectional study was carried out with 58 patients who underwent coronary artery bypass graft (CABG) and great saphenous vein was harvested as a conduit. Out of which 29 patients underwent single layer (Group-A) and rest 29 patients underwent double layer closure (Group-B) of saphenectony wound. Incidence of wound complications was compared between the two groups.*

Results: *On analysis of age, sex, weight, comorbidities and per operative variables, no significant differences were observed between two groups. There was significant statistical difference of mean ASEPSIS score (p=0.011) between the group A (4.17±5.9) and group B (9.55±9.44). Serous discharge was noted in 4 (13.8%) patients in group A and 10 (34.5%) patients in group B. Four (13.8%) patients had erythema in group A and 11 (37.9%) in group B. Four (13.8%) patients had purulent exudates in group A and 1 (3.4%) in group B. Three (10.7%) patients had edema in group A and 10 (34.5%) in group B. The differences of erythema and edema were statistically significant (p<0.05) between two groups. Almost three fourth (72.4%) of patients had satisfactory healing in group A and 12 (41.4%) in group B. No patient had severe wound infection.*

Conclusion: *Single layer interrupted closure had shown an overall improved wound outcome and less pain compared to double layer closing technique in terms of erythema, edema and satisfactory wound healing.*

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Introduction:

Coronary artery bypass graft (CABG) surgery is the gold standard for the treatment for coronary artery disease.[1-3] The long-term success of coronary artery bypass surgery depends on continued patency of the bypass conduits. The superior patency and long term results associated with the left internal thoracic artery (LITA) has stimulated the use of arterial grafts in order to overcome the limitations of saphenous vein grafts. Currently there is increasing use of bilateral internal thoracic arteries[4] and the radial artery (RA)[5] to achieve complete myocardial revascularization, although there are problems associated with the use of arterial conduits. The site from which they are removed may become ischemic and sternal complications may be more common when two internal thoracic arteries are

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used, particularly in co-morbid patients like diabetic patients.[6] The potential for graft spasm is another serious concern that occurs with radial grafts as well as other free arterial grafts.[7] Therefore, the great saphenous vein (GSV) remains an important conduit for patients undergoing bypass surgery.[8]

The selection of the graft conduit in CABG is influenced by various factors and is crucial for postoperative outcome, affecting survival, freedom from myocardial infarction, symptoms and re-interventions, and correlating with patient outcome. The first choice is that selection of a venous or an arterial conduit. In general, the main advantage of arterial grafts is their superior long-term patency compared with saphenous vein grafts (SVGs) and, accordingly, arterial grafts are more indicated in younger patients or in those who have a life expectancy of more than 10 years, which is beyond the benefit of SVGs.[9-11] On the other hand, the technique of arterial grafting is more challenging and time- consuming, and therefore venous grafting is preferred and venous graft is suitable for patients with a higher operative risk. Therefore, great saphenous vein remains the most frequently used conduit for coronary revascularization.

Great saphenous vein harvested from either the ankle (below-knee) or the thigh (above-knee), with the preference of below- knee approach since it is associated with lower wound infection rates as compared to the above-knee technique.[12] Saphenous vein harvesting technique is making a longitudinal incision along the length of the greater saphenous vein entering the fascial canal surrounding the vein. Following vein isolation from the surrounding tissues, ligation of side branches, as well as a transection of the vein for completion of the harvest is performed. The traditional open technique which is performed under direct visualization of the vein was found to preserve the endothelium of the vein quite well, but also came with the complications of leg pain i.e. wound healing, post-operative cellulitis, and increased length of hospital stay.[13] Wound infection is an important concern after saphenous vein harvest in CABG surgery and increases the hospital length of stay, hospital costs and reduces the quality of life.

There are two methods of saphenectomy wound closure: Single layer and double layer techniques. Conflicting results have been demonstrated in the literature with both these techniques. Traditionally, double-layer technique has been utilized in the approximation of saphenous vein harvest wound. The rationale behind this strategy is the elimination of dead space, which in turn, prevents hematoma formation and exudates.[14] On the contrary, opponents of double layered closure of saphenectomy wound highlighted substantial skin edge necrosis with resultant wound infection and favored single layered closure technique.[15] A study demonstrated that mean ASEPSIS wound infection score was reduced significantly from 9.467±5.32 in double-layer closure to 4.038±8.93 with single-layer closure after saphenous vein harvest.[16]

In a study, Tiryakiogluet al. reported that patients undergoing saphenous removal using standard procedures, it is sufficient to close the incision line using only skin sutures. They also observed that during the follow-up performed in-hospital and in the first week after discharge, infection, pain, edema and numbness were observed significantly less when the wound closure were made through incision line using only skin sutures.[17] In 2006, a randomized controlled trial by Stenviket al., investigated single-layer leg wound closure against double-layer closure and result shows a lower incidence of infection in the single-layer group, although this was not statistically significant.[18] The aim of the study was to compare the early outcome of the leg wound between two closing techniques after great saphenous vein harvesting in CABG.

Methods:

This comparative cross-sectional study was conducted in the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Dhaka during September 2019 to December 2021. Total 58 patients underwent CABG and great saphenous vein harvested as a conduit for CABG were enrolled in this study. Patients with lower limb varicosities, deep vein thrombosis, h/o previous surgery in leg (knee joint surgery, fracture fixation), re-do CABG, end stage renal disease, morbid obesity with body mass index >34 kg/m^2 were excluded from study.

Detailed history, clinical examination and relevant investigation reports of all patients recorded in the data collection sheet pre-operatively in addition to omission of aspirin and clopidogrel respectively 3 and 5 days before surgery. A median sternotomy was performed and at the same time great saphenous vein was harvested and prepared. GSV harvested from any one leg up to below knee joint. Beginning three cm above the ankle anterior to medial malleolus the skin was incised down to the level of the saphenous vein and the incision extended proximally. Proper hemostasis was secured. Tributaries ligated proximal and distal to the vein with 3/0 silk, use of diathermy avoided. Included patients were allocated in to two groups, out of which 29 patients underwent single layer (Group-A) and rest 29 patients underwent double layer closure (Group-B) of saphenectony wound.

Leg wound was closed before reversal of anticoagulation by protamine. Single- layer interrupted closure achieved by closing the skin along with subcutaneous fat layer by prolene (Polypropelene) 2/0 cutting body suture interruptedly and double-layer closure involved separate closing the subcutaneous fat layer continuously with 2-0 Vicryl (polygalactin) round body suture. Than subcuticular closure done by vicryl 3/0 (polygalactin) cutting body suture after achieving satisfactory haemostasis. All wounds were covered with a surgical dressing and the leg wrapped with an elastic crepe bandage for 48 hours. Postoperatively antimicrobial agents were administered according to hospital protocol for the first 72 hours. Wounds were checked & assessed after third, fifth, day of discharge. Wounds were assessed for inflammation, extent of edema, discharge, infection. Pain assessed by Numeric pain rating scale. A standardized semi-structured questionnaire was used for data collection. Statistical analysis was conducted using Statistical Package for Social Science (SPSS) version 26.0 for windows software.

Results:

Among study population, almost half (41.4%) of patients belonged to age 51-60 years in group-A and 10(34.5%) in group-B. The mean age was 52.14±9.35 years in group-A and 52.52±8.84 years in group-B. The mean weight was 60.55±6.54 kg in group-A and 61.45±6.39 kg in group-B. Majority (79.3%) of patients were male in group-A and 24(82.8%) in group-B. The differences of demographic characteristics were not statistically significant ($p>0.05$) between group-A and group-B. (Table I)

Per-operative variables shows that mean length of incision was 24.48±5.06 cm in group-A and 23.62±5.33 cm in group-B. Almost two third (65.5%) of patients had pedicled harvesting in group-A and 22(75.9%) in group-B. The differences of length of incision and types of harvesting were not statistically significant ($p>0.05$) between group-A and group-B. (Table II)

Table-I

Demographic characteristics of respondents (58)

Demographic characteristics	Group-A (n=29)		Group-B (n=29)		p value
	Number	%	Number	%	
Age in years					
<40	4	13.8	3	10.3	$^{b}0.686^{ns}$
41-50	9	31.0	11	37.9	$^{b}0.581^{ns}$
51-60	12	41.4	10	34.5	$^{b}0.588^{ns}$
>60	4	13.8	5	17.2	$^{b}0.716^{ns}$
Mean±SD	52.14±9.35		52.52±8.84		$^{a}0.565^{ns}$
Weight (kg)					
Mean±SD	60.55±6.54		61.45±6.39		$^{b}0.598^{ns}$
Gender					
Male	23	79.3	24	82.8	$^{b}0.737^{ns}$
Female	6	20.7	5	17.2	

$p<0.05$ significant; ns=not significant; [a]p value reached from Unpaired-t test
[b]p value reached from Chi-square test

Table-II

Distribution of cases according to per-operative variables (n=58)

Per-operative Variables	Group-A (n=29) f	%	Group-B (n=29) f	%	p value
Length of Incision (cm)					
Mean±SD	24.48±5.06		23.62±5.33		[a]0.531[ns]
Range(min-max)	15-30		15-30		
Types of Harvesting					
Pedicled	19 (65.5%)		22 (75.9%)		[b]0.386[ns]
Skeletonized	10 (34.5%)		7 (24.1%)		

ns=not significant; [a]p value reached from Unpaired-t test; [b]p value reached from Chi-square test

Table III shows the wound characteristics of study participants. It was observed that four (13.8%) patients had serous discharge in group-A and 10(34.5%) in group-B. Four (13.8%) patients had erythema in group-A and 11(37.9%) in group-B. One (3.8%) patient had purulent exudates in group-A and 4(13.8%) in group-B. One (3.8%) patient had separation of deep tissues in group-A and 2 (6.8%) in group-B. Three (10.7%) patients had edema in group-A and 10 (34.5%) in group-B. One (3.4%) patients had hospital stayed over 14 days in group-A and 5 (17.2%) in group-B. The differences of erythema and edema were statistically significant ($p<0.05$) between group-A and group-B.

Table IV shows the pain scores of study participants. It was observed that more than one third (37.9%) of patients had mild pain in group-A and 12 (41.4%) in group-B. The differences of pain score was statistically significant ($p<0.05$) between group-A and group- B.

Table V shows the distribution of the study population by category of infection. It was observed that almost three fourth (72.4%) of patients had satisfactory healing in group-A and 12 (41.4%) in group-B. Almost one fourth (24.1%) of patients had disturbance of healing infection in group-A and 12 (41.4%) in group-B. One (3.4%) patient had minor wound infection in group-A and 3(10.3%) in group-B. Two (6.9%) patients had moderate wound infection in group-B and not found in group-A. No patient had found severe wound infection between group-A and group-B. The differences of satisfactory healing infection was statistically significant ($p<0.05$) between group-A and group-B.

ASEPSIS score revealed the mean ASEPSIS score was 4.17±5.9 in group-A and 9.55±9.44 in group-B. The differences of ASEPSIS score was statistically significant ($p<0.05$) between group-A and group-B. (Table VI)

Table-III

Postoperative wound characteristics between groups (n=58)

Wound Characteristics	Group-A (n=29)	Group-B (n=29)	p value
Serous Discharge	4 (13.8%)	10 (34.5%)	0.065[ns]
Erythema	4 (13.8%)	11 (37.9%)	0.035[s]
Purulent Exudates	1 (3.4%)	4 (13.8%)	0.160[ns]
Separation of Deep Tissues	1 (3.4%)	2 (6.8%)	0.553[ns]
Edema	3 (10.7%)	10 (34.5%)	0.027[s]
Hospital stay over 14 days	1 (3.4%)	5 (17.2%)	0.084[ns]

s=significant; ns=not significant; p value reached from Chi-square test

Table-IV

Distribution of cases according to pain score (n=58)

Pain scores	Group-A(n=29)	Group-B(n=29)	p value
None	16 (55.2%)	8 (27.6%)	0.027[s]
Mild	11 (37.9%)	12 (41.4%)	
Moderate	2 (6.9%)	9 (31.0%)	
Severe	0 (0.0)	0 (0.0)	

s=significant; p value reached from Chi-square test

Table-V

Comparison of category of infection between groups (n=58)

Category of infection	Group-A(n=29)	Group-B(n=29)	p value
Satisfactory healing	21 (72.4%)	12 (41.4%)	0.017[s]
Disturbance of healing	7 (24.1%)	12 (41.4%)	0.161[ns]
Minor wound infection	1 (3.4%)	3 (10.3%)	0.300[ns]
Moderate wound infection	0 (0.0)	2 (6.9%)	0.150[ns]
Severe wound infection	0 (0.0)	0 (0.0)	-

s=significant; ns=not significant; p value reached from Chi-square test

Table-VI

Comparison of ASEPSIS score between groups (n=58)

ASEPSIS score	Group-A(n=29)	Group-B(n=29)	p value
Mean±SD	4.17±5.9	9.55±9.44	0.011[s]
Range(min-max)	0-21	0-32	

s=significant; p value reached from Unpaired-t test

Discussion:

This comparative cross sectional study was carried out with an aim to compare the early post-operative outcome between the groups having single layer interrupted and double layer continuous closure of leg wound after great saphenous vein harvest in coronary artery bypass grafting. In this present study it was observed that mean age was 52.14±9.35 years in group-A and 52.52±8.84 years in group-B. Siddiqi et al. and Perveen et al., observed similar age distribution.[16,19] On the other hand, Zafar et al., study observed that the mean age was 65.3±7.79 years in single layer and 68.3±9.95 years in double layer, which is higher with the present study.[20] The higher mean age obtained by the above author maybe due to geographical variations, racial, ethnic differences and genetic causes may have significant influence in their study subjects.

Present study shows that 79.3% and 82.8% of patients were male in group-A and in group-B respectively, which indicates coronary artery disease is more common in male subject. Male and female incidence was almost identical between single and group-B, no statistical significant ($p>0.05$) differences was observed between group-A and group-B. Similar observations regarding the male predominant in coronary artery disease were also observed other studies.[16,19,20]

Wound infection is an important concern after saphenous vein harvest in CABG and increases the hospital length of stay, hospital costs and reduces the quality of life. With the below-knee approach the incidence of wound infection is 11.0%. In this present study, the mean ASEPSIS score was 4.17±5.9 in group-A and 9.55±9.44 in group-B, statistically significant. A study Siddiqi

et al., demonstrated that mean ASEPSIS wound infection score was reduced from 9.467±5.32 in double-layer closure to 4.038±8.93 with single-layer closure after saphenous vein harvest.[16]

Regarding the wound characteristics in this present study it was observed that 13.8% patients had serous discharge in group-A and 34.5% in group-B. Four 13.8% patients had erythema in group-A and 37.9% in group-B. Three 10.7% patients had edema in group-A and 34.5% in group-B. One (3.8%) patient had purulent exudates in group-A and 4(13.8%) in group-B. One (3.8%) patient had separation of deep tissues in group-A and 2 (6.8%) in group-B. One 3.4% patients had hospital stayed over14 days in group-A and 17.2% in group-B. Erythema and edema were significantly ($p<0.05$) higher in group-B. However, Serous Discharge was higher in group-B but the difference was not statistically significant ($p>0.05$) between group-A and group-B group. Overall wound characteristics were more common in group-B.

Perveen et al.observed the wound infection by a scoring method ASEPSIS and found that the mean ASEPSIS wound infection scores were reduced from 5.68±1.30 in double layer closure to 3.10±1.02 with single layer closure after saphenous vein harvest ($p<0.05$).[19] Siddiqi et al.observed that almost a half of the patient in double layer group had serous discharge, inflammation, edema, whereas only one-fourth of the patients had these problems in single layer group. The investigators found 28.8% and 46.6% patients had serous discharge in single layer and double layer respectively. Edema was observed 23.07% in single layer and 46.6% in double layer, which support with the present study.[16]

Zafar et al., study showed there was a greater incidence of postoperative donor leg edema in the double layer closure group compared with patients who had their wounds closed in a single layer over a suction drain. In addition the authors obtained that, patients who had their wounds closed in a single layer over a drain had less postoperative edema in the donor leg compared with the conventional method of leg wound closure. This can be attributed to decreased dead space due to evacuation of the hematoma and minimal tissue handling when using the single-layer closure technique.[20] Their study showed the superiority of single-layer closure with a suction drain over the more traditional double layer approach in the promotion of leg wound healing, probably due to a combination of less tissue handling and decreased postoperative edema, which is consistent with the current study.

In this present study it was observed that 55.2% and 27.6% patients had no pain in group-A and group-B respectively. Mild pain was found 37.9% in group-A and 41.4% in group-B. Moderate pain was observed 6.9% in group-A and 31.0% in group-B. No pain was significantly higher group-A and moderate pain was significantly more common in group-B. Perveen et al. observed on the 5 postoperative day the mean pain score was 3.10±1.02 in single layer and 5.68±1.30 in double layer group, which showed significantly higher common in double layer.[19] Siddiqi et al.[16] study found that more than half of the patient had pain-free in single layer group whereas only one-fourth of the patients were pain-free in double layer group which is statistically significant. Mild pain observed by the authors 38.46%in single-layer and 40.0%in double layer, which is closely resembled with the present study.

Surgical site infection is an acute wound infection developed at the surgical site within 30 days following surgery. The definition of infection which is used worldwide and is adopted by the Centers for Disease Control. About the category of infection in this current study it was observed that 72.4% of patients had satisfactory healing infection in group-A and 41.4% in group-B, which was significantly higher group-A. Nearly one fourth (24.1%) of patients had disturbance of healing infection in group-A and 41.4% in group-B. One (3.4%) patient had minor wound infection in group-A and10.3% in group-B. Two 6.9% patients had moderate wound infection in group-B and not found in group-A. No patient had found severe wound infection between single and group- B, which were lesser in group-A but the differences was not statistically significant between group-A and group-B.

Siddiqi et al.[16] study categorized wound healing disturbances as satisfactory healing, disturbance of healing, minor wound infection, moderate wound infection and severe wound infection according to wound scale and found 82.69% of

patients had satisfactory healing in single layer and 53.33% in double layer. 17.31% of patients had disturbance of healing in single layer and 33.33% in double layer. Minor and moderate wound infection was not found in single layer and 6.66% in double layer, which is closely resembled with the present study. Zafar et al. concluded that single layer closure was superior to the double layer method of closure, as it showed overall improvement in wound outcomes and less pain.[20] So, single layer interrupted closing technique may be implemented rather than conventional double layer closing technique for achieving early wound healing and better post operative outcome.

Conclusion:

Present study concluded that superiority of the single layer interrupted closing techniques in terms of erythema, edema, better wound healing that would be helpful for further management of the patient undergoing CABG. So it is recommended that single layer interrupted closing technique should be used in leg wound after great saphenous vein harvesting in coronary artery bypass grafting.

Conflict of Interest - None.

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