

Hyperacute Carotid Artery Occlusion with Insufficient Collateral Flow: A Case Report Illustrating a Largely Ignored Life-Threatening Traumatic Cerebrovascular Injury

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Case report

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Abstract

Background: Traumatic cerebrovascular injuries (TCI) are rare diseases, with the incidence of 0.18%-1.5% among trauma patients. Among TCI, ischemic TCI is more likely to be ignored when compared with hemorrhagic TCI. However severe ischemic TCI such as acute total occlusion of carotid artery may also be life-threatening especially when without sufficient collateral flow.

Case presentation: We report an 18-year-old male patient in cardiopulmonary arrest was transported to our hospital 13 minutes after falling from a 60-feet tall building. After physical examination, an acute right internal carotid arteries (ICA) occlusion was suspected and be further confirmed by digital subtraction angiography (DSA) examination. Subsequent angiograms showed bilateral traumatic dissections of the ICA with complete occlusion of the right ICA just distal to the carotid bifurcation, and severe narrowing of the left ICA. Two covered stents were implanted to reconstruct bilateral ICAs followed by proximal occlusion of ruptured ECA branches using coils. The patient's blood pressure gradually improved after the procedure. Dual antiplatelet therapy was initiated on the second day. Six-month Follow-up CTAs indicated that bilateral ICAs were well reconstructed, and the patient had a mRS score of 1 at six-month follow-up.

Conclusion: TCI may achieve very good clinical outcome if they were diagnosed and properly treated via timely endovascular intervention.

Background

Traumatic cerebrovascular injury (TCI), including hemorrhagic and ischemic ones, is one of the main causes of death for patients with severe trauma^[1]. Ischemic TCI is more likely to be ignored due to its occult symptoms and unobvious imaging features comparing with hemorrhagic TCI. However, severe ischemic TCI such as acute total occlusion of carotid artery may also be life-threatening especially when without sufficient collateral flow^[2]. What's more, it's noteworthy that this particular TCI can achieve very good clinical outcome if diagnosed and treated timely.

Case Presentation

An 18-year-old male patient in cardiopulmonary arrest was transported to our hospital 13 minutes after falling from a 60-feet tall building. Spontaneous circulation returned after 10 minutes of cardiopulmonary resuscitation, but the patient remained intubated and under mechanical ventilation, as he was in hypovolemic shock that was not reversible using intravenous fluids and vasopressors. Active otorrhagia and epistaxis were noticed and thought to be the likely cause of his shock which was further confirmed by improvement of blood pressure after left carotid artery compression. However, the patient's bilateral pupils dilated 5 minutes later and returned to normal after stopping compressing the left carotid artery. Therefore, an acute right ICA occlusion was also suspected. The patient was transferred to the angiosuite and underwent DSA examination. A cone beam flat detector CT was performed before the angiogram to

exclude intracranial contusional hemorrhages. Subsequent angiograms showed bilateral traumatic dissections of the ICA with complete occlusion of the right ICA just distal to the carotid bifurcation, and severe narrowing of the left ICA. Traumatic disruptions of multiple branches of bilateral external carotid arteries (ECA) were demonstrated. After examination, two covered stents (R: Gore 6/50;L: Gore 7/50) were implanted to reconstruct bilateral ICAs (**Figure A, B, D & E**) followed by proximal occlusion of ruptured ECA branches using coils. The patient's blood pressure gradually improved after the procedure. Dual antiplatelet therapy was initiated on the second day. After the endovascular procedure, the patient was transferred to ICU. After two days' sedation, the patient recovered with retrograde amnesia and left hemiparesis. Although the right ICA recanalization was timely achieved, 3-day follow-up CT scan revealed some acute infarction in right hemisphere (**Figure H**). Six-month Follow-up CTAs (**Figure C, F & I**) indicated that bilateral ICAs were well reconstructed, and the patient had a mRS score of 1 at six-month follow-up.

Discussion

TCl are rare diseases, which occurred in 0.18%-1.5% of all trauma patients^[3]. As suggested by the blunt cerebrovascular injury practice management guidelines, trauma patients with some risk factors such as LeFort II or III fracture, seat belt abrasion, and diffuse axonal injury with GCS score < 6 et al, or some neurological signs/symptoms should receive cerebrovascular injury screening^[4, 5]. In clinical practice, ischemic TCl were more likely to be ignored or delayed than hemorrhagic TCl due to its easily neglected symptoms and signs especially in the settings of severe multiple injuries^[6]. Some studies have reported that high-velocity events were associated with the dissection of carotid artery, which was often one of the main causes of ischemic TCl^[7]. And if not treated timely, ischemic TCl often lead to severe acute ischemic stroke (AIS).

As highlighted by this case, the artery dissection resulted in the occlusion of right ICA, which is life-threatening with insufficient collateral flow in combination with low blood pressure due to hemorrhagic shock. Within limited time window, the irreversible AIS can be prevented^[8]. Recent studies have demonstrated that recanalization of large vessel occlusion within 6 hours can improve patients' clinical outcome^[9-11]. Since endovascular recanalization of traumatic ICA occlusion using stent placement is technically feasible with a high success rate, timely and accurate diagnosis of such lesions became more important. Physicians should pay special attention to this life-threatening but rescuable TCl in order not to miss the optimal time window for treatment.

Conclusion

TCl is one of the main causes of death for patients with severe trauma owing to its high mortality, although the incidence of TCl is relatively low. Compared with hemorrhagic TCl, the symptoms and imaging features of ischemic TCl are unobvious, which needs more concerns for neurosurgeons. Ischemic TCl may achieve very good clinical outcome if diagnosed and treated in a timely way, as is shown in this case.

Abbreviations

TCI: Traumatic cerebrovascular injuries; ICA: Internal carotid artery; ECA: External carotid artery; DSA: Digital subtraction angiography; AIS: acute ischemic stroke; CT: Computed tomography; CTA: Computed tomography angiography

Declarations

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Authors' contributions

PFY, YX and JML participated in the treatment of this patient and were involved in the development of the conclusions. HST and HL wrote the first draft with assistance from RZ, QL and HJZ, KJZ and QHH edited the final draft. All authors had read and approved the final manuscript.

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Ethics approval and consent to participate

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Consent for publication

Written informed consent for publication of the clinical details and clinical images was obtained from the patient.

Competing interests

The authors declare that they have no competing interests.

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Figures

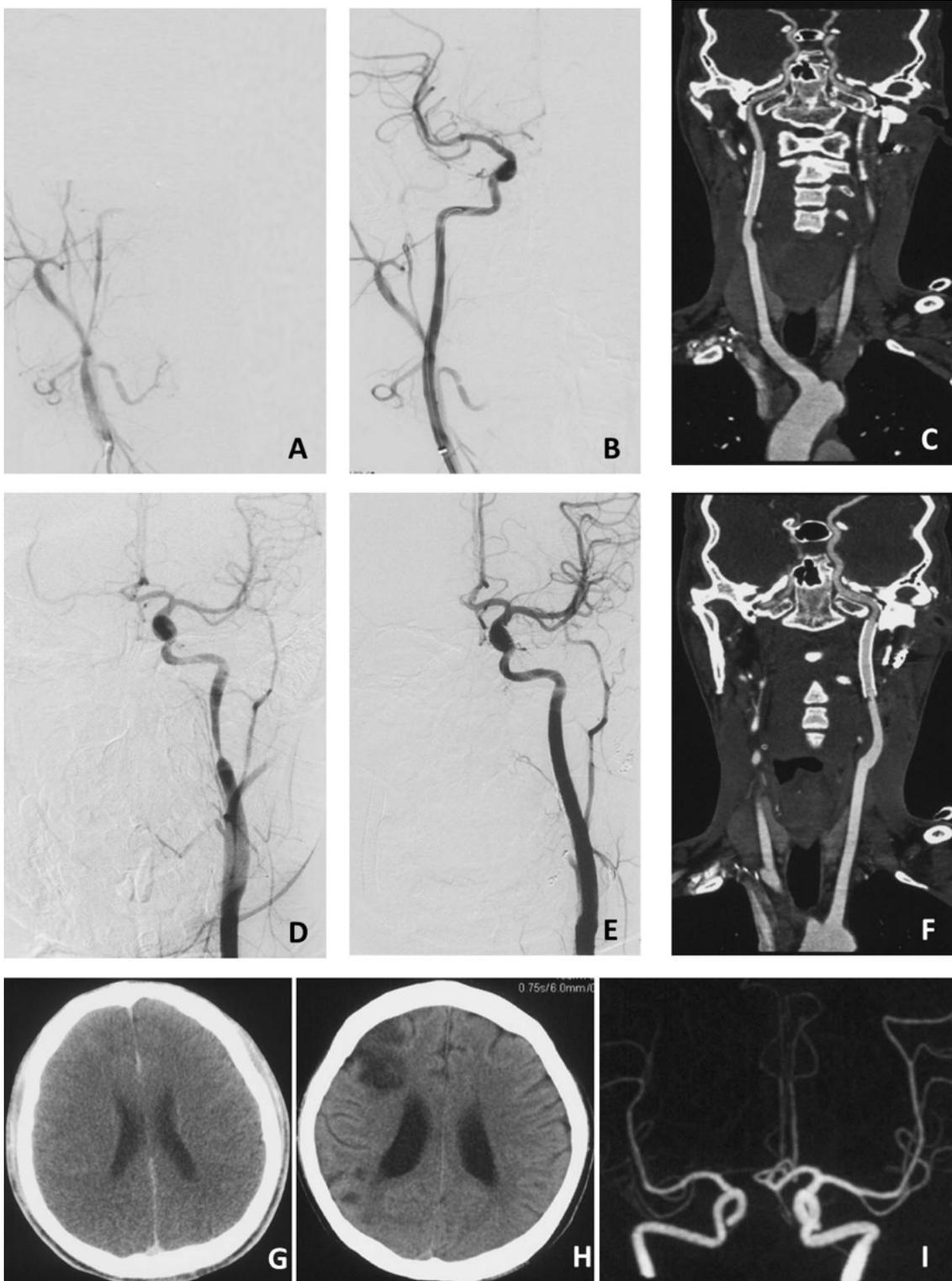


Figure 1

This figure showed the endovascular treatment procedure of case A: DSA of R-CCA shows occlusion of R-ICA; B: Angiography of R-CCA after stenting shows recanalization of R-ICA 1.5 hours after trauma; C: Six-month follow-up CTA shows patency of R-ICA without stenosis; D: DSA of L-CCA shows an acute dissection with significant narrowing of the L-ICA; E: After stenting, L-CCA shows improvement of L-ICA stenosis; F: Six-month follow-up CTA shows patency of L-ICA without restenosis; G: CT Scan immediately

after endovascular procedure reveals no sign of infarction; H: Three-day follow-up CT scan reveals multiple acute infarction of right hemisphere; I: Six-month follow-up Cranial CT Angiography shows patency of bilateral ICAs.