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ORIGINAL ARTICLE

Cardiologist Operated Ultrasound Guided Thrombin Injection as a Safe and Efficacious First Line Treatment for Iatrogenic Femoral Artery Pseudoaneurysms

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Objectives To assess the efficacy and safety of ultrasound guided thrombin injection (UGTI) as a first line treatment for post arterial cannulation iatrogenic femoral artery pseudoaneurysms (IFAP).

Background IFAPs complicate up to 1% of diagnostic and 8% of interventional cardiac catheterisation procedures. UGTI remains a second line or non-attempted treatment after ultrasound guided manual compression (UGMC) and surgical repair in many centres.

Methods A retrospective review was undertaken of 121 consecutive patients who received UGTI as a first line treatment for IFAPs following cardiac diagnostic, interventional or catheter ablation procedures between 1999 and 2011 at our centre. The mean patient age was 70.7 years and 63% were male. At the time of injection, 89% were on at least one antiplatelet or anticoagulant. Pseudoaneurysms had a mean maximum dimension of 26.7 mm (range 10-122 mm) and 25% were multilobed. UGTI was performed by an interventional cardiologist with a mean bovine thrombin dose of 648 IU (range 50-5000 IU).

Results Primary success, defined as immediate IFAP thrombosis with UGTI, was achieved in 111 (92%) patients. Recurrence occurred in seven patients, three of whom required surgical repair. Multilobed IFAPs had significantly lower primary success rates than unilobed IFAPs (80% vs. 96%, p = 0.016). Antiplatelet and anticoagulant use and IFAP size did not significantly affect outcomes. UGTI was not associated with any serious complications (such as thromboembolism, aneurysm rupture, venous thrombosis or abscess formation).

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Conclusion Interventional cardiologist operated UGTI should be considered as a first line therapy for uncomplicated IFAPs following interventional and diagnostic cardiac procedures. Despite high rates of concomitant antiplatelet and antithrombotic therapy, initial thrombosis rates exceeded 90% and we did not experience serious complications.

Keywords Thrombin • Ultrasonography • Doppler • Duplex • Cardiac Catheterisation • Pseudoaneurysm

Introduction

Pseudoaneurysms are caused by a defect in the layers of the arterial wall, allowing abnormal flow into a localised region contained by either the adventitia or surrounding tissues [1]. The defect is most commonly iatrogenic following endovascular procedures, with a reported incidence of up to 1% following diagnostic angiogram and 8% following therapeutic intervention [1–3], although a significant number of these may be asymptomatic and subclinical. Risk factors for pseudoaneurysm formation include anticoagulation, obesity, large sheath size, suboptimal catheterisation technique, simultaneous catheterisation of artery and vein, arterial hypertension, heavily calcified arteries and haemodialysis [3]. The most serious complication of IFAP is acute rupture and haemodynamic compromise. Other complications include local pain and swelling, overlying skin ischaemia, local infection, compression of nearby structures and distal embolisation [3].

Ultrasound-guided thrombin injection (UGTI) involves percutaneous injection of thrombin directly into the pseudoaneurysmal sac under real-time ultrasound guidance. The reported dose varies from 20 international units (IU) to 4000IU, with a median of 400IU in one recent study [4]. Successful thrombosis can be confirmed immediately with Doppler imaging, and can occur within 5 secs of injection [2]. The procedure can be performed as a day procedure without sedation. Potential serious complications of the procedure include arterial thromboembolism due to leakage of thrombin into the vessel lumen, pseudoaneurysm rupture and venous thrombosis [1]. Other complications include infection and allergic reaction to bovine thrombin [3].

This study examines the efficacy and safety of UGTI in a group of consecutive patients with iatrogenic femoral artery pseudoaneurysms (IFAP) at a single tertiary referral centre.

Patients and Methods

A retrospective review was undertaken of UGTI used to treat IFAPs following cardiac diagnostic and interventional procedures in our department between 1999 and 2011. During this period, there were a total of 42,467 femoral cannulations. Patient details were prospectively entered at the time of injection and additional data was retrospectively obtained from medical records. The project was approved by the South Eastern Sydney Local Health District Human Research Ethics Committee (Northern Sector).

Pseudoaneurysms were diagnosed by colour Doppler ultrasound where there was appropriate clinical suspicion following femoral arterial cannulation. Where a pseudoaneurysm was diagnosed, the artery of origin, size, and number of chambers were specifically noted.

All patients with IFAP larger than 0.5 cm in diameter following endovascular procedures were considered for primary treatment with UGTI. Patients were only excluded if they had a complicated IFAP causing significant compression of surrounding structures, a complicating arteriovenous fistula, an infected IFAP, an extremely large defect, active bleeding, or a rapidly expanding haematoma. Concomitant anticoagulation and antiplatelet therapy was not a contraindication. Similarly, the length and width of the pseudoaneurysmal neck did not prevent UGTI.

Procedures were performed by an interventional cardiologist in the coronary care unit of our department under light sedation with a combination of fentanyl and midazolam. Prior to thrombin injection, pseudoaneurysms were visualised with two-dimensional (2D) ultrasound. The procedure was performed under sterile conditions with colour flow Doppler ultrasound guidance in the transverse plane. Ultrasound was performed with either the Philips L9-3 or Philips C5-1 ultrasound transducers, and images were obtained via either one of the Philips IU 22 xMATRIX, the Philips/ATL HDI 5000, or the Philips/ATL HDI 3000 ultrasound systems.

Thrombin-JMI (King Pharmaceuticals Inc, Bristol UK) bovine thrombin was used in the procedures, at a cost of AUD$162.90 (approximately US$172.70) per vial of 5000 IU. Each vial of 5000 IU was diluted in 5 ml of normal saline, to achieve a resultant concentration of 1000 IU/ml. For each case, the centre of the pseudoaneurysmal sac was initially accessed with a 23-gauge needle and a normal saline-filled 3 cubic centimetre (cc) Luer Lock Tip Syringe (Terumo Medical Corporation, New Jersey USA). Correct placement of the needle was confirmed by the 2D appearance in the transverse projection on ultrasound, withdrawal of arterial blood and with Doppler flow on saline injection into the sac. The needle was left in situ, and thrombin was injected into the pseudoaneurysmal sac by slow push in 0.1 ml (100 IU) aliquots via a 1 cc TB Syringe (Terumo Medical Corporation, New Jersey USA) with 0.01 cc graduations, until thrombosis was confirmed by cessation of Doppler flow. Importantly, we did not inject thrombin adjacent to the pseudoaneurysmal neck. The total dose administered was generally limited to a maximum of 2000 IU based on early publications of technique [5].

A longer, 23 gauge spinal needle was used for deep IFAPs and in a number of obese patients where access to the pseudoaneurysmal sac was difficult. In multilobed IFAPs, the deepest pseudoaneurysmal sac was injected first, followed