·Case report 病例报告·

Iatrogenic subclavian artery pseudoaneurysm close to the origin of the vertebral artery: an endovascular strategy

XU Gao-feng, Dae Chul Suh

Summary: Subclavian artery pseudoaneurysm that induced from central venous catheterization through the internal jugular vein is relatively uncommon. However, the management of subclavian artery pseudoaneurysm remains a challenge because of their non-compressibility of deep locality and relationship to important surrounding anatomy, such as the origin of vertebral artery. In this paper, the authors report a patient with larger iatrogenic subclavian arterial pseudoaneurysm near the origin of vertebral artery, that was treated successfully by endovascular covered stent and coils.

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The central venous catheterization through the internal jugular access may induce some complications at the access site, one of which is the subclavian artery damage, such as pseudoaneurysm of this artery. Traditional US-guided compression and surgical intervention are difficult because of its deep position and relationship to important surrounding structures [1]. Recently, percutaneous thrombin injection becomes an alternative technique in the treatment of subclavian artery pseudoaneurysm, but it is only suitable to the small pseudoaneurysm with stable hemodynamic condition and has a risk of arterial embolus entering into the cerebral circulation [2,3]. To date, minimally invasive endovascular treatment has been successfully used in the patient with pseudoaneurysm[4-12]. In this paper, the authors report a case of larger iatrogenic subclavian artery pseudoaneurysm just close to the origin of vertebral artery, that was successfully treated by endovascular covered stent and coils.

Case report

A 33-year-old woman with progressive swelling and pain of the right lower neck area after a failure of right central venous catheterization was transferred to our hospital. She was definitively diagnosed as an end stage nephropathy and dilative cardiomyopathy with ejection fraction of 15 %. Contrast-enhanced CT scan showed a large (4 cm × 4 cm × 3 cm)saccular pseudoaneurysm in the right supraclavicular fossa without obvious evidence of abscess or soft tissue inflammation and digital subtraction angiogram(DSA) of right subclavian artery showed a large right subclavian arterial pseudoaneurysm adjacent to the right vertebral artery(Fig 1). After coils embolization the pseudoaneurysmal sac was not filled up completely, and then a bare stent-assisted coil embolization was performed. A 6F guiding catheter was positioned at the origin of the right subclavian artery through a 6F sheath via femoral approach and a 8 mm × 3 cm bare Precise stent(Cordis, Miami, FL) was placed into the right subclavian artery. Then, multiple Tornado coils (Cook) were successfully delivered into the neck and lumen of this

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pseudoaneurysm using a microcatheter (Excelsior 1018, Boston Scientific/Target, Fremont, CA) through the stent interstices. Post-procedure angiogram showed small amount contrast filling of residual sac (Fig 2). One week later, Doppler US showed residual aneurysmal lumen gradually enlarged with progressive pain, so that an endovascular strategy was made to treat this pseudoaneurysm using a covered stent in conjunction with protective vertebral artery embolization by coils.

After venous injection of 3000 units heparin, a 9F sheath was inserted via the right femoral artery and a 4F Simmon catheter was used to perform right subclavian artery and left vertebral artery angiography, in order to evaluate residual pseudoaneurysm lumen, anterior spinal artery and the inflow status of left vertebral artery (Fig 3A). First, a microcatheter (Prowler plus, Cordis, Miami, FL) was advanced through the previous placed bare stent interstices into the middle segment of right vertebral artery over a 0.014-inch microguidewire (Transend, Boston Scientific/Target, Fremont, CA), and a 0.035-inch stiff guildwire (Terumo, Tokyo, Japan) was simultaneously advanced into the distal right subclavian artery through the 4F simmon catheter (Fig 3B). Then, a 10 mm × 5 mm self-expanding nitinol stent (NITI-S stent, TaeWoong medical Co., Korea) was carefully placed to cover this pseudoaneurysmal neck and the origin of right vertebral artery, and a Matrix 12 mm × 30 mm 3D coil (Boston Scientific/Target) was deployed into C5 level of the right vertebral artery via microcatheter for distal protection, following six Tornado coils (Cook; one sized 8 mm × 4 mm, two 7 mm × 2 mm and three 6 mm × 2 mm) being packed in its proximal end. Post-procedure right subclavian arteriogram revealed that faint contrast filling of this aneurismal lumen, after 10 minutes repeated angiogram showed that pseudoaneurysm was occluded completely (Fig 3C). Three months follow-up, the clinical symptoms of swelling and pain of right neck area were all disappeared without any neurologic signs.

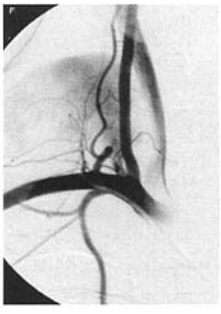

Fig 1 Preprocedural subclavian artery angiogram showed the location of the right subclavian arterial pseudoaneurysm, its sac was just proximal to the origin of right vertebral artery

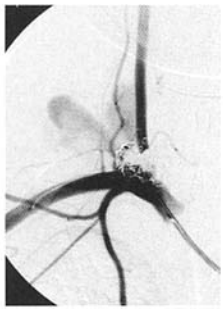

Fig 2 Angiogram after coils and stent-assited coils embolization showed small amount contrast filling of residual sac

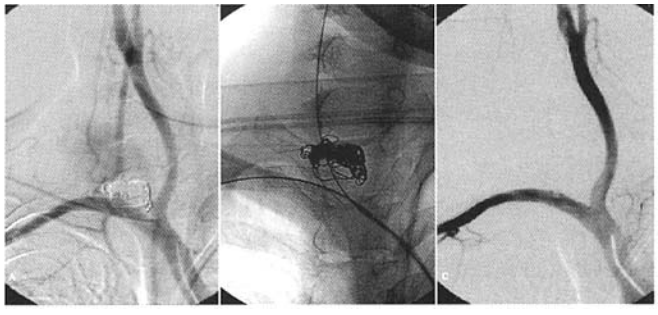

Fig 3 Angiogram of 1 month after stent-assited coils embolization demonstrated residual pseudoaneurysm lumen (A); microcatheter was placed into C5 level of right vertebral artery through the previous stent interstices, and another wire was simultaneously advenced into the distal right subclivian artery (B); after covered stent placement in conjunction with vertebral artery embolization by coils, the pseudoaneurysm was occluded completely (C)

Discussion

Subclavian artery pseudoaneurysm is relatively uncommon and generally arises from penetrating injuries, blunt trauma and rarely from endovascular intervention as an iatrogenic complication [4]. Pseudoaneurysm formation occurs when injury of various layers of the artery wall, extravasation of blood into a compartment in continuity with the arterial lumen. The purpose of treatment is to prevent embolic or thrombotic complications threatening to the upper extremity or the brain and reduce the pain as well as a risk for pseudoaneurysm rupture [5].

Since Becker GJ et al. [6]first reported the

endovascular treatment of an accidental subclavian artery injury caused by cannulation of the subclavian vein in 1991, many modalities of endovascular treatment have been successfully used in subclavian artery pseudoaneurysm, which include of transcatheter embolization, bare stent with or without coil embolization, and covered stent [4-12]. Especially in recent years, the use of covered stents has become a promising alternative to other endovascular techniques [4-6,8-9]. However, this pseudoaneurysm arisen from the right subclavian artery close to right vertebral artery, that was not suitable to use covered stent alone, owing to risk of vertebral artery occlusion, the uncertain long-term consequence and potential complications of implanted covered stent[5,9,10].

Covered stent placement could compromise the right vertebral arterial flow in our patient, because the pseudoaneurysm was very closely located to the origin of the right vertebral artery. If free of coverage of right vertebral arterial rim when covered stent was placed, there was no proximal safe margin of the covered stent. Therefore, we had to plan how to sacrifice the right vertebral artery safely.

In our patient, we did not know whether pseudoaneurysm can be completely occluded by covered stent alone, and also worried about retrograde filling of pseudoaneurysm by patent right vertebral artery blood supplied from contralateral vertebral artery, such as the case reported by Sanado J. et al [11], or the thrombi of the partially occluded vertebral artery entering into cerebral circulation. So that we tried to manage covered stent placement in conjunction with vertebral artery embolization by coils.

However, vertebral artery embolization is very dangerous, because it usually gives off small anterior spinal artery (ASA). While vertebral artery is needed to be occluded by covered stent and coils, the origin of the ASA shoud be identified. Normally the ASA arises from the distal vertebral artery at C 4-5 level [13]. If ASA is not identified, contralateral vertebral artery angiography must be mandatory in order to secure the ASA. In our patient, the contralateral vertebral artery and ASA branch were opacified clearly on angiography before embolization. In order to preserve ASA branch as sure as possible, the segment from C5 level to origin of the right vertebral artery was selected to embolize by us.

Watelet J. et al reported a patient with traumatic subclavian artery pseudoaneurysm, in which failed stent-graft procedure was successfully salvaged with coils embolization via the gap between the stent and the arterial wall [12]. In our patient, microcatheter was first placed into C5 level of right vertebral artery through the previous stent interstices and another wire was simultaneously advanced into the distal right subclivian artery. After covered stent placement, GDC was deployed into right vertebral artery via microcatheter as distal protection, following six coils were packed at its proximal end.

The endovascular management of our patient experienced three kinds of approaches: coils embolization, stent-assited coils embolization and covered stent in conjunction with vertebral artery embolization by coils. We thought it remains as the logical option of treatment for subclivian artery pseudoaneurysm close to the origin of vertebral artery. Although our case have made success with covered stenting and coils at last, the use of covered stent as first choice must be cautious, especially for that of younger patient and near origin of vital vessel.

In summary, endovascular treatment with covered stent and coils was successful in this patient with iatrogenic subclavian artery pseudoaneurysm close to the origin of vertebral artery. This approach is a reasonable option in instances of identification of ASA, and preserving ASA branch of distal vertebral artery as possible.

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