Emergent Surgical Repair for Penetrating Injury of the Cervical Carotid Artery Associated With Shock
—Case Report—

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Abstract
A 41-year-old male presented with penetrating carotid artery injury after being stabbed in the left neck with a knife. He had profuse bleeding from the wound and was in hemorrhagic shock. No neuroimaging evaluation was possible, so emergent surgery was begun with continuous manual compression of the left neck. Graft reconstruction of the injured carotid artery was performed. He recovered well without neurological deficits. Urgent hemostasis is required for patients with penetrating carotid artery injury presenting with shock. Surgical reconstruction of the carotid artery with a vascular graft is a safe option.

Key words: penetrating carotid artery injury, shock, reconstruction, surgery

Introduction
The diagnosis and management of traumatic carotid artery injury remains controversial. Immediate hemostasis and restoration of cerebral blood flow are essential for survival if the patient suffers shock associated with hemorrhage from the carotid artery. We report a patient with a penetrating carotid artery injury with shock, who had excellent outcome after carotid artery reconstruction.

Case Presentation
A 41-year-old man presented with hemorrhagic shock after being stabbed in the neck with a knife. Effective manual compression resulted in temporary hemostasis as he was transported to our center. Physical examination found a 30-mm deep penetrating wound just below the left mandibular angle. His blood pressure was 80/46 mmHg, and he was confused with apparent right hemiparesis. Immediate sedation, intubation, and fluid resuscitation stabilized his condition with blood pressure of 100/56 mmHg. However, when he was transferred for computed tomography examination, massive arterial bleeding from the wound recurred and he fell into shock again. The imaging was abandoned, and the patient was immediately carried into the operating room, with continuous manual compression of the left neck.

Oblique skin incision along the anterior margin of the left sternocleidomastoid muscle disclosed a huge hematoma, which was carefully removed to reveal the proximal left common carotid artery. Arterial clamping at this site resulted in moderate reduction of the arterial bleeding and enabled release of the manual compression. Dissection distally along the left common carotid artery identified the lacerated site of the left common carotid artery with back-bleeding from the distal end (Fig. 1). The left common carotid artery was almost transected. The distal common carotid artery was clamped, then the artery was completely transected with the rim trimmed. A 4-mm diameter, 30-mm length expanded polytetrafluoroethylene synthetic graft was interposed, and end-to-end anastomosis was performed (Fig. 2). The internal and external jugular veins were also lacerated with active bleeding, and were ligated and coagulated. After the operation, intra-venous heparin was administered for 2 days, and warfarization followed.
Fig. 1 Surgical photograph showing triangular laceration (arrow) of the common carotid artery (dotted line). The distal common carotid artery was secured with a red vascular tape and a clamping clip.

Fig. 2 Surgical photograph showing the interposed graft (arrow).

Fig. 3 Postoperative computed tomography angiogram showing the expanded polytetrafluoroethylene graft as a bright line (arrows), with mild stenosis at the graft site.

Two days after the surgery, the patient had no neurological deficits. Diffusion-weighted magnetic resonance imaging disclosed a few hyperintense spots in the left frontal lobe. Computed tomography angiography showed that the left common carotid artery was patent with mild stenosis at the graft site (Fig. 3). Single photon emission computed tomography revealed normal cerebral blood flow in the left cerebral hemisphere. He was discharged home 9 days later without neurological deficits and returned to his previous job 2 months later. The patient is being followed for 3 years under anticoagulant therapy with warfarin and annual magnetic resonance imaging. Mild stenosis of the graft site showed no deterioration and no new ischemic lesion was found.

Discussion

The chance of survival is very slim for patients in hemorrhagic shock and/or coma with active arterial hemorrhage from penetrating carotid artery injury. Among 30 patients with penetrating carotid artery injury presenting with shock or coma, 3 of 4 patients with shock died, despite surgical repair of the injured vessel, and 19 of 26 patients with coma died.

In our patient, no presurgical radiological evaluation was possible because he had profuse bleeding from the wound, so continuous manual compression was essential. Manual compression was continued until the proximal common carotid artery was secured. To reach the proximal common carotid artery directly, a new skin incision was made proximal to the stab wound along the anterior margin of the sternocleidomastoid muscle. This incision in usually used in carotid endarterectomy surgery. It is useful to choose a familiar surgical route whenever possible in an emergent and critical situation. The left common carotid artery appeared to have very small caliber, probably due to arterial spasm. Therefore, we chose a graft of smaller diameter, which resulted in local narrowing of the left common carotid artery on postoperative imaging. Arterial repair is reported to achieve better neurological outcome and survival rate compared to ligation for patients with penetrating carotid artery injury. Interposition of synthetic vascular graft is rarely performed for carotid ar-
tery reconstruction because of the risk of thromboembolic complications, but this procedure was very effective in our case.\(^6,10\) The carotid artery in our case was damaged so irregularly and severely that end-to-end suturing without a graft was impossible. Radial artery graft was not realistic in this emergency situation.

Endovascular covered stent placement is another option.\(^1,3\) However, our patient also had venous injury which was also controlled by manual compression. The damaged veins were ligated and coagulated, which resulted in complete hemostasis. We suspect that these venous lacerations could not be treated through the transarterial endovascular approach. The direct surgical approach was a safe, fast, and secure method to provide immediate hemostasis in the present case.

Immediate surgical hemostasis is our treatment of choice for penetrating carotid artery injury. Carotid artery reconstruction is preferred. Management of hypovolemic shock and cerebral hypoperfusion is also important to achieve better outcome for the patient.

References


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