Case report

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Occlusion of upper limb artery pseudoaneurysms with US-guided fibrin glue injection: a valid minimally invasive treatment option? Two case reports.

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Abstract

Arterial pseudoaneurysms (PSAs) typically occur after (iatrogenic) damage (i.e., puncture) to the arterial wall and are the most frequent complication following percutaneous interventions.

In this article we report on successful treatments of two iatrogenic PSAs in two patients (87-year-old male; 69-year-old-female) with a brachial (10 x 7 mm; 10 mm-length "neck") and radial (17 x 7 mm; 3 mm-length "neck") artery PSA by US-guided fibrin glue injection (UGFI). Both PSAs were effectively occluded without any complications. To our knowledge this is the first report on successful treatments of upper limb artery PSAs using UGFI, which may represent a valid first-line, minimally invasive treatment option for brachial artery PSA.

Keywords: ultrasound guided treatment; pseudoaneurysm; fibrin glue

Introduction

Arterial pseudoaneurysms (PSAs) typically occur after (iatrogenic) damage (i.e., puncture) to the arterial wall and are the most frequent complication following percutaneous intervention with an incidence ranging between 0.05% and 8.0% [1,2]. In contrast to a true aneurysm, a PSA does not involve all the layers of arterial wall and is connected to the arterial blood flow and pressure of the actual vessel by a so-called "neck", covered by the tunica adventitia and soft tissue [3]. The necessity for treatment of a PSA depends on its size (rupture risk) and any ongoing anticoagulation therapy. In many cases, PSAs with diameters of less than 2 cm undergo spontaneous thrombosis and may safely be managed conservatively by compressive therapy and periodic assessment with duplex ultrasound (DUS) [3,4]. However, PSAs with diameters >2 cm and in patients under anticoagulation require active treatment.

As a first-line treatment, open surgical repair has already been replaced by other, less invasive treatment options, such as US-guided compression therapy (UGCT), US-guided thrombin injection (UGTI), or US-guided fibrin injection (UGFI) [3-5].

While there are several reports and studies on successful minimally invasive treatments of femoral PSAs, to our knowledge, reports on minimally invasive treatment options of PSAs of upper limb arteries are rare. Thus, we present our technique of UGFI and report on successful treatments of a brachial and radial artery PSA in an 87-year-old male and a 69-year-old female, respectively.

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Case report

This study was approved by the institutional Review-Board of Innsbruck (study number: EK Nr. 1085/2022).

Case 1

In May 2021, an 87-year-old male inpatient developed a pulsatile swelling and complained about pain on his right upper arm after percutaneous puncture of the brachial artery during angiography. The patient had a history of coronary artery disease and hypertension. On physical examination, the pulsatile mass demonstrated a systolic bruit on auscultation at the site of the puncture. DUS confirmed the presence of a 10x7 mm PSA originating from the brachial artery, presumably iatrogenic (fig 1a, b). The so-called "neck" of the PSA was 10 mm long, very thin, and kinked.

Case 2

In August 2021, a 69-year-old female inpatient noticed a pulsatile and painful swelling in her wrist region. She had recently been transferred from the intensive care unit to an ordinary ward after a stroke. A subsequent DUS confirmed the diagnosis of a 17x7 mm PSA originating from the radial artery, also presumably iatrogenic after invasive blood pressure measurement (fig 2a, b). The so-called "neck" of the PSA was only 3 mm long, but very thin and kinked.

The technique of UGFI

After approval to the procedure and written informed consent the patients were placed in a stable supine position with the affected arm extended at 90º and the hand positioned supinated on a supporting cushion. Two belts were used to fix the forearm and fingers, respectively. After cleansing, the region was covered with sterile drapes, in order to guarantee strict aseptic conditions. Using a Canon Aplio i800 system (Canon Medical Systems, Tokyo, Japan) with a high-frequency i18LX5 linear or an i22LH8 hockey-stick transducer (including sterile cover and sterile gel) the upper limb artery PSA was punctured directly with a 21G needle under US-real time control, strictly adopting an "in plane" approach (fig 1c, 2c). The tip of the needle was positioned as close as possible to the "neck" of the PSA with subsequent injection of 4 ml fibrin glue (Tisseel Lyo, Baxter AG, Vienna, Austria) under steady compression by the transducer. During injection of the fibrin glue, an immediately occluding clot became obvious within the PSA (fig 1d, 2d). After withdrawal of the needle still under US-control, the PSA was compressed permanently by the transducer for about 10

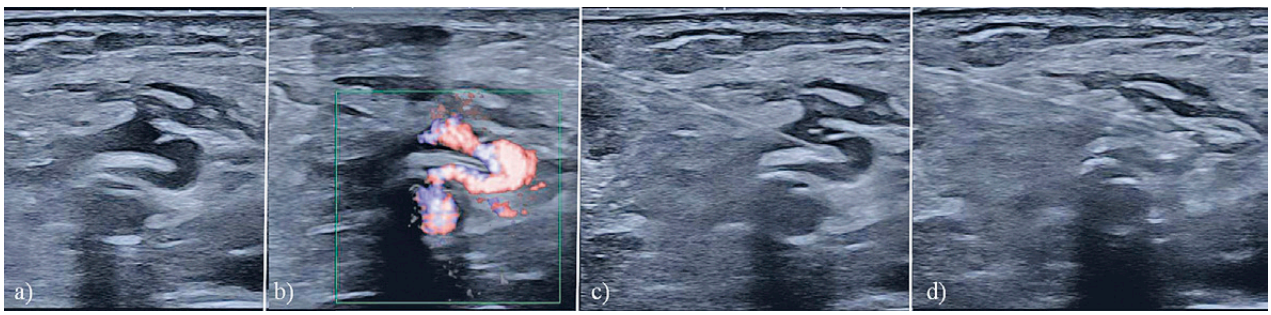

Fig 1. US-guided fibrin injection (UGFI) of an iatrogenic brachial artery pseudoaneurysm (PSA) in an 87-year-old male. Axial view of the 10x7 mm PSA on B-mode (a) and duplex ultrasound (b). US-guided, strictly "in-plane" puncture of the aneurysm sac using a 21G needle with positioning of the needle tip as close as possible to the aneurysm "neck" (c). Injection of fibrin glue with immediately visible occluding clot within the PSA (d).

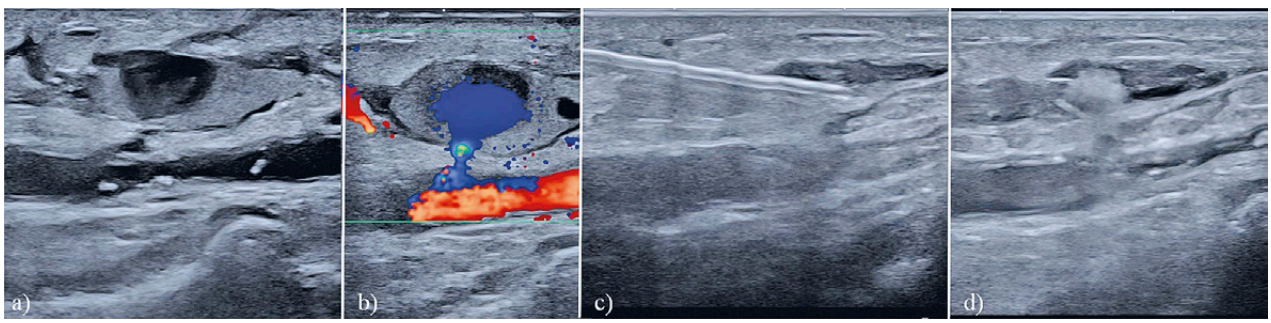

Fig 2. US-guided fibrin injection (UGFI) of an iatrogenic radial artery pseudoaneurysm (PSA) in a 69-year-old female. Longitudinal view of the 17x7 mm PSA on B-mode (a) and duplex ultrasound (b). US-guided, strictly "in-plane" puncture of the aneurysm sac using a 21G needle (d). Injection of fibrin glue with immediately visible occluding clot within the PSA (d).

minutes. Peripheral embolization was excluded by defining an inconspicuous capillary refill time at all fingertips. After the procedure, the patients were transferred back to the ward with a focal compression bandage (applied for 24 hours).

For both patients, successful intervention excluding complications could be confirmed 24 hours later by DUS including superb microvascular imaging (SMI) (fig 3 and 4).

Discussion

The urge for less invasive and thus more convenient treatment options is a general endeavor in medicine, particularly in a steadily aging patient population with increasing comorbidities. This also applies for the treatment of PSAs, where minimally invasive approaches such as UGCT, UGTI or UGFI have replaced open surgery as first-line treatments [1-3].

In fact, in a recently published study, Gummerer et al [3] concluded with UGFI being a safe and effective first-line alternative to open surgery, which consecutively was obsolete in most cases. They reported a primary success rate of 87.3% for UGFI in 55 patients with femoral PSAs and a major complication rate of 4%, consisting of peripheral embolization with subsequent necessity for embolectomy. Although the reported complication rate of 4% is low, the authors clearly stated that the risk of peripheral embolization during treatment with UGFI must not be underestimated. Crucial factors here are the length and width of the aneurysm "neck". Indications for injection of fibrin glue or other thrombogenic substances should be very stringent if the "neck" of a PSA is broad and shorter than 1 cm with an immanent risk of "wash out". However, wwe report on UGFIs of upper limb artery PSAs, which are not comparable to the femoral artery by means of diameter and blood flow as well as the possibility for a more effective focal compression using the transducer during the intervention. Thus, the cut off of 1 cm seems to be too restrictive for minimally invasive treatment of upper limb artery PSAs and we hypothesize it was possible to extend this indication even for shorter "necks"; of course, always under consideration of the risks and benefits.

To our knowledge this is the first report on successful treatments of upper limb artery PSAs using UGFI. A minimally invasive approach, such as UGFI avoids complications related to open surgery under general anesthesia, particularly in patients at high risk of periopera-

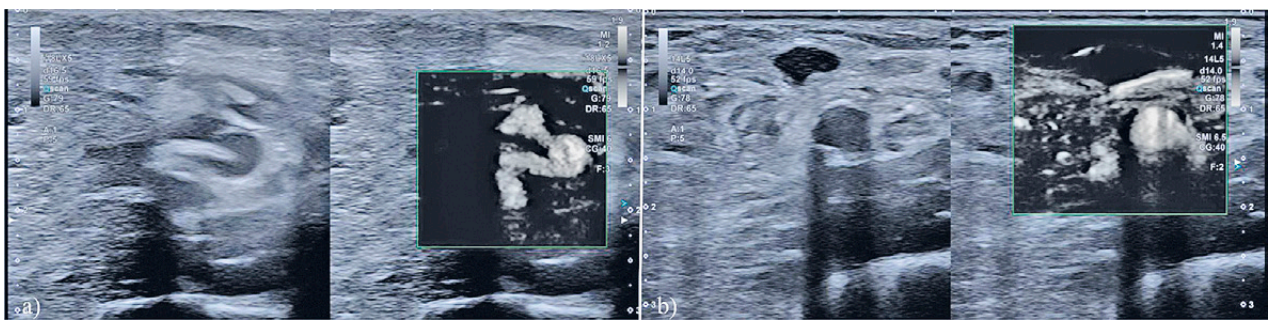

Fig 3. Complete occlusion of the brachial artery pseudoaneurysm (PSA). Axial view with superb microvascular imaging (SMI) before (a) injection of the fibrin glue with visual flow signals in the PSA and the "neck" and after (b) successful intervention with no flow signals within the PSA evident.

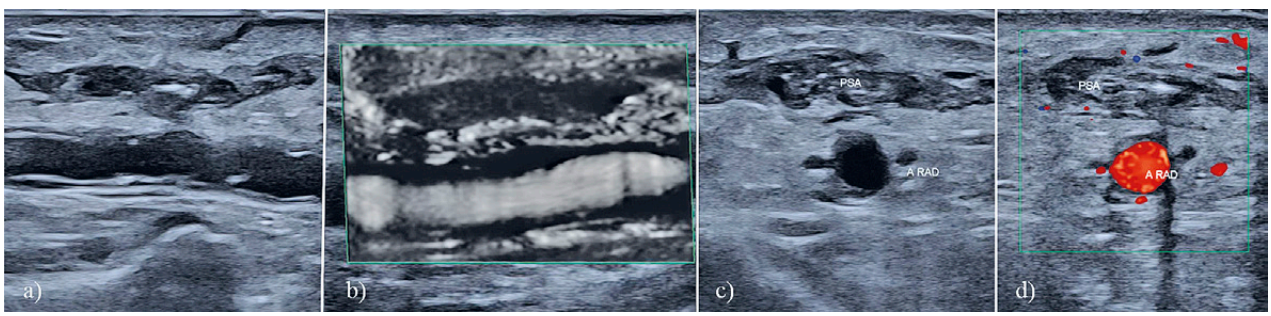

Fig 4. Confirmation of successful intervention with completely occluded radial artery pseudoaneurysm (PSA) excluding complications 24 hours later by duplex ultrasound (DUS). Longitudinal view on B-mode (a) and superb microvascular imaging (b), as well as axial view on B-mode (c) and DUS (d) with confirmation of complete occlusion of the PSA and verification of sufficient blood flow in the radial artery.

tive morbidity/mortality and shortens the length of the hospital stay. Thus, we believe that UGFI may represent a valid first-line, minimally invasive treatment option for upper limb artery PSAs. Further studies for validation are highly desirable.

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