CASE REPORT

Subclavian Artery Stent Fracture

C E Lee, MRCP*, A Y Shaiful, MMed (Int Med), H Hanif, MS (Vascular)*****

*Department of Medicine, University Malaya Medical Centre, **Department of Cardiology, National Heart Institute (IJN), ***Department of Vascular Surgery, Kuala Lumpur Hospital

SUMMARY

We report a case of a 52 year-old dentist who had stent implantation for a left subclavian artery stenosis. However, this was later complicated by a stent fracture within one week of stent placement. A chest radiograph showed two pieces of the fractured stent, which was confirmed by computed tomographic angiogram (CTA) of the affected artery. We then discuss the occurrence of stent fractures, which are not uncommon but serious complications of endovascular therapy.

KEY WORDS:

Subclavian artery stenosis, Subclavian artery stent, Coronary angiography, Subclavian angiography/ Aortography, Stent fracture, Thoracic Endovascular Repair (TEVAR) Surgery

INTRODUCTION

Endovascular stent implantation is a major tool in the current management of peripheral arterial disease [1,2]. Initial technical success rates are high for supra-aortic artery angioplasty and stenting; however, knowledge of the durability of these devices is limited, and has become a concern following many reports of stent fractures and vessel restenosis [3,4].

The mechanism of fracture has long been felt to be excessive mechanical stress due to extreme contraction and/or flexion of the vessel. A fracture rate of about 15-30% has been reported for stents implanted near pulsatile structures such as the heart or the proximal great vessels. Furthermore, aggressive post-dilatation of a deployed stent may also contribute to the mechanism of stent fracture [5].

The subclavian vessels are exposed to extrinsic compression between the clavicle and the first rib, as well as flexion forces particularly when the arm is abducted. Endovascular stents implanted in the lateral portion of either the subclavian artery or vein are subjected to these mechanical forces and risk structural failure [3].

CASE REPORT

A 52 year-old dentist with Type 2 Diabetes Mellitus and hyperlipidaemia first presented in June 2005 with a Non-ST Elevation Myocardial Infarction (NSTEMI). Blood pressure (BP) was stable 100-120/70-72 mmHg throughout admission, and she was subsequently discharged well. During follow-up, her left radial pulse was noted to be weaker than her right. Her left brachial BP was 90-110/50-70 mmHg, but her right brachial BP was 130-140/80-90 mmHg, documented on four separate occasions. She also started to complain of exertional left arm pain and weakness in November 2007.

Angiography showed a proximal left subclavian artery stenosis close to the ostium, with a rat-tail appearance (Figure 1). Percutaneous transluminal angioplasty (PTA) and stenting of the left subclavian artery was then performed on 11 December 2007, whereby the ostium and proximal left subclavian artery was implanted with a *Genesis* stainless steel stent 7mm x 39mm *(Cordis, J&J)*, at 8-10 atm pressure. Immediate clinical response was excellent, with equal brachial and radial pulses bilaterally. Double anti-platelet agents (aspirin and clopidogrel) were commenced and she was allowed home the next day.

Unfortunately, she returned four days later, complaining of left shoulder and left arm pain, associated with an absent left radial pulse on examination. Left brachial BP was unrecordable while her right brachial BP was 120/90 mmHg. An initial diagnosis of acute subclavian stent thrombosis was made and she was started on an intravenous heparin infusion. Double anti-platelet agents were continued. A chest radiograph showed that the subclavian artery stent had broken into two pieces, hence the diagnosis of a stent fracture.

A computed tomographic angiogram (CTA) of the left subclavian artery on 18 December 2007 revealed a fractured stent and intra-stent thrombosis, with 70% stenosis of the arterial lumen. There was also an associated peri-arterial haematoma and contrast leakage. Conservative medical therapy was planned as she had mild clinical improvement with anti-coagulation and her left brachial BP was later recordable at 120-160/74-100 mmHg. A repeat CTA on 26 December 2007 (Figure 2) showed continued leakage of contrast at the site of the stent fracture, with a larger haematoma; but the distal subclavian and other surrounding arteries were patent.

Left subclavian angiography on 8 January 2008 showed a large 4.9cm left subclavian artery pseudo-aneurysm with the proximal stent fragment embedded within the pseudo-aneurysm. Anti-platelet agents and anti-coagulation were stopped. She was subsequently referred to the Vascular Surgery team, who performed a Thoracic Endovascular Repair (TEVAR) procedure, and thoracic aorta stenting using a *Valiant* aortic nitinol stent 28mm x 150mm *(Medtronic)*. Post-operatively, her left brachial BP was 70-100/42-80 mmHg, while her right brachial BP was 130-160/70-85 mmHg. Aspirin as well as enoxaparin (low-molecular weight heparin)

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Corresponding Author: Lee Chee Eng, Department of Medicine, University Malaya Medical Centre, 50603 Kuala Lumpur, Malaysia
Email: leecheeeng@gmail.com

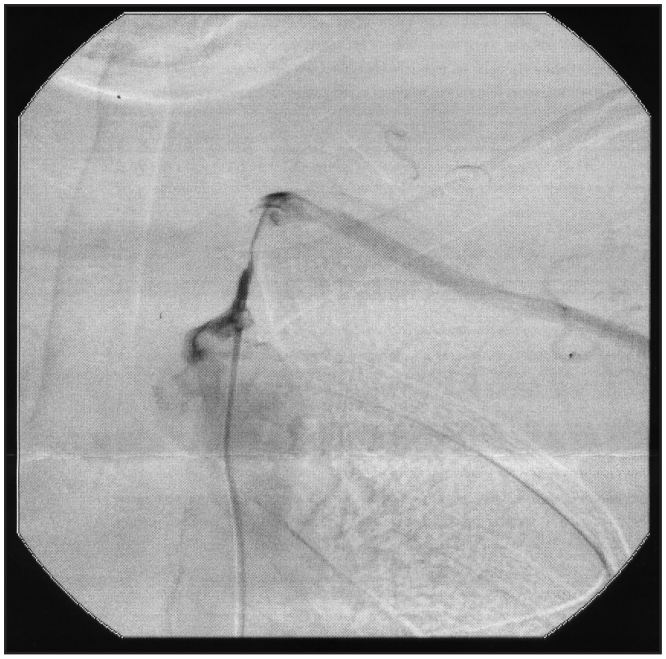

Fig. 1a: Left subclavian angiography showing arterial stenosis at the ostial region, with a rat-tail appearance (Pre-PTA)

Fig. 1b: Left subclavian angiography showing good angiographic outcome following angioplasty and stenting with a Genesis stent 7mm x 39mm at the proximal left subclavian artery

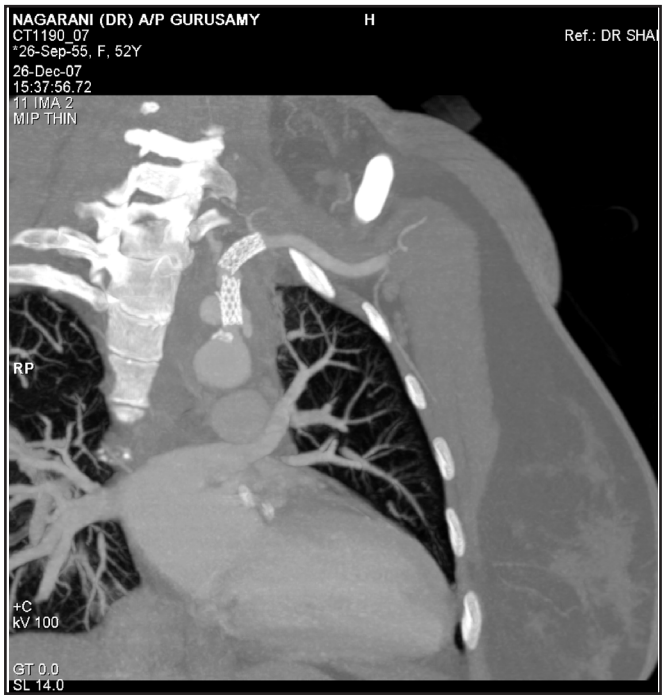

Fig. 2: Fractured stent on CT angiography with associated contrast leakage and a peri-arterial haematoma at fracture site

were restarted, and she was discharged well on Day 6 post-operatively. A subsequent CTA showed that the leak had sealed, with the *Valiant* aortic stent in situ. She currently has regular follow-up Duplex scans and appointments at the Vascular Surgery Clinic.

DISCUSSION

Angioplasty and stenting have generally been successful in the management of stenosis and occlusion of the supra-aortic trunks. The subclavian vessels are large and easily accessible from the femoral or brachial approach, making them well suited to endovascular intervention. Balloon-expandable stents account for the majority of implantations in the brachio-cephalic vessels as they have been readily available for the past two decades.

However, knowledge of the durability of these devices is limited, and has become a growing cause for concern following many reports of stent fractures and vessel restenosis[3,4]. Localised stiffness of the arterial wall may play a role in the fracture of an implanted stent, as seen in cases of overlapping stents or stents used for intra-stent restenosis [5]. Furthermore, aggressive post-dilatation of a deployed stent may also contribute to the mechanism of stent fracture[5]. Other contributory factors which may result in stent fractures include the mechanical properties and solidity of the stent, post-deployment apposition defects and the length of the implanted stent [4].

Stent fracture invariably leads to stent thrombosis and restenosis. The broken fragments cause local mechanical stimulation of the vessel wall, resulting in inflammation and focal intimal hyperplasia. For drug-eluting stents used in coronary angioplasty, a fracture leads to destruction of the stent architecture locally, hence the eluting drug is no longer equally distributed along the entire length of the stent. In consequence, localised restenosis occurs in an otherwise patent stent [6].

Worse still, vessel wall perforation may result in leakage and pseudo-aneurysm formation, as has occurred in this case. Management is extremely challenging as decision whether to continue with anti-platelet agents has to be made, bearing in mind the risk of worsening leakage and enlarging pseudo-aneurysm. Another consideration is whether to treat such a case conservatively (medical therapy), repeat percutaneous transluminal angioplasty (PTA), or open surgery.

In this case, the subclavian artery stent fracture was treated with a TEVAR procedure, after having failed conservative therapy and an attempted PTA. Although stent fractures involving this artery do not cause severe morbidity, disastrous results can occur, especially in coronary artery stent fractures, whereby cases of acute myocardial infarctions have been reported. In conclusion, endovascular stent implantation of the subclavian vessels should still be undertaken with caution, as has been proposed since the published report in 1999 [3].

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