BEDSIDE RETAINED RADIAL ARTERY CATHETER REMOVAL IN A HEMODYNAMICALLY UNSTABLE NEUROCRITICALLY-ILL PATIENT: A CASE REPORT.

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Abstract

Radial artery insertion is a common procedure in intensive care units. We describe a case of a critically-ill 73-year-old man in the neurocritical care unit with a subarachnoid hemorrhage whose radial arterial catheter tip was transected from the main line and was successfully managed with bedside retrieval of the catheter.

Introduction

Radial artery insertion is usually done in the neurocritical care unit (NCCU) for the purposes of blood pressure monitoring and arterial blood sampling. Several complications are known such as temporary occlusion, thrombosis, pseudoaneurysm formation, hematoma formation, abscess, cellulitis, median nerve involvement and air embolism. Retained radial artery catheter is rare but has been reported in literature. Several causes have been mentioned such as accidental transection, repeated catheterization and repeated wrist movements. Several modalities have been mentioned to confirm the location of the arterial catheter as well as different methods to remove the catheter.

We describe a case of a 73-year-old man who presented with aneurysmal subarachnoid hemorrhage due to an anterior communicating aneurysm and underwent aneurysmal clipping. His course was complicated by cardiopulmonary instability. On his first post-operative day, the radial arterial catheter tip on his left wrist was fractured from the main line as it was being removed. He then underwent a bedside vascular exploration and removal of the foreign body. We also present a review and summary of the available literature regarding retained radial catheters and the available modes of image confirmation and options for treatment.

Case

A 73-year-old man was admitted in our Neurosciences critical care unit (NCCU) for an aneurysmal subarachnoid hemorrhage (ASAHI), Hunt and Hess 3, Modified Fischer Scale 3. He underwent aneurysmal clipping after a four vessel angiogram revealed a 3-millimeter irregular and superiorly projecting anterior communicating artery aneurysm. Post-operatively day 1, he was very agitated and his left radial arterial catheter was discontinued due to very poor waveform. As it was being pulled out, the nurse noticed that the long portion of the distal cannula was not there. It was highly suspected that it was still in the vessel. Pulses and perfusion distally were adequate.
stat portable 3-view X-ray of the wrist and hand done visualized a 4cm catheter fragment in the anterolateral soft tissue aspect of the distal forearm proximal to the left wrist (Figure 1). A vascular surgery consult was placed and surgical removal and exploration was planned the following day. His family was informed of the incident and consented for the procedure. On the day of the planned exploration, the patient had acute respiratory failure further complicated by an asystolic event. He was immediately resuscitated and was started on norepinephrine, dopamine, epinephrine to maintain his mean arterial pressure. The surgical procedure was postponed due to hemodynamic instability. Three days after, it was deemed that due to the patient’s continued hemodynamic instability, he was not a good surgical candidate to transport to the operating room. The bedside exploration of the left radial artery and the removal of the distal catheter tip were then done with local anesthesia under ultrasound guidance. The incision was made at the top of the radial artery on the left forearm. The catheter was identified right at the entry site of the radial artery. DeBakey pickups were used to extract the catheter out of the radial artery (Figure 2). The radial artery was found to be thrombosed at that location. Dopplers were performed after the procedure to assure adequate pulses and perfusion distally. The procedure was tolerated well and perfusion was maintained throughout the hospital stay.

Discussion

The radial arterial line for this patient was for strict blood pressure monitoring which is one of the most common reasons for its placement. The reason for the radial artery catheter breakdown in this patient is unclear. Several reasons for this type of breakdown have been reported in the past including accidental transection while separating the arterial line from the intravenous line, possible damage to the catheter sheath due to repeated catheterization attempts, transection while suturing, shearing off of the cannula due to repeated wrist movement postoperatively during recovery, reinsertion of the stylet needle, accidental cutting during suture removal and dressing removal. In our case, our suspicion is that the patient was probably moving his wrist repeatedly during his post-operative agitation. Prompt vascular surgery consult for possible exploration is very important to prevent the possibility of distal embolization and distal migration with thrombosis. There is also a possibility of proximal migration and the use of ultrasound to confirm the location of the catheter preoperatively is recommended. Described by Aslam et al., this proximal migration, although unlikely, may occur because of arterial spasm distally. Several imaging modalities may be used to confirm the location of the retained fragment (Table 1). In this patient, the most rapid way to confirm the imaging late at night was a plain radiograph. With the vascular surgery team...
Table 1
Summary of causes, diagnostic imaging and approach to removal of retained radial artery catheters
(CT = computed tomography, OR = operating room)

<table>
<thead>
<tr>
<th>Source</th>
<th>Patient characteristic</th>
<th>Cause of cannula transection</th>
<th>Diagnostic procedure for confirmation</th>
<th>Consulting service/Procedure for removal</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moon et al.1</td>
<td>69 y.o., Male</td>
<td>Accidental transection by scissors while separating intravenous and arterial catheter</td>
<td>7.5 MHz high-frequency ultrasonography, 3-D CT</td>
<td>Plastic surgery/OR Surgical exploration and removal of fragment by microforceps</td>
<td>Recovered, no residual sequelae</td>
</tr>
<tr>
<td>Lee SY et al.4</td>
<td>69 y.o., Male</td>
<td>Reinsertion may have damaged the catheter sheath, manufacturing defect of angiocatheter is suggested</td>
<td>Wrist CT</td>
<td>Service not mentioned/OR surgical exploration and removal of fragment</td>
<td></td>
</tr>
<tr>
<td>Ho KS et al.6</td>
<td>20 y.o., Female</td>
<td>Repeated wrist movement</td>
<td>Not mentioned</td>
<td>Vascular surgery/OR surgical exploration under local anesthesia</td>
<td>Recovered, no residual sequelae</td>
</tr>
<tr>
<td>Aslam M et al.1</td>
<td>63 y.o., Female</td>
<td>Not mentioned</td>
<td>Ultrasound</td>
<td>Vascular surgery/OR surgical exploration under local anesthesia</td>
<td></td>
</tr>
<tr>
<td>Shah U.S. et al.3</td>
<td>72 y.o., Female</td>
<td>Transected while securing the arterial catheter with suture.</td>
<td>None</td>
<td>Vascular surgery/OR surgical exploration simultaneous with planned indicated surgery</td>
<td></td>
</tr>
<tr>
<td>Bengezi OA et al.7</td>
<td>58 y.o., Male</td>
<td>Hypothesized to be repeated flushing and manipulation created a vulnerable point along the catheter length</td>
<td>Plain X-ray of wrist and hand with ultrasound confirmation pre- and intraoperatively</td>
<td>Vascular surgery/OR surgical exploration with arteriotomy</td>
<td>Excellent flow with good capillary refill in all fingers.</td>
</tr>
<tr>
<td>Kim IS et al.9</td>
<td>74 y.o., Male</td>
<td>Reinsertion of stylet needle through the embedded catheter sheath intraoperatively for pleural decortication</td>
<td>Portable X-ray</td>
<td>Unclear if vascular surgery involved/OR Exploration and removal during scheduled primary surgery</td>
<td>Recovered uneventful</td>
</tr>
<tr>
<td>Moody C et al.10</td>
<td>Unknown elderly</td>
<td>Accidental cutting of the plastic cannula</td>
<td>Ultrasound imaging pre-and intraoperatively</td>
<td>Surgical team involved/OR exploration with arteriotomy and removal of catheter</td>
<td>Recovered uneventful</td>
</tr>
<tr>
<td>Ferguson E et al.11</td>
<td>62 y.o., Male</td>
<td>Accidental cutting of catheter fragment</td>
<td>Portable X-ray</td>
<td>Vascular surgery/OR arteriotomy and removal of catheter</td>
<td>Uneventful</td>
</tr>
<tr>
<td>Mayne D and Kharwar F9</td>
<td>64 y.o., Male</td>
<td>Repeated flexion and extension</td>
<td>Portable X-ray</td>
<td>Unclear if vascular surgery involved/Unclear if OR Exploration and removal or bedside</td>
<td>Uneventful</td>
</tr>
<tr>
<td>Hamid et al.12</td>
<td>Unknown</td>
<td>Accidental transection with dressing removal</td>
<td>Sonosite, X-ray</td>
<td>Percutaneous approach using a snare</td>
<td>Some spasm on angiography however no complications after removal</td>
</tr>
</tbody>
</table>
on board, they were able to perform their bedside ultrasound localization both preoperatively and during the surgery itself. Ideally, patients are taken to the operating room for surgical exploration and removal of the fragment with generally good outcome (Table 1). However that is not always possible as in our case. The patient was hemodynamically unstable and was unable to tolerate repeated position changes even just for transportation. However, as soon as the patient was deemed able to tolerate the surgical exploration at bedside, it was immediately arranged and another ultrasound was performed preoperatively. The procedure was performed in our NCCU.

Retained radial artery catheter is rare but has been reported. Clinicians should be aware of the various mechanisms by which the catheter may be transected so precautions can be observed. Appropriate wrist stabilization, careful suture placement and removal and avoidance of multiple stylet needle reinsertion are the suggested ways to prevent this complication. Prompt confirmation of the location of the retained fragment is indicated with simultaneous vascular surgery consultation for timely exploration and removal. Intraoperative confirmation of the catheter may be needed. If the patient is unable to tolerate transport to the operating room, it is feasible to perform the procedure at bedside. To the authors’ knowledge this is the first report of a bedside surgical exploration for a retained radial arterial catheter in a hemodynamically unstable patient.
References


The key to Lock-up Postoperative Pain

**STEP I**
Initial bolus
Inject 1 ampoule Tramal® 100 mg i.v. or i.m. slowly over 2-3 minutes

**Ways of administration after initial bolus**

- **Infusion**
  - Inject 2 ampoules Tramal®, each 100 mg, in 500 ml of infusion solution.
  - Infusion rate 12-24 mg Tramal®/h (16-20 ml of infusion solution or 30-60 mg/h).
  - Subsequent increments of 26 mg with a lock-out time of 5 minutes.
  - Total daily dose 150 mg to 300 mg; give further doses only if needed.

- **PCA**
  - Usual dose 50 mg or 100 mg 4-6 hours up to a total daily dose of 400 mg (except in special clinical circum-
  - stances where intravenous daily dose up to 600 mg may be administered).
  - Further treatment with Tramal® boluses on demand.

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  - Usual dose 50 mg or 100 mg 4-6 hours up to a total daily dose of 400 mg (except in special clinical circum-
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**STEP III**
Follow-up
- 50 mg 1-2 capsules every 4-6 hours
- 50 mg 20-40 drops every 4-6 hours
- 100 mg 1 suppository every 4-6 hours
- slow release 100 mg, 150 mg, 200 mg 1 tablet every 12 hours

**Loading Dose**
2.5 - 5 mg/kg at wound closure

**Intra-Operative**
An intra-operative loading dose of Tramal® will reduce PONV rates

**Post-Anaesthesia Care Unit**
If intra-operative dose not given then:
BOLUS I.V.
100 mg over 2-3 mins

*If needed further doses of 50 mg up to a total of 200mg (incl. the initial bolus) may be given within the first 60 min.

For patients with localized burning, shooting, stabbing, neuropathic pain.
BRIDION—

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**Predictable and complete reversal**

- 98% of BRIDION patients recovered to a TOF* ratio of 0.9 from reappearance of T₂ within 5 minutes²
- 97% of BRIDION patients recovered to a TOF* ratio of 0.9 from 1 to 2 PTCs † within 5 minutes³

**Rapid reversal**

- BRIDION rapidly reversed patients from reappearance of T₂ ‡ in 1.4 minutes³
- BRIDION rapidly reversed patients from 1 to 2 PTCs † in 2.7 minutes³

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade.¹

**Important safety information**

BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the Intensive Care Unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nondepolarizing neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimacing, or sucking on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The relation to BRIDION was uncertain. In a few individuals, allergic-like reactions (e.g., flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, bronchospasm was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (13%–22%) and transient (<30 minutes) prolongation of the prothrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION; however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or concomitant condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preclinical data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

³ Train-of-four
² Post tetanic counts
† Second twitch

REFERENCES
1. BRIDION Summary of Product Characteristics (SPC).

Please see summary of product characteristics for full prescribing information.
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