A Case of Right Shoulder Penetrating Injury Inflicted by a Hollow Metal Fence

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Case Report

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Abstract

**Background:** Right shoulder penetrating injury are rare and challenging diagnoses that should not be missed.

**Case presentation:** The patient, a 30-year-old male, had a clear mind, stable vital signs, a gcs score of 15 points, unbearable pain in his right shoulder and chest wall, and no abnormal breathing. His right radial artery was unclear, and the right ulnar artery was thin and unclear, suggesting comminuted fractures of the right humeral shaft and scapula. After the multi-disciplinary discussion in the emergency department, we planned to perform an emergency operation to take out the foreign body from his right shoulder.

**Conclusions:** Penetrating injury is very important to systematically and comprehensively assess the peripheral vascular nerve and muscle tissue at the site of injury. The foreign body should be carefully removed during the operation to avoid further damage to the patient, and it is necessary to perform fluoroscopy again after the removal of the foreign body. The placement of drainage, secondary debridement and sutures, and fixation can effectively reduce postoperative infection.

Introduction

With the rapid economic development and technological progress, penetrating injuries are rare in our emergency trauma center. Patients with penetrating injuries often sustain serious injuries and hemodynamic instability, and penetrating chest and back injuries account for 10% of all traumatic cases. [1] The life safety of the patient who suffered from such kind of trauma is closely related to the anatomical distribution and density of important tissue structures at the site of the injury. The penetrating injury to the case in our study originated from a traffic accident, and the direct violence caused damage to important blood vessels and nerves in the chest and shoulders. [2] The injury mechanism of the patient was caused by a hollow metal pipe, which would pose serious danger to life as it was too close to the axillary artery and vein, brachial plexus, and thoracic cavity. This case describes a rare penetrating injury of the right shoulder and chest wall caused by a hollow metal fence.

Case

The patient, a 30-year-old male, was admitted to the emergency department of our hospital because of the penetrating injury to his right shoulder and chest wall caused by collision with the roadside fence when he drove a car (Fig. 1A,1B). At the time of admission, he had a clear mind, stable vital signs, a gcs score of 15 points, unbearable pain in his right shoulder and chest wall, and no abnormal breathing. Examination showed that a hollow metal fence of about 13*6*30 cm penetrated from the middle of his right latissimus dorsi (Fig. 1C), and exited above his right clavicle. He couldn’t lift his right upper arm nor move his right elbow, but his right wrist was moving normally and the skin on his right forearm and upper arm was feeling well. The trauma assessment was completed in the emergency department, and his head CT scan demonstrated a fracture of his left occipital condyle (the fracture line involved the ipsilateral
atlantooccipital joint surface), but no obvious intracranial hemorrhage was observed. There were no signs of bleeding into thoracic cavity nor of pneumothorax by CT scanning of cervical vertebra and chest in this patient, but a fracture of the left anterior arch of the atlas and a right scapula fracture were found. His right shoulder and chest wall were penetrated by a foreign body (Figs. 2A, 2B). Three-dimensional reconstruction of his right shoulder joint CT prompted a foreign body to come out from the front of his right clavicle (Fig. 2C). His right upper artery angiography showed that the right axillary and brachial arteries were slightly thinner, the right radial artery was unclear, and the right ulnar artery was thin and unclear, suggesting comminuted fractures of the right humeral shaft and scapula. There was no obvious abnormality in the clinical blood test results. After the multi-disciplinary discussion in the emergency department, we planned to perform an emergency operation to take out the foreign body from his right shoulder with the consent of the patient and his family.

Surgical procedure: After being anaesthetized, the patient was placed in the right lateral decubitus position, and his right upper extremity and right side of trunk were routinely disinfected with a drape. During the operation, a foreign body penetration injury on his right shoulder could be seen. A 13 * 4 cm wound on the front and a 13 * 6 cm wound on the back of the body were visible. PVP iodophor solution was used again to sterilize the foreign body and surrounding tissues of the wound. Exploring the anterior wound, we observed that the metal fence penetrated the body from the junction of the right side of platysma, anterior bundle of deltoid and pectoralis major. The cephalic vein had been damaged and formed a traumatic thrombosis. The injured blood vessel was removed and the stump was sutured and ligated. When slowly pulling out the metal fence to the back and outside, we probed again and found that it penetrated from the front of the patient's right clavicle, and touched the axillary artery pulsation on the anterior and lateral sides of the foreign body. There was no obvious bleeding in the axillary artery and vein, and some branches of his right brachial plexus nerve were damaged. After removing the foreign body, we carefully explored on his right thoracodorsal wound. It was found that his right serratus anterior muscles, teres major muscles, teres minor muscles, infraspinatus muscles, latissimus dorsi muscles and right thoracodorsal nerve were partially injured. Intraoperative fluoroscopy confirmed no obvious foreign body residue (Fig. 3A). The broken end of the right scapular fracture could be touched. The wound area stopped bleeding completely after flushed with PVP, hydrogen peroxide and saline again, and a drainage tube was placed on his right thoracodorsal wound (Fig. 3B). The wound was covered with iodoform gauze and applied with pressure bandage (Fig. 3C).

The revaluation of the patient's upper limb function after surgery revealed that his right wrist moved normally, but he had the dermal sensation exceptionally on his right forearm and upper arm. Postoperative MRI examination of his right shoulder joint showed comminuted fractures of the proximal humerus and scapula, injury of glenoid labrum of his articulatio humeri, and partial injury of the tendon of biceps brachii muscle and tator cuff. Multiple muscles and muscle gap were injured around articulatio humeri, and local subcutaneous soft tissues were defected, but the brachial plexus bundle was intact at both injury sites. The patient was transferred to the burn department for flap transplantation two weeks later. His humeral shaft fractures were treated with the standard open reduction and internal fixation
techniques, which significantly improved the symptoms of decreased muscle strength and restricted right upper extremity postoperatively.

**Discussion**

A high priority should be given to a penetrating injury, whatever its cause. The degree of epidermal damage cannot represent the patient's potential tissue damage\(^3\) because the foreign body can cause severe and violent damage to the deep tissues around the penetrating site. Therefore, it requires not only comprehensive imaging and evaluation, but also surgical examination to assess the condition of the internal organs and surrounding tissues when a penetrating injury occurs. From the damage situation, the foreign body remaining in the body is a risk factor for infection after penetrating injury. The sinus tract formed by the passage of foreign body would increase the risk of postoperative infection, postoperative complications and the need for reoperation.\(^4\)

The penetrating injury of the case in this paper is relatively rare in modern society. Prospective studies had not yet confirmed the effective management of prevention of infection or other complications.\(^5\) We summarize the experience of diagnosis and treatment of this case as follows. First of all, systemic trauma assessment is the first priority, and occult injuries of head, neck, chest and abdomen must be excluded. We should remove foreign objects as soon as possible, and avoid blind attempts before surgery, so as to prevent further damage to the tissues around the patient's injuries. During the transportation and inspection in the emergency room, we must pay attention to protect the blood vessels around the injured part of the patient. Severe shaking should be avoided to prevent rib fractures and pneumothorax since the hollow metal fence was close to the chest. The subclavian artery of this case was found in the anterolateral region of the foreign body during the operation, and a part of his cephalic vein had been completely damaged. Preoperative and intraoperative imaging examinations should be combined to fully assess the residue of the foreign body in the penetrating injury.\(^6\) The patient was given empirical tetanus vaccination and anti-ketone therapy. Secondly, the iodophor solution was routinely applied in the intraoperative wound treatment, and the deep tissue debridement was washed with normal saline and diluted pvp after removing the foreign body\(^7\). A drainage tube was placed during deep tissue surgery (Fig. 3B). Primary closure of wounds may increase the risk of wound infection.\(^8\) Intraoperative fluoroscopy after removal of the foreign body helped determine whether there was foreign body residual in the patient's body.\(^9\) During the operation, it was necessary to avoid damage to the axillary artery, axillary vein and subclavian artery, so as not to further harm the brachial plexus. In the process of slowly pulling out the foreign body to the posterolateral side, attention should be paid to preventing the sharp head of the metal fence from further incising brachial plexus and aggravating the damage to the surrounding nerve tissues. Primary external fixation or internal fixation was not recommended for patients with humeral shaft and scapula fractures because these two techniques would increase the risk of infection.\(^10\) There were no obvious signs of purulent infection in the superficial and deep tissues of the wound during the hospitalization and the examinations showed no
significant increase in the infection indicators of the patient, indicating that the prophylactic use of antibiotics was effective.

What is special about this case: The penetrating injury on the right shoulder and chest was a violent injury caused by a car accident, which resulted in a comminuted fracture of the patient's right scapula, but no fracture of his clavicle. The biomechanical characteristics analysis indicated the metal foreign body penetrated from the back of the clavicle of the patient, but in fact, it penetrated from the front of the clavicle. More surprisingly, both the subclavian artery and axillary artery and vein areas located in front of the metal fence were free from any damage. There was no obvious contrast medium overflow in the enhanced CT of the right upper limb before the operation. Only the cephalic vein injury and the superior scapular vein injury were detected during the operation.

**Conclusion**

Penetrating injury is a severe injury caused by a violent foreign body penetrating a certain part of the body. It is very important to systematically and comprehensively assess the peripheral vascular nerve and muscle tissue at the site of injury. Empirical administration of tetanus prevention and antibiotics prevention can help reduce the length of hospital stay. The foreign body should be carefully removed during the operation to avoid further damage to the patient, and it is necessary to perform fluoroscopy again after the removal of the foreign body. The placement of drainage, secondary debridement and sutures, and fixation can effectively reduce postoperative infection. This method could accelerate the wound healing of the patient and create favorable conditions for fracture fixation surgery as soon as possible.

**Abbreviations**

CT, computed tomography.

**Declarations**

**Availability of supporting data:**

All relevant data and materials are presented in the paper.

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**Authors' contributions:**

GPC conducted data collection, manuscript preparation and editing, ZGF contributed the data curation, ZHM conducted proofreading, and ZM conducted the final manuscript editing and review. All authors read and approved the final manuscript.
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Consent:

Written informed consent for the publication of this case report and any accompanying images was obtained from the patient. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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Competing interests:

The authors declare that they have no competing interests.

Consent for publication:

Consent for publication has been obtained.

Ethics approval and consent to participate:

Ethical clearance was not required for this retrospective case assessment in accordance with Chinese law. Anonymous patient data were retrospectively assessed. No medical procedures were performed for study purposes. Accordingly, this case report did not fulfill the criteria for description as a scientific project involving humans according to § 9.2 of the Law of the Association of Hamburg Physicians (“Hamburgisches Kammergesetz für Heilberufe”), and ethical counseling was not required according to § 15.1 of the Professional Guidelines of Hamburg Physicians.

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