

# Critical ischaemia following endovascular instrumentation: resolution with general anaesthetic

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## Abstract

Critical ischaemia of the lower limb secondary to occlusion of the puncture site vessel is an unusual but well-recognized complication of endovascular intervention. We present two patients who developed such a complication. In each case, the initial treatment plan was to perform an emergency thrombectomy. However, both cases were found to resolve dramatically with the administration of isoflurane and fentanyl anaesthetic agents.

## Keywords

Arteries; interventional procedures; anaesthesia; complications.

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## Case report

### Patient 1

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A 61-year-old woman with a 10-year history of bilateral intermittent claudication was admitted for aortic stenting, having had an aortic angioplasty that had not relieved her symptoms 2 months earlier.

The stenting procedure was uneventful. Entry was made through a right groin puncture with a 10-F sheath. No resting pressure gradient was measured across the aorta, but a gradient of 24 mmHg across the stenosis was recorded after papaverine administration. A 16 mm, 5 cm Wallstent was therefore deployed and dilated to 14 mm. The gradient fell to 10 mmHg with a systolic pressure of 140 mmHg.

At the end of the procedure, the patient developed symptoms of critical ischaemia of the right lower limb. Examination revealed a cold, white limb with no palpable pulses. Intra-arterial digital subtraction angiography (IADSA) showed occlusion of the right common femoral and external iliac arteries (Figs 1, 2). She was taken to theatre 90 min later with a view to exploration and repair of the common femoral artery. She received an isoflurane general anaesthetic with fentanyl as the induction agent. When the patient was examined in theatre, the limb was found to be fully perfused with palpable pulses.

### Patient 2

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An 80-year-old gentleman was referred to the vascular team after developing a false aneurysm of the popliteal artery as a complication of a total knee replacement. The presence of the aneurysm was confirmed by ultrasound imaging and angiography.

The pseudo-aneurysm was treated by an ultrasound-guided injection of thrombin into the pseudo-aneurysm. After the procedure, patency of the popliteal artery was confirmed with duplex ultrasound. However, shortly afterwards the patient showed signs of a critically ischaemic limb, with no palpable pulses below the femoral pulse. The patient

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**Fig. 1.** IADSA of the abdominal aorta shows a distal aortic plaque with hyper-trophied lumbar arteries superior to it.

was taken to theatre 1h later and again given isoflurane with fentanyl in the anaesthetic room. Immediately after induction the limb was found to be fully perfused with easily palpable pulses and no vascular deficit.

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**Fig. 2.** IADSA after stenting shows a good result in the aorta but acute occlusion of the right external iliac and common femoral arteries.

## Discussion

Arterial spasm has been recognized as a cause of critical ischaemia since the days of Hunter.<sup>[1]</sup> This response is believed to be a myogenic reflex to the external forces acting

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on the vessel wall, such as shearing, stretching and puncture, which is independent of innervation.<sup>[2]</sup> Occlusion of the femoral and popliteal arteries following endovascular instrumentation is rare, but more commonly seen with the use of large sheaths, as in the first case. Several mechanisms have been suggested for occlusion, including stripping of thrombus formed on the intra-arterial catheter; distal embolization of thrombus formed at the puncture site; and subintimal dissection of an atherosclerotic plaque with secondary thrombosis.<sup>[3]</sup> However, more recent work has implicated vasospasm as a common culprit.<sup>[4]</sup> This results in flow reduction, which can lead to accelerated platelet aggregation, thrombus formation and occlusion.<sup>[5]</sup>

The same anaesthetic agents were employed for both of these patients. Isoflurane is a volatile anaesthetic known to induce vasodilatation and to modify endothelium-derived nitric oxide production.<sup>[6]</sup> Numerous studies have investigated the role of halogen anaesthetic agents in mediating vascular tone. It has become clear that isoflurane actually inhibits endothelium-dependent vasodilatation, but induces endothelium-independent vasodilatation, possibly through the calcium ionophore A23187.<sup>[7]</sup>

Sudden onset of critical ischaemia of the lower limb is treated as a surgical emergency. Although spontaneous fragmentation of thrombus may have occurred at the time of anaesthetic induction, it seems unlikely. The importance of these cases is the demonstration that when critical ischaemia is due to vasospasm, occlusion of the medium-sized arteries of the lower limb may be reversible with general anaesthesia, foregoing the need for further unnecessary intervention. With the determined increase in the number of endovascular techniques being performed, it is quite probable that these complications will be seen more often.

## Lesson

Occlusion of the puncture site vessel following angiography and/or angioplasty is an uncommon but important complication of endovascular intervention. When this causes critical ischaemia, urgent surgical intervention is generally required, because vessel

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thrombosis is often the underlying pathology. However, these two cases suggest that severe spasm may be the pathogenic mechanism in some cases, and that this may be reversed with the administration of modern anaesthetic agents.

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