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COMMENTARY

Decoding the revolution of total arterial coronary artery bypass graft surgery

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The revolutionary total arterial coronary artery bypass graft (TA-CABG) surgery approach represents a significant leap forward in managing coronary artery disease, promising groundbreaking advancements in long-term outcomes. In 1986, Loop and colleagues' landmark study first observed the long-term prognostic benefits of the left internal mammary artery to the anterior descending graft.[1] Nevertheless, TA-CABG surgery demonstrates a compelling alternative to conventional CABG by employing exclusively arterial conduits, such as the bilateral internal mammary artery (BIMA) and radial arteries, in anaortic in-situ "Y" grafts or free sequential grafts.[2] TA-CABG offers superior durability with sequential grafting and minimally invasive techniques in off-pump CABG, resulting in better long-term graft patency, fewer reoperations, and improved survival rates, especially for younger, high-risk patients.[2,3]

Downsides of saphenous vein grafts: What to know?

Albeit saphenous vein grafts can effectively relieve ischaemia, venous grafts are prone to early atherosclerosis and degenerative changes, resulting in graft failure or restenosis.[2] The harvested great saphenous vein often exhibits pre-existing vascular disease, which can compromise its long-term viability as a graft. Additionally, harvesting techniques, including graft preparation and conduit handling, can contribute to endothelial injury and vasospasm, impacting the effectiveness of venous grafts.[3] Unlike arterial conduits, post-CABG venous grafts exhibit diminished biological effects of endothelial nitric oxide, heightened prothrombotic properties, and increased smooth muscle cell proliferation, contributing to inferior patency rates.[4] However, advancements in graft preservation and minimally invasive techniques promise to mitigate these risks and enhance the longevity of venous grafts in CABG surgery.

TA-CABG: The rationale behind the revolution

The rationale behind the TA-CABG technique lies in the inherent characteristics of arterial conduits comprising robust muscular layers, which exhibit greater resistance to atherosclerosis and plaque formation compared to veins.[2] Arterial conduits, specifically the radial artery, demonstrate superior endothelium-dependent relaxation and remodelling under high-pressure circulation, crucial in maintaining vascular tone, regulating blood flow, and preventing graft thrombosis. Furthermore, the oxygen-rich, high-pressure environment of arteries fosters graft adaptation, reducing the risk of early failure. By performing multi-arterial CABG, surgeons can offer more resilient bypass grafts, potentially yielding superior long-term outcomes and enhancing patients' quality of life. Additionally, TA-CABG minimises the need for vein harvesting from the lower extremities, thereby reducing surgical morbidity and hastening

Key message

Total arterial coronary artery bypass graft utilising bilateral internal mammary artery and radial artery either in-situ, free, or "Y" graft techniques improves long-term survival rate and quality of life. Arterial grafts are less prone to atherosclerosis than veins, which is why arterial conduits in coronary artery bypass graft surgery reduce the likelihood of graft failure over time.

postoperative recovery. Patients undergoing TA-CABG experience less pain, reduced risk of wound complications except for uncontrolled diabetes mellitus, and shorter hospital stays.[3] Furthermore, preserving venous conduits for future interventions becomes increasingly crucial, particularly for patients necessitating multiple revascularisation procedures.

Strengths and overcoming challenges of TA-CABG

While TA-CABG surgery offers improved graft patency and clinical outcomes, it requires expert surgical skills for precise anastomoses.[2,3] Further, patients may require mixed arterial and venous grafts due to limited suitable arterial conduits due to prior coronary interventions and anatomical variations. While harvesting BIMA may be associated with a higher risk of sternal wound infection; studies have not found a direct causal link in the absence of specific comorbidities like diabetes mellitus.[1,3] Albeit rare, radial artery harvesting carries the risk of superficial radial nerve injury similar to the saphenous nerve during great saphenous vein harvesting; hence, the meticulous surgical technique is paramount to minimise harvest site complications.[5] Furthermore, TA-CABG might entail slightly higher procedural expenses due to the extra equipment and resource requirement, but the superior long-term graft patency offsets concern about cost-effectiveness.

Despite the compelling advantages of TA-CABG, widespread adoption was hindered by various factors, especially a lack of surgical expertise, technical challenges, and concerns regarding long-term graft patency. However, recent initiatives, including training programmes and international collaborations, have highlighted the benefits of arterial conduits due to physiology and structural resilience, preserved endothelial function, and resistance to graft disease in real-world scenarios. Moreover, the time has come to wholeheartedly embrace the innovative TA-CABG approach to advance arterial revascularisation and optimise patient clinical outcomes. Finally, preserving venous conduits for potential future interventions is highly recommended, especially in patients who may require multiple revascularisation procedures.

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