CABG of the right gastroepiploic artery and of the left internal mammary artery

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History

A 42-year-old male patient, suffering from exertional chest tightness and shortness of breath for the past 4 days, presented himself to the hospital. His symptoms could be relieved after a few minutes of rest, had been however progressive. A coronary angiography was performed which revealed severe stenoses in the mid right coronary artery (RCA) and the proximal left anterior descending artery (LAD). Coronary artery bypass grafting (CABG) was immediately performed. Seven days later, a CT angiography (CTA) was requested to assess the patency of the grafts as well as of the anastomoses.

Diagnosis

The CTA images showed two grafts – the right gastroepiploic artery (RGEA), arising from the gastroduodenal artery (GDA), was anastomosed to the distal RCA. The left internal mammary artery (LIMA), originating from the left subclavian artery (LSA), was anastomosed to the mid LAD. Both grafts were patent without kinking or twisting. The anastomoses were also patent. Mixed plaques in the mid RCA and the proximal LAD, causing severe stenoses, were seen and were consistent with the coronary angiography findings. A calcified plaque in the proximal circumflex artery (Cx) was visualized, causing no significant stenosis. The patient recovered uneventfully and was discharged.

Comments

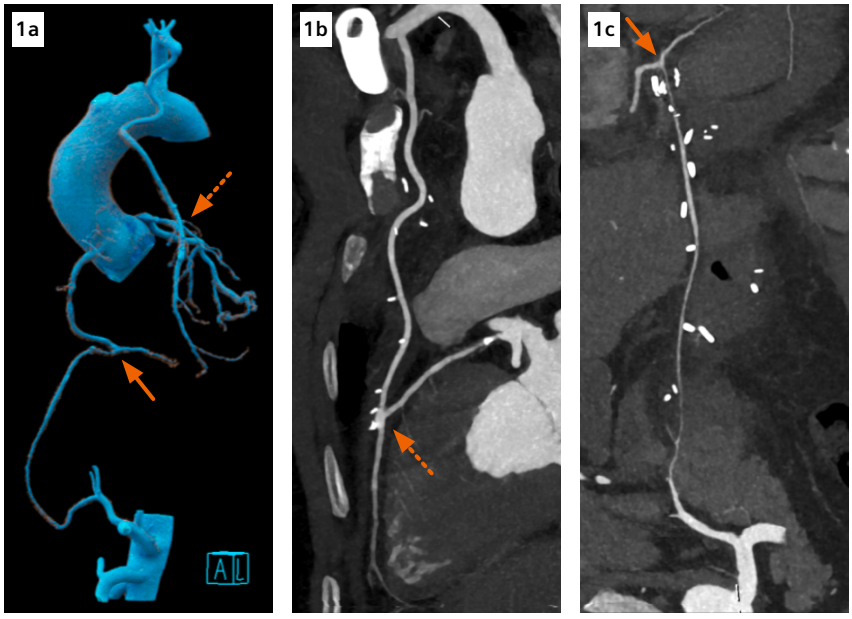
CABG surgery is performed to bypass the diseased coronary arteries to maintain blood supply to the affected areas of the myocardium. The choice of conduit has been a major concern for cardiac surgeons desiring a good surgical outcome. The RGEA is most suitable for grafting the distal right coronary artery and the posterior descending artery since this site is the nearest for the in-situ GEA graft. According to American Heart Association guidelines, an RCA with more than a 90% stenosis is considered as a proper target for applying a GEA graft. [1] The LIMA is most commonly used as an in-situ graft to revascularize the LAD, due to its proximity to the LAD and favorable patency rates. [2] As the long-term clinical outcome depends upon the patency of the CABG, proper follow-ups are essential. Coronary CTA is a non-invasive imaging method and is capable of depicting the entire course of the grafts, providing detailed information for the evaluation of the vessel lumen and the anastomoses in three dimensions. To overcome the technical challenges, such as the presence of calcifications and clip material over a long scan range obscuring the visualization of the lumen, as well as elevated, irregular heart rates of the patients causing motion artifacts, sophisticated hardware and intelligent software are required and have been developed.

This case is performed on a Dual Source CT scanner, SOMATOM Force, which provides a high temporal resolution of approximately 66 ms – a feature that is essential for motion-free image acquisition. A retrospective ECG gated spiral mode is available for scanning patients with elevated, irregular heart rates. A lower kV setting of 90 kV is selected by the system using CARE kV – an automated feature that adjusts the tube voltage, tailored to the individual patient, the system capabilities and the clinical task, improving the contrast enhancement and reducing the amount of contrast agent needed. These technical advancements support physicians for post CABG evaluation. ●

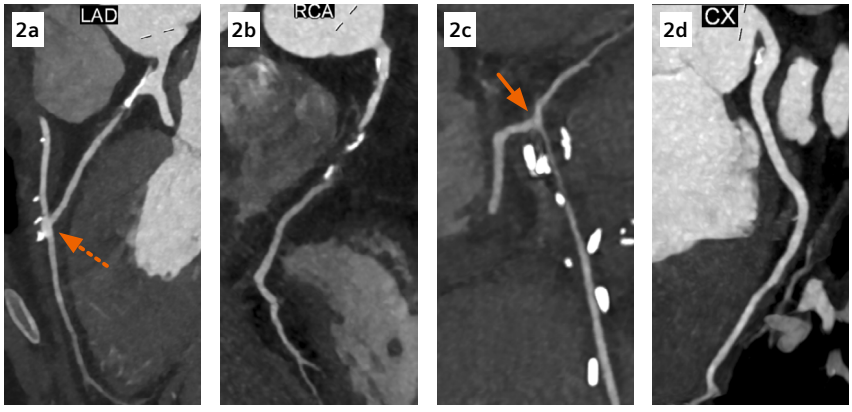
References

[1] Hisayoshi Suma. The Right Gastroepiploic Artery Graft for Coronary Artery Bypass Grafting: A 30-Year Experience. Korean J Thorac Cardiovasc Surg 2016;49:225-231.

[2] Robert Chapman Gilkeson, Alan H. Markowitz. Multislice CT Evaluation of Coronary Artery Bypass Graft Patients. J Thorac Imaging 2007;22:56–62



1 **A cinematic VRT image (Fig. 1a) and two curved MIP images (Figs. 1b & 1c) show an overview of the two grafts – the RGEA, arising from the GDA, is anastomosed to the distal RCA (arrows); the LIMA, originating from the LSA, is anastomosed to the mid LAD (dashed arrows). Both grafts and anastomoses are patent.**



2 **Curved MPR (Figs. 2b & 2d) and MIP images (Figs. 2a & 2c) show mixed plaques in the mid RCA and the proximal LAD, causing severe stenoses. A calcified plaque in the proximal Cx is seen, causing no significant stenosis. Both anastomoses to the LAD (dashed arrow) and to the RCA (arrow) are patent.**

Examination Protocol

Scanner	SOMATOM Force
Scan area	Chest/Abdomen
Scan mode	Retrospective ECG gated spiral mode
Scan length	350 mm
Scan direction	Cranio-caudal
Scan time	4.8 s
Tube voltage	90 kV
Effective mAs	351 mAs
Dose modulation	CARE Dose4D
$CTDI_{vol}$	24.8 mGy
DLP	953.8 mGy*cm
Rotation time	0.25 s
Pitch	0.32
Slice collimation	192 x 0.6 mm
Slice width	0.75 mm
Reconstruction increment	0.4 mm
Reconstruction kernel	Bv40
Heart rate	85 – 89 bpm

Contrast	350 mg/mL
Volume	64 mL + 38 mL saline
Flow rate	4.2 mL/s
Start delay	Bolus tracking triggered at 100 HU in the descending aorta + 6 s

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The products/features (mentioned herein) are not commercially available in all countries. Their future availability cannot be guaranteed.