CASE REPORT

Titanium plate artefact mimicking popliteal artery dissection on digital subtraction CT angiography

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SUMMARY

Titanium plates used for the internal fixation of long bone fractures cause significant artefact on CT scans but have not been reported to affect digital subtraction CT angiography. We present a patient with clinical suspicion of popliteal artery injury following a high tibial osteotomy. The osteotomy was stabilised with a titanium locking plate. During the digital subtraction process used to produce reconstruction CT angiography, removal of artefact caused by the titanium plate produced CT images mimicking the appearance of a popliteal artery dissection. The imaging inaccuracy was realised prior to the patient undergoing further intervention. We highlight the potential error caused by titanium plates on digital subtraction CT angiography and recommend careful analysis of such images prior to further treatment.

BACKGROUND

Popliteal artery dissection is a rare but potential complication of high tibial osteotomy.^{1–3} Digital subtraction CT angiography is the current gold standard technique for assessing the anatomy and integrity of vessels.⁴ Arterial contrast is administered and precontrast images are subtracted from postcontrast images, generating images of the vascular tree in isolation. Both the imaging and the subtraction processes are subject to potential errors caused by interference from regional metal, such as arterial clips.⁵

CASE PRESENTATION

We present a previously fit and well 40-year-old lady who underwent a medial opening wedge high tibial osteotomy for medial compartment osteoarthritis of her left knee. A titanium plate was utilised for osteotomy stability. A femoral nerve block was given for postoperative pain control. Approximately 12 h following her operation, potentially correlating to a cessation in the function of the femoral nerve block, she developed severe leg pain not relieved by intravenous morphine, removal of circular dressings or elevation. Clinical examination revealed tense musculature in the lateral and posterior compartments, a cool foot with a capillary refill time of 4 s and pain aggravated by passive muscle stretch of her peroneals and flexor digitorum longus. A diagnosis of compartment syndrome was made. The delayed capillary refill time (normal <2) was at the time thought to be because of the increased compartmental pressure compromising arterial flow to the foot. She underwent emergency fasciotomies of all four compartments of her left leg. This demonstrated an

increase in pressure in her lateral and deep posterior compartments. Her pain resolved immediately postoperatively. A few hours later she developed further excruciating pain with a persistently cool foot, capillary refill time of 4 s and a weak posterior tibial pulse detectable on Doppler ultrasound only. Concern was that this presentation could represent an ischaemic foot secondary to posterior tibial artery injury during the high tibial osteotomy (a rare but recognised complication for this procedure), rather than purely compartment syndrome from postoperative swelling. The delayed capillary refill and poor pulses would in this scenario represent a decreased flow of blood to the foot occurring through small tributaries bypassing the occluded/transected artery. An emergency digital subtraction CT angiogram was performed to investigate this potential diagnosis. Initial coronal images appeared to confirm a dissection through the popliteal artery at the level of the osteotomy (figure 1). Only when the axial images were examined it was deduced that the artery was in fact intact and only missing from the digital subtraction images (figures 2–4). If this had not been realised the patient would have undergone unnecessary emergency vascular surgery. She instead underwent operative reassessment of her fasciotomies, checking for adequate decompression of the entirety of

Figure 1 Coronal digital subtraction CT angiogram demonstrating apparent popliteal artery dissection.

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Figure 2 Axial CT angiogram proximal to the tibial plate demonstrating the popliteal artery.

all compartments. Her fasciotomies were deemed to be satisfactory with full decompression achieved and no further operative intervention was carried out.

INVESTIGATIONS

Digital subtraction CT angiography.

DIFFERENTIAL DIAGNOSIS

1. Popliteal artery transection secondary to osteotomy cut.
2. Popliteal artery thrombus secondary to localised trauma from the osteotomy.
3. Ongoing compartment syndrome secondary to inadequate fasciotomies.

OUTCOME AND FOLLOW-UP

The patient's severe pain decreased the same day following the assessment of her fasciotomies. Pain continued to be an issue relating to both her osteotomy and her fasciotomy sites. Her

inpatient stay was extended to 1 week to accommodate recovery from her initial tibial osteotomy, delayed fasciotomy closure and pain control. She required no further invasive investigations or operative intervention. She did not experience any long-term neurovascular complications and returned to full mobility. Her clinical picture was ascribed as likely to have been secondary to compartment syndrome, potentially initially masked by her femoral nerve block.

DISCUSSION

Vascular injuries during high tibial osteotomies are a rare but recognised complication. Case reports have been published of damage to the popliteal artery from the osteotomy cut and the anterior tibial artery from soft tissue retraction, the latter of which appears more common.⁶ Compartment syndrome is also a recognised complication of high tibial osteotomy.⁷ Virtually all postoperative analgesic modalities, including regional anaesthesia, have been linked to a delay in clinical diagnosis of compartment syndrome, but without high level evidence. A systemic review by Mar *et al*⁸ did not demonstrate any significant evidence that regional blockade of single nerves has been shown to delay the diagnosis of compartment syndrome, but acknowledged that multineve blockade, such as three-in-one blocks, may have delayed the diagnosis in isolated lower limb cases. The patient in question developed acute rapid pain 12 h postoperatively which could coincide with her femoral nerve block wearing off.

Artefact can occur on angiograms secondary to the presence of regional metal. Metallic aneurysm clip artefact is widely reported in the literature.⁹ Titanium is reported to produce the lowest levels of artefact. Digital subtraction CT angiography is reported as the gold standard form of vessel imaging for reducing artefact inaccuracies.¹ While titanium plates and screws used for the internal fixation of bones induce artefact on CT and MRI, no reports exist on their effects on angiography. We believe this to be the first case reported in the literature where a titanium plate has affected a digital subtraction CT angiogram with potentially significant effects to the patient.

Figure 3 Axial CT angiogram at the level of the tibial plate with the popliteal artery obscured by artefact.

Figure 4 Axial CT angiogram distal to the tibial plate demonstrating the popliteal artery.

Learning points

- ▶ Artefact from titanium plates may interfere with the subtraction process in digital CT angiography; therefore, care must be taken when interpreting such images.
- ▶ Compartment syndrome is a recognised complication of high tibial osteotomy and a high index of clinical suspicion needs to be maintained especially in the presence of regional anaesthesia.
- ▶ Though this patient did not sustain a vascular injury, cases have been reported following high tibial osteotomy and should be considered in the presence of atypical postoperative symptoms.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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