Short Report

Stent-Graft Repair of Iatrogenic Subclavian Artery Pseudoaneurysm with Planned Exclusion of the Vertebral Artery

S. Demirel a,*, C. Winter a, H. Weigand b, G. Gamstätter a

a Department of Vascular Surgery, Wiesbaden City Hospital, University of Johannes – Gutenberg, Mainz, Germany
b Department of Radiology, Wiesbaden City Hospital, University of Johannes – Gutenberg, Mainz, Germany

Submitted 25 April 2008; accepted 1 August 2008

Keywords
Subclavian artery pseudoaneurysm; Overstenting vertebral artery; Covered stent; Iatrogenic injury; Central line placement

Abstract
Iatrogenic subclavian artery pseudoaneurysm is an uncommon complication secondary to central line placement. Therapeutic options include conservative therapy, direct surgical repair and minimal invasive techniques such as endovascular exclusion by covered stents, coiling, transcendent coiling and ultrasound guided percutaneous thrombin injection (UPTI).

We present a case report of subclavian artery pseudoaneurysm as a result of puncture of the internal jugular vein treated by covered stent with planned occlusion of vertebral artery.

Although many publications have addressed the concept of endovascular repair, to the best of our knowledge, planned overstenting the vertebral artery by endograft placement for exclusion of subclavian artery pseudoaneurysm has been described only once previously.

Case report
A 77-year-old woman, suspected of having a pseudoaneurysm of the left subclavian artery, was referred to our department. The patient complained of left sided shoulder pain with subacute onset 5 days after puncture of the left internal jugular vein for placement of a central venous line.

A subsequent CT-scan demonstrated a false aneurysm, measuring 3 × 3.2 cm (Fig. 1), possibly arising from the left subclavian artery. Ultrasound guided percutaneous thrombin injection (UPTI) was considered as primary therapy. This option was contraindicated due to possible bovine allergy of the patient on account of a history of allergic reactions after contact with cattle. Therefore, we decided for endovascular coil embolization. Through right

* Corresponding author. Serdar Demirel, M.D. Dr.-Horst-Schmidt-Kliniken, Ludwig-Erhard-Str. 100, 65199 Wiesbaden, Germany. Tel.: +49 611 432681; fax: +49 611 433138.
E-mail address: serdar.demirel@arcor.de (S. Demirel).

doi:10.1016/j.ejysextra.2008.08.004
femoral approach, the neck of the pseudoaneurysm adjacent to the left vertebral artery could be proved in the angiogram (Fig. 2). However, with the intention of coil embolization, catheterization of the lesion was impossible in spite of repeated attempts. Finally a covered stent-graft placement (7 mm in diameter and 3.7 cm in length; BARD inc., Karlsruhe, Germany) was chosen. The localization of the aneurysmal neck adjacent to the vertebral artery necessitated occlusion of the vertebral artery. Prior to the stent-graft placement patency of the contralateral vertebral artery with a sufficient flow was proved via color duplex ultrasound (CDU). Six months later the patient was free of local and neurologic symptoms. As expected, the angiogram demonstrated a patent stent graft without signs of stent-graft deformation or fracture and a totally occluded vertebral artery (Fig. 3).

Discussion

Injury of the subclavian artery leading to pseudoaneurysm formation is an uncommon complication of central venous line placement. Conservative therapy is rarely indicated due to potential expansion and mass effect on adjacent structures. Conventional surgical therapy requires at least a thoracotomy with extensive dissection to obtain control of the subclavian artery resulting in a relatively high morbidity and mortality.\textsuperscript{1,2}

Minimally invasive therapy includes ultrasound guided percutaneous thrombin injection (UPTI) and endovascular techniques such as coiling, transfemoral coiling and covered endograft placement.\textsuperscript{1–9} UPTI results in immediate pseudoaneurysm thrombosis and its use for treatment of iatrogenic subclavian artery pseudoaneurysm has already been reported.\textsuperscript{3,4} Thrombin is a bovine product that may trigger allergic reactions. Patients with known and possible bovine allergy, as our patient, have to be excluded.\textsuperscript{3} This particular patient revealed a history of contact dermatitis when in contact with cattle, which was suggestive of a possible bovine allergy. On account of that we have decided on endovascular exclusion of the pseudoaneurysm and finally used a stent graft with coverage of the ipsilateral vertebral artery, according to the data concerning the safety of contralateral patency of the vertebral artery.\textsuperscript{10}

Treatment of subclavian artery pseudoaneurysm with covered stents is immediately successful in the most of cases.\textsuperscript{1,2,7–9} The stent graft itself has a notable risk of deformation or fracture due to biomechanical interaction.
as a result of repeated stent flexion and significant dynamic compression of the subclavian artery, in particular, at the lateral portion within the costoclavicular space (between the clavicle and the first rib) during arm abduction.\textsuperscript{11,12} Phipp et al.\textsuperscript{11} reported 3 cases with stent-graft fracture in the subclavian vessels, one arterial and two venous, due to the mechanism as explained above. Sitsen et al.\textsuperscript{12} demonstrated a “cigar-shaped” deformation of a covered stent graft (10 mm × 50 mm self-expandable Corvita Endovascular Graft [CEG], Schneider, Switzerland) with hemodynamically significant stenoses at the proximal and distal ends at 3 months. In this case the authors explain the reason for deformation by oversizing the CEG. However, in the current case no signs of stent-graft deformation or fracture after 6 months were detectable. It is imaginable that the position of the graft at the medial portion of the subclavian artery makes the possibility of fracture due to compression less likely.

A major limitation of covered-stent exclusion is the risk of occlusion of the vertebral artery leading to risk of cerebellar or posterior fossa infarction. The first report demonstrating planned exclusion of the vertebral artery during placement of a covered stent graft following iatrogenic subclavian artery pseudoaneurysm was published by Burbridge et al.\textsuperscript{13} As it was in the current case, no neurologic deficit could be proved in this specific case. Considering the possible neurological consequences Assali et al.\textsuperscript{6} proposed the use of uncovered flexible self-expandable stents with transient coil embolization of the aneurysm cavity to protect side branches. An alternative to transient coil embolization has been reported by Aalami et al.\textsuperscript{14} in the form of a hybrid procedure. In this case an iatrogenic right subclavian artery pseudoaneurysm was excluded by implantation of a covered stent 7 days after transposing the origin of the vertebral artery from the subclavian artery 3 cm distal to the pseudoaneurysm neck. However, Cloft et al.\textsuperscript{10} illustrated that occlusion of the vertebral artery due to dissection in patients with non-compromised blood supply of the contralateral vertebral artery is usually tolerated well without significant risk of neurologic deficit (transient neurologic deficit: 0.55–2.2%; permanent neurologic deficit: 0.1–0.5%). Compromised supply of the contralateral vertebral artery due to stenosis or occlusion may lead to neurologic deficits of the brain stem such as dizziness, fainting, spots before the eyes, and transient diplopia (double vision).\textsuperscript{5} Therefore, ruling out a contralateral insufficiency preinterventionally is mandatory.

Our decision to overstent the vertebral artery was made since other minimally invasive techniques were ruled out due to possible bovine allergy of the patient and failed catheterization of the aneurysm cavity. Under these circumstances planned occlusion of the vertebral artery after verification of contralateral patency seems to be an acceptable option for avoiding open surgery. In addition, stent-graft deformation or fracture is a potential risk with subsequent occlusion of the subclavian artery, which has to be taken into consideration during the follow-up.

**Conflict of interest:**

none.

**Obtained funding:**

none.

**Ethical Approval:**

Approving the report by the ethical committee was not necessary, because no biomedical research involving human subjects has been done.

**References**


