A Rare Case Report of Early Myocardial Ischemia after Coronary Artery Bypass Surgery due to Mechanical Compression of Vein Graft by Pericardial Drainage Tube: Role of Transesophageal Echocardiography

Abstract

New onset regional wall motion abnormality (RWMA) following coronary artery bypass grafting adversely affects the patient outcome. Early detection and addressing the cause of RWMA improves overall morbidity and mortality of the patient. We report a rare case of early myocardial ischemia detected by intraoperative transesophageal echocardiography due to mechanical compression of a vein graft by a pericardial drain tube.

Keywords: *Myocardial ischemia, pericardial drain, transesophageal echocardiography*

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Introduction

Myocardial ischemia due to graft occlusion/thrombosis is common after coronary artery bypass grafting (CABG) surgery. Left ventricle (LV) diastolic dysfunction is one of the earliest clinical manifestations after coronary artery occlusion, and it generally precedes the development of an abnormal systolic function. However, regional wall motion abnormality (RWMA) detected by transesophageal echocardiography (TEE) has been shown to be a more sensitive method of detecting myocardial ischemia in patients undergoing CABG, compared with ST-segment changes.[1]

Case Report

A 61-year-old male patient diagnosed to be a case of coronary artery disease (CAD) scheduled for CABG. The patient had a history of chest pain and dyspnoea on exertion of New York heart association classification II (NYHA II). General physical examination revealed a pulse rate of 68/min with a blood pressure of 122/74 mmHg in sitting position. His respiratory rate was 14/min and systemic oxygen saturation was 98% on room air. No murmur was heard on auscultation. Preoperative Chest X-ray and blood investigations were found to be normal. An echocardiographic assessment revealed LV Ejection fraction (EF) of 55% with no RWMA, LV diastolic dysfunction grade I, and no valvular abnormalities. Angiography revealed critical triple vessel disease. In the operating room (OR) after instituting standard American Society of Anaesthesiologist monitoring, cannulation of the right radial artery, and the right internal jugular vein was accomplished under local anesthesia. Anesthesia was induced and maintained using the balanced narcotic technique. A 5 MHz phased array transducer (6VT) transesophageal probe was inserted orally.

TEE was performed using a GE vivid E9 (Norway) echocardiography system. No RWMA was found in TEE during the pre-bypass period. On pump, CABG was performed by anastomosing left internal mammary artery to left anterior descending artery, saphenous venous grafts to the obtuse marginal artery and posterior descending artery (PDA). Weaning from cardiopulmonary bypass was uneventful. Aortic cross-clamp time and cardiopulmonary bypass time were 83 and 110 min, respectively. In our institute, we routinely use to perform TEE after cardiopulmonary bypass (CPB) in patients undergoing CABG. Incidentally, we found the presence of RWMA in the inferolateral wall of the left ventricle in two dimensional (2D) trans-gastric short axis view [Video 1]. Further, on

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speckle tracking echocardiography (STE), we observed that segment 5 (basal inferolateral) and segment 11 (mid inferolateral) in 17 segmental model had the strain value of +3 and +1, respectively (represented as blue color in Bull's eye, Figure 1a). However, we did not observe any electrocardiography (ECG) or hemodynamic changes during the period. The surgeon was informed about RWMA and surgeon assessed graft supplying inferolateral wall of LV and found venous graft to the PDA was being compressed by the 28 size pericardial drain tube [Figure 2]. Following which, the drain tube was repositioned, which relieved the mechanical compression on the venous graft anastomosed to PDA. Again, we performed TEE after tube repositioning, which showed no RWMA in the inferolateral wall of the left ventricle [Video 2]. In addition, on STE, we noticed that segment 5 and segment 11 of 17 segment model had the better strain value of −8 and −8, respectively (blue zone changed to the red zone in Bull's eye as shown in Figure 1b). The patient was shifted to the surgical Intensive care unit (ICU) and the trachea was extubated after 6 hours of mechanical ventilation. Following an uneventful postoperative period, the patient was shifted to ward on the third postoperative day and discharged from hospital on the tenth postoperative day.

Discussion

Intraoperative TEE is an integral part of the treatment of patients undergoing valve surgery.[2] However, the impact of intraoperative TEE in patients undergoing CABG is less well documented.[3] The utility of intraoperative TEE in revascularization surgery should be considered to confirm the preoperative diagnosis, detect new unsuspected pathology, manage both anesthetic and surgical plans appropriately, and evaluate surgical results.[4] Also, it is reasonable to consider TEE for monitoring of hemodynamic status, ventricular function, RWMA, and valvular function in patients undergoing CABG.[5]

New RWMAs may be related to loading conditions of the ventricle, electrolyte abnormalities, blood viscosity, air embolism, level of inotropic support, hypothermia, cardiac pacing, and bundle branch conduction abnormalities. Perioperatively, it is extremely difficult to determine whether new segmental wall motion abnormality represents inadequate revascularization, ongoing ischemia, or stunned myocardium. Treatment of new onset RWMA includes increasing the coronary perfusion pressure, normalizing electrolytes, and arterial blood gas, and inspecting coronary graft patency. On extreme situations, it may warrant a need to return to cardiopulmonary bypass. Savage *et al.* found that the use of intraoperative TEE decreased mortality and morbidity in patients undergoing on-pump procedures and the intraoperative TEE should be used routinely in cardiac operations.[6] In another study by Bergquist *et al.*, use of intraoperative TEE in CABG can optimize volume replacement therapy in 47% of cases. Moreover, intraoperative TEE played a significant role in decision making regarding the use of inotropes, vasodilators, and volume replacement.[7]

Although previous studies mentioned that left ventricular diastolic dysfunction is an earlier, more sensitive sign of myocardial ischemia and persists longer than the systolic disturbance, it may not hold good immediately after CPB.[8,9] McKenney *et al.* observed temporary impairment in diastolic dysfunction following on-pump CABG surgery.[10] Possible mechanisms of diastolic dysfunction after CPB can be due to free oxygen radicals, altered intracellular calcium homeostasis, or both.[11] Perioperatively, regional wall motion changes detected by 2D echocardiography guide us to locate the exact coronary vessel involvement. Further, study by Smith *et al.* indicated that RWMAs occur earlier and are a more sensitive indicator of myocardial ischemia than the abnormal changes detected with an ECG.[12] Similarly, we observed RWMA in TEE before ECG changes in our case. However,

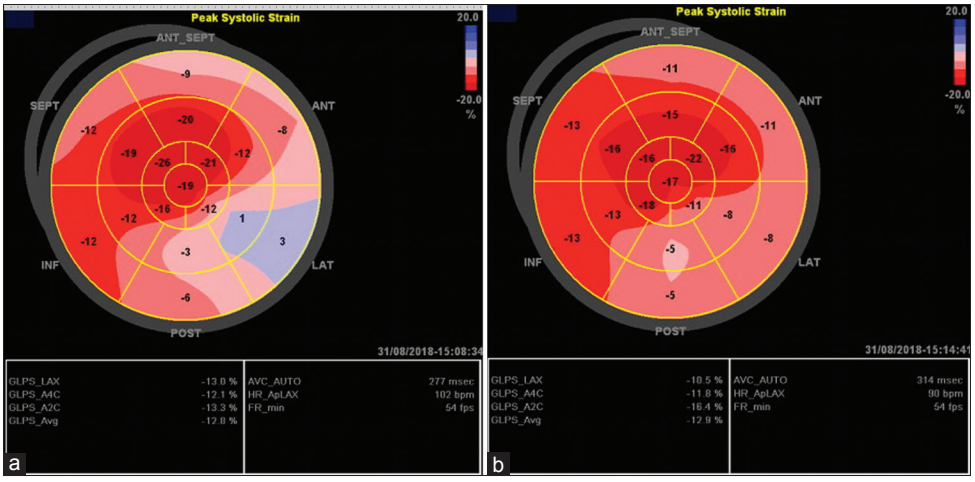

Figure 1: (a) Speckle tracking echocardiography showing changes in 5 and 11 segments during drain compression. (b) Speckle tracking echocardiography showing improvement in 5 and 11 segments after drain removal

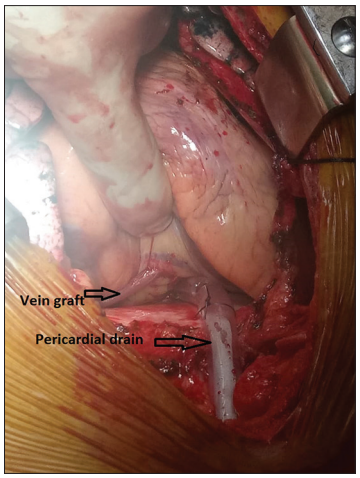

Figure 2: Surgical field showing compression of graft to PDA by pericardial drain

adequacy of RWMA analysis by echocardiography may be influenced by artifacts and inter-observer variations. In addition, RWMA analysis does not differentiate stunned or hibernating myocardium from acute ischemia. Here, comes the role of advanced echocardiographic technologies, such as tissue Doppler, strain, and strain rate, which improve the diagnostic accuracy in detecting myocardial ischemia.

Myocardial strain can be measured by tissue Doppler imaging (TDI) or by speckle-tracking echocardiography (STE). STE is a recently developed technique that provides a non-Doppler, relatively angle-independent measurement of myocardial deformation, and LV systolic and diastolic dynamics.[13] Moreover, it provides an accurate and reproducible measurement of regional and global LV contractility. While in normal myocardium, longitudinal shortening is associated with more negative strain, whereas in ischemic myocardium, strain value becomes more positive. Further, subjective variations and variations due to pacing are less with STE. In our case, strain analysis exactly predicted the location of myocardial involvement, which helped in rectifying the cause. Thus, perioperative strain analysis plays a crucial role in assessing regional wall motion.

Conclusion

Intraoperative TEE is one of the most sensitive modalities in the diagnosis of myocardial ischemia, detecting RWMA within a minute after inadequate myocardial perfusion, which can be due to inadequate revascularization or due to mechanical compression of grafts.

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Conflicts of interest

There are no conflicts of interest.

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