SHORT COMMUNICATION

Radial artery harvesting with skin bridge technique among patients undergoing coronary artery bypass grafting: An approach for developing countries

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Abstract

The risk of wound dehiscence and sternal infections remains high after coronary artery bypass grafting, especially in patients with diabetes. Radial artery is a potential alternative which has shown good post-operative outcomes with least complications. Open and endoscopic techniques for harvesting have been used till now. We propose an interrupted or bridging technique, for harvesting the radial artery. This report describes 25 patients undergoing CABG, using radial artery graft, harvested via skin bridge technique, at South City Hospital, Karachi. It has a better cosmetic outcome, reduced postoperative pain, shortened hospital stay and increased level of satisfaction. The interrupted technique offers less invasive cost-effective approach compared to open and endoscopic techniques for radial artery harvesting.

Keywords: Coronary artery bypass grafting, Radial artery harvesting, Arterial revascularisation.

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Introduction

Coronary artery disease (CAD) is on the rise worldwide. Specifically in South Asia, the prevalence is significantly high and is particularly increasing in the younger population (below the age of 40 years)—5% to 10% versus approximately 1% to 2% in the remaining world.[1,2] Total arterial revascularisation is used in the management of complex CAD, both in the young and old population. The use of bilateral inferior mesenteric artery (IMA) can lead to increased risk of wound dehiscence and deep sternal infections in regions such as Pakistan, due to high prevalence of uncontrolled diabetes, obesity, immunocompromised state, and chronic obstructive pulmonary diseases. This makes radial artery graft a better alternative.[3] Radial artery graft can lead to better survival rates and surgical outcomes and reduced risk of post-surgical complications.[4,5] Two approaches have been used for radial artery harvesting: an open technique, which involves a straight full length forearm incision along the route of the radial artery, and the endoscopic technique which involves a single 3cm-long incision over the radial artery pulsations near the radial styloid and insertion of an endoscope through the incision. Open technique has decreased the risk of haematoma formation, whereas the endoscopic technique leads to smaller incision with better cosmetic outcome and less complications.[6-8]

However, the endoscopic technique is not an attainable option in South Asia due to high costs, since most of the population in South Asia belongs to a lower- or middle-income background. Therefore, there is a need for an approach which is less invasive, has a better cosmetic outcome and is cost-effective. This study aims to describe a modified technique for radial artery harvesting used in our hospital, which meets these requirements and will be a suitable option for lower- and middle- income countries like Pakistan.

Methodology

A prospective study was conducted at the South City Hospital, Karachi, from January 1, 2021, to September 30, 2021. A total of 25 patients, 10 females and 15 males were enrolled who fulfilled the study's inclusion criteria, as age less than 60 years, requiring CABG using radial artery as one of the grafts.

Patients above the age of 60, or undergoing redo CABG, those having non-dominant arm affected by trauma that would make radial artery a poor choice for graft, or patients with chronic kidney disease (CKD) were excluded.

Informed consent was obtained from each patient prior to enrolment in the study. Every patient was briefed about the purpose of the study, potential risks and benefits and the voluntary nature of participation.

Sample size was not calculated as no similar studies have been conducted in our population. The sampling technique used was non-probability purposive sampling

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from the patients presenting to the Cardiac Surgery Department of South City Hospital.

Surgical Technique: Allen's test[9] was performed in all patients preoperatively to ensure that adequate collateral circulation is maintained by both the ulnar and the radial arteries. Only the patients with a sufficient established palmar collateral circulation were eligible for radial artery harvest, and the non-dominant hand was chosen for the purpose.

The interrupted technique was employed for radial artery harvesting instead of open technique. Initially, the patient's arm was abducted to 90 degrees on an arm board and the wrist was hyperextended. Following draping, two incisions were made on the forearm. The distal incision was made starting from the wrist crease, extending 5cm to 6cm proximally. The proximal incision was made starting just below the antecubital crease, extending 5cm to 6cm distally. The skin , about 7cm to 8cm, between the two incisions was spared as a bridge (Figure 1)

After incising the skin, subcutaneous tissue and the fascia, the radial artery was isolated, and its branches identified. A sterile laryngoscope with light source was used as retractor to lift the middle un-incised portion of the forearm skin. The radial artery under the un-incised (Skin Bridge) portion of the forearm was identified and dissected. With the help of LigaSure™ with a 5mm width and 23cm length (Maryland Jaw Open Sealer/Divider) (Figure 1), the side branches of the radial artery were separated. The thin diameter and the long length of the device enabled the harvesting of the radial artery under the skin, with proper access without the need to fully incise the forearm skin.

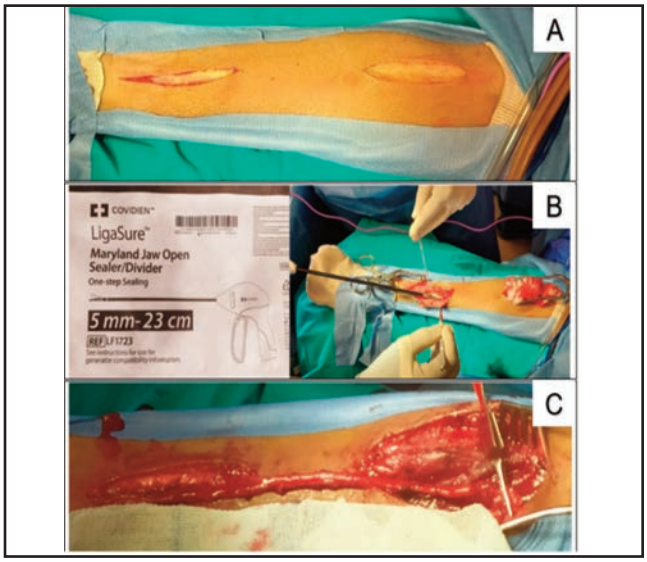

Figure-1: A) Two incisions, each 2 to 3 inches long are made, bridging the middle 3 to 4 inches of the skin. This technique is termed as the interrupted or bridging technique. B) LigatureTM Maryland Jaw Open Sealer/Divide with a 5 mm width and 23 cm length used to separate the side branches of the radial artery. C) Radial artery harvesting.

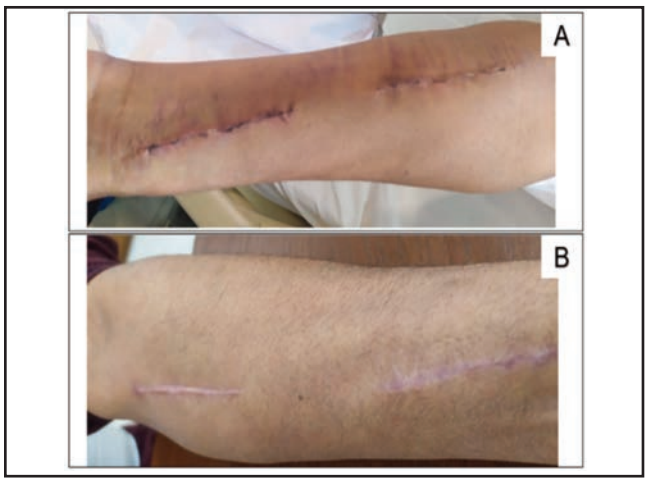

Figure-2: Patient's follow-up; A) A patient followed up at 1-week interval. The surgical site is healing well. B) Patient followed up at 6-month interval. The wound site has completely healed.

The proximal end of the radial artery was partly divided to check for the retrograde flow and if satisfactory, was ligated and divided first, and then the distal end was ligated and separated (Figure 1). Once completely divided, the radial artery was gently removed and placed in heparinised Verapamil and Glyceryl Trinitrate solution (VG Solution). After securing haemostasis, the subcutaneous fascia and the skin was closed without drainage and pressure dressing was applied.

Results

The study included 25 patients (15 males and 10 females) None of the patients developed a haematoma or infection at the harvesting site. All 25 patients reported better cosmetic outcome due to a smaller incision, quicker healing, less scarring and absence of haematoma formation.

Healing initiated within one week in 24(96%) patients whereas in all 25(100%) patients complete scar healing and full recovery of hand use was achieved in six months (Figure 2). Satisfaction on scar healing was expressed by 23(92%) patients whereas 2(8%) patients expressed less satisfaction.

Discussion

Literature shows that using radial artery graft can lead to better graft patency rate and keeps the patients free from subsequent major adverse cardiac events for longer periods. The sparing of one internal mammary artery leads to lower risk of postoperative sternal infections, and, therefore, contributes to shorter hospital stays, reduced hospital costs, and decreased need of a subsequent

surgical procedure.[10-12]

Two approaches have been used for harvesting radial artery—open and endoscopic harvesting—and both show suitable outcomes. Studies have shown that the endoscopic radial artery harvesting technique was linked to shorter hospital stay, shorter time spent on harvesting the graft, good short-term outcomes at the wound site, and comparable costs associated with the management.(6, 13-15) The conventional open harvesting technique was first introduced by Reyes et al, which involved making a straight full length forearm incision along the route of the radial artery in the lateral third of the arm. The artery is dissected from its pulsations near the wrist, between the radial styloid and flexor carpi radialis muscle tendon till its origin from the brachial artery, near the palpable biceps tendon. This technique enables the surgeon to monitor haemostasis in the arm and, therefore, avoid haematoma formation, leading to fewer chances of compartment syndrome post-operatively. However, this method may lead to mild numbness in the first and the second digits for a brief period.[6,10,13] Another technique suggested by Connolly et al utilises an endoscope for harvesting the radial artery. A single, 3cm-long incision is made over the radial artery pulsations near the radial styloid and an endoscope is inserted through the incision. Using ultra-retractor and endo-scissors, assisted with video, the radial artery is harvested. The study also showed that the endoscopic approach led to better satisfaction among patients due to a smaller incision and increased readiness among patients pre-operatively to allow for radial artery grafting, if needed.[16]

Since the open technique is invasive and the endoscopic technique is expensive, we have introduced a new technique called interrupted/bridging technique for radial artery harvesting. This technique involves the use of two incisions, while sparing the middle portion of the forearm. Better cosmetic outcome, reduced pain, and reduced time to heal postoperatively was noticed among the patients. These factors contributed to higher rates of satisfaction among patients postoperatively. Therefore, it is believed that the new technique will be most suitable in developing countries like Pakistan.

This technique had favourable outcomes and can be adopted by developing countries as a potential method to harvest the radial artery for coronary artery bypass grafting. One additional benefit is the reduced time taken to close the incisions on the forearm. However, this technique depends on the skill and expertise of the surgeon.

Bridging technique has been used for harvesting the saphenous vein, with the use of smaller and multiple incisions. A study noted that post-operative pain was significantly reduced in patients who were operated with a bridging technique. These patients had reduced cases of haematoma formation, better cosmetic outcome, and better satisfaction levels. This eventually reduces the need of prolonged post-operative care or a subsequent procedure.[17,18] However, the use of bridging technique for radial artery harvesting was not noted in literature. We used the interrupted/bridging technique for radial artery harvesting and achieved better outcomes.

Limitations: This study is a single centre study with a small sample. Therefore, this study is not a true representation of the population. There is a scarcity of studies that explore the pre-operative factors and postoperative outcomes of CABG using the radial artery. The strategy mentioned in our study can be employed in a large-scale multicentre study to better analyse the outcomes of this technique. Our study can form the foundation of similar studies in future. As the sample size was not calculated, it could influence the power of the study.

Conclusion

The bridging technique was conducted successfully at our hospital. It resulted in better outcomes in terms of cosmetic effect, time required for wound healing, and patient satisfaction level. We believe that this technique can be adopted by developing countries since it is less invasive than the open technique and is less expensive than endoscopic technique.

Ethical Considerations: The approval for the study was obtained from the Ethics Review Committee at the South City Hospital. Anonymity and confidentiality of all patients was maintained.

Disclaimer: None.

Conflict of Interest: None.

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