

# Comparative Study of Pedicled versus Skeletonized Left Internal Mammary Artery Graft in Coronary Artery Bypass Graft Surgery

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## Abstract

**Introduction:** Coronary artery disease (CAD) has emerged as a major health burden. There is a sharp increase in CAD incidence in the developing countries such as India. CAD has got multifactorial etiology. Coronary artery bypass graft (CABG) surgery is the important surgical procedure done in the history of CAD. CABG has prolonged the patients' lifetime. Arterial revascularization provided long-term good results in CABG.

**Aim:** This study is done to compare the clinical outcome of pedicled left internal mammary artery (LIMA) versus skeletonized LIMA.

**Materials and Methods:** A total of 40 patients of CABG from our institution from the year January 2014 to January 2015 who had undergone LIMA to left anterior descending artery or proximal obtuse marginal branch were followed up to know about the post-operative distal flow and sternal wound healing.

**Results:** In both pedicled and skeletonized LIMA groups, the distal flow of blood is adequate. Better sternal wound healing is found in skeletonized LIMA group.

**Conclusion:** This study had proved that both pedicled and skeletonized LIMA graft in CABG has equal distal flow and better sternal wound healing in skeletonized LIMA group make this a choice in patients with increased chance of sternal wound infections.

**Key words:** Coronary artery bypass graft surgery, Coronary artery disease, Left internal mammary artery, Pedicled left internal mammary artery, Skeletonized left internal mammary artery, Sternal wound infections

## INTRODUCTION

Coronary artery disease (CAD) has emerged as a major health burden. There is a sharp increase in CAD incidence in the developing countries such as India. CAD has got multifactorial etiology. Coronary artery bypass graft (CABG) surgery is the important surgical procedure done in the history of CAD. CABG has prolonged the patients'

lifetime. Arterial revascularization provided long-term good results in CABG.

The internal thoracic artery (ITA) is the gold-standard conduit for coronary artery bypass surgery.<sup>1,2</sup> Until, recently, it was used almost exclusively as a pedicle, with construction of 1 distal anastomosis. Skeletonization of the ITA has recently been advocated to increase the number of arterial anastomoses and decrease the occurrence of sternal wound infections.<sup>3,4</sup> When skeletonized, the vessel loses its "milieu," which raises the question of whether this technique sacrifices the superior longevity of the conduit. The current status of research on the effects of skeletonization<sup>5,6</sup> (depriving the ITA of vasa vasorum, innervation, and lymphatic and venous drainage, together with creating an imbalance between vasoconstricting and

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vasodilating substances) appears to support the superiority of the pedicled graft.

Long-term patency studies of the skeletonized ITA, with meticulous follow-up and confirmation by angiography, are not currently available.<sup>7-10</sup> Theoretically, skeletonization of the ITA might adversely affect its long-term resistance to atherosclerosis. More data are needed before this technique can be universally recommended. If the skeletonized ITA has decreased long-term patency, bypass surgery may be at a disadvantage when compared with the new generation of drug-eluting stents.<sup>11,12</sup>

### Aim

This study is done to compare the clinical outcome of pedicled left internal mammary artery (LIMA) versus skeletonized LIMA.

## MATERIALS AND METHODS

This study was conducted in the Department of Cardiothoracic Surgery (CTS) at Government Rajaji Hospital. Case selection for LIMA harvesting whether pedicled or skeletonized includes patients admitted in our CTS Department. LIMA harvesting was done by the same group of surgeons in our unit. Under general anesthesia after starting central venous and arterial line, with chest elevated, strict midline sternotomy or mild left sternotomy done. Thymus gland dissected or separated, and in some cases, it was excised.

Using LIMA retractor left sternum elevated, surgeon sits in a chair to harvest the LIMA. The table is adjusted in such a way that surgeon's eye looks at the bottom of the left sternum. This position does not hinder other operating surgeon taking the vein grafts in legs.

Initially, it took 45-60 min to harvest LIMA. However, later on, the time taken was reduced to 20-30 min.

After identifying the proximal, middle, and distal portions of the LIMA, dissection is started at distal portion after making an incision 5 mm medial to the medial mammary vein for harvesting pedicled LIMA. LIMA Harvesting done by blunt and sharp dissection with diathermy at 10 desiccate mode. Pedicled LIMA graft includes fascia, muscles, mammary vein, and internal mammary artery. After dissecting the entire course of LIMA, heparin injected intravenously at a dose of 2 mg/kg body weight. After injection of heparin, LIMA is divided with proximal extent up to the first costal cartilage, still proximally up to the subclavian artery, distally up to the division of LIMA into superior epigastric artery, and musculophrenic artery up to the

level of xiphisternal junction. LIMA branches are clipped flush with LIMA.

For skeletonized LIMA harvesting, we made an incision just adjacent to the LIMA, and parietal pleura is separated. By viewing the underside of the LIMA alone, by holding the parietal pleura firmly, we can harvest the skeletonized LIMA without looking the mammary vein during the dissection.

The skeletonized LIMA harvested by blunt and sharp diathermy burst at 10 desiccate mode. We adopted this method of harvesting LIMA in all total 40 cases of our study. LIMA is kept in papaverine-soaked gauze until left anterior descending artery (LAD) is made ready for anastomosis.

## RESULTS

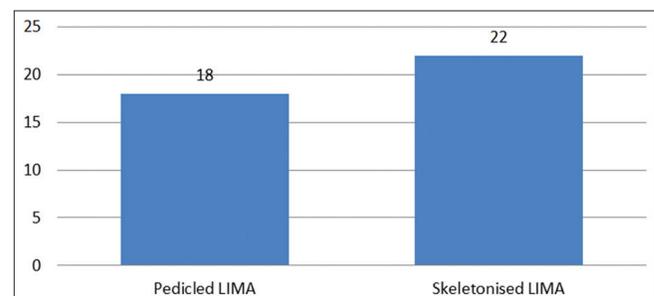
Pedicled LIMA harvested in 18 cases and skeletonized LIMA harvested in 22 cases in our study of 40 patients and divided into 2 groups and followed up (Figure 1).

In our study group, male patients contribute the majority of cases around 82% with female patients 18%. Skeletonized LIMA harvested in 58% of male patients and pedicled LIMA harvested in 42% of male patients in our study group. Skeletonized LIMA harvested in 43% of female patients and pedicled LIMA harvested in 57% of female patients in our study (Table 1).

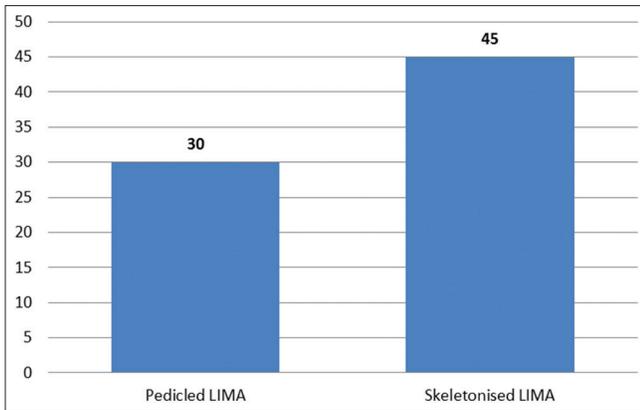
Majority of patients about 18 patients in our study belong to age group 61-65 years. 40-45 years age contribute only 2 cases (Table 2).

Initially, it took 45-60 min to harvest LIMA. However, later on, the time taken was reduced to 20-30 min. Average time for harvesting pedicled LIMA is 30 min and skeletonized LIMA is 45 min (Figure 2).

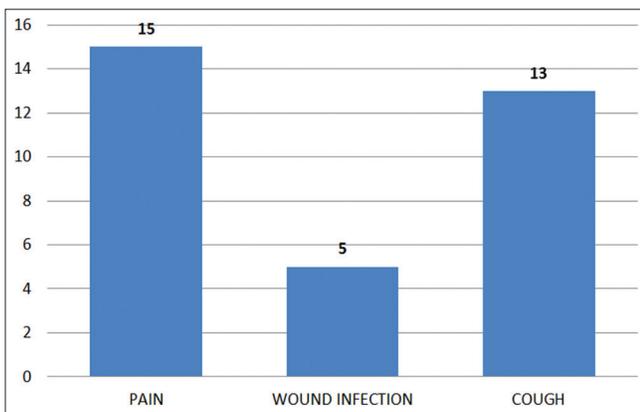
In the pedicled LIMA group, 15 patients had pain over the surgical site, and 5 patients have sternal wound infection (Figure 3).



**Figure 1: Pedicled versus skeletonized left internal mammary artery - number of cases**



**Figure 2: Average operating time for harvesting left internal mammary artery**



**Figure 3: Post-operative complications - pedicled left internal mammary artery**

**Table 1: Gender distribution**

| Gender | Pedicled LIMA | Skeletonized LIMA |
|--------|---------------|-------------------|
| Male   | 14            | 19                |
| Female | 4             | 3                 |

LIMA: Left internal mammary artery

**Table 2: Age distribution**

| Age group (years) | Number of patients (%) |
|-------------------|------------------------|
| 40-45             | 2 (5)                  |
| 46-55             | 8 (20)                 |
| 55-60             | 12 (30)                |
| 61-65             | 18 (45)                |

In the skeletonized LIMA group, 6 patients had pain over the surgical site, and only 1 patient has sternal wound infection (Figure 4).

**DISCUSSION**

CABG had become the most common surgery done in cardiothoracic departments all over the country.<sup>3</sup> The

ITA is the gold-standard conduit for coronary artery bypass surgery.<sup>1,2</sup> We have taken 50 cases for our study initially, out of which 10 cases showed poor flow of LIMA intraoperatively so excluded from the study. Rest of 40 cases taken for the study. Pedicled LIMA harvested in 18 cases and skeletonized LIMA harvested in 22 cases in our study of 40 patients and divided into 2 groups and followed up. Male patients contribute majority of cases around 82% with female patients 18% in our study group.<sup>6</sup> In our study group, skeletonized LIMA harvested in 58% of male patients, and pedicled LIMA harvested in 42% of male patients, and skeletonized LIMA harvested in 57% of female patients, and pedicled LIMA harvested in 43% of female patients, in our study. Majority of patients about 18 patients in our study belong to age group of 61-65 years. 40-45 years age contribute only 2 cases. Initially, it took 45-60 min to harvest LIMA. However, later on, the time taken was reduced to 20-30 min. Average time for harvesting pedicled LIMA is 30 min and skeletonized LIMA is 45 min.<sup>10</sup>

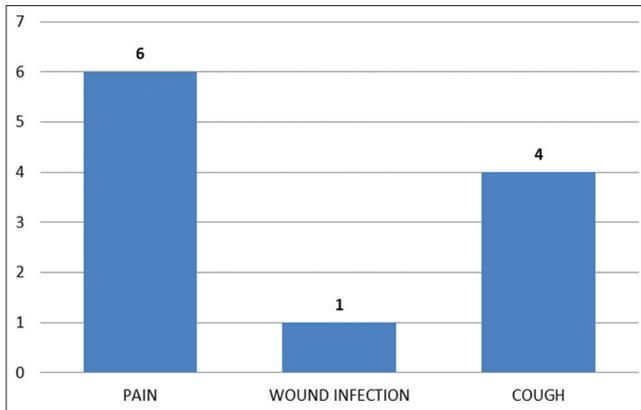
In the pedicled LIMA group, 15 patients had pain over the surgical site, and 5 patients have sternal wound infection.

In the skeletonized LIMA group, 6 patients had pain over the surgical site, and only 1 patient has sternal wound infection.

Among the study group, 3 female patients and all of them are diabetic. One patient had LIMA to LAD and right internal mammary artery to ramus anastomosis done and discharged without any complications. All patients were subjected to echo evaluation periodically in the post-operative period for ejection fraction and motion wall abnormality of the left ventricle. Further follow-up echo done 3 months after discharge. Out of 40 patients, 6 had sternal wound infection (5 in the pedicled group and one in the skeletonized group), which were managed conservatively after pus culture and sensitivity and daily dressing and appropriate antibiotics given.<sup>13-15</sup>

**CONCLUSION**

This study had proved that both pedicled and skeletonized LIMA graft in CABG has equal distal flow and better sternal wound healing in skeletonized LIMA group make this a choice in patients with increased chance of sternal wound infections. Even though skeletonized LIMA harvesting took more time than the pedicled LIMA harvesting, it has the advantage of less sternal wound complications post-operatively. Further analysis needed by doing check angiogram post-operatively to find out the adequacy of flow in these grafts. Long-term comparative studies are



**Figure 4: Post-operative complications - skeletonized left internal mammary artery**

needed, with complete or near-complete angiographic and freedom from, reintervention data. Until prospective, randomized studies of pedicled versus skeletonized ITA grafts are conducted, with follow-up periods of 15-20 years, we cannot conclude that skeletonization does not adversely affect patency.

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