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CLINICAL STUDIES

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- Solitaire™ FR With the Intention For Thrombectomy (SWIFT). *The Lancet*, 2012
- Solitaire™ FR Thrombectomy for Acute Revascularization (STAR). *Stroke AHA Journals*, 2013
- The Endovascular Treatment for Small Core and Proximal Occlusion Ischemic Stroke (ESCAPE) Study. *The New England Journal of Medicine*, February 2015
- Extending the Time for Thrombolysis in Emergency Neurological Deficits – Intra-Arterial (Extend-IA) Study. *The New England Journal of Medicine*, February 2015
- MR CLEAN: A Multi-center Randomized Clinical trial of Endovascular treatment for Acute Ischemic Stroke in the Netherlands. *The New England Journal of Medicine*, December 2014
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Clinical References:

1. EXTEND-IA Study presented by Dr. Bruce Campbell at the International Stroke Congress 2015
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3. Trevo Versus Merci Retrievers for Thrombectomy Revascularisation of Large Vessel Occlusions in Acute Ischaemic Stroke (TREVO 2): a randomised trial. Nogueira et. al., doi:10.1016/S0140-6736(12)61299-9.
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Perforation of superior thyroid artery by guidewire during carotid artery stenting

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Abstract

Background and aim: Although carotid artery stenting (CAS) has become a common treatment for carotid artery stenosis, some complications occur related to the procedures. Perforation of an external carotid artery (ECA) branch is a rare complication.

Case description: An 83-year-old man presented with gait disturbance and dysarthria. MRI demonstrated a fresh cerebral infarction in the watershed territory of the left cerebrum and severe stenosis of the left internal carotid artery (ICA). He underwent CAS for the left ICA stenosis. After the procedure, the patient complained of discomfort of the throat. Swelling of the neck was observed and angiography showed extravasation of contrast medium from the superior thyroid artery. The patient was immediately sedated and intubated. Strict control of the blood pressure was continued. Two days after CAS, the tracheal tube was extracted. He was discharged without deficit on the 17th post-stenting day.

Conclusion: Injury of ECA branches is a potential complication when a guidewire is inserted during advancement of the materials. It may be life threatening due to associated respiratory problems. Once bleeding from the ECA is suspected, close observation of the patient's neck and respiration and immediate intervention are necessary.

Keywords

CAS, external carotid artery, superior thyroid artery, perforation, guidewire

Introduction

Carotid artery stenting (CAS) is a common and effective treatment for carotid artery stenosis.¹ Although techniques and equipment have advanced, complications sometimes occur.^{2–4} Well-known dangerous complications are ischemic stroke and intracranial hemorrhage. Although injury of an external carotid artery (ECA) branch is a rare complication, it may be critical. In this report, we present our experience of perforation of the superior thyroid artery and discuss the prevention and management of this rare complication.

Case report

An 83-year-old man presented with gait disturbance and dysarthria. His past history included chronic heart failure, angina pectoris, chronic kidney disease, arteriosclerosis obliterans, and atrial fibrillation. He was taking 100 mg of aspirin and 2 mg of warfarin transorally per day.

Magnetic resonance imaging (MRI) on admission demonstrated fresh cerebral infarction in the watershed territory of the left cerebrum and severe stenosis of the left internal carotid artery (ICA). On the third day of

admission, CAS was performed under local anesthesia. Preoperative angiography demonstrated 90% stenosis of the left ICA (Figure 1(a)). A 9F-sheath was placed in the left femoral artery, because the right superficial femoral artery had been stented because of arteriosclerosis obliterans. A 4F-sheath was introduced to the right femoral vein to return refluxed blood. Advancement of a guiding catheter (9F, Optimo, Technocrat, Aichi, Japan) was attempted to the left common carotid artery (CCA) with an inner catheter (COUNTDOWN 6, MEDIKIT, Tokyo, Japan) and a guidewire (Radifocus, Terumo, Tokyo, Japan), but it failed. Insertion of the guidewire and inner catheter was then attempted to the ECA. However, even this failed. The materials could not be advanced, even though the guidewire was exchanged to a half-stiff one (Radifocus, Terumo). Then, a retriever (ANPLATZ GOOSE NECK Snare Kit, ev3, Microvena, Whitebear Lake, MN, USA) was introduced via the

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right brachial artery and the guiding catheter was held at the orifice of the left CCA. On holding the guiding catheter with the retriever, the guidewire and inner catheter could be advanced to the left ECA. The guidewire was further advanced to the superior thyroid artery (Figure 1(b)). Then, the guiding catheter was pulled up to the left CCA by a retriever. During this procedure, the guidewire was kept in the left superior thyroid artery. The guidewire and inner catheter were then withdrawn. The activated clotting time (ACT) was 201 seconds. A total of 4000 IU of heparin was administered intravenously. After heparinization, ACT was controlled between 246 and 392 seconds. Then, PercuSurge Guardwire (Medtronic, Minneapolis, MN, USA) was inserted to the left ECA at the origin of the superior thyroid artery. Filterwire EZ (Boston

Scientific, Boston, MA, USA) was advanced to the left ICA. The balloons of PercuSurge Guardwire and the guiding catheter were inflated. Refluxed blood from the ICA was returned to the right femoral vein through a filter. The lesion was dilated by a balloon catheter (Re-Genity, 2.0 × 40 mm, Kaneka, Osaka, Japan). Then, stenting was performed with carotid Wallstent (Boston Scientific) (Figure 1(c)). Fifty-five minutes passed from withdrawal of the guidewire from the superior thyroid artery to the completion of CAS. After the procedure, the patient complained of discomfort of the throat. Swelling of the neck was observed, and repeated angiography showed the extravasation of contrast medium (CM) from the superior thyroid artery (Figure 1(d)). Perforation of the superior thyroid artery by the guidewire was suspected. Forty and ninety



Figure 1. (a) Angiography prior to CAS showing about 90% stenosis of the left ICA. (b) Angiography during the procedure showing that the guidewire has been inserted to the superior thyroid artery (arrow). (c) Post-CAS angiography showing dilation of the left ICA. (d) Angiography after procedures showing extravasation of CM (arrow) from the left superior thyroid artery (arrowhead). CAS: carotid artery stenting; ICA: internal carotid artery; CM: contrast medium.

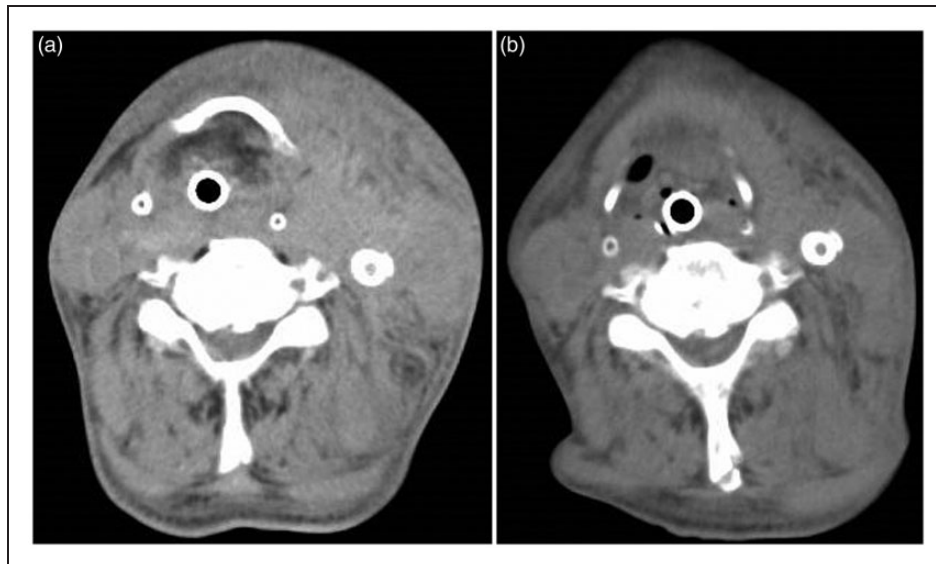


Figure 2. (a) CT after intubation showing swelling of the neck due to hemorrhage. (b) CT obtained 20 hours after hemorrhage showing improvement of the neck swelling. CT: computed tomography.

minutes had passed until deflation of the balloon in the ECA and withdrawal of the guidewire from the superior thyroid artery, respectively. The patient was immediately sedated with propofol and intubated. Computed tomography (CT) revealed swelling of the neck (Figure 2(a)). His blood pressure was strictly controlled to prevent rebleeding. No further swelling of the neck was observed; therefore, the superior thyroid artery was not embolized. Swelling of the neck gradually improved (Figure 2(b)). CT obtained the next day showed decreased swelling. Two days after CAS, the tracheal tube was extracted. After extubation, his course was uneventful. He was discharged without deficit on the 17th post-stenting day.

Discussion

Thrombosis, intracerebral hemorrhage due to hyperperfusion, bradycardia, and hypotension are well-known complications related to CAS.⁴ Complication related to injury of ECA branches is not common. Ecker et al.⁵ reported four cases with rupture of ECA branches during CAS. Among them, three were due to perforation by a guidewire. Bleeding from ECA branches sometimes results in compression of the trachea and the necessity of respiratory support by intubation. Once extravasation of CM is observed, it is critical to ensure patency of the patient's airway.⁵

The ECA branches are often used to support the guidewire during insertion of the guiding catheter. In our case, advancement of the guiding catheter to the CCA was difficult, despite using half-stiff and stiff guidewires. By holding and pulling the guiding catheter with the retriever, the guidewire could be deeply inserted to the superior thyroid artery and kept there with pushing force. Neurosurgeons tend to pay less

attention to ECA branches compared to the ICA. However, excessive force on the insertion of a guidewire to ECA branches should be avoided to prevent ECA branch injury. When the support of a guidewire in ECA branches is not sufficient, the guidewire may occasionally be changed to a stiffer one. A stiff guidewire can damage an artery. In cases of ICA stenosis in which a guidewire is advanced to the ECA during an endovascular procedure, close postoperative observation of the respiratory status and any neck swelling is necessary.

In our case, neck swelling became apparent about 100 minutes after guidewire insertion to the ECA branch. Patients who undergo CAS commonly take multiple antiplatelet agents to prevent thromboembolic events during the procedures. Grandhi et al.⁶ reported a patient with carotid artery stenosis who showed extravasation from the distal ECA. In their case, the bleeding continued for six hours after the procedure, and persistent hemorrhage was seen on angiography. In our case, the patient took both antiplatelet and anticoagulation agents. Although tracheal intubation was conducted, emergency embolization of the perforated artery was not necessary. Swelling of the neck was noted 90 minutes after the extraction of the guidewire from the superior thyroid artery. Therefore, although the bleeding might not be so marked, a small amount of hemorrhage might continue due to the effects of aspirin, warfarin, and heparin. Perforation of ECA branches may result in a huge hematoma that compresses the respiratory tract in the neck. Therefore, the therapeutic embolization of ruptured blood vessels is necessary.

Another option to prevent arterial damage due to manipulation is to change the access route to that via the brachial artery. In cases in which it is difficult to gain access to the lesion, we should not hesitate to change the approach route.

Conclusion

Injury of an ECA branch is a rare but potential complication when a guidewire is inserted to advance materials. Once bleeding from the ECA is noted during CAS, close observation of the patient's neck and respiration is necessary. And immediate embolization of the affected artery should be considered.

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Conflict of interest

None declared.

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