CASE REPORT

Where did the clot go? An unusual complication of mechanical thrombectomy caused by malignancy related subclavian steal phenomenon in a patient with acute basilar artery occlusion

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SUMMARY

Subclavian steal is a relatively common vascular phenomenon usually caused by atherosclerotic disease. While symptoms are rare, arm claudication of the ipsilateral limb is most common, with paroxysmal symptoms of vertebrobasilar insufficiency (often exercise induced) being relatively uncommon. Here we present a case of brachial artery embolism during mechanical thrombectomy for basilar artery thrombosis, secondary to subclavian steal phenomenon. This atypical and potentially irreversible complication should be considered in patients with acute ischemic stroke undergoing neurointerventional management when subclavian steal is discovered angiographically.

BACKGROUND

Brachial artery embolism is a previously unreported complication of mechanical thrombectomy for acute ischemic stroke. This complication should be considered in patients undergoing neurointerventional management for acute ischemic stroke affecting the posterior circulation in the context of subclavian steal phenomenon.

CASE PRESENTATION

An elderly patient recently diagnosed with stage 3A lung cancer presented with symptoms of a basilar artery stroke syndrome with a National Institutes of Health Stroke Scale (NIHSS) score of 21.

Examination revealed mild drowsiness, anarthria, bifacial weakness, lower extremity plegia, upper extremity paresis and ataxia, and bilateral upgoing toes.

INVESTIGATIONS

Vascular imaging confirmed proximal occlusion of the basilar artery (figure 1A). Also noted was occlusion of the origin of the left subclavian artery due to an adjacent large left upper lobe lung mass, with the occlusion being proximal to the vertebral artery origin (figure 1B, C).

OUTCOME AND FOLLOW-UP

The patient was treated with intravenous tissue plasminogen activator with improvement in her NIHSS score to 7, and subsequently underwent mechanical thrombectomy. Catheter angiography confirmed persistent long segment basilar artery occlusion (figure 2A). Mechanical thrombectomy using a Solitaire stent retriever was successful on the first pass, with no evidence of distal emboli (figure 2B). On withdrawal of the device however, no thrombus was found. Angiography via a right vertebral injection demonstrated left subclavian steal phenomenon with retrograde contrast flow down the left vertebral artery into the subclavian artery with no flow beyond the brachial segment due to clot migration into the left brachial artery at its bifurcation at the antecubital fossa (figure 3A, B). Clinical examination confirmed an absent left

Figure 1 (A) Coronal reformat from CT angiogram demonstrating thromboembolic occlusion in the basilar artery (white arrow), extending from its proximal segment to the basilar bifurcation, into the P1 segments of both posterior cerebral arteries (not shown). (B) Axial image from CT angiography shows a large mass in the left upper lobe (asterisk), representing the known bronchogenic carcinoma, with (C) coronal reformat demonstrating left subclavian artery thrombosis (broken white arrow), extending from its origin to proximal to the left vertebral artery takeoff.

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Figure 2 (A) Pre- and (B) post-stent retriever mechanical thrombectomy frontal angiograms, demonstrating complete recanalization of the basilar artery and related branches (arrow).

radial pulse. After emergency consultation with vascular surgery, the patient underwent emergency surgical thrombectomy with heparin started after 24 hours. There was significant clinical improvement, with an NIHSS score of 1 for decreased right nasolabial fold. The patient was discharged home a few days later.

DISCUSSION

With the recent publication of five large randomized controlled multicenter trials, there is now level 1 evidence for mechanical thrombectomy as treatment for acute ischemic stroke in patients due to large vessel arterial occlusions. However, this procedure is not without complications, including vessel dissection, stent occlusion, vasospasm of the access vessel, reperfusion hemorrhage, and distal embolization.^{1 2} We have presented a previously unreported complication of mechanical thrombectomy—brachial artery thromboembolic occlusion due to subclavian steal syndrome following stent retriever recanalization.

Subclavian steal syndrome, once thought to be rare and relatively benign, refers to a constellation of symptoms that result from retrograde flow down a vertebral artery due to ipsilateral subclavian artery stenosis or occlusion proximal to the vertebral origin. Although atherosclerosis is the most common etiology, other conditions include Takayasu's arteritis, thoracic outlet syndrome, aortic dissection, and various congenital abnormalities.^{3 4} Newer neuroimaging techniques have shown that subclavian stenosis of >50%, which has a prevalence of 0.6–6.4%, leads to decreased pressure in the subclavian artery, falling below that of

the contralateral vertebral artery and causing flow reversal in the ipsilateral vertebral artery in up to 90% of patients with moderate subclavian stenosis.^{4 5} This results in a hemodynamic challenge to the posterior circulation, leading to paroxysmal vertigo, diplopia, ataxia, dysarthria, and syncopal attacks due to compromised vertebrobasilar blood flow. Symptoms of arm claudication arise from impaired brachial artery blood flow, and cardiac ischemia can occur in patients undergoing coronary artery bypass with left internal mammary artery grafts.^{3 5 6} Symptoms may also be provoked by vigorous exercise of the ipsilateral arm or sudden head turning ipsilateral to the lesion when there is moderate severity, intermittent steal, or a significantly elevated blood pressure differential between arms >20 mm Hg, which may indicate the need for intervention.^{4 5} Most patients however have normal neurologic examinations unless symptomatic at the time of assessment.⁴ Lesions appear to be mostly left-sided, more common in men, and in patients >50 years of age, likely relating to the increased prevalence of atherosclerosis in this population.^{4 5}

Standard or transcranial Doppler serves as the screening investigation of choice for subclavian steal syndrome in suspected cases.^{4 5} These modalities allow assessment of steal related hemodynamics and assess related changes in flow in the posterior circulation. If convincing on ultrasound, lesions can be confirmed with CT or MR angiography.³ All stroke patients identified to have subclavian steal syndrome should have aggressive treatment of their vascular risk factors, particularly atherosclerosis, as well as lifelong antiplatelet therapy.⁴ Surgical or endovascular management is reserved for those with complete steal or severely symptomatic patients, with stenting being the initial treatment offered in these cases and surgery thereafter if stenting fails.^{4 5}

To our knowledge this is the first case demonstrating brachial artery thromboembolic occlusion as a complication of non-target embolism of stent retriever assisted mechanical thrombectomy for basilar artery thrombosis in the setting of subclavian steal phenomenon. Our patient had occlusion of the left subclavian artery proximal to the left vertebral artery origin due to an adjacent mass lesion as the cause of the subclavian steal physiology. This rare complication should be considered in patients with acute stroke undergoing neurointerventional management for posterior circulation stroke when subclavian stenosis and resulting steal physiology is suspected on clinical assessment or discovered angiographically. Awareness of this potential complication may aid in utilizing interventional techniques aimed at minimizing the likelihood of non-target embolism, with the goal being to potentially prevent this complication altogether or allow early recognition such that irreversible limb ischemia does not occur.

Figure 3 (A) Right vertebral arteriogram, demonstrating left subclavian artery 'steal', with retrograde flow down the left vertebral artery (white arrow), and into the left subclavian and brachial arteries (broken white arrow). (B) Further angiographic imaging of the left arm confirms distal thromboembolic occlusion of the brachial artery (black arrow), just above its bifurcation at the antecubital fossa.

Learning points

- ▶ Understanding of subclavian steal phenomenon and subsequent altered hemodynamic physiology.
- ▶ Consider in patients with acute stroke undergoing neurointerventional treatment for posterior circulation stroke given the risk of brachial artery thromboembolic occlusion.
- ▶ Awareness of subclavian steal physiology and associated complications may altogether prevent or allow early recognition of potential irreversible limb ischemia.

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Competing interests None declared.

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