Iatrogenic subclavian artery pseudoaneurysm causing airway compromise: Treatment with percutaneous thrombin injection

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Central venous cannulation is a common diagnostic and therapeutic procedure in modern medical practice. Iatrogenic injury to an adjacent major artery during attempted central venous cannulation is an uncommon but potentially lethal complication. If injury leads to pseudoaneurysm formation, complications may arise from mass effect, embolism, or even rupture with continued hemorrhage. Traditional surgical repair of these lesions is often difficult, especially if access within the thorax is required in patients at high risk. We present a case report of successful management of a large subclavian artery pseudoaneurysm with the new approach of percutaneous thrombin injection. (J Vasc Surg 2004;40:371-4.)

Central venous cannulation is a common diagnostic and therapeutic procedure. A rare, yet potentially serious, complication of central venous access is development of a pseudoaneurysm of the subclavian artery after inadvertent puncture of the artery, its subsequent progression, and eventual rupture. Traditional surgical repair of these lesions remains difficult, particularly if access within the thorax is required, and in patients at high risk surgery is often unsuitable. In recent years the management of traumatic or iatrogenic subclavian artery injuries has evolved with the dissemination of endovascular and minimally invasive techniques.

We present the case of a large subclavian artery pseudoaneurysm that caused mediastinal shift and airway compromise. The pseudoaneurysm occurred as a consequence of inadvertent subclavian artery injury during attempted subclavian vein catheterization for hemodialysis access, and was successfully repaired with percutaneous thrombin injection.

CASE REPORT

A 79-year-old woman had acute abdominal sepsis, and underwent emergency laparotomy with sigmoid colectomy and endocolostomy because of a perforated colonic diverticulum with gross fecal peritoneal contamination. She was electively admitted to the intensive care unit for further management.

On postoperative day 1 she showed signs of acute renal dysfunction, further complicated by sepsis and respiratory dysfunction. Established oliguric acute renal dysfunction evolved, and to facilitate renal replacement therapy an attempt was made to insert a central venous dialysis catheter into the left subclavian vein. Vessel access was obtained with standard needle–guide wire technique, overwire dilation of the tract, and triple-lumen catheter placement. At this stage the attending clinician recognized that the catheter had been inadvertently placed in the left subclavian artery. The catheter was immediately removed, and local pressure was applied to the puncture site. This was followed by rapid development of an expansile swelling in the left supraclavicular fossa and a period of profound hypotension. Hemodynamic stability was restored with intravenous fluid resuscitation and subsequent blood transfusion. The mass effect in the left supraclavicular fossa and upper mediastinum was noted to cause significant airway compromise with tracheal deviation. Endotracheal intubation was continued, with increased requirement for both oxygen and pressure support.

Initial ultrasound duplex scans confirmed the presence of a large pseudoaneurysm in the left supraclavicular fossa. A contrast-enhanced computed tomography (CT) scan (Fig 1) demonstrated a large pseudoaneurysm in the upper left side of the chest and neck region, originating from the left subclavian artery distal to the origin of the vertebral artery. This was confirmed on reconstructed 3-dimensional images (Fig 2).

The patient was subsequently transferred to the regional oncology liver unit for further management. At assessment the iatrogenic left subclavian artery pseudoaneurysm was expanding, causing a mass effect and mediastinal shift, compromising the airway and left lung, which required increasing ventilator pressure support. The patient was believed to be at excessively high risk for open surgical exploration, on the basis of age, renal failure, respiratory dysfunction, sepsis, and medical history. Endovascular options were considered, but placement of a covered endoluminal subclavian artery stent, in our judgement, would have necessitated covering the left vertebral artery in the presence of significant ipsilateral internal carotid artery stenosis (>70% on duplex ultrasound scans) and the potential risks of placing the stent in the presence of systemic sepsis. Therefore emergency percutaneous thrombin injection of the left subclavian pseudoaneurysm under
duplex ultrasound control was performed, with injection of 1000 U of human thrombin hemostat (500 U/mL) into the lumen of the false aneurysm. After the injection, complete absence of flow within the lumen of the pseudoaneurysm was noted (Fig 3), without compromise of the left subclavian artery flow, distal arm pulses, or skin perfusion of the left upper limb.

The patient was transferred back to her base hospital intensive care unit, where she underwent an elective surgical tracheostomy to facilitate safe ventilator weaning, and the endotracheal tube was removed on day 10 after the procedure. Recovery was slow but steady, with return of renal function. Follow-up duplex ultrasound scans confirmed normal subclavian flow and exclusion of the thrombosed left subclavian artery pseudoaneurysm at hospital discharge (day 21 post-procedure) and at outpatient review (3 months post-procedure).

DISCUSSION

Various complications of central vein cannulation have been described, including pneumothorax, chylothorax, carotid artery injury, rupture of the superior thyroid artery,
stroke, arteriovenous fistula, pseudoaneurysm, arrhythmia, azygos arch cannulation, diaphragmatic paralysis, nerve injury, ventricular perforation, and cardiac tamponade. Some of these complications are rare, yet potentially fatal, if successful intervention is not possible. Pseudoaneurysm formation of the left subclavian artery is rare in patients undergoing central venepuncture. Complications include enlargement of the pseudoaneurysm with subsequent hemorrhage, arterial thrombosis, compression of the neighboring neurovascular structures, and erosion through the skin with external bleeding. In this patient the cannula was removed when inadvertent arterial placement was identified. Had the catheter had been left in situ, hemorrhage may have been averted, and arterial repair may have been achieved with guide wire exchange to a percutaneous closure device. Alternatively this would also have provided a guide if open surgical repair had been anticipated. However, the decision had to be balanced against the risk for arterial thrombosis or embolism, but generally with an injury involving such a large-caliber catheter specialist advice should be sought before removal. The use of ultrasound guidance is now advocated for routine central vein cannulation, and may well reduce the incidence of inadvertent arterial injury. In this patient the subclavian vein was selected for access by the referring team, influenced by the presence of a pre-existing central venous neck line and the convenience of this access point for possible long-term renal support, and indeed has been widely advocated.

Duplex ultrasound scanning is highly sensitive and specific for accessible arterial injuries, and has no significant adverse effect. Thus it is often useful for rapid bedside assessment, and was used to make the initial diagnosis in this case. Spiral contrast-enhanced CT usually provides rapid appropriate diagnostic images, and the ability to assess the extent of any impingement on surrounding anatomic structures. Angiography not only enables accurate diagnosis, but also opens up a range of endovascular treatment options, such as intraluminal stenting or embolization. In this case CT was performed before transfer of care, and did provide useful information regarding the size and relationship of the pseudoaneurysm to surrounding structures. However, both of these methods require intravascular contrast agents, which are often associated with significant nephrotoxicity, especially if given in the presence of pre-existing renal dysfunction. Renal complications can be limited with careful hydration, use of low doses of contrast agent, and choosing less toxic alternatives.

In our patient the arterial pseudoaneurysm arose from the left subclavian artery, distal to the vertebral artery. Endovascular therapy was technically feasible, and has been reported for treatment of iatrogenic pseudoaneurysm. However, in our patient it was relatively contraindicated in the presence of systemic sepsis syndrome and the need to cover a healthy vertebral artery in the presence of ipsilateral significant carotid stenosis. Our patient was hemodynamically stable, and the location of the pseudoaneurysm enabled safe ultrasound-guided percutaneous access for injection of human thrombin solution. Thrombin injection is most appropriate in patients who are hemodynamically stable with a small pseudoaneurysm; however, as illustrated here, it can also be used to treat larger, symptomatic pseudoaneurysms. There are several risks associated with percutaneous human thrombin injection, most notably embolization and arterial thrombosis, and this has particular concerns in relation to the cerebral circulation. The use of human thrombin reduces the potential risk for prion disease transfer; furthermore, use of autologous thrombin obviates this risk and that of allergy. In our patient with recovering acute renal dysfunction, duplex ultrasound scanning was believed to be most appropriate for follow-up imaging, and demonstrated thrombosis of the pseudoan-
eurysm immediately, and near complete resolution of the thrombus after 3 months.

In conclusion, injection of percutaneous thrombin into an iatrogenic pseudoaneurysm of the left subclavian artery under duplex ultrasound guidance is an alternative technique to open or endovascular repair, yielding satisfactory results even in emergency situations.

REFERENCES


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