We report a rare case of failed depiction of a patent right internal thoracic artery (RITA) to left anterior descending artery (LAD) bypass on 64-slice multidetector row computed tomographic (MDCT) angiography due to the presence of a large lateral costal artery. A 66-year-old male with acute coronary syndrome due to triple vessel disease underwent urgent coronary artery bypass grafting, in which bilateral ITA and saphenous vein grafts were used. Postoperative MDCT angiography showed an occluded RITA-LAD bypass, which was eventually shown to be patent by angiography. Angiography also revealed a large lateral costal artery that was considered to affect the flow to the LAD. Thus, coil embolization of the branch was attempted. However, it was abandoned because the patient suffered from severe back and intercostal pain during balloon occlusion of the lateral costal artery. Postoperative MDCT angiography is not always accurate for the assessment of graft patency in patients with large ITA side branches. In addition, embolization is not always possible because occlusion of this large branch may cause severe pain when its size becomes quite large.

Keywords: CABG, computed tomography, surgery, complications, anatomy

Introduction

Multidetector computed tomography (MDCT) has been widely used as a noninvasive assessment of postoperative graft patency after coronary artery bypass grafting (CABG). We experienced a rare situation of a failed depiction of a patent right internal thoracic artery (RITA)-left anterior descending artery (LAD) graft by MDCT, which was considered to be due to the steal phenomenon by a large lateral costal artery on coronary angiography.

Case Report

A 66-year-old male with unstable angina due to severe triple vessel disease was transferred to our hospital and underwent urgent CABG. He underwent RITA-LAD anastomosis, a left internal thoracic artery to high lateral branch anastomosis, and saphenous vein graft (SVG) anastomosis to the diagonal branch and distal circumflex artery and to the posterior descending and posterolateral branches of the right coronary artery. His postoperative course was uneventful, and he did not experience recurrent angina. However, routine MDCT performed 8 days...
after the operation revealed occlusion of the RITA-LAD
graft (Fig. 1). Because the blood supply to the LAD
was crucial for this patient, we decided to perform coronary
angiography for further investigation.

On angiography, the RITA-LAD graft was found to be
patent, but had low flow; in addition, a large intercostal
side branch was present. The diameter of the branch was
larger than that of the RITA, and it coursed as far as the
seventh intercostal space to provide a blood supply to
each intercostal artery (Fig. 2A). Thus, we considered
that the failed depiction of the RITA-LAD graft was due
to the steal phenomenon by this large branch. Although
the patient was asymptomatic, we attempted occlusion of
the branch using a coil embolization technique to prevent
future complications involving the LAD.

During the procedure, the steal phenomenon was con-
confirmed by test occlusion of the branch using a balloon
catheter (Fig. 2B). However, the patient began to com-
plain of severe pain along the chest wall immediately
after the test balloon occlusion of the branch. The pain
disappeared when the balloon was deflated. This phe-
nomenon occurred each time we attempted to occlude the
branch. Thus, we abandoned our attempt to close the
large costal artery, and instead performed stent interven-
tion to the LAD to protect its flow through the native cor-
onary artery. The patient was discharged and remained
symptom-free 12 months after the operation.

Discussion

The presence of a large lateral costal artery of the in-
ternal thoracic artery is reported in 10% to 20% of the
population.4) The size of the branch varies depending on
the length of the intercostal artery. The incidence of a
very large lateral costal artery that reaches beyond the
sixth intercostal space, as in our case, has been reported
in only 2% of lateral costal artery cases.5) Although sev-
eral reports have revealed recurrent angina due to a large
side branch of the internal thoracic artery,2,3) there is con-
tinued controversy regarding whether this large branch
can cause ischemia by stealing blood flow from the
branch to the LAD.3) This case revealed two important
factors regarding this branch: the steal phenomenon and
the risk of occlusion.

With recent improvement in the temporal and spatial
resolution of CT, noninvasive assessment of bypass graft
patency by MDCT can provide reliable information, and
the diagnostic accuracy has been improving.1) At our in-
stute, MDCT is used as a routine evaluation modality
for graft patency after CABG when there is no contrain-
dication. This case involved a rare situation of failed de-
piction of RITA-LAD graft anastomosis due to the pres-
ence of a large lateral costal artery. MDCT could not de-
ct this large branch, and the diagnosis was “occlusion,”
which was incorrect. To the best of our knowledge, this is
the first MDCT case of failed depiction of a patent RITA-
LAD graft due to the steal phenomenon by a large lateral
costal artery. In this case, the patient did not complain of
angina symptoms after the operation, and assessment by
coronary angiography was able to provide us more accu-
rate information. This may be a limitation of assessment
by MDCT.

The effect of large side branches on internal thoracic
artery to LAD bypass grafts is unknown. Some reports
maintain that internal thoracic artery steal is very un-
likely because the left coronary system is perfused in di-
astole while the chest wall artery system is perfused in
systole;2 however, others support the concept of the steal phenom-
emon, considering ligation of the side branch as the ap-
propriate treatment.2) In this case, LAD was not well de-
picted by MDCT, and the RITA-LAD flow was very
slow on coronary angiography. Although the patient did
not show any symptoms, we believed that it would be
better for him to establish enough flow to the LAD. Oc-
closure of large lateral costal arteries has been widely re-
ported, and almost all of the treatments have been suc-
cessful without any problems. Our case is the first report of a rare complication of occlusion of a large side branch. The patient suffered from severe, intolerable pain along the chest wall during test occlusion using a balloon. We must be aware of the potential for this complication when attempting to occlude a large lateral costal branch. Although it is rare to encounter a large lateral costal artery such as this, it is important to consider the possibility of its presence. Of course, long-term follow-up was needed in our case for further evaluation of the outcome of this anastomosis.

**Conclusion**

In conclusion, in the presence of a large lateral costal artery, care should be taken in the evaluation of ITA graft patency by MDCT. When occlusion of this artery is needed, we must consider that occlusion is not always possible because of severe pain.

**References**


**Fig. 2** (A) Coronary angiography showed the large costal artery from the right internal thoracic artery (white arrow). The flow toward the left anterior descending artery was slow (black arrow). (B) The flow from the right internal thoracic artery to the left anterior descending artery was well depicted (black arrow) during balloon occlusion of the large costal artery (gray arrow).