An Iatrogenic Complication of Radial Artery Cannulation

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Received: May 25, 2009
Revised: Oct 5, 2009
Accepted: Oct 9, 2009

KEY WORDS: catheters, indwelling; tomography, X-ray computed

1. Introduction

Arterial cannulation is a useful way of establishing continuous monitoring of blood pressure. In addition, arterial cannulation allows reliable access to the arterial circulation for the measurement of arterial oxygenation and for frequent blood sampling. Major complications related to arterial cannulation occur in fewer than 1% of patients, and the rates or probabilities are similar for the radial, femoral and axillary arteries. Common complications of arterial lines include ischemic damage, sepsis, local infection, pseudoaneurysm, hematoma, and bleeding. We report an iatrogenic complication of accidental transection of arterial catheter which required radiologic and surgical intervention.

2. Case Report

A 73-year-old man with a medical history of hypertension and diabetes mellitus received Hartmann’s procedure due to ischemic bowel disease 6 months previously. He was admitted to our hospital for closure of the colostomy. A 20-gauge arterial cannula (Terumo Corporation, Binan, Laguna, Philippines) was inserted into the right radial artery for continuous arterial pressure monitoring. It was secured to the skin with Tegaderm transparent dressing (3M Health Care, St Paul, MN, USA). The takedown of Fend colostomy and restorative coloanal anastomosis T-end colostomy were performed under general anesthesia. After completion of the operation, he was transferred to the postanesthesia room for close observation.

One hour later, when continuous arterial pressure monitoring was no longer required, the postanesthesia room nursing staff were instructed to remove the arterial line. While trying to remove the arterial line, the patient’s hand suddenly moved. After the arterial line was removed, a nurse used gauze to compress the wound immediately, and another nurse helped to check the integrity of the removed object. However, it was found that the
removed arterial catheter was shortened with a length of only about 0.5 cm attached to its hub. We had never encountered this situation before in our hospital. A broken arterial catheter was suspected and the broken piece was supposed to be lost in the vessel. There was no active bleeding from the puncture site. The peripheral circulation of the patient’s right hand was checked and no untoward findings were found. His right hand appeared pink and warm. The radial pulsation was intact. There was no catheter-like object found when we palpated his right wrist. After consultation with the radiologist on duty, an emergency computed tomography (CT) was performed, which revealed a 4.5 cm radio-opaque fractured fragment of the catheter anchored in the volar aspect of the distal radius (Figure 1).

The patient and his family were informed of the incident and the retained fractured fragment in the body. He was reviewed by the plastic surgeon on duty that night, and was advised to undergo immediate surgical exploration under local anesthesia, to which he consented. The retained catheter fragment was removed by radial artery cutdown and the wound was closed in layers (Figure 2A). He was followed-up 4 weeks later, which showed that the wound had healed well. There were no residual sequelae.

3. Discussion

The complications of arterial cannulation have been comprehensively reviewed.\textsuperscript{2–4} Cannula loss to vessels after arterial (venous) cannulation has previously been reported, but rarely. Similar cases were reported by Shah et al\textsuperscript{5} in 1996, Mayne and Kharwar\textsuperscript{6} in 1997, Ho et al\textsuperscript{7} in 2003, and Ferguson et al\textsuperscript{8} in 2005.

Although cannula loss in the body is a very rare complication, it is important to find where the broken piece is when it does occur. Mayne and Kharwar\textsuperscript{6} and Ferguson et al\textsuperscript{8} used radiographs of the wrist to show the presence of a broken catheter in the radial artery. Shah et al\textsuperscript{5} and Ho et al\textsuperscript{7} undertook surgical exploration without imaging proof. Ball et al\textsuperscript{9} suggested that real-time ultrasound imaging might be helpful by allowing rapid localization of the intraluminal arterial foreign body before surgical removal. Moody et al\textsuperscript{10} used ultrasound to guide localization and removal of a retained arterial cannula fragment. Application of ultrasound is advantageous because it is real-time, inexpensive, and does not expose the patient to radiation. However, in our case, the arterial catheter transection happened

![Figure 1](image1.png)  
**Figure 1** Three-dimensional reconstructed computed tomography image of the patient’s right hand shows a radio-opaque retained arterial catheter in the volar aspect of the distal radius.

![Figure 2](image2.png)  
**Figure 2** (A) The retained arterial cannula after removal by surgical exploration. The proximal part of the arterial cannula is also shown. (B) Inspection of the proximal fragments showed clean edges.
at midnight, and we could not carry out ultrasonography ourselves because we did not have an ultrasonograph at hand. After consultation with the radiologist on duty, emergency CT was performed. The broken fragment of cannula was confirmed to be in the body, and its location was clearly displayed on CT.

CT, especially three-dimensional reconstructed CT, is a useful tool for identifying intravascular foreign bodies. We had tried to use C-arm during surgical exploration to see if it could be a useful tool to show the presence of the retained catheter, but it was not. Neither anteroposterior nor lateral view could show the retained arterial catheter. It was difficult to find the presence of the retained catheter by C-arm. We did not perform a common X-ray, so we do not know whether the retained arterial catheter fragment could have been visualized on X-ray. Mayne and Kharwar\(^6\) attempted to view a broken arterial catheter fragment in the distal radial artery by X-ray of the wrist (lateral view). However, the image\(^6\) showed only a hazy linear material, which was not very clear. In contrast to radiography, the image on CT was very clear. To the best of our knowledge, there is no precedent of using three-dimensional CT for diagnosis and localization of a retained arterial cannula fragment in the peripheral artery, although Colacchio et al\(^11\) used CT to locate an intra-aortic foreign body. Takada et al\(^12\) suggested that three-dimensional CT is a useful tool for the diagnosis of an ingested foreign body. We suggest that CT is a useful alternative tool to recognize an intravascular foreign body.

Grave consequences might have occurred if our nursing staff had been unaware that the arterial cannula had broken, with the proximal fragment retained in the radial artery. It is important to check the removed arterial cannula carefully. Egwu and Sadr\(^13\) reported a broken arterial cannula that was retained in the patient’s radial artery for 4 weeks without being discovered. Distal thrombosis and embolization resulting in digital ischemia and subsequent infection might occur if surgical exploration for fragment removal is not performed in time.\(^13,14\) We should always check the integrity of every medical object that is removed from a patient.

The reasons for catheter loss should also be investigated. In Shah et al’s\(^5\) case, the arterial catheter was damaged by the surgical needle while sewing the catheter to the skin. In Mayne and Kharwar’s\(^5\) case, the arterial line was noted to be dislodged and broken while the patient was in the intensive care unit, and the cause of breakage was unknown. In Ho et al’s\(^7\) case, the arterial line was noted to be shortened after they removed it, and the cause of cannula breakage was unknown. In our case, according to the statement of the nursing staff in the post-anesthesia room, the arterial catheter was secured to the skin with Tegaderm transparent dressing together with an adjacent intravenous catheter. The nurse used scissors to cut the tape to separate the intravenous catheter and the arterial catheter. The patient’s hand moved suddenly while she was trying to remove the arterial catheter. Inspection of the proximal fragment showed that the fracture edge was smooth (Figure 2B). Judging by the smooth edge, the arterial catheter is suspected to have been severed accidentally by the scissors. Ferguson et al\(^8\) reported a similar complication of transection of an arterial cannula that resulted from cutting the securing stitch with a stitch cutter. We strongly suggest that scissors or other sharp tools should not be used to remove an arterial line. In addition, an arterial cannula should be taped separately, not taped together with another adjacent object such as an intravenous line. Difficulty in removing an arterial cannula would then be minimized.

Although iatrogenic catheter transection is a rare complication of arterial cannulation, we should always be aware of the possibility of this severe complication.

References