Multi-detector Row CT Evaluation of Coronary Artery Bypass Graft Using Reverse Left Internal Mammary Artery: a case report

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CASE REPORT

A 51-year-old male hypertensive patient without regular control presented with a sudden onset of dizziness, chest tightness and general weakness. ECG revealed ST-T elevation. With suspicious of unstable angina, cardiac catheterization was performed and critical stenoses were found in all three coronary arteries. As a result, coronary artery bypass grafting (CABG) revascularization...
was arranged using the da Vinci surgical system (Intuitive Surgical, Inc, Sunnyvale, Calif.). At surgery, accidental electrocauterization of left internal mammary artery (LIMA) occurred, the proximal end of LIMA was ligated and distal LIMA was mobilized and fixed to the pericardium. In this instance, the reverse LIMA flow was from left inferior epigastric artery and two intercostal arteries. In the surgical procedure, the LIMA was anastomosed with proximal segment of radial artery; the radial artery was then anastomosed with left anterior descending coronary artery, second obtuse marginal branch and posterior descending artery sequentially. After a successful operation, the patient recovered well and was discharged 10 days later.

In order to monitor the graft after operation, cardiac catheterization was planned. However, the interrupted proximal LIMA and multiple supply of the reverse LIMA (left inferior epigastric artery and intercostal arteries) made catheterization very difficult, if not impossible. Thus, MDCT was performed 3 months later for the purpose of assessing the graft patency. The scan was performed with a 40-detector-row CT scanner (Brilliance 40; Philips, Best, The Netherlands) with the following protocol: 40×0.625 mm collimation, 120 kVp tube voltage, 350 mA tube current, a rotation time of 0.42 s, and a pitch of 0.2 with retrospective ECG gating. The 100 mL contrast medium (Omnipaque 350; GE healthcare) was used at a flow rate of 3.5 mL per second and followed by 30 mL saline chaser at the same flow rate. The scan was from 1-cm above the carina to the end of the heart. Bolus tracking was used with the region of interest set in the ascending aorta at the level of scan start. After enhancement had reached 150 HU, a 6.5 s post-threshold delay was applied before the scan. Ten equally spaced phases of images were reconstructed from 0% to 90% RR intervals with a slice thickness and index of 0.67 and 0.33 mm [4].

The interpretation was performed on a dedicated MDCT workstation (Extended Brilliance Workspace; Philips, Best, The Netherlands). The graft structure, patency, anastomosis and distal native coronary arteries can all be visualized well (Fig. 1). The left ventricular wall motion was also satisfactory, with an ejection fraction of 63.5%. The MDCT revealed a satisfactory surgical revascularization result.

**DISCUSSION**

The major finding of this case report is that MDCT can serve as a problem-solving technique when catheterization is unable to evaluate a graft’s anatomical detail. Thus, MDCT not only provides good accuracy in evaluating CABG compared to

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**Figure 1.** A 51-year-old man with triple vessel disease post CABG with composite arterial graft using reverse LIMA. Volume rendering shows a composite graft (U-graft) using reverse LIMA and radial artery (Ra) to anastomose with left anterior descending artery (LAD), second obtuse marginal artery (OM2) and posterior descending artery (PDA). **a.** The LIMA is well-supplied by two left intercostal artery (ICA) and inferior epigastric artery, anastomosing radial artery to supply distal LAD. **b.** The OM2 anastomosis only gives retrograde perfusion. Distal OM2 is occluded. **c.** The PDA anastomosis is good, but proximal PDA shows severe atherosclerotic change, making retrograde perfusion less than optimal.
catheter angiography, but also has a wider clinical applicability.

The long term survival rate for patients who undergo CABG is dependant on the success of revascularization and graft patency. Therefore, accurately assessing the state of the bypass graft is crucial for providing appropriate clinical management of the patient. Angiography remains the standard diagnostic tool for the assessment of bypass grafts. However, angiography is an invasive procedure which carries potential procedure-related risk and requires hospitalization. Despite marked changes in patient profile and improved equipment, the complication rates for cardiac catheterization have changed little over the past decade [5]. Furthermore, post-CABG catheterization is more difficult due to the anastomosis of vein grafts which can be undetectable on fluoroscopy and attempts to selectively engage the ostium of a vein graft or a complex arterial graft can sometimes be unsuccessful. This means that the procedure time for angiography is prolonged and patient exposure to fluoroscopic radiation and contrast media are increased. Alternative methods for accessing graft patency have been made with noninvasive approaches, including radionuclide ventriculography, thallium-201 myocardial perfusion scintigraphy, MR imaging, and transthoracic echocardiography. However, these imaging modalities have very limited accuracy [6-8]. In the 1990s, the development of MDCT scanner and powerful post-processing software was used to overcome these limitations. Although the early MDCT scanner still had some limitations [9], technical progress of MDCT for coronary imaging has been impressive over the past few years. Many studies have demonstrated that the MDCT has almost the same sensitivity, specificity and diagnostic accuracy of conventional angiography [1-3, 10].

Furthermore, MDCT has a shorter scan time than conventional angiography, and it is noninvasive. Meyer et al. [2] reported that MDCT is a reliable method for assessment of bypass graft patency and stenosis in a “real-world” patient population. Jabara et al. [10] found that two grafts were not demonstrated by invasive angiography but were detected by MDCT. There are still no reports in recent literature questioning whether MDCT can have a wider clinical applicability than catheter angiography. However, this case allows us to discover that MDCT can be useful when catheterization is unable to access the complex composite graft.

In conclusion, we present a case with composite arterial graft using reverse LIMA. The LIMA was supplied by several vessels; the cardiac catheterization was unable to access this graft. Alternatively, MDCT served as a problem-solving tool. In this case, MDCT demonstrated its powerful capability in CABG with complex anatomy, resolving the limitations of cardiac catheterization.

ACKNOWLEDGEMENT

This research was supported in part by Taichung Veterans General Hospital under grants TCVGH-985506C.

REFERENCES


截至目前，許多研究都已證實多切面電腦斷層在評估冠狀動脈繞道接枝的準確性。但尚無研究或個案報告說明多切面電腦斷層在臨床上的實用性是否有可能超越心導管檢查。我們將介紹一位患者，由於手術中傷及近端內乳動脈，故繞道接枝以反向內乳動脈接續橈動脈完成三大冠狀動脈支配區域的血液供應。由於在技術上，反向內乳動脈以心導管是無法評估的，本例清楚說明多切面電腦斷層在評估複雜繞道接枝狀況時的優勢與實用性。