

Fracture and Intravascular Migration of a Radial Arterial Catheter: A Case Report

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ABSTRACT

Background: Arterial catheterization is routinely used for continuous blood pressure monitoring in critically ill patients and during major surgical procedures. Although generally considered safe, catheter-related complications such as intra-arterial fracture and migration are rare but potentially serious and may result in digital ischemia or other vascular complications.

Objective: This case report describes an uncommon episode of arterial catheter fracture followed by intravascular migration and discusses the diagnostic and therapeutic approach to this potentially serious complication.

Case Report: A 45-year-old North African Berber man with no significant medical history was admitted following a road traffic accident resulting in severe traumatic brain injury. During the postoperative period, a sudden flattening of the arterial pressure waveform was observed. Examination revealed that the radial arterial catheter had fractured, with no distal tip visible externally. Radiographs and Doppler ultrasonography demonstrated the fractured catheter within the radial artery. Despite the absence of clinical signs of limb ischemia, the patient underwent successful surgical removal by the vascular surgery team. The affected limb had a favorable outcome.

Conclusion: Arterial catheter fracture with intravascular migration is an uncommon but potentially serious complication. Sudden changes in the arterial waveform should prompt immediate assessment of catheter integrity and position. Early imaging and appropriate intervention are essential to prevent vascular compromise and irreversible limb ischemia.

KEYWORDS: Arterial catheterization; catheter fracture; intravascular migration; digital ischemia; vascular complications; Doppler ultrasonography; critical care.

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INTRODUCTION

Arterial catheterization provides continuous and accurate blood pressure monitoring and is particularly valuable in critically ill patients, those with hemodynamic instability, and patients undergoing major surgery with a potential risk of significant blood loss or cardiovascular compromise.

Although complications are uncommon, fracture and intravascular migration of an arterial catheter represent potentially serious events. A retained catheter fragment may impair distal blood flow and lead to thrombosis, ischemia, or tissue necrosis. We report a case of radial arterial catheter fracture with intravascular migration identified through a sudden change in the arterial pressure waveform and subsequently confirmed by radiological investigations.

CASE REPORT

A 45-year-old North African Berber man with no relevant medical history was admitted to the emergency department after a road traffic accident causing severe traumatic brain injury. On initial assessment, his Glasgow Coma Scale score was 7/15, with left-sided anisocoria. Despite the severity of the neurological injury, he remained hemodynamically and respiratory stable.

Initial management included endotracheal intubation following rapid sequence induction, insertion of a right internal jugular central venous catheter, and placement of a left radial arterial catheter for continuous invasive blood pressure monitoring.

Cerebral imaging revealed an acute subdural hematoma measuring 15 mm in thickness with associated midline shift.

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Neurosurgical intervention was indicated. Noradrenaline was initiated to optimize hemodynamic stability, and mannitol was administered at 1 g/kg for osmotherapy. The patient was subsequently transferred to the operating room for hematoma evacuation and decompressive craniectomy. The procedure was completed without complications, and the patient was admitted to the intensive care unit.

Postoperatively, the patient remained deeply sedated with midazolam and fentanyl, required noradrenaline for hemodynamic support, and was maintained on invasive mechanical ventilation.

On the first postoperative day, a sudden flattening of the arterial pressure waveform was noted. Inspection of the radial arterial catheter revealed that it had been severed, with no distal catheter tip visible. The patient remained asymptomatic, and examination of the affected limb showed no clinical evidence of digital ischemia.

Plain radiographs of the wrist and forearm, obtained in anteroposterior and lateral views, demonstrated the catheter and its trajectory. Doppler arterial ultrasonography subsequently confirmed the intravascular position of the catheter and allowed localization of the proximal tip.

The patient was referred to the vascular surgery team, who performed surgical removal of the retained catheter fragment. The postoperative evolution of the affected limb was favorable. A multidisciplinary discussion involving intensivists, vascular surgeons, and neurosurgeons was conducted to assess the risks and benefits of anticoagulation. Given the high risk of intracranial hemorrhage, anticoagulation with heparin was not initiated.

DISCUSSION

Arterial catheterization is an essential component of monitoring in critically ill patients and those undergoing major surgery. Despite its widespread use and generally favorable safety profile, invasive arterial monitoring can be associated with mechanical and vascular complications. Catheter fracture followed by intravascular migration is particularly uncommon but may result in significant vascular compromise, including digital ischemia and tissue necrosis.

Causes and Mechanisms

Several mechanisms can contribute to arterial catheter malfunction, including arterial spasm, mechanical obstruction, thrombus formation, or catheter tip occlusion. Intravascular catheter fracture occurs when the catheter is disrupted within the artery, with subsequent migration of the retained fragment.

Potential contributing factors include excessive patient movement, external mechanical forces, trauma, and repeated mechanical stress during catheter insertion or manipulation. In the present case, catheter fracture and migration were considered most likely related to hand movements during the immediate postoperative period.

The principal concern following intravascular migration is distal arterial obstruction. A retained fragment may

compromise blood flow directly or promote local thrombosis, potentially resulting in digital ischemia and, in severe cases, tissue necrosis.

Diagnosis and Management

Catheter fracture should be suspected when there is an unexplained loss or flattening of the arterial pressure waveform, particularly when blood reflux is absent during catheter flushing. Once catheter fracture is suspected, prompt imaging is required to determine the location of the retained fragment.

Plain radiographs of the wrist and forearm can provide rapid identification of the catheter and its trajectory. Doppler ultrasonography can further confirm its intravascular location, assess arterial blood flow, and help identify the position of the catheter tip.

In this case, both radiography and Doppler ultrasonography confirmed the presence and location of the retained catheter fragment. Although the patient had no clinical signs of ischemia, early removal was considered necessary to prevent potential vascular complications. Surgical extraction was successfully performed by the vascular surgery team.

Endovascular retrieval may represent an alternative in selected cases, depending on the catheter location, vascular anatomy, and available expertise. The optimal approach should be individualized according to the clinical and anatomical circumstances.

Prevention and Monitoring

Prevention requires careful catheter insertion, secure fixation, and regular inspection of the catheter and insertion site. Particular attention should be paid to catheter integrity during patient repositioning, transfer, and postoperative care.

Continuous observation of the arterial pressure waveform is also essential. Any sudden flattening or loss of the waveform should prompt immediate investigation for catheter obstruction, dislodgement, fracture, or migration. Minimizing excessive external forces and uncontrolled limb movements may further reduce the risk of mechanical catheter damage.

Clinical Significance

This case emphasizes the importance of maintaining vigilance when using invasive arterial monitoring. Although catheter fracture with intravascular migration is rare, delayed recognition may result in irreversible ischemia, tissue necrosis, or even limb loss.

Early recognition of abnormal arterial waveforms, followed by prompt radiological assessment, allows timely diagnosis and appropriate management. Involvement of vascular surgeons is particularly important when a retained catheter fragment is identified.

The management of this patient also illustrates the importance of multidisciplinary decision-making. The high risk of intracranial bleeding in the context of acute traumatic brain injury influenced the decision to avoid anticoagulation, despite the presence of an intravascular foreign body.

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CONCLUSION

Fracture and intravascular migration of an arterial catheter is a rare but potentially serious complication of invasive hemodynamic monitoring. Sudden changes in the arterial pressure waveform should prompt immediate assessment of catheter integrity and position.

Early radiological evaluation, particularly using plain radiography and Doppler ultrasonography, can facilitate rapid diagnosis and guide treatment. When intravascular migration is confirmed, prompt removal should be considered to prevent vascular compromise and irreversible ischemic injury. Careful catheter fixation, monitoring, and handling, together with multidisciplinary management, are essential to minimize complications and achieve favorable outcomes.

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