EJVES Extra (2008) **15**, 33–36

SHORT REPORT

Stenting in Zone II Stab Wounds of Carotid Arteries

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Submitted 24 July 2007; accepted 11 March 2008

KEYWORDS
Stenting;
Stab wounds;
Carotid arteries;
Zone II

Abstract We present three cases of endovascular treatment of a cervical Zone II carotid artery pseudoaneurysm and arteriovenous fistulae following stab wounds using covered Wall-graft stents in three male patients. All three were clinically stable with no other associated aerodigestive injuries or neurological deficit. Angiography revealed pseudoaneurysms and arteriovenous fistulae. Under local anaesthesia, using Seldinger technique and femoral approach, a covered Wall graft stent (Boston Scientific) was inserted using the standard endovascular technique. No cerebral protective devices were used in our patients. Patients received aspirin before the procedure. Patients were discharged on aspirin 24 hours later. Patients were followed up with duplex ultra sound at 3, 6 and 9 months intervals, with good patency.

Introduction

Penetrating trauma to the carotid arteries accounts for more than 90% of all carotid injuries. Carotid injuries constitute 5–10% of all arterial injuries.[1] These injuries are classified according to the level of injury. The neck is divided into 3 zones. Zone I refers to the area between the sternal notch and the cricoid cartilage – Zone II is the area between the cricoid and the angle of the mandible; Zone III refers to the area above the angle of the mandible.[2,3] It is accepted practice to image (angiography) injuries in Zone I and Zone III because of the difficulty in surgical exposure.[2,4,5]

It is also recommended that Zone II injuries be explored.[4,6–9] The recommendation stems from the fact that the area is accessible and deemed to be safe. There is limited published experience in the stenting of stab wounds in Zone II.[2] Most published experience in the literature on endovascular stenting of carotid injuries relates to Zone I and III.[10] We present three male patients who were stabbed on the lateral aspect of the neck (Zone II) and treated successfully with endovascular stents for arteriovenous fistulae and pseudoaneurysms. All these patients were haemodynamically stable with no neurological deficit or aerodigestive injuries.

Case 1

A 21 year old male with a stab wound to the neck (Zone II). The patient was reported to have bled significantly at the scene which required a blood transfusion.

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1533-3167
doi:10.1016/j.ejvsextra.2008.03.002

On physical examination the patient had a 2 cm laceration on the left side of the neck Zone II that had already been sutured. He had no expanding haematoma but a palpable thrill. The laboratory values showed a haemoglobin of 7,4 mmol/l (after 2 Units packed cells). The patient had no other organ injuries in the neck. Clinically, the patient had no tracheo-oesophageal injury. Gastrografin swallow showed no injury. The remainder of the examination was unremarkable with no neurological deficit. Given the stable haemodynamic status of the patient, an angiogram was done. This showed an arteriovenous fistula (carotid artery — jugular vein) Fig. 1.

Twenty hours later the patient was taken for endovascular stenting. Fig. 2 shows a post stent result.

Through the femoral approach, using a Seldinger technique, a 7 mm covered Wall graft stent (Boston Scientific) was inserted without any complications. Heparin was used intravenously during the procedure, with clotting time monitored. No cerebral protective device was used during the procedure and no complications were noted. The patient was discharged 2 days later on aspirin. He was reviewed at 3, 6 and 9 months intervals and the duplex Dopplers done showed good patency.

Case 2

A 31 year old male was brought to the casualty department after being stabbed on the neck.

On physical examination he had a 2 cm laceration on the lateral neck that had already been sutured. He had a non expanding haematoma on the injury site. The rest of the examination was unremarkable. Oesophageal injury was excluded clinically and radiologically. The laboratory values were normal. An angiogram was performed which demonstrated a pseudoaneurysm in the common carotid artery and an arteriovenous fistula Fig. 3.

The patient was later taken for endovascular stenting 24 hrs later Fig. 4.

Through the femoral approach using the Seldinger technique, an 8 mm covered Wall stent graft (Boston Scientific) was inserted using routine endovascular technique. There were no complications during the procedure. The patient was discharged 2 days later on aspirin. The patient was followed up to 9 months. The Duplex doppler done showed good patency and there was still no neurological deficit.

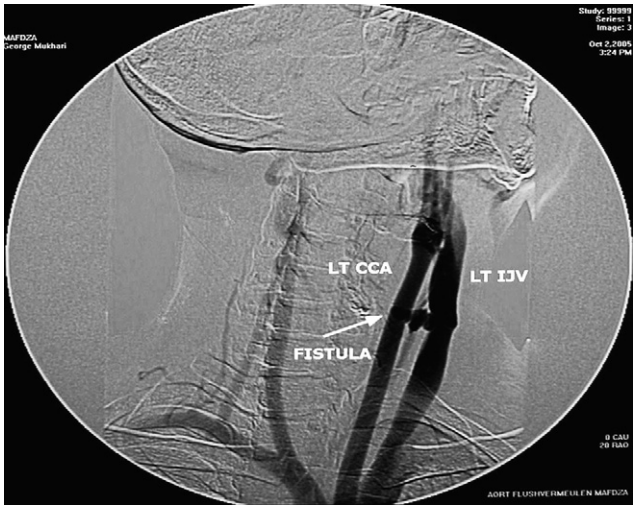

Figure 1 Angiogram showing A-V fistula of (L) carotid artery — jugular vein.

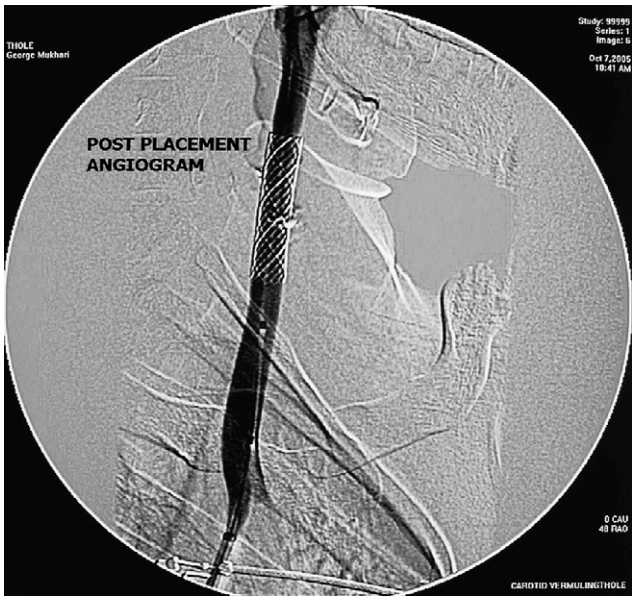

Figure 2 Angiogram showing an endovascular stent in the (L) carotid artery.

Case 3

A 25 year old male stabbed on the neck. The examination revealed a 2 cm laceration on the lateral side of the neck Zone II, with a haematoma and a palpable thrill. An angiogram was performed which showed a pseudoaneurysm (Fig. 5A). Fig. 5B shows intact blood flow into the brain through the opposite carotid artery.

Endovascular stenting was done 48 hours later without any complications and the patient was discharged 24 hours later on aspirin. Fig. 6 shows the post stent angiogram.

Figure 3 Angiogram showing a Pseudoaneurysm of (L) common carotid artery.

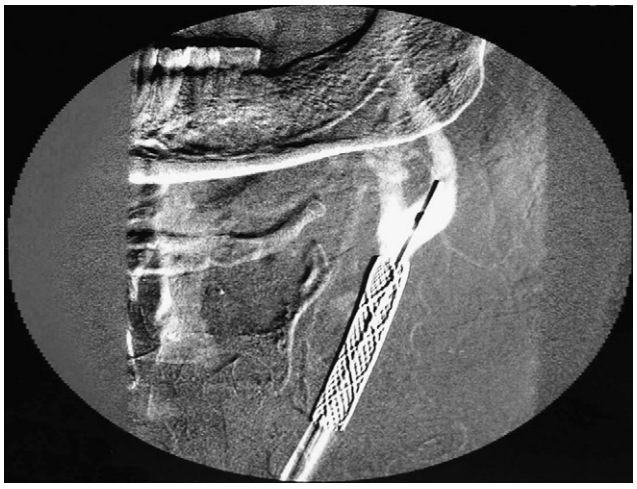

Figure 4 Angiogram showing stent in Zone II carotid artery.

Follow-up at 3, 6 and 9 months intervals showed good patency on ultrasound.

Discussion

The most common cause of carotid injuries is penetrating trauma. Most of the patients are young males. The mortality and morbidity of these injuries remain high despite advances in diagnosis and treatment. Mortality for carotid injuries ranges from 10—31% with permanent neurological deficit ranging from 16—60%.[2,11] Injuries to Zones I and III pose a management difficulty because of limited access.[12] With the advent of endovascular stenting, these injuries tend to be better managed avoiding extensive surgical dissections (with cranial nerve injuries) and long hospital stays.[2,13]

Patients with active bleeding and a compromised airway require immediate exploration, while those who are haemodynamically stable and have a patent airway should undergo further investigation: ie. duplex Doppler and angiography.[1,2,11] Duplex Doppler is recommended for Zone II injuries while angiography is better for Zone I and III injuries.[4,5]

Ultrasound sensitivity in these injuries is reported to be 100%.[3,5,14] Mandatory exploration of all penetrating neck injuries has been replaced by a selective approach in patients with soft signs.[2] Soft signs of arterial injury are: history of severe bleeding, diminished distal pulse, injury of anatomically related structures, small non expanding haematoma, multiple fractures and extensive tissue injury and injury in anatomical areas of major blood vessels.

Mandatory exploration remains necessary in patients with hard signs of arterial injury: active pulsatile bleeding, shock with ongoing bleeding, absent distal pulses, symptoms and signs of acute ischaemia, expanding or pulsating haematoma and bruits or thrill over the area of injury.[4]

Management of carotid injuries in Zone II using endovascular techniques is controversial because it is accessible to open surgery.[12] The controversy stems from the occurrence of possible complications such as distal embolism, in-stent stenosis and stent migration, stent breakage and endoleaks, and the fact that patients are young.[1]

It is known that stents have been used for many years in the treatment of patients with stenosis due to atherosclerosis even though these were older patients. The concern in its widespread usage was the cost and durability especially because patients are young. A study comparing endovascular stenting and open surgery in patients with penetrating vascular injuries in Johannesburg showed costs to favour endovascular treatment.[15] This demonstrated increased complication rate in open surgery.

We did not have any immediate complications in the three patients who were treated with endovascular stents. Our patients did not have associated aerodigestive injuries which also supported the decision to stent. It seems that the problem of the vein was solved after stenting in our patient with an arteriovenous fistula. After nine months the vessels were still patent on ultrasound. Even though our

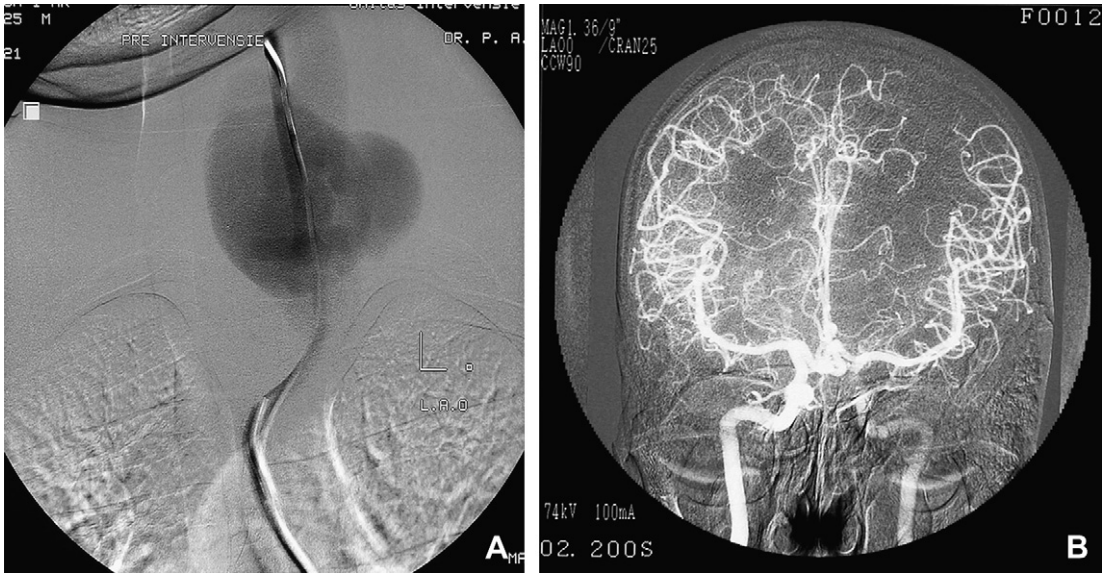

Figure 5 Angiogram showing Pseudoaneurysm (A) after stabwound to the neck. Brain angiogram showing intact flow through the opposite side into the brain (B).

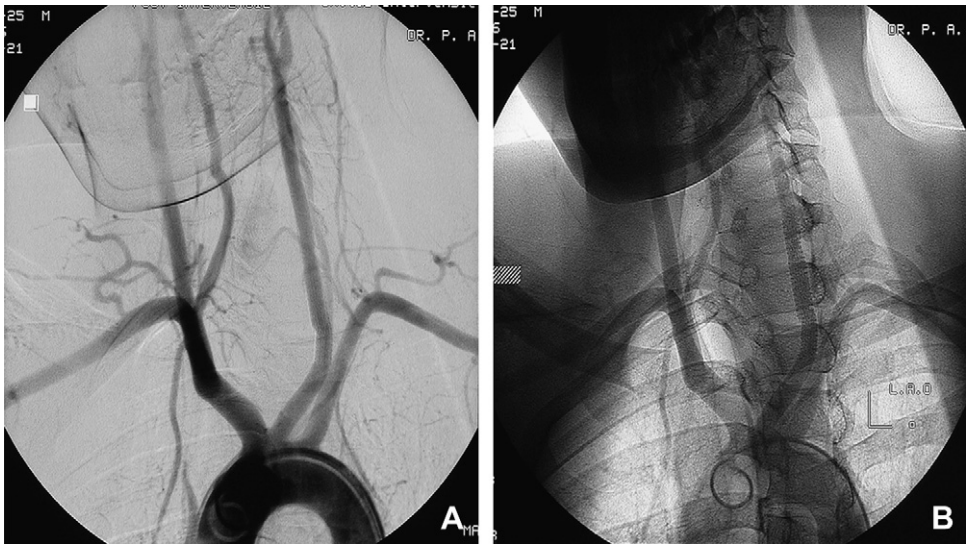

Figure 6 Angiogram showing carotid arteries after stenting.

sample was small, the results yield a promising and encouraging milestone in the treatment of these injuries. This is also supported by results from Schonholz *et al.*[16]

Although the open surgical approach is still the mainstay of therapeutic treatment, the study suggests that minimally invasive management with the utilization of endovascular techniques is a viable option in Zone II carotid injuries in selected patients.

Acknowledgements

A special thank you to Mrs M Howard and Mrs J C Ferreira for typing the manuscript.

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