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Computed tomography angiography for visualisation of distal coronary arteries and selection for surgical revascularisation in a patient with acute myocardial infarction

Tomografia komputerowa w obrazowaniu obwodów tętnic wieńcowych i kwalifikacji do rewaskularyzacji chirurgicznej u chorego z zawałem serca

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Abstract

Patients with symptomatic multivessel coronary artery disease rejected for coronary revascularisation have adverse prognosis. We describe a 61 year-old male with non-ST-elevation myocardial infarction who was considered unsuitable for coronary revascularisation based on the conventional angiography findings. Unlike conventional angiography, computed tomography angiography visualised distal coronary segments and the patient underwent successful coronary artery bypass grafting.

Key words: coronary artery imaging, computed tomography, coronary angiography, myocardial infarction, coronary artery bypass grafting

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INTRODUCTION

Conventional coronary angiography is the method of choice for identifying coronary artery disease (CAD). Recently, computed tomography coronary angiography (CTCA) has been developed into a reliable and noninvasive evaluation of coronary morphology [1]. Here, we report the potential role of CTCA in the accurate visualisation of distal coronary segments which had been missed using conventional coronary angiography in a patient with acute myocardial infarction.

CASE REPORT

A 61 year-old male, with no medical history, was transferred to the emergency room with a diagnosis of non-ST-elevation myocardial infarction (NSTEMI) complicated by pulmonary oedema. The admission ECG showed marked ST-segment depression in leads I, aVL, V2–V6, III and aVF. Due to haemodynamic instability, intra-aortic balloon counterpulsation was initiated. Transthoracic echocardiogram demonstrated an ejection fraction of 30% with akinetic anteroseptal segments and hypokinetic inferolateral and posterior walls. Coronary angiography was performed showing significant stenosis of the distal left main, total occlusion of the proximal left anterior descending artery (LAD), significant stenosis of the first obtuse marginal branch (OM) and total occlusion of the proximal right coronary artery (RCA) (Fig. 1). Coronary artery bypass grafting (CABG) was considered the most appropriate strategy of coronary revascularisation because of the difficulty of assessing the culprit lesion, as well as the significant distal left main disease and the high risk of circumflex artery occlusion during percutaneous coronary intervention (PCI). Since conventional angiography failed to visualise the distal segments of the occluded arteries, emergency dual-source CTCA using a Somatom Definition scanner (Siemens, Germany) was performed in a last-ditch attempt to visualise the

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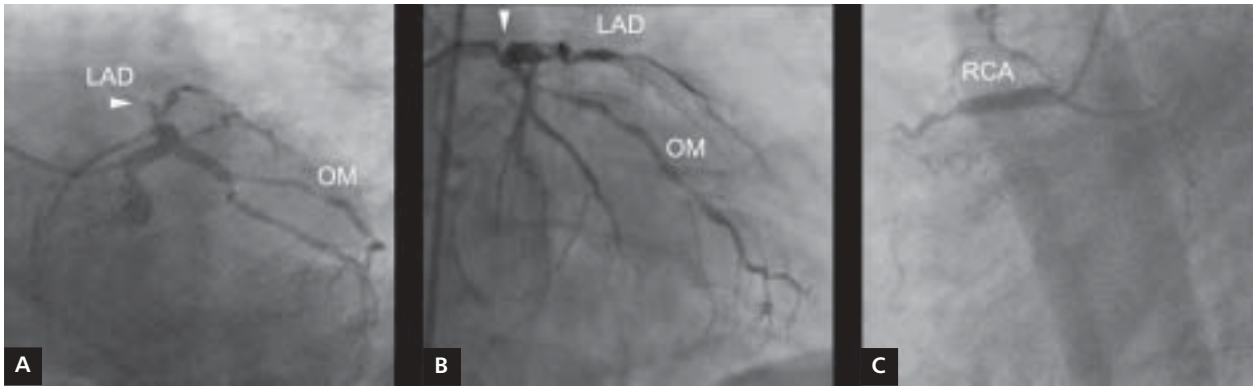

Figure 1. A, B. Left coronary angiography revealed occlusion of the proximal left anterior descending artery (LAD), significant stenosis of the distal left main and significant stenosis of the first obtuse marginal branch (OM). Coronary angiography failed to visualise distal segments of the LAD; **C.** Right coronary angiography showed proximal occlusion of the right coronary artery (RCA)

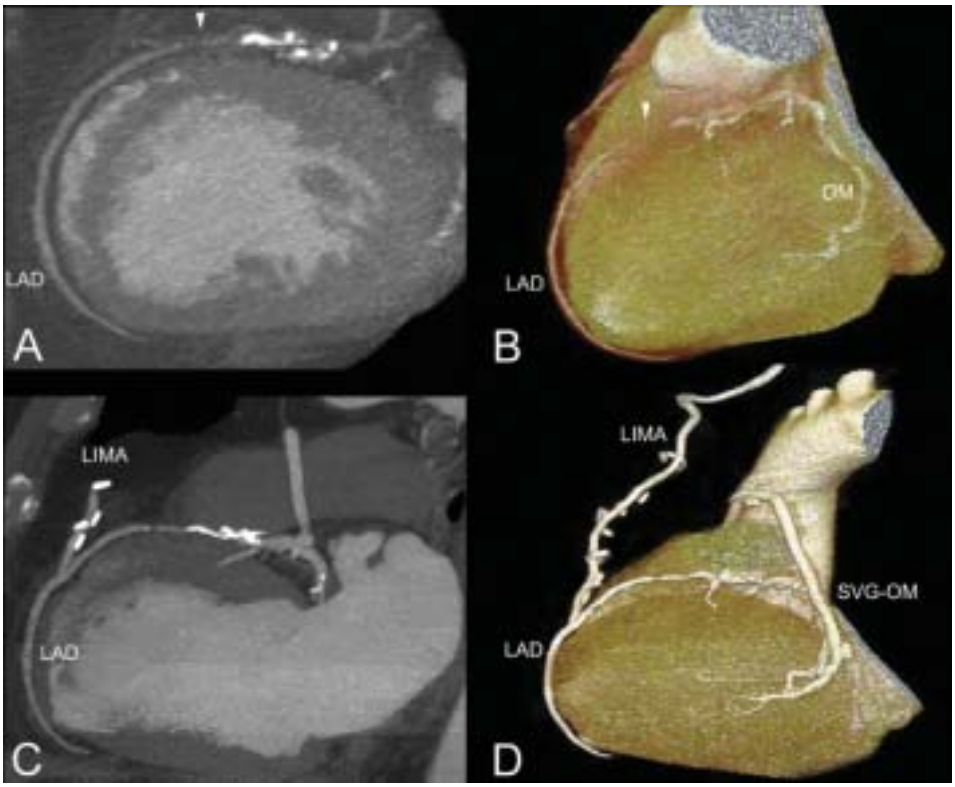

Figure 2. A, B. Axial and 3D volume-rendered CTCA images showed large distal left anterior descending artery (LAD) at the apex; **C, D.** Axial and 3D volume-rendered CTCA images demonstrated excellent patency of the bypass grafts at five month follow-up; LIMA — left internal mammary artery; OM — obtuse marginal branch; SVG — saphenous vein graft

target coronary arteries for bypass grafting. The CTCA scan was acquired using the following protocol: test bolus technique with biphasic injection of 80 mL intravenous contrast agent at 6.0 mL/s, pitch 0.26, gantry rotation time 300 ms, reconstruction increment 0.4 mm, tube current 400 mA at 120 kV. The CTCA demonstrated the accurate course of distal LAD wrapping around the cardiac apex (Figs. 2A, B) as well as the distal RCA. Based on the CTCA findings, the final decision on emergency three-vessel CABG was taken.

The chest was opened through a median sternotomy and the graftable distal parts of LAD and RCA were identified. Off-pump CABG with the left internal mammary artery graft to the distal LAD and saphenous vein grafts to the OM and RCA was performed. During the early post-operative period, the

patient required prolonged inotropic support. However, he made a full recovery and was discharged home with left ventricle ejection fraction of 45% and no signs of ischaemia on ECG. After five months, a control CTCA scan demonstrated excellent patency of the three bypass grafts and the patient presented without symptoms (Figs. 2C, D).

DISCUSSION

It is estimated that patients with symptomatic, severe CAD rejected for coronary revascularisation account for 9.6% of the catheterisation laboratory population [2]. Currently, selection for CABG is based on the visual aspect of distal coronary arteries in conventional coronary angiography. Furthermore, it has been demonstrated that diffuse distal CAD predicts surgical death [3]. Thus, failure of visualisation, or severe atherosclerotic involvement of distal coronary segments in invasive angiography, results in a rejection for surgical revascularisation and a poor patient prognosis [4].

Conventional coronary angiography is the method of choice for identifying CAD and selection of patients for attempted CABG. However, its diagnostic value in the assesment of distal coronary segments may be limited due to manual contrast injection lacking simultaneous antegrade-retrograde filling of both coronary ostia [5]. Contrary to conventional coronary angiography, with the venous injection at CTCA, a considerable amount of simultaneous retrograde filling of the distal coronary arteries via collaterals is observed. Moreover, an automatic bolus injection at high flow rate, followed by a flush of saline, results in longer injection time and more accurate assessment of distal coronary segments.

Further CTCA advantages include three-dimensional reconstruction imaging, detection of coronary calcifications and absence of foreshortening effects [6]. Therefore, we suggest that CTCA may be superior to conventional coronary angiography in detecting distal coronary segments. In our case, the final decision on surgical revascularisation was taken on the basis of CTCA findings. It can be assumed that rejection for CABG would lead to a substantial infarcted area and a poor patient prognosis.

CONCLUSIONS

We believe this is the first published case illustrating the potential role of CTCA for accurate visualisation of distal coronary arteries which have been missed using conventional coronary angiography. Thus, performance of CTCA may change referral patterns for surgical revascularisation and improve long-term clinical outcomes in patients initially rejected for CABG based on conventional angiography. Further studies are needed to evaluate the usefulness of CTCA in delineating distal coronary segments.

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