

# Emergent management of penetrating trauma of aortic arch in a countryside hospital

DI Dong-mei, ZHANG Xiao-ying\* and JING Huo-jun

**【Abstract】** According to the literature, only a small proportion of occurrences regarding penetrating trauma of the thoracic aorta can be treated successfully. Herein we reported our experience of a recent rescue of such a patient in a countryside hospital lacking advanced instruments for cardiopulmonary bypass operations. A 20-year-old male was admitted for a penetrating injury with disrupted innominate vein and right common carotid artery together with a 1.5-cm

laceration on the aortic arch between the innominate artery and the left common carotid artery. The patient was successfully saved without the implementation of cardiopulmonary bypass. Presentation and management in this case were discussed.

**Key words:** *Aorta, thoracic; Wounds, stab; Hospitals*

*Chin J Traumatol 2011; 14(2):114-116*

**P**enetrating injury of large blood vessel is a life-threatening condition with high mortality.<sup>1,2</sup> Open surgical repair under bypass circulation is a well accepted treatment in emergency settings.<sup>3,4</sup> Endovascular stent graft repair of penetrating aortic injury is an alternative when the patient has contraindications for open surgical repair.<sup>5</sup> However, in most of the countryside hospitals in China, both bypass circulation and endovascular stent graft are still luxurious and experience in treatment of penetrating aortic injury is limited too. In this study, we presented a case report that a patient had severe large vessel injuries and was successfully saved without the implementation of cardiopulmonary bypass.

## CASE REPORT

The 20-year-old male suffered a stab wound into the thoracic cavity near the right sternoclavicular joint during a quarrel. About 30 minutes after the incident, the patient was admitted to the nearest local hospital, which was a countryside hospital without cardiopulmo-

nary bypass equipment, at 9:34 pm on July 2nd 2007. On arrival, he was at shock condition with heart rate of 126/min and blood pressure of 80/50 mm Hg (1 mm Hg = 0.133 kPa). There was an active bleeding wound about 3.0 cm above the right sternoclavicular joint. The patient was immediately given hard pressed bandage and quick blood transfusion. Meanwhile, he underwent an emergency thoracic CT scan, which revealed a very large upper mediastinal hematoma (Figure 1). Surgeons decided to have an emergent operation. A neck arc incision combined with upper median sternotomy was performed at 11:00 pm. Massive bleeding was encountered in the upper mediastinum, and it was difficult to correctly and accurately identify the origin of hemorrhage. An estimated 5 000 ml blood was lost within the first two hours and blood pressure subsequently dropped to 0 mm Hg, despite receiving quick and continuous blood transfusion. Pressing hard with gauze pad stopped the bleeding, meanwhile the shock was treated by quick blood transfusion. An emergent consultation was sent to our hospital at 12:30 pm. About one hour later we reached the hospital. In primary examination, we speculated that he had heart or great vessel injuries. The upper median sternotomy was extended to a standard median sternotomy. In order to find the origin of bleeding, gauze pad was moved on very slowly, the innominate vein was found to be disrupted and two ends of the innominate vein were ligated rapidly. Then a tearing at the middle innominate artery was found. A vascular clamp was placed on the proximal innominate artery, and the injury was quickly repaired with a 4-0 polypro-

DOI: 10.3760/cma.j.issn.1008-1275.2011.02.011

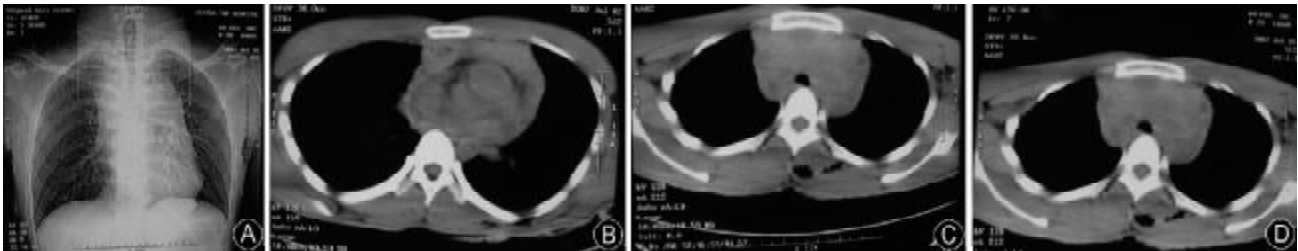
Department of Cardiovascular Surgery, Third Affiliated Hospital of Suzhou University, Changzhou 213003 (Di DM and Zhang XY)

Jingtang Chinese Medicine Hospital, Jingtang 213200, Jiangsu Province, China (Jing HJ)

\*Corresponding author: Tel: 86-519-68871278, Fax: 86-519-86621235, Email: xiaoyingzhang6689996@msn.com

pylene suture. Another 1.5 cm laceration between the left common carotid artery and the innominate artery was identified. Partial aortic arch, including the left common carotid artery and the innominate artery, was clamped with the vascular clamp. The laceration was closed with 4-0 polypropylene suture. The partial aortic arch clamping time was only about 1 minute. After unclamping the aortic arch, the bilateral pupils were

normal. During the operation blood transfusion was underway continuously and blood pressure slowly rose to the normal level. About 10 000 ml of blood in total were lost and the patient received 9 000 ml blood transfusion during the treatment. The operation lasted 4 hours. Eventually, the patient had a successful and uneventful recovery, and was discharged from the hospital 14 days later.



**Figure 1.** A: Posteroanterior chest radiograph reveals a widened mediastinum. B: CT scan reveals hematoma within the pericardium. C and D: CT scan reveals hematoma in mediastinum.

## DISCUSSION

Penetrating injuries to the heart and great vessels are critical emergency cases and offer a great surgical challenge to clinicians due to the difficulties in preoperative diagnosis, choice of incision and management of massive bleeding. Only a small proportion of the patients can survive long enough to reach the hospital and be treated successfully. Especially, thoracic aortic injuries are seldom managed successfully in small hospitals. In this case, the stab wound caused injuries of the innominate vein, innominate artery and aortic arch simultaneously, while the local hospital had no cardiopulmonary bypass instruments. To manage this uncommon stab wound is of great challenge and difficulty for surgeons, especially without taking cardiopulmonary bypass.

Conventional angiography has been considered as the standard reference to detect cardiovascular injury, although it is not recommended for patients with unstable hemodynamics.<sup>6</sup> Furthermore, conventional arteriography is an invasive procedure that may cause severe complications. In practice, we find that preoperative helical CT scanning, especially contrast helical CT scanning, is helpful to identify cardiovascular injuries quickly. In this case, the patient only underwent helical CT scanning rather than contrast helical CT scanning, which made it very difficult to identify the laceration of the thoracic aorta before operation. A contrast helical CT scanning may be helpful for identifying the origin of mediastinal hematoma in such cases.

If an operation needs to be performed immediately without confirmed diagnosis, surgeons should have a sufficient assessment and alternative plans of surgical procedures. In this case, surgeons in the local hospital, who lacked experience in treating cardiovascular injury and had no sufficient assessment of the operation, performed the surgical exploration uncertainly with incorrect surgical incision, which might produce further risks for the patient. In addition, if injury to the aortic arch, or if injury to more than one of arch vessels is suspected, it is best to use cardiopulmonary bypass during operation. According to the literature, deep hypothermia and circulatory arrest may contribute to an optimal exposure of aortic arch in a bloodless field and it is easy for surgeons to inspect entire aortic arch within the lumen.<sup>7</sup> The advantage of repairing laceration under circulatory arrest condition and full intraluminal inspection of aortic arch is also illustrated by the fact that the surgeons are able to detect and repair other lacerations at the posterior wall of the aortic arch.<sup>8</sup> In this case, although there was no extracorporeal circulation machine and corresponding equipments available in the countryside hospital, and no specialized cardiovascular surgeon at the scene, the treatment was successful under such limited and harsh medical conditions due to a special management. Partial aortic arch clamping has to be used with cautions. Other contributions include the large blood resource prepared for transfusion, specialized consulting clinician, properly selected polypropylene suture, quick performance of the operation, short time partial aortic arch clamping,

precise reparation of major blood vessels, etc. As we know, once partial aortic arch clamping time exceeds 4 minutes, irreversible brain damage may occur.

It is concluded that an accurate, skilled, prompt manipulation during operation is the key point for rescuing such a patient in a countryside hospital without facilities or capabilities for cardiopulmonary bypass.

## REFERENCES

1. Hoyt DB, Bulger EM, Knudson MM, et al. Death in the operating room: an analysis of a multi-center experience. *J Trauma* 1994;37(3):426-432.
2. Deree J, Shenvi E, Fortlage D, et al. Patient factors and operating room resuscitation predict mortality in traumatic abdominal aortic injury: a 20-year analysis. *J Vasc Surg* 2007;45(3):493-497.
3. Cox CS Jr, Black CT, Duke JH, et al. Operative treatment of truncal vascular injuries in children and adolescents. *J Pediatr Surg* 1998;33(3):462-467.
4. Esterra A, Mattox KL, Wall MJ. Thoracic aortic injury. *Semin Vasc Surg* 2000;13(4):345-352.
5. Hoffer EK. Endovascular intervention in thoracic arterial trauma. *Injury* 2008;39(11):1257-1274.
6. Demetriades D, Skalkides J, Sofianos C, et al. Carotid artery injuries: experience with 124 cases. *J Trauma* 1989;29(1):91-94.
7. Seitelberger R, Bialy J, Rajek MA. Repair of stab-wound laceration of the aortic arch using deep hypothermia and circulatory arrest. *Ann Thorac Surg* 2004;77(2):703-704.
8. Buchan K, Robbs JV. Surgical management of penetrating mediastinal arterial trauma. *Eur J Cardiothorac Surg* 1995;9(2):90-94.

*(Received October 9, 2010)*

Edited by LIU Jun-lan