Diagnosis of Iatrogenic Femoropopliteal bypass Graft Entrapment Syndrome by MDCT: A Case Report

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Popliteal artery entrapment syndrome is a well-known congenital condition causing limb ischemia. A similar entity caused by entrapment of a femoropopliteal bypass graft by the muscle and tendons around the knee has also been described. Ultrasonography or MR imaging is considered a choice of a noninvasive modality for this condition, but there are some limitations. We report a case of iatrogenic entrapment of a femoropopliteal bypass graft that was confirmed by multidetector row computed tomography (MDCT).

Index words: Graft occlusion, vascular
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Currently, many vascular surgeons perform a femoropopliteal bypass graft from the groin to the knee to save the lower extremities of patients that have severe arterial disease. The most common cause of early failure of a femoropopliteal bypass graft is usually technical error. Sometimes, extrinsic compression by surrounding structures may result in impediment of blood flow within the graft [1]. The femoropopliteal bypass graft can be entrapped by the medial head of the gastrocnemius muscle in the popliteal fossa against the bone. The same situation is seen in “popliteal artery entrapment syndrome”, in which the native popliteal artery is compressed by the abnormally migrated medial head of the gastrocnemius [2].

In previous reports, physical examinations, Doppler ultrasonography, and conventional angiography of patients undergoing a femoropopliteal bypass graft have been described [1-4]. Multidetector row computed tomography (MDCT) might also be a useful tool for diagnosing this condition. MDCT offers high spatial resolution and can provide excellent depiction of not only luminal patency but also adjacent anatomical structures that cause the extrinsic compression. We report a case of iatrogenic entrapment of a femoropopliteal bypass graft that was confirmed by the use of MDCT.

Case Report

A 56-year-old man visited our hospital with worsening left lower leg pain. The patient had known histories of hypertension, angina, and cerebrovascular attack. CT angiography was obtained with a 16-detector row spiral CT scanner (Sensation 16, Siemens, Forchheim, Germany) for evaluation of the lower extremity arteries. The patient was placed in the supine position on the CT
The acquisition volume included the abdomen and both lower extremities from the upper 12th thoracic spine to the lower end of both feet. An 18-gauge intravenous cannula was inserted into a vein in the antecubital fossa. Scanning was performed after intravenous injection of contrast medium ([Ultravist 370; Schering, Berlin, Germany]) with an automatic power injector at a flow rate of 3.5 mL/sec (total 150 mL). The scan time delay was determined by the automatic bolus tracking method. The R.O.I. was positioned at the descending aorta at the level of the diaphragm. The CT scan started 15 seconds after the attenuation reached 150 H.U. The CT examination was performed by using 16 × 1.5 mm collimation, a table feed of 24 mm per gantry rotation. The X-ray tube voltage was 120 kV, and the amperage was 130 mAs. Volume data were reconstructed as 2-mm thickness at a 1-mm interval. We interpreted the reconstructed data set with the use of PC-based 3-dimensional software (Rapidia 2.8; Infinitt, Seoul, Korea) and applied the various post-processing algorithms [MPR, MIP, and/or volume rendering]. CT angiography revealed complete occlusion of the left superficial femoral artery at the proximal aspect with distal reconstruction at the popliteal level via collaterals. Femoro-popliteal bypass graft insertion using an autologous greater saphenous vein was performed. Postoperative MDCT angiography was obtained after a week, and blood flow was absent in the graft during extension of both knees. At that time, the patient did not have any ischemic symptoms. We repeated the CT examination on the next day after discussing the possible cause of apparent graft failure with the physician. The dorsalis pedis artery of the patient was normally palpable on flexion of the knee and it disappeared on extension. Therefore, we planned to repeat the CT examination during two phases, both with flexion and extension of the knee. A further examination revealed that the flow was normalized and the lumen of the graft was patent without any stenosis seen on the CT scan during the first phase (the knee flexion at 30 degrees). The degree of knee flexion was determined after a physical examination at the point of disappearing dorsalis pedis pulse. On a CT scan during the second phase, with the knee extension the graft was seen to be narrowed and compressed extrinsically between the medial head of the gastrocnemius muscle and the semimembranous tendon (Figs. 1, 2). We diagnosed the patient as having iatrogenic graft entrapment syndrome of the femoro-politeal vein graft. As the patient did not have any ischemic symptoms in his left lower leg, he refused to undergo surgical revision of the graft.

Ten months later the patient revisited our hospital via the emergency room complaining of pain and coldness in his left lower leg for 3 days. There was diffuse thrombosis within the graft lumen. Gangrenous change of the

**Fig. 1.** CT angiography of the femoropopliteal bypass graft during flexion of the affected limb

Sagittal MRP (A) and MIP (B) images show the preserved normal patency of the graft without any extrinsic compression during flexion of the affected limb.
left foot was found.

**Discussion**

Popliteal artery entrapment syndrome is one of the well-known causes of lower extremity ischemia (1). A similar occlusive condition can be created during a below-the-knee femoro-popliteal bypass graft. Femoro-popliteal bypass graft entrapment syndrome is defined as the compression of the graft occurring between the medial head of the gastrocnemius muscle and the semimembranosus tendon on the axial image (A). The same findings are also noted on sagittal MPR (B), MIP (C), and volume rendering images (D). This feature is suggestive of iatrogenic femoropopliteal bypass graft entrapment syndrome. (*: Semimembranosus tendon, **: Gastrocnemius medial head)

Conventional angiography can be regarded as the gold standard for evaluating this condition. However, it has the disadvantage of being invasive (6). In addition, conventional angiography does not show structures adjacent to the graft that cause the extrinsic compression. Cross-sectional imaging modalities such as ultrasonography, CT, and MRI are useful non-invasive diagnostic tools. They have the common capability of demonstrating the cause of the extrinsic compression. However, Doppler ultrasonography is an operator-dependent procedure and has its limitations when evaluating a deep-seated lesion (4, 7). Although MR angiography has excellent diagnostic capability for peripheral vascular disease resulting in claudication and ischemic changes of the affected limb (1, 3).
(7), it is relatively expensive to use as a standard tool. Recently, many roles of conventional angiography have been substituted by the use of MDCT owing to the comparable high diagnostic accuracy of the latter modality (8). MDCT angiography has superior spatial resolution compared with that of MR angiography, and it is substantially less expensive to perform. Additionally, it allows three-dimensional visualization of the pathological site from any angle and in any direction. Besides providing the same information as conventional angiography regarding the luminal patency of the femoropopliteal artery, it provides additional information regarding the condition of the vessel wall and surrounding structures (9).

Regardless of the imaging modality performed, a diagnosis can be made only in the appropriate clinical setting. In our patient, preserved intraluminal blood flow accounted for the clearly depicted vein graft on MDCT during flexion of the patient’s knee, while the blood flow was seen to disappear during extension. This feature is pathognomonic for iatrogenic vein graft entrapment syndrome.

Iatrogenic vein graft entrapment syndrome is a rare cause of graft failure. Our case demonstrates the effectiveness of the use of MDCT as a diagnostic tool for this rare condition, providing many advantages over the use of other modalities. An severe ischemic change of the affected limb may be irreversible, often leading to amputation, and thus it is important to understand the diagnostic features of iatrogenic femoropopliteal bypass graft entrapment syndrome.

References