Comparison of the Quality of Life after Skeletonized versus Pedicled Grafts in Coronary Artery Bypass Graft Surgery

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Abstract

It remains a controversial issue whether internal thoracic artery (ITA) should be dissected in skeletonized or pedicled manner during coronary artery bypass graft (CABG) surgery. The main objective of this cohort study was to compare skeletonized versus pedicled grafts on the basis of patients' perceptions of their physical and mental well-being. Isolated nonemergent CABG patients were divided into two groups according to the type of graft used; skeletonized or pedicled. The quality of life (QOL) was measured preoperatively, 6 months postoperatively, and 12 months postoperatively for each patient using the 36-Item Short Form Health Survey tool. The main outcome variables were physical component summary (PCS) score and mental component summary (MCS) score. A total of 140 patients were included in the study with 70 patients in each group. The PCS (p -value = 0.235) and MCS (p -value = 0.239) scores of patients were similar in both the groups before CABG. The PCS and MCS scores were significantly (p -values < 0.0001) improved after CABG at 6 months in both the groups. However, the PCS and MCS scores in the skeletonized group were significantly higher (p -values < 0.0001) than the scores in the pedicled group at 6 and 12 months post-CABG. Both the harvesting techniques improve QOL significantly after CABG. However, skeletonization results in significantly better PCS and MCS scores compared with pedicled harvesting technique.

Keywords

- ▶ quality of life
- ▶ pedicled
- ▶ skeletonized
- ▶ grafts
- ▶ internal thoracic artery

The primary goal of coronary artery bypass graft (CABG) surgery is to increase the patient's survival and quality of life (QOL).¹ Patients with coronary artery disease experience wide array of problems that include impaired physical, social, and mental functioning.² The majority of the patients experience improved QOL after CABG making it the most effective treatment.³ However, there is a considerable debate that whether internal thoracic artery (ITA) should be dissected in skeletonized or pedicled fashion during CABG.

Most of the studies that have been done to compare skeletonized versus pedicled ITA have focused on blood flow,⁴ incidence of sternal complications,⁵ chest wall dysesthesia,⁶ number of distal anastomosis, and graft length.⁷ Very few studies have evaluated and compared QOL after using skeletonized and pedicled ITA. We believe QOL is a vital factor when assessing outcomes after surgical interventions so it should govern clinical decision-making.

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The main aim of this study was to compare skeletonized versus pedicled grafts on the basis of patient perceptions of their physical and mental well-being.

Materials and Methods

This retrospective cohort study was conducted during the time period from January 2011 to February 2013 after approval from the Institutional Review Board of Dow University of Health Sciences. In this time frame, out of the 191 patients who had undergone CABG, 153 underwent primary nonemergent CABG. Patients with comorbidities such as stroke, subclavian artery stenosis, chronic obstructive pulmonary disease, and renal failure were excluded from the study. Similarly, patients with a history of myocardial infarction or congenital anomaly were also excluded. Only 153 patients who had undergone primary nonemergent CABG were included in our study population.

The patients were divided into two groups according to the type of graft used; skeletonized or pedicled. The QOL was measured preoperatively, 6 months postoperatively, and 12 months postoperatively for each patient using the 36-Item Short Form Health Survey (SF-36) tool. The SF-36 uses eight dimensions of health which are grouped to form two major subheadings, namely, physical component summary (PCS) and mental component summary (MCS). The reliability for PCS and MCS scores has been reported to be greater than 0.90.⁸ Norm-based scoring (transformed to mean = 50 ± 10) was used in which higher score indicates better health.

Out of the 153 patients, 6 (3 from each group) were lost for follow-up and 5 (3 from the pedicled group and 2 from skeletonized group) died within the 12 months of their surgery. We had to exclude these patients due to their missing data. We were left with 142 patients out of whom 72 had been operated through pedicled grafts. Two of these patients chosen randomly were excluded to have an equal number of patients in both the groups. No imputation models were used and only subjects with complete data were included. All the patients gave written consent to take part in our study.

In all of the surgeries after performing median sternotomy and thymic remnant removal, the ITA retractor was applied and the pleura was opened. In skeletonized ITA, the dissection was done from upwards with the help of fine tip scissors, ring tip fine forceps, and unipolar electrocautery at low levels. In the pedicled ITA, the dissection was done from down upwards along with the satellite veins and muscle with the help of fine tip curved forceps and unipolar Bovie electrocautery. The ITA was sprayed with papaverine in both skeletonized and pedicled techniques. Narcotics were not given to any of the patients from either group upon discharge or follow-up. All the surgeries were performed by two surgeons with equal skill set and caliber using on-pump technique. The choice to skeletonize or not was decided among the surgeons at the hospital. The patients were blinded to the fact that whether their ITA graft was skeletonized or not.

Data are presented as the mean and standard deviation for continuous variables and frequency with percentages for categorical variables. The scores of QOL were checked for normality using Kolmogorov-Smirnov test. Based on normality of the scores, parametric and nonparametric tests were applied for the comparison of observations. To check for significant difference in scores between skeletonized and pedicled group, independent samples *t*-test (as parametric test) and Mann-Whitney test (as nonparametric test) were applied. To check for changes in QOL preoperatively and postoperatively (after 6 and 12 months), repeated measures analysis of variance was used. A *p* value less than 0.05 was considered as significant.

Results

A total of 140 patients were included in the study with 70 patients in each group. Overall, 62 (44.3%) patients were older than 70 years of age while most of the study population was male (65.7%). The frequency of hypertension and diabetes was 79.2 and 40.7%, respectively. Total 64 patients (45.7%) were current smokers. The distribution of these demographic characteristics was not significantly different in skeletonized and pedicled grafted patients (► **Table 1**).

Table 1 Demographic characteristics of skeletonized and pedicled grafted patients

		Skeletonized	Pedicled	<i>p</i> -Value
Age	>70 years	32 (51.6%)	30 (48.4%)	0.73
	70 or less	38 (48.7%)	40 (51.3%)	
Gender	Female	23 (47.9%)	25 (52.1%)	0.72
	Male	47 (51.1%)	45 (48.9%)	
Hypertension	Yes	55 (49.5%)	56 (50.5%)	0.83
	No	15 (51.7%)	14 (48.3%)	
Diabetes	Yes	30 (52.6%)	27 (47.4%)	0.61
	No	40 (48.2%)	43 (51.8%)	
Smoker	Yes	35 (54.7%)	29 (45.3%)	0.31
	No	35 (46.1%)	41 (53.9%)	
Body surface area (m ²)		1.72 ± 0.03	1.74 ± 0.02	0.04

Bilateral ITAs in skeletonized and pedicled group were received by eight (11.4%) and six (8.6%) patients, respectively. In the skeletonized group, 61 (87.1%) patients had total arterial vascularization while 56 (80%) patients in the pedicled group had total arterial vascularization. The mean length of the graft and number of anastomosis in patients with skeletonized ITA were 16.8 ± 0.7 and 4.2 ± 0.6 cm, respectively. Similarly, in the pedicled group the mean length of the graft and number of anastomosis were 13.8 ± 0.9 and 3.9 ± 0.74 cm, respectively.

The PCS (p -value = 0.235) and MCS (p -value = 0.239) scores of patients were similar in both the groups before CABG (►Fig. 1). However, the PCS and MCS scores in the skeletonized group were significantly higher (p -values < 0.0001) than the pedicled group 6 months postoperatively (►Fig. 2). Moreover, the PCS and MCS scores remained significantly (p -values < 0.0001) higher in the skeletonized group compared with the pedicled group even 12 months after the surgery (►Fig. 3).

►Table 2 describes the changes in PCS scores of both the groups which were observed before CABG and 6 and 12 months post-CABG. Similarly, ►Table 3 describes the changes in MCS scores of both the groups which were observed before CABG and 6 and 12 months post-CABG. The PCS and MCS scores were significantly (p -values < 0.0001) improved after CABG at 6 months in both the groups. However, on comparing the scores at 6 and 12 months post-CABG, no statistical difference was found in both the groups. Four patients from the pedicled group had developed sternal dehiscence within the first 6 months compared with zero from the skeletonized group (p -value = 0.042).

Moreover, none of the patients from either group suffered postoperative stroke or myocardial infarction.

Discussion

As the most studied topic in books of surgical interventions, CABG is associated with a very low mortality rate making it an effective treatment for severe angina.⁹ Conventionally, the ITA for CABG is harvested in pedicled fashion. However, the skeletonized ITA is now becoming increasingly popular among cardiac surgeons. Our literature review suggests that this is the first study to use post-CABG QOL as a factor in comparing skeletonized and pedicled forms of ITA grafting for CABG. We found that skeletonized ITA significantly increases the QOL as compared with the pedicled ITA at 6 and 12 months post-CABG.

QOL is a vital outcome after CABG, and for many patients, maintaining QOL is of equal significance to increasing life expectancy.^{10,11} Our study assessed the QOL in terms of both mental and physical well-being of patients. A previous study conducted by Boodhwani et al has demonstrated that skeletonization of ITA results in significant reduction in postoperative pain and incidence of major sensory deficits and total area of dysesthesia.¹² Moreover, the same study also showed that skeletonization technique increases the sternal perfusion, which may reduce the incidence of deep sternal wound infections.¹² In short, it has been shown previously that skeletonization technique for ITA reduces morbidity following CABG. Our results strengthen this notion and further adds that skeletonization of ITA improves QOL significantly in terms of mental and physical

Fig. 1 Preoperative physical and mental component summary scores in skeletonized and pedicled grafted patients.

Fig. 2 Physical and mental component summary scores in skeletonized and pedicled grafted patients 6 months postcoronary bypass graft surgery.

well-being of patients, both at 6 and 12 months postoperatively by possibly reducing the postoperative pain and occurrence of sternal complications.

Our study also found that QOL remains same at 6 and 12 months post-CABG regardless of the type of harvesting

technique used. This holds true for both physical and mental component scores of patients. This signifies that major improvement in QOL occurs during the first 6 months after the surgery with no significant improvement during the next 6 months. Although previous literature tells us that CABG

Fig. 3 Physical and mental component summary scores in skeletonized and pedicled grafted patients 12 months postcoronary artery bypass graft surgery.

Table 2 Quality of life: changes in physical component summary score

	Preoperative	Postoperative (after 6 mo)	Postoperative (after 12 mo)	p-Value
Skeletonized	32.1 ± 1.9	47.4 ± 3.2	47.8 ± 3.3	<0.0001
Pedicled	32.3 ± 1.7	42 ± 3.4	42.2 ± 3.6	<0.0001

Table 3 Quality of life: changes in mental component summary score

	Preoperative	Postoperative (after 6 mo)	Postoperative (after 12 mo)	p-Value
Skeletonized	43.3 ± 2.1	48.2 ± 3.0	48.4 ± 3.6	<0.0001
Pedicled	43.1 ± 2.5	46.3 ± 2.9	46.6 ± 3.0	<0.0001

results in significant improvement in QOL³ and psychosocial status of majority of patients,¹³ there is also evidence that suggests some patients experience continuous or worsening depression after CABG.¹⁴ Previous literature also tells us that sexual problems still remain markedly common 2 years following CABG.³ Therefore, more long-term prospective studies should be conducted to see if the type of harvesting technique has any influence on the incidence of sexual problems after CABG.

We believe this study will help to grow awareness that evaluation of medical interventions should include QOL as one of the most important outcomes. Our study included preoperative QOL data for both the groups which we believe was essential for the validation and reliability of our results. Moreover, the patients' general characteristics such as age, gender, hypertension, diabetes, and smoking status were also insignificant between the skeletonized and the pedicled group allowing for fair comparison. A relatively good follow-up rate with no imputation methods used and QOL measured at 6 and 12 months post-CABG also greatly help to validate our conclusions. However, our study has some limitations. First, as this was not a prospectively randomized study, there might have been some selection bias. Second, the study was based on a relatively small number of patients admitted to a particular hospital in the city. Third, although our study has given some intriguing findings that were statistically significant, it is difficult to tell whether these differences will be clinically significant. Finally, there might have been some confounding variables such as mood disorders and sexual activity to name a few that might have affected the analysis. Nevertheless, we recommend that long-term studies involving larger sample sizes should be conducted to fully study the effects of type of harvesting technique on QOL of the patients.

Conclusion

In summary, this study proves that both pedicled and skeletonized ITA result in significant improvement in the QOL post-CABG. However, skeletonization technique results in

greater improvement in the QOL of the patients as compared with the conventional pedicled technique.

Conflict of Interest
None.

Acknowledgments
None.

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