CASE REPORT

Percutaneous Thrombin Injection: An Alternative Therapy for Iatrogenic Carotid Artery Pseudoaneurysms

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Introduction: Carotid artery pseudoaneurysm is a rare but potentially morbid complication of central venous catheter insertion. Traditionally managed by open surgical or endovascular repair, this article describes a case that used percutaneous thrombin injection. Delivered at the point of care under ultrasound guidance, it offers a less invasive and less resource dependent approach where conventional therapies are unsuccessful.

Case report: A 63 year old man re-presented to hospital with a right common carotid artery pseudoaneurysm following internal jugular vein catheterisation for a staged transcatheter aortic valve implantation. An attempt was made at coil occlusion by the neuro-interventional radiology team, but this was unsuccessful given inability to pass a delivery catheter to the pseudoaneurysm tract in the setting of a tortuous and calcified proximal circulation. Subsequently, direct percutaneous thrombin injection, administered under ultrasound guidance was undertaken as an alternative approach. Complete thrombosis was achieved with no complications and the patient was discharged on day three of admission.

Discussion: While percutaneous thrombin injection is commonly used in the treatment of femoral pseudoaneurysms, there remains a paucity of evidence regarding its use in the management of carotid pseudoaneurysms. This case demonstrates its effectiveness in treating this complication. Percutaneous thrombin injection may offer a highly effective treatment option for carotid pseudoaneurysm, particularly where more conventional therapies have been unsuccessful or are relatively contraindicated.

Keywords: Carotid pseudoaneurysm, Thrombin injection

INTRODUCTION

Carotid artery pseudoaneurysms (CAPs) are a rare but potentially morbid complication of central venous catheter insertion.1 There is a paucity of literature detailing CAP complicating internal jugular vein (IJV) catheterisation, with a limited number of case reports. Typical treatment options for iatrogenic CAP include either an endovascular or open surgical approach.2 With the informed consent of the patient, this report outlines the case of a patient who developed a right common carotid pseudoaneurysm following IJV catheterisation treated successfully by percutaneous thrombin injection.
Percutaneous Thrombin Injection

**DISCUSSION**

CAPs commonly present with a painful, pulsatile neck mass, as in this case, but can also present with symptoms of stroke. If left untreated, complications such as enlargement, thrombosis, embolisation, and rupture can occur. In the present case, after an unsuccessful attempt at coil embolisation, a decision was made to treat by percutaneous thrombin injection under US guidance in favour of a covered stent, given the multiple previous arterial site canulations and tortuous anatomy.

Since its introduction, percutaneous thrombin injection has demonstrated superior outcomes vs. mechanical compression in treating iatrogenic femoral artery pseudoaneurysms. The major complication associated with thrombin injection is distal thrombus embolisation. Other less common potential risks include anaphylaxis secondary to bovine thrombin and infection (abscess formation and skin cellulitis). The risk of distal embolisation, occurring in approximately 2% of cases when treating femoral pseudoaneurysms, can be reduced with distal protection devices (including balloon occlusion) and by employing an optimal technique and minimising the thrombin volume. A neuroprotective device was not used in the described case.

Despite the favorable outcomes of percutaneous thrombin injection in treating iatrogenic peripheral pseudoaneurysms, there is a paucity of literature documenting successful treatment of CAP with this method. Of the five available case reports (Table 1), all CAPs developing after carotid puncture had been managed initially by direct manual pressure. In all but one case, open surgical repair was contraindicated due to patient comorbidities or hae-modynamic instability and the remaining case had failed to achieve thrombosis after endovascular stent placement. In each case the operator used US guidance when administering thrombin directly into the pseudoaneurysm sac; however, a distal neuroprotection device was only used for three of the procedures. One report noted a 2 mm thrombus had been captured by the protection device during the procedure. Complete thrombosis was achieved in all cases without neurological complication.

The present case supports the safety and efficacy of the modality in treating CAP when administered in a tertiary centre, and highlights the advantages of thrombin injection being less invasive and less resource dependent. It can be delivered timely and efficiently in the critical care setting and is a lower risk alternative in the comorbid patient. The decision to manage the present patient with US guided thrombin injection followed an unsuccessful attempt at coil embolisation. Although this alternative option was supported by the cases discussed above, there are limited published clinical data and certainly no randomised or even observational reports comparing treatment options for CAP. While it is not a risk free procedure, the anatomy of the defect was thought to be favourable for percutaneous thrombin injection. It was felt that a small defect size with a relatively long tract to the carotid artery would be at lower risk of distal embolisation. Separately, there is uncertainty regarding the role of distal protection during thrombin injection (either by balloon occlusion or embolic protection device) to offset procedural stroke risk. While there are case reports to support its use, it is unclear how effective it is against thrombin micro-aggregates. Hopefully, future data will further define both the mandate and effectiveness of its use. Regardless, it was decided to proceed with thrombin therapy for the present patient without distal or proximal protection. Although considered, given multiple recent radial and bilateral femoral arterial punctures for both PCI and TAVR access, it was felt that the added risk of a repeated arterial site canulation would potentially offset any clinical benefit of a distal neuroprotection device. Additionally, the risk of embolisation was thought to be lower due to a small defect size with long neck (Fig. 1A and C). This balanced decision was particularly reinforced by the operator’s very significant experience with US guided textual content.
thrombin injection in treating iatrogenic femoral pseudoaneurysms with a well established institutional protocol and technique associated with high procedural efficacy and safety. Intra-procedural neurological monitoring such as transcranial Doppler may be considered as it offers real time assessment and allows for early detection of microemboli and cerebral hypoperfusion.

In the years following this case, TAVR programmes have matured with advanced computed tomography guided pre-procedural planning, improved prosthesis technology, and increased clinical experience. Whereas invasive lines were once common practice, the procedure is now done with local anaesthesia and conscious sedation. Although the use of CVCs has fallen, the case highlights thrombin injection as a viable option in the management of CAP after failed conventional approach with coiling and high operative risk.

**Conclusion**

CAP, a rare but potentially morbid complication of CVC insertion, has been traditionally managed by an open surgical or endovascular approach. However, as the present case illustrates, percutaneous thrombin injection may offer a highly effective treatment option with an apparently low

| Case                  | Cause                         | Symptoms                                                     | Treatment                                      | Adjuncts                                           | Outcome                                                                 |
|-----------------------|-------------------------------|--------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------|
| Moller et al.          | IJV catheterisation without US guidance | Arterial puncture recognised immediately 2.3 cm pseudoaneurysm with 8 mm neck | Manual compression (unsuccessful) Thrombin injection (75 units) | A neuroprotective device was not used              | Complete thrombosis was achieved with no neurological complications |
| Holder et al.          | IJV catheterisation without US guidance | Increasing pain, bruising Pulsatile mass noted after 72 h 3.5 cm pseudoaneurysm | US guided compression (unsuccessful) Thrombin injection (250 units) 8.5 mm occlusive balloon positioned at level of pseudoaneurysm neck (inflated for 10 s) | | Complete thrombosis was achieved with no neurological complications |
| Lee et al.             | IJV catheterisation without US guidance | Arterial puncture noticed on routine blood draw Neck swelling at puncture site 5 cm pseudoaneurysm | Manual compression (unsuccessful) Thrombin injection (200 units) 6.5 mm embolic protection device was deployed distal to the pseudoaneurysm neck | | Complete thrombosis was achieved with no neurological complications |
| Randazzo et al.        | Carotid endarterectomy        | A large pulsatile neck mass noted at two week follow up 3 cm pseudoaneurysm with a 1 × 2.3 mm neck | Thrombin injection (125 units) | A neuroprotective device was not used              | Complete thrombosis was achieved with no neurological complications |
| Sablani et al.         | Not described                  | Symptoms not described 6.8 × 6.1 × 4.5 cm pseudoaneurysm | Placement of six coils in the external carotid artery Placement of three covered stents followed by balloon dilatation over two staged procedures Thrombin injection (500 units) Balloon inflation in the right internal carotid artery (inflated for 2 min) | | Complete thrombosis was achieved with no neurological complications |

IJV = internal jugular vein; US = ultrasound.

Table 1. Published case reports of carotid artery pseudoaneurysms managed by percutaneous thrombin injection.

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complication rate particularly where more conventional therapies have been unsuccessful or are relatively contraindicated.

CONFLICT OF INTEREST
None.

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