Case report - Vascular thoracic

Transection of left common carotid artery with arch extension after blunt chest trauma

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Abstract

We report the case of a 63-year-old man, admitted after a traffic accident. Clinical examination found chest trauma, mandibular and long bone fractures but there was no cerebral ischemic signs. The chest X-ray showed a widening of the mediastinum; therefore an aortography demonstrated a false aneurysm, an intimal flap of the left common carotid artery (LCCA) and a middle aortic arch disruption. Surgical reconstruction was accomplished by inserting Dacron prosthesis from the ascending aorta to the LCCA. The aortic arch wound was reconstructed by an autologous pericardial patch. In light of this surgical case, we discuss early methods of diagnosis and details of medical, surgical or endovascular treatments.

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1. Introduction

Blunt injuries to cerebrovascular arteries must be considered in any patient after deceleration injury [1]. Innominate artery is the most frequently injured vessel, followed by subclavian arteries. Carotid injuries are infrequently reported [2]. Rapid diagnosis and successful outcome justified aggressive approach for management of suspected aortic and cerebrovascular vessels injuries.

We report a case of left common carotid artery (LCCA) rupture with aortic arch disruption.

2. Case report

A 63-year-old man was admitted after road accident. He was conscious but amnesic in regard to the accident. Initial clinical examination revealed chest wall trauma, mandibular fracture and limb bone fractures.

Chest radiography revealed a widened mediastinum, extrapleural hematoma, bilateral pulmonary contusion, and multiple rib fractures. CT scan confirmed left extrapleural and mediastinal haematomas with pulmonary contusion signs. Aortography demonstrated a LCCA false aneurysm with a proximal aortic arch intimal dissection (Fig. 1). Deceleration was the most important mechanism of arterial injuries.

Surgery was performed through a midline sternotomy prolonged to the right side of the neck (Fig. 2). After heparinization, cardiopulmonary bypass was instituted between the right atrium and the right femoral artery with a second arterial canula in the right common carotid artery for brain protection. Aorta was cross-clamped between left common carotid and subclavian arteries. Left common carotid and right subclavian arteries were also cross-clamped and cold blood cardioplegia was performed by aorta. During cooling to 25 °C, arch vessels were approached after mobilisation of innominate vein. Circumferential subadventitial transection of LCCA ostium with extension to proximal aortic arch was confirmed. Dacron™ prosthesis bypass from the ascending aorta to the LCCA and repair of wound aortic arch with autologous pericardial patch were performed (Fig. 2). Despite heparin treatment, no ischemic or hemorrhagic event was noted during
postoperative course. Patient was discharged 22 days after surgery without neurological complications.

3. Comment

Avulsion of LCCA is uncommon after blunt chest trauma. In 1994, Pretre et al. reported 14 cerebrovascular arterial injuries: subclavian arteries in 11, innominate arteries in two and right carotid artery only in one case. Diagnosis is often delayed because of frequent severe injuries association or, in some case, of absence of neurological signs [2]. These uncommon injuries should be suspected in presence of head injury with Glasgow score <8, chest injury or neurological signs [3,4]. Early clinical and radiological diagnosis is the key to successful management. CT scan or RMI, are interesting for aortic injuries detection but limited for supra-aortic arteries injuries. Duplex ultrasound can confirm diagnosis but cannot be useful for screening all patients with acute blunt chest trauma [3]. Aortic and cerebrovascular arteries arteriography is the ‘gold standard’ exam with good sensibility and specificity [5]. Some authors realise systematically four-vessel angiograms for patients with possible cerebrovascular artery injuries [6]. Severity of the supra-aortic arterial vessels lesions was graded on arteriographic findings. Five different grades have been describing [7].

– Grade I lesions (intimal injury) have the best outcome within classical case, complete regression under heparin or antiplatelet therapy [8]. No surgical indication is kept for this lesion.

– Grade II (dissection or hematoma with patent lumen) lesions progress towards the lumen stenosis in 70%; then ‘surgical’ treatment is indicated [8]. In 2003, endovascular treatment is possible without large heparin injection during surgery with extracorporeal circulation [8]. However, arterial lumen is almost occluding, surgery can be preferred to stentgraft because of the difficulties to catheterise the arterial lumen.

– 92% of Grade III (pseudoaneurysm) lesions progress under medical treatment; risks of rupture and hemorrhage impose rapid surgery [8]. Endovascular approach is an interesting option for pseudoaneurysm treatment because surgical dissection is not needed.
When proximal or distal necks are absent, no endovascular treatment is possible and surgical reparation is necessary because of high risk of stentgraft dysfunction. Hypothermic circulatory arrest with cerebral perfusion and complete vessel reconstruction is indicated for complicated pseudoaneurysm associated with large aortic lesions [1,8].

- Grade IV lesions (occlusion) can be treated by bypass (vein or PTFE) in acute or symptomatic cases [8]. But most of them, fortuitously discover during systematic examination, are asymptomatic. In these cases no vascular treatment is implemented except anticoagulation therapy.

- Grade V lesions (transection) can be treated by covered stentgraft or surgical procedures [9]. Most important part of these patients, died during the accident and survivors, have a high risk of complete rupture before surgery.

In fact, to repair isolated vascular lesion, extracorporeal circulation and heparinization can be often avoided, but cardiopulmonary bypass is needed to control and repair complexes injuries of supra-aortic arteries especially with arch extension.

Our patient presented a LCCA grade V lesion with aortic arch extension. For this reason, we have chosen the surgical approach with hypothermic extracorporeal circulation (25 °C) with right carotid artery perfusion. We have used hypothermia to improve brain protection during LCCA clamping and no circulatory arrest was needed. We performed a bypass with 8 mm Dacron* graft between the ascending aorta and the LCCA because of anastomotic stricture risk after direct anastomosis. Aortic repair has been realised with an autologous patch of pericardium without any biochemical treatment. Some authors report that glutaraldehyde can avoid patch retraction but for this patient we have not used this treatment. Large aortic lesions need a partial or complete arch replacement with branched Dacron graft under circulatory arrest and cerebral perfusion.

After surgery, all authors report that anticoagulation is highly efficient and reduce neurological morbidity [2,5,6,8] and global mortality despite an increase of hemorrhagic signs and need of blood transfusion for patients with multiple injuries [2,7,8]. Walh use only antiplatelet treatment after surgery without heparin and found same neurological and mortality results without need of blood transfusion [10].

In conclusion, we report the case of disruption of the aortic arch with rupture of the LCCA after blunt chest trauma successfully treated by surgical approach and with uneventful clinical course.

References


Appendix A. ICVTS on-line discussion

Author: Dr. Hitoshi Hirose, The Cleveland Clinic Foundation, Department of Thoracic and Cardiovascular Surgery, Metro Health Drive, Cleveland OH 4410, USA.

Date: 14-Oct-2004

Message: Injuries to the great vessels of the aorta after blunt chest trauma is uncommon. Detection of mediastinal hematoma is the key to the diagnosis. A large mediastinal hematoma may be diagnosed on the chest x-ray. However, smaller mediastinal hematoma may be diagnosed by CT scan. However, the specific diagnosis of the injury of the vessel and the extension of the injury should be accessed by angiography.

Response

Author: Dr. Rubin Sylvain, Department of Thoracic and Cardiovascular Surgery, Robert Debre Hospital, Reims, France

Date: 24-Oct-2004

Message: I agree with you for small and partial injury. But with new generation CT scan (16 or 32), we are able to identify very small arterial lesions, less than 2 or 3 mm.

However, angiography can be helpful in some difficult cases. For us, this invasive investigation must be used as a second intention if the CT scan shows a real mediastinal hematoma without any lesions.
Figure A. CT scans shows mediastinal hematoma around the innominate artery.

Figure B. Aortogram confirms innominate artery injury.