

## Recovery of an Impalement and Transfixion Chest Injury by a Reinforced Steel Bar

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**A 36-year-old man was admitted to our hospital because of impalement injury due to a downwards fall upon some reinforced steel rods. An emergency operation was performed using percutaneous cardiopulmonary support (PCPS). The steel rods were taken out in the operating room. The heart, great vessels, vertebrae, and spinal cord were not involved in the impalement wounds. We performed a bronchoplasty of the torn and separated right main bronchus, and repaired the impaled left lung without any pulmonary resection. He recuperated without sequelae. (Ann Thorac Cardiovasc Surg 2001; 7: 304-6)**

**Key words:** impalement injury, bronchoplasty, percutaneous cardiopulmonary support (PCPS)

### Introduction

Impalement and transfixion injuries are uncommon in civilian practice. Such injuries are often lethal depending on the organs involved. There are even fewer reports of impalement injuries limited to the chest.<sup>1-3)</sup> The hospital where the patient is transported must react with rapid and proper management. We experienced such an injury in a 36-year-old man. The present case report illustrates the successful surgical treatment of the impalement injuries to the chest using percutaneous cardiopulmonary support (PCPS).

### Case Report

A 36-year-old construction worker fell 3 m from a supporting harness and became impaled upon two reinforced steel bars (rokubu-tekkin). One of the two steel bars entered his left anterolateral thorax and exited from the right posterolateral thorax, and the other one penetrated his right thigh. His coworkers sawed off the reinforced steel

bars but did not draw the bars out of his chest and right thigh. He was taken to a regional hospital where a chest X-ray revealed bilateral pneumothorax. Chest drains were inserted bilaterally (Fig. 1), and he was given oxygen. On admission to the hospital he was conscious and hemodynamically stable. He had no brain damage, which was confirmed by a brain CT scan. His responses to the neurological examinations were quiet and normal. After these examinations and treatment he was transferred to our hospital by ambulance.

He gradually complained of difficulty of breathing and his blood oxygen level decreased. Following the arrival of our team, he was taken immediately to the operation theater. He was immediately intubated but when no improvement of the blood gas was seen, we connected him to a PCPS and started a flow of 2000 ml/min. PCPS gave him a normal blood oxygen concentration. Both the pleural cavities and the pericardial cavity were examined through a median sternotomy and the rod in his thigh was removed directly. The other rod in his chest had penetrated the pericardium and bilateral lungs. Even though the rod passed through the transverse sinus, his heart and large vessels (ascending aorta, pulmonary aorta, descending aorta, pulmonary vein, superior vena cava) were fortunately unharmed (Fig. 3). When the rod was carefully removed under direct vision, no massive bleeding occurred. We examined him for any other wounds to the chest. We found that the right bronchus was torn and separated (Fig. 4). We performed a bronchoplasty of the right

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Received December 4, 2000; accepted for publication January 5, 2001.

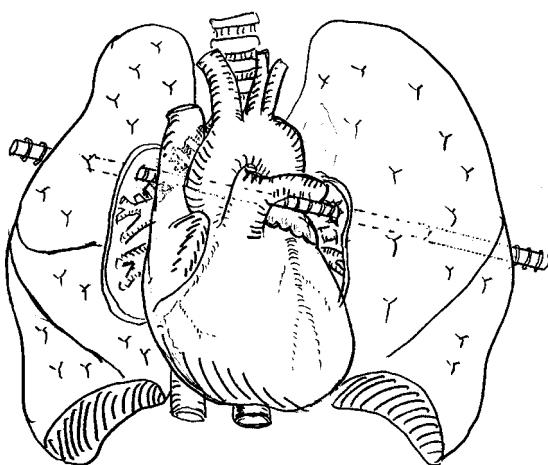
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**Fig. 1.** An anteroposterior supine chest roentgenogram shows the position of the reinforced steel bar that had completely penetrated the chest from the left to right. Note that subcutaneous emphysema is seen in the neck and body, and bilateral thoracic drainage tubes are already positioned.



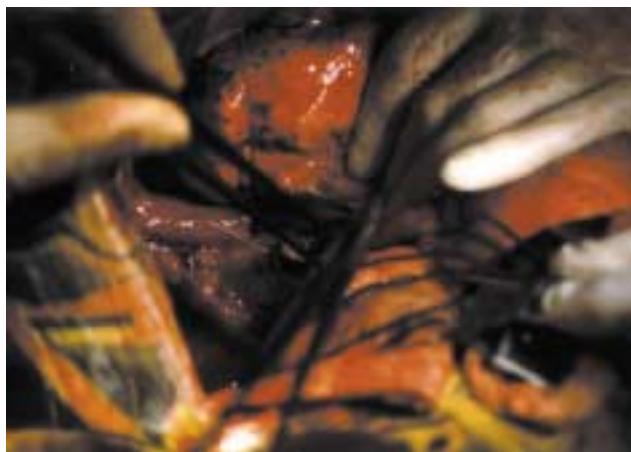
**Fig. 2.** Photographs taken of the patient's anterior left side (upper), and posterior right side (lower) in the operation room, shows the reinforced steel bar and thoracic drainage tube. The victim had a very beautiful tattoo [a rising dragon (Nobori-Ryu)] on his anterior chest and back.



**Fig. 3.** The drawing illustrate how the reinforced steel bar passed through the central lungs and pulmonary hilus. The steel rod passed through the transverse sinus without any damage to the heart and great vessels.

bronchus which was reinforced by the adjacent tissue (thymus). As soon as he received the bronchoplasty he was able to be disconnected from the PCPS. The overall operating time for the PCPS was 1 hour and 42 min and, appropriate surgical treatment was carried out, without lung resection because there were few contusions to the

lungs. The wounds were debrided of the devitalized chest wall muscle and debris, and irrigated. The perforated thigh wound was also debrided of the devitalized muscle and debris, irrigated, and drained with a penrose drainage tube. Four drainage tubes were positioned in the top and bottom bilateral chest cavities. The day after the operation he received a prophylactic inoculation for tetanus because the penetrating steel bars were not clean. Two days after the operation he was taken off an artificial ventilator. These treatments had facilitated his rapid recovery. His postoperative chest X-ray and chest CT revealed only a little pleural effusion but nothing else unusual. He required some more days for the rehabilitation of his right thigh. About one month after the operation a bronchoscopic examination demonstrated a scar without any anastomotic stenosis and granulation (Fig. 5). The patient's recovery was uneventful. He needed a longer hospital stay for the rehabilitation of his legs and left our hospital without sequelae on the 57th postoperative day.



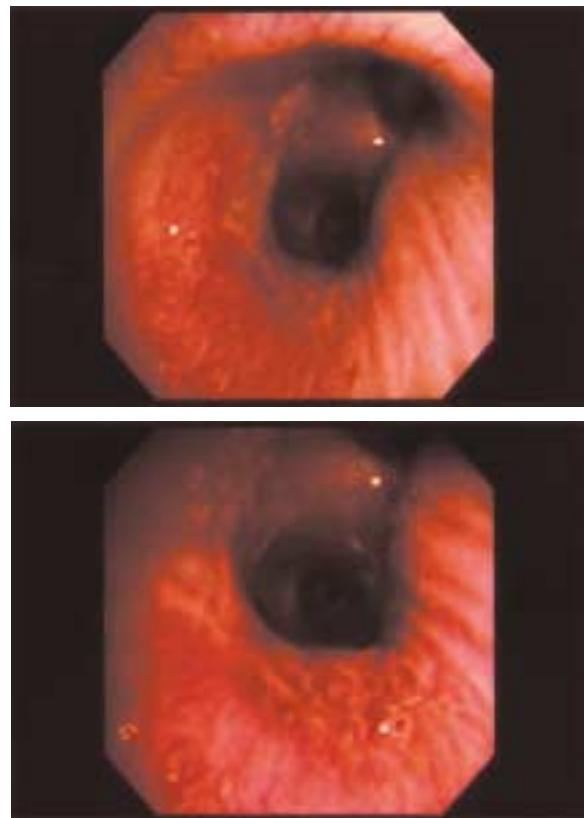
**Fig. 4.** An intraoperative view during broncoplasty shows that the right bronchus is torn and the operator is repairing the bronchus.

## Discussion

Thoracic impalement is an uncommon injury and one of the most severe types of penetrating chest injuries. Only a few cases have been reported in which the patient recuperated without sequelae.<sup>1-3)</sup> Generally, impalement injuries combine aspects of both blunt and penetrating trauma. The degree of damage depends on which organs are involved, especially when the heart or great vessels are impaled, there is an extremely high mortality rate.<sup>4,5)</sup> First of all, for the management of impalement injuries, it is essential to rapidly transport the victim to the hospital without attempting to remove the impacted foreign body.<sup>4,6-8)</sup> No time should be wasted with X-ray studies or other time-consuming examinations. To avoid major bleeding, the impaled object should be removed under direct vision in a well-controlled environment (an operating room).<sup>1,2,7-10)</sup> The operation should be begun as soon as the patient's general condition is stable. Needless to say, the impalement injuries to the chest involve many important organs (heart, great vessels, lungs, and vertebrae) therefore the cooperation of cardiovascular, chest, and orthopedic surgeons is essential for the proper treatment of a transfixated injury of the chest.

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**Fig. 5.** A bronchoscopic examination 33 days after the operation shows no granulation at the site of the bronchoplasty and no stenosis of the right bronchus.