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Direct common carotid artery puncture for acute thrombectomy against ischemic stroke

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Acute thrombectomy has been increasingly recognized as an effective treatment method for acute ischemic stroke and rapid recanalization is considered one of the most important factors for treatment success. However, elderly and arteriosclerosis patients often show difficult access to the occlusive vessel, and may result in longer therapeutic time and poor outcome. The authors report three cases with direct common carotid artery (CCA) puncture for acute thrombectomy which resulted prompt and safe recanalization.

A 83-year-old female presented with left middle cerebral artery (M1) occlusion. She was previously diagnosed to have aortic and femoral artery aneurysm, and trans-femoral was considered as inappropriate (Fig. 1A). Direct CCA puncture was performed under ultrasound guidance. 6-French sheath (Medikit Supersheath, Tokyo, Japan) was inserted to CCA (Fig. 1B), and distal end of the catheter was subsequently inserted in the internal carotid artery. Continuous heparinized saline line was connected to one of the side port. A direct aspiration first-pass thrombectomy (ADAPT) using Penumbra 5MAX ACE (Penumbra, Alameda, California, USA) system was performed and partial recanalization was achieved. After another failure attempt, Solitaire stent (Covidien) was applied with Penumbra system (So-called Solumbra) was considered. Solitaire was retrieved into the 5 MAX ACE under continuous aspiration at the carotid siphon. Small amount of thrombus can also be retrieved with Solitaire and modified Thrombolysis in Cerebral Infarction score (TICI) 2a recanalization was achieved. The patient was subsequently anesthetized and intubated to avoid tracheal obstruction by puncture related hemorrhage. Twenty-minutes manual compression of the puncture site enabled complete hemostasis. After computed tomography angiography (CTA)

and ultrasonography to confirm no CCA injury or aneurysm on the next day, the patient recovered from anesthesia without any complication.

2nd patient is 93-year-old female and 3rd patient is 87-year-old with acute right internal carotid artery (ICA) occlusion. The patients showed high aortic arch with low tortuous right innominate artery which is thought to be difficult to access. Intravenous alteplase (t-PA) was immediately administered. After several attempts from trans-femoral or brachial approach, direct CCA puncture was selected and same procedures were taken as patient one (Fig. 1C, D, E). ADAPT was applied and patient 3 showed immediate TICI 3 recanalization. On the other hand, while after withdrawing the 5MAX ACE from the catheter, continuous blood aspiration from the side port of 6Fr catheter could not be obtained in patient 2, showing that distal end of the 6F sheath maybe clogged with clot. We decided to withdraw the distal end of catheter from ICA to CCA under continuous negative pressure on the sheath, and then send the distal end of the sheath to the external carotid artery to release the possible clot to the external artery. The sheath can be used soon after this procedure, and TICI 3 recanalization was confirmed by the angiogram. Same postoperative procedures were undertaken, and both patients showed no puncture related complication (Fig. 1F).

Transfemoral and transbrachial access route are generally considered for acute thrombectomy, but tortuous anatomy of the aortic arch, and carotid arteries can hamper access, and resulting longer therapeutic time. Several tips have been reported to access the difficult tortuous artery, such as the use of Simmons type inner catheter, 0.038 firm type guidewire, snare catheter to hold guiding catheter, carotid compression method, and so on, but even with these techniques, there still exists a difficult access cases.

Direct carotid artery puncture may be an alternative option for patient with difficult

access. As far as we know, there has been several papers which adopted trans-carotid artery approach for treatment of intracranial disease (Table 1),(1-3) however, carotid artery puncture for acute thrombectomy has not been reported. The most common problem of carotid artery puncture is to gain complete hemostasis, since puncture site subcutaneous hematoma formation can sometime causes lethal tracheal obstruction,(3) and occlusion of the puncture artery can also end up with catastrophic ischemic infarction.

Use of closure devices for common carotid artery puncture have recently been reported. Blanc et al. have reported the successful case of Angio-Seal device (Daig/St. Jude Medical, ST. Paul, MN) for common carotid artery puncture after coil embolization.(1) However, there also exists a concern regarding the use of closure device such as narrowing of the artery by tackling suture, distal emboli of intraluminal collagen plug protrusion, anchor migration, and thrombi formation. This may result in catastrophic complication and the use of device needs further experience and consideration.

We have reported three cases of direct common carotid artery puncture for acute thrombectomy. Although further examination is necessary to elucidate its safety, successful recanalization with no postoperative complication are achieved and this method may be an alternative for difficult access cases.

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2. Blanc R, Piotin M, Mounayer C, Spelle L, Moret J. Direct cervical arterial access for intracranial endovascular treatment. *Neuroradiology.* 2006 Dec;48(12):925-9.
3. Nii K, Kazekawa K, Onizuka M, Aikawa H, Tsutsumi M, Tomokiyo M, et al. Direct carotid puncture for the endovascular treatment of anterior circulation aneurysms. *AJNR Am J Neuroradiol.* 2006 Aug;27(7):1502-4.

Authors' contributions:

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S Mabuchi: data management

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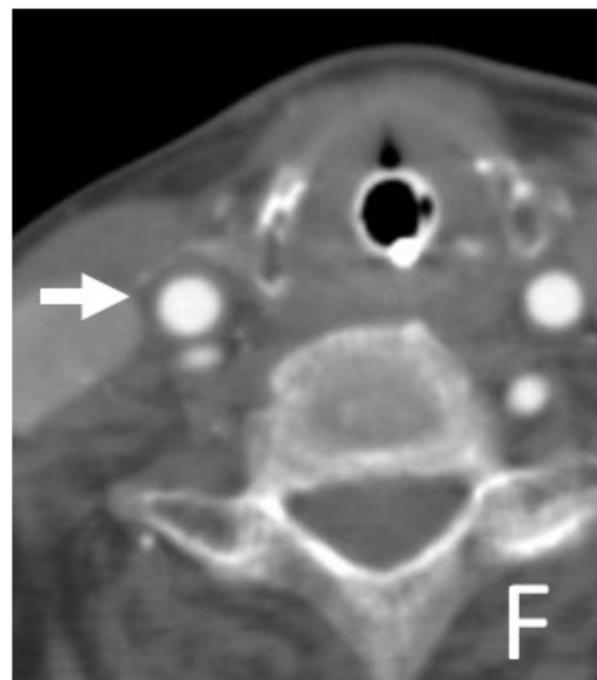
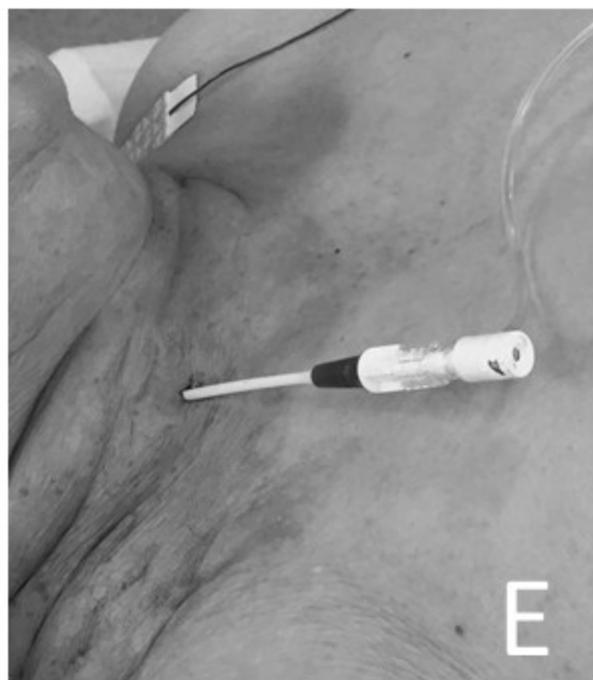
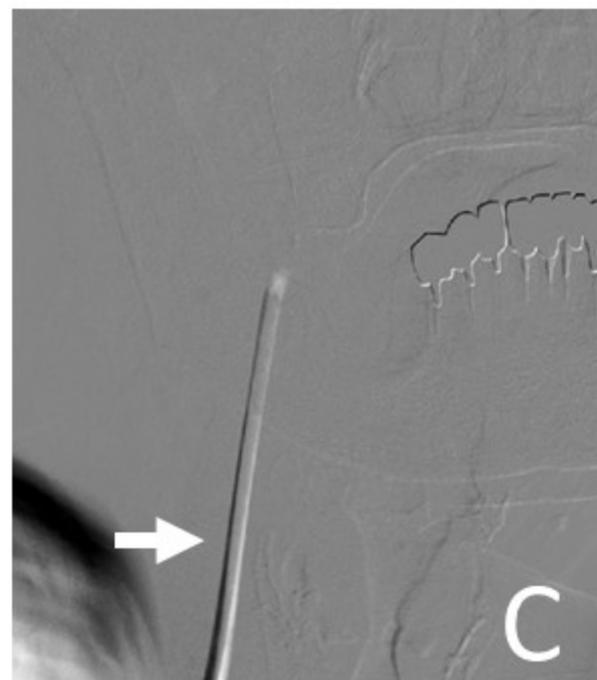
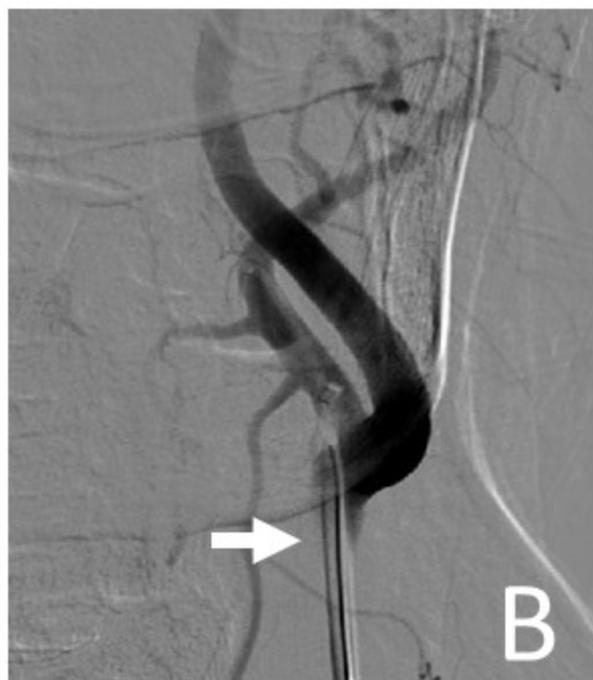
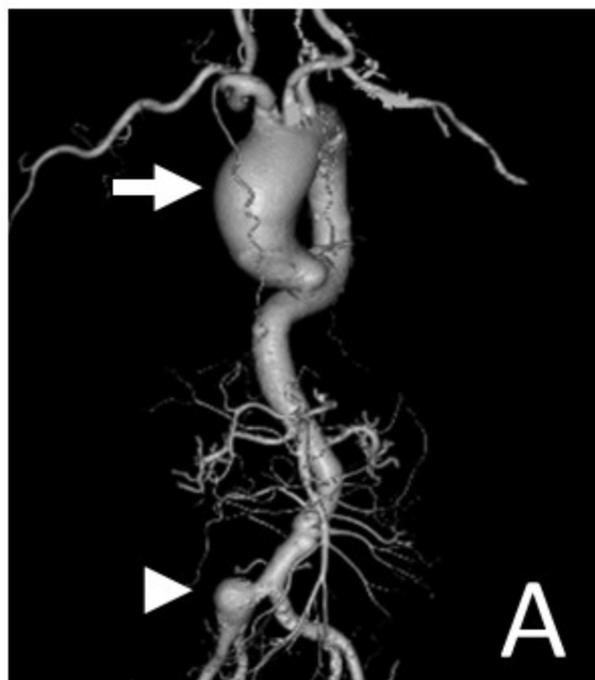
Conflicts of interest: none

Figure Legends

Fig. 1. Patient 1 showed arterial aneurysms on aortic arch (A, arrow) and on femoral artery (A, arrow head) and inserted 6 French sheath can be seen (B, lateral view, arrow). Inserted 6 French catheter can be seen in patient 2 (C, anterior view, arrow). Intraoperative photo showing the insertion of 6 French catheter for patient 3 (D, E), and postoperative computed tomography angiography (CTA) shows no puncture site hemorrhage or occlusion (F, arrow).

Table. 1.

List of cases for direct common carotid artery puncture.



| Author | Year | Journal | No. of cases | Disease | Reason for carotid puncture | Size of Sheath | Closure | Complication | Additional treatment |
|-----------|------|----------------|--------------|---------------------|---|----------------|---|--|-----------------------------------|
| Blanc | 2002 | AJNR | 1 | Aneurysm | Tortuosity | 6F | Angio-Seal | none | |
| Nii | 2006 | AJNR | 27 | Aneurysm | Tortuosity (23) and aortic dissection (4) | 5F | Manual compression | Hemorrhage 1/27 (3.7%) | 5hr compression |
| Blanc | 2006 | Neuroradiology | 34 | Aneurysm and others | Tortuosity (85%) and others | 5-8F 6-8F | Manual compression Angio-Seal | Hemorrhage 3/34 (8.9%), Pseudo-aneurysm 1/34 (2.9%) | open surgery for hemorrhage (1/3) |
| Our cases | 2017 | | 3 | Thrombectomy | Tortuosity and aortic An | 6F | Manual compression and anesthetized & intubated | none | |