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CASE REPORT

A rare case of life-threatening traumatic carotid artery dissection in a child

Fulya Kamit Can[1] · Soysal Turhan[2] · Ayse Berna Anil[3] · Kadir Burhan Karadem[4] · Onur Aras Isik[2]

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Abstract
Penetrating injuries of the carotid and vertebral arteries are rare, but life-threatening conditions. There are still challenges in the first intervention management and patient treatment. Deciding which methods to apply in the first intervention, whether to perform imaging, and the preferred appropriate treatment for the patient (open surgery or endovascular intervention) plays a main role in the patient's survival without neurological deficit. The general management of trauma in penetrating neck injuries and the knowledge of special approaches to carotid artery injury are important for pediatric trauma centers. In this case report, we presented a case of penetrating carotid artery injury in a child who has recovered with no disability after a successful first intervention, surgical repair, and proper postoperative care.

Keywords Critically ill child · Carotid artery injury · Carotid artery repair · Horner's syndrome · Penetrating neck trauma

Introduction

Control and management of the penetrating trauma, including the carotid artery in the neck region, is difficult. The management of those patients and the surgical repair procedure are still controversial [1]. Here, we present a child with carotid artery dissection due to a longitudinal penetrating injury as a rare case without any neurological deficit after successful management of the whole process.

Case

A previously healthy 8-year-old girl was admitted to our emergency department. We learned acute bleeding started in the neck region after she fell in the park. She was taken to the emergency department by her father, who compressed the bleeding wound. She was unconscious, had a Glaskow coma scale (GCS): 3, and both pupils were reactive to light and mid-dilated. She was breathing superficially and had cyanosis with a heart rate of 138/min. She was cold, and the peripheral pulses were not palpable at admission. There was no active bleeding at the initial evaluation. Rapidly, 20 mL/kg of normal saline boluses were given two times, and then she was intubated. An initial diagnosis of decompensated hemorrhagic shock was made. A femoral central venous catheter was inserted, 15 mL/kg erythrocyte suspension was given, and dopamine infusion at 10 mcg/kg/min was started simultaneously. After that, perfusion improved, blood pressure could be obtained, and a massive bleeding was seen gushing out from the wound on the neck. Compression was applied to the wound, and the blood pressure was kept at the lower limit. The initial laboratory analyses were as follows: pH: 7.06 mmHg; pCO_2: 48.6 mmHg; HCO_3: 11.8 mmol/L;

✉ Fulya Kamit Can
fulyakamit@yahoo.co.uk

Soysal Turhan
soysal.turhan@gmail.com

Ayse Berna Anil
aysebernaanil@hotmail.com

Kadir Burhan Karadem
kbk.karadem@gmail.com

Onur Aras Isik
dr.onur.aras@gmail.com

1 Pediatric Intensive Care Unit, Izmir Tepecik Teaching and Research Hospital, Yenisehir, Konak, 35170 Izmir, Turkey

2 Department of Cardiovascular Surgery, Izmir Tepecik Teaching and Research Hospital, Izmir, Turkey

3 Pediatric Intensive Care Unit, Izmir Katip Celebi University, Izmir, Turkey

4 Izmir Tepecik Teaching and Research Hospital, Izmir, Turkey

lactate: 7.74 mmol/L; hemoglobin: 8 g/dL; hematocrit: %24; platelets: 322,000 mm^3; glucose: 180 mg/dL; calcium: 7.8 mg/dL; INR: 1.37; PZ: 15.8 s; and aPTZ: 33.7 s. The patient was transported to an operating room after receiving fresh frozen plasma at a 10 mL/kg dose and underwent emergency exploration by cardiovascular surgeons. During the operation, a penetrating injury (about 2 cm in length) was recorded in the medial margin of the left sternocleidomastoid muscle in the lower one-third of the neck. When the compression was removed, active arterial bleeding continued. The incision was extended, and the carotid arteries were checked: A penetrating injury (transection) in the one-third proximal part of the common carotid artery and a partial injury in the vagus nerve was recorded; the trachea was patent. The ends of the injured carotid artery were trimmed and end-to-end anastomosis was performed (Fig. 1). The vagus nerve was repaired by the neurosurgeons, and she was transported to the pediatric intensive care unit (PICU) after the operation. She was intubated and hemodynamically stable at admission to the PICU (heart rate: 110/min, sinus rhythm, blood pressure: 92/60 mmHg). During the first hour of monitoring in the PICU, her heart rate and blood pressure increased suddenly (heart rate: 186/min, and blood pressure: 180/65 mmHg). Her heart rhythm was sinus, perfusion was normal, and postoperative pain and sedation management was optimal. We suspected baroreflex dysfunction or failure due to the neck trauma or operation and/or reperfusion. Esmolol infusion was given at the beginning, but when the dosage was titrated to 100 µg/kg/min, the patient developed significant bronchospasm. Esmolol was discontinued due to the ventilation failure from bronchospasm. Bronchospasm was improved after discontinuation of esmolol. Because the patient was still hypertensive and tachycardic, intravenous metoprolol (0.1 mg/kg) was tried. Heart rate and blood pressure were kept at the 95th percentile of normal values. On the fourth day, her heart rate and blood pressure were within normal limits without medication. On the second day, when the patient was extubated, (left sided) ipsilateral ptosis and myosis were detected without any neurological abnormalities. She was conscious and felt good with no other pathological signs on examination. The diagnosis of Horner's syndrome was made and monitored closely. On the eighth day, she was discharged without any abnormality on examination except the Horner's syndrome signs. On the 6-month of follow-up, the signs of Horner's syndrome were improved and magnetic resonance angiograph demonstrated no abnormalities on carotid arteries (Fig. 2), and diffusion-weighted magnetic resonance imaging was normal.

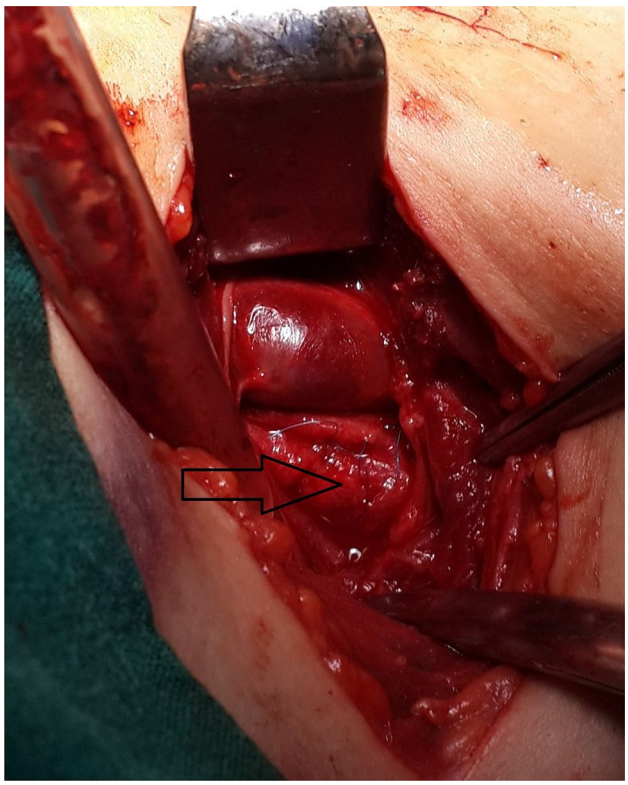

Fig. 1 End-to-end anastomosis of injured carotid arteries, intra-operative picture

Discussion

Severe penetrating injuries of carotid artery is reported rare and also one of the most urgent challenge of vascular surgery [2]. This rare occurrence causes some difficulties in

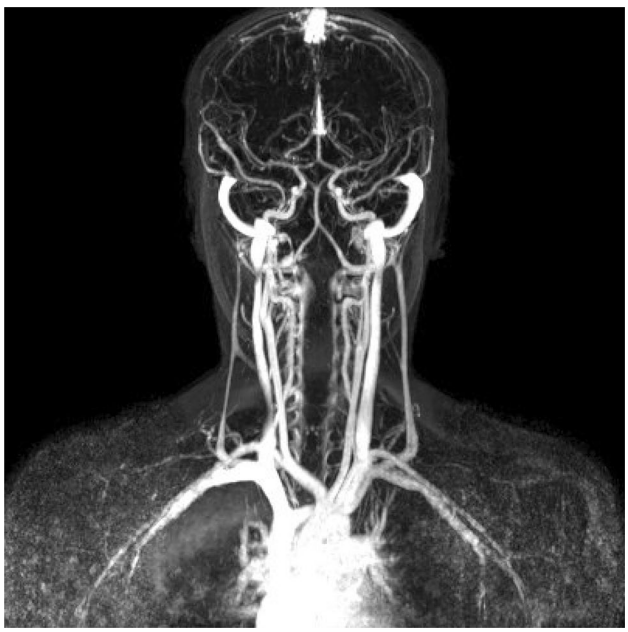

Fig. 2 Magnetic resonance angiography of carotid arteries on the 6 month of follow-up

managing this situation, which is not in the routine practice of surgeons. The rate of ischemic stroke is reported at 28%, with a mortality rate of 17% due to common carotid artery injuries [3]. Patients in coma or shock at admission have poor prognosis, with a mortality rate of 50% [3]. Other factors that affect the outcome of patients with carotid artery injuries are mechanism of the trauma, the anatomic localization of injury (involving segments), comorbidities of the patient, the hospital arrival time after trauma, and effective resuscitation in the emergency department [3]. In our case, short arrival time to the hospital after injury, effective compression on the bleeding site before admission, successful resuscitation in emergency department, and the localization of injury (a short segment) were the important factors regarding the outcome.

There is no consensus on the diagnosis and the management of these injuries due to such rare occurrences. We prefer urgent exploration and surgical repair to the injury without a delay due to diagnostic methods after effective resuscitation in the emergency department if the patient is unconscious or hemodynamically unstable at admission. In stable patients, imaging modalities can guide management, whether endovascular interventions or observation may be preferred. Nevertheless, those patients stable at admission usually have dissections or pseudoaneurysms due to blunt trauma rather than transections due to penetrating injuries [4].

The surgical procedure performed after exploration of the injury is also controversial. Some of the authors suggest the ligation of the artery is more useful in controlling the active bleeding, while others state that repairs may be beneficial in protecting for cerebral infarct [5, 6]. However, immediate revascularisation should be performed in the presence of coma, which has very poor prognosis irrespective of the type of operation [7]. Even the efficacy of Transcranial doppler ultrasonography and near-infrared monitoring spectroscopy could not be considered established, neuromonitoring techniques for monitoring brain perfusion while pressurizing the carotid artery, and also during the operation would provide useful information which might help managing the patient in emergency department and also during the operation about hypoperfusion or vasospasm [8]. Unfortunately, at that time there was no other technique except physical examination, that was our limitation.

Horner's syndrome is characterized by ipsilateral ptosis and myosis occurs in such injuries due to the compression and/or direct trauma to the assendan sympathetic nerves. This is reported among almost half of the carotid artery region traumas. Though there are some empiric treatment for Horner's syndrome, these patients usually recover in approximately 6–12 months [9]. Our patient was also completely recovered without any treatment 6 months after she developed Horner's syndrome.

The carotid sinus reflex plays an important role in blood pressure regulation. Surgical procedures performed in the neck region may cause baroreceptor dysfunction/failure due to carotid sinus nerve damage, which causes hypertension and tachycardia. Hypertension is usually transient in unilateral damage [10]. In our case, hypertension and tachycardia developed 1 h after the operation and responded to beta blocker therapy before completely recovering on the fourth day.

Our patient was discharged without any neurological disability due to successful management of resuscitation, reconstructive surgery, and postoperative care, despite the GCS score being 3 at admission. This case reminds us that rapid, effective, and organized interventions may affect survival and may prevent neurological disabilities due to penetrating injuries of neck.

Compliance with ethical standards

Conflict of interest All the authors declare that there is no conflict of interest.

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