



## Stabbing Neck Injury with Complete Spinal Cord Transection and Neurogenic Shock: A Case Report

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### Abstract

Penetrating neck injury is a relatively uncommon type of traumatic injury that has potential for significant morbidity and mortality. Therefore, a patient with a penetrating neck injury must be examined promptly and treated urgently; this is especially important because spinal cord injury can cause variable motor and sensory deficits with loss of the sympathetic tone, which can lead to neurogenic shock and death. In this article, we describe a case of stabbing neck injury with complete spinal cord transection and neurogenic shock, and we review the relevant literature.

**Keywords:** Penetrating neck injury; Stabbing injury; Spinal cord injury; Neurogenic shock

### Introduction

Penetrating neck injury is a relatively uncommon type of traumatic injury that has the potential for significant morbidity and mortality [1,2]. The neck contains various important structures such as the major vessels, nerves, trachea, esophagus, and spinal cord. Therefore, a patient with a penetrating neck injury must be examined and treated promptly [3]. Non-operative management can be adequate sometimes, but emergency surgical intervention performed in the operation room by a head and neck surgeon, a thoracic surgeon, and a neurosurgeon is usually required depending on the extent of the injury.

When a patient with a penetrating neck injury is hemodynamically stable, comprehensive physical examination and imaging studies must be performed initially. However, if there is active bleeding, progressive edema, or shock, surgical exploration should be performed as soon as possible. The major vessels, esophagus, larynx, trachea, and spinal cord must be examined thoroughly; primary repair, ligation, or decompression should be performed according to the specific indications in each case [4].

Penetrating neck trauma can be caused by a gunshot (50%), a stabbing (10~20%), or another cause [5]. Stabbing spinal injury is uncommon. It usually occurs as a result of interpersonal violence. The most common site of stabbing spinal injury is the thoracic spine, and stabbing injury to the cervical spine is rare [6]. When the knife blade is retained in the neck, it is typically lodged in the vertebral body, lamina, or pedicle, making it difficult to remove.

In practice, complete spinal cord injury due to stabbing with a retained knife blade is very rare. In this article, we describe a case of penetrating neck injury with complete spinal cord transection and neurogenic shock, and we review the relevant literature.

### Case Presentation

An 85-year-old woman was brought to the emergency room by her son due to a penetrating stab injury on the anterior neck. A kitchen knife was deeply stuck in the midline of the anterior neck, but there was no active bleeding (Figure 1). The patient was semiconscious, and bradycardia and hypotension were noted. She had been diagnosed to have dementia and depression a long time previously. She thrust herself against a knife positioned at the level of the neck for the purpose of committing suicide, and the knife penetrated her neck. She bowed forward a few more times while the knife was stuck in her neck so that it would get deeper.

Initial imaging of the neck using Computed Tomography (CT) with contrast enhancement showed the knife had penetrated the spinal cord completely, and there was a fracture of the T1 vertebral body; injuries to the esophagus and thyroid were also suspected (Figure 2A and 2B).

The emergency operation was performed immediately under general anesthesia. Extracorporeal

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**Figure 1:** Patient with a stabbing neck injury and a retained knife blade.

Membrane Oxygenation (ECMO) circuit was inserted in preparation for cardiopulmonary bypass, and the stab wound was explored with extension of the neck wound. It was noted that the knife blade had penetrated the soft tissues of the neck and was stuck on the vertebra. The knife had passed between the trachea and left common carotid artery; therefore, the trachea, common carotid artery, and internal jugular vein were intact (Figure 3A). After a careful removal of the knife blade (Figure 3B), it was observed there was complete transection of the spinal cord and a fracture of whole body of the T1 vertebra (Figure 3C). In addition, esophageal lacerations measuring 1.0 cm and 0.5 cm were noted, and they were closed primarily.

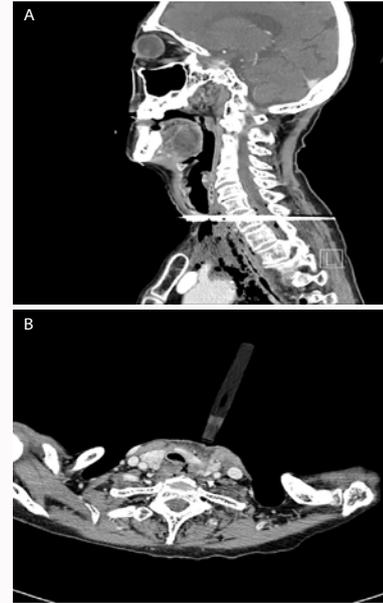
The patient was tetraplegic, and her body temperature and Blood Pressure (BP) fluctuated postoperatively. On the 4<sup>th</sup> day after the surgical procedure, severe hypotension (BP, 50/20 mmHg) and bradycardia (pulse rate, 26) were noted. Cardiopulmonary resuscitation was performed immediately, and the vital signs were restored. Conservative treatment was administered under the impression that the patient was having neurogenic shock. However, the vital signs remained unstable, and the patient died 17 days after the surgical procedure.

## Discussion

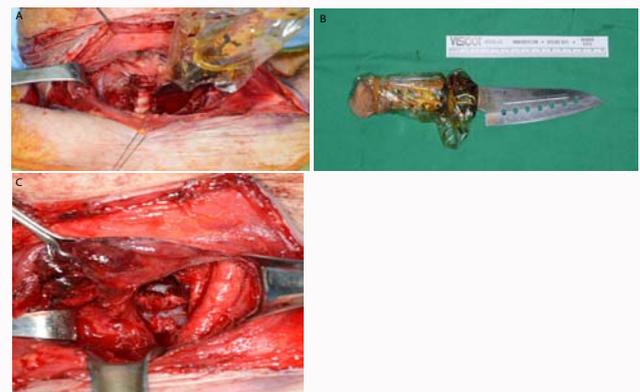
A patient with a penetrating neck injury is often in a life-threatening condition [7]. Most patients should undergo an emergency operation for exploration, and the mortality is variable depending on the extent and degree of the injury.

Neck injuries can occur in three areas: area I – from the clavicles to the lower edge of the cricoid cartilage; area II - from the lower edge of the cricoid cartilage to the angle of the jaw; and area III - from the angle of the jaw to the skull base [8]. Area II injuries usually require immediate surgical exploration, whereas area I and III injuries may require further investigation with angiography, bronchoscopy, esophagoscopy, and swallowing tests [9,10].

A stabbing neck injury that involves the spinal cord can manifest with variable symptoms depending on the degree and level of injury [11]. The spinal cord is very sensitive to injuries and cannot repair itself if it is damaged. In an incomplete spinal cord injury, some sensation and movement is possible below the level of the injury. In a complete spinal cord transection, there is complete loss of motor and sensory function below the level of the injury; in most cases, both sides of the body are affected equally [12]. In addition, spinal cord injury can affect the autonomic nervous system with loss of the sympathetic tone, which may lead to neurogenic shock. Only the parasympathetic tone remains in subjects with neurogenic shock. Neurogenic shock presents with unpredictable cardiovascular dysfunction characterized



**Figure 2:** Sagittal (A) and axial (B) computed tomographic images showed the retained knife had penetrated the spinal cord completely, and there was a fracture of the T1 vertebral body.



**Figure 3:** The operative views. (A) During the exploration of the neck, it was noted that the knife blade had passed between the trachea and left common carotid artery without injuring them, and it had stuck on the vertebral body. (B) The removed knife. (C) After careful removal of the knife blade, it was noted there was complete transection of the spinal cord and a fracture of the T1 vertebral body.

by significant hypotension, bradycardia, and hypovolemia; eventually, it leads to death [13].

The incidence of neurogenic shock is higher in subjects with cervical spinal cord injury compared with those with thoracic and lumbar spinal cord injuries [14]. Neurogenic shock is also more likely to occur in subjects with complete spinal cord injury than in those with incomplete injury [15]. The current therapeutic management of spinal cord injury includes early surgical exploration, strict blood pressure control, and administration of steroids; however, the use of steroids is debatable. It is also necessary to focus on minimizing secondary injuries after the primary trauma has occurred [16,17]. When a spinal cord injury is suspected, immobilization of the spine and decompression of the spinal cord are extremely important [18]. The retained knife blade must be removed by an experienced surgeon while the patient is in an operation room to minimize further injuries and complications [6,19]. Intravenous hydration and

administration of dopamine, norepinephrine, or atropine must be considered in subjects with neurogenic shock to prevent hypotension or bradycardia. In addition, the patient should be kept warm because of the risk of hypothermia [20].

Our patient underwent prompt surgical exploration to remove the retained knife, and appropriate treatment for neurogenic shock was administered. A large amount of intravenous fluids for hydration and norepinephrine were administered for the treatment of hypotension and bradycardia. However, the autonomic dysfunction was very severe, and the patient died eventually. In practice, few patients with complete spinal cord transection achieve partial recovery despite the immediate management of the neurogenic shock [21].

## Conclusion

Stabbing cervical spinal cord injury with a retained knife blade is very rare. Careful assessment and immediate surgical exploration are necessary, and the retained knife must be removed while the patient is in the operating theatre. In addition, physicians should be aware of the possibility of neurogenic shock in patients with spinal cord injury, and they should manage it appropriately because it is unpredictable and it has variable outcomes.

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