CERVICAL GUNSHOT INJURY

Gede Andry Nicolas, Heru Sutanto Koerniawan, Raka Janitra, Tjokorda GB Mahadewa

ABSTRACT

The incident of cervical spine injury and cervical spinal cord injury is between 2.0% to 5.0%. The advanced trauma life support (ATLS) stated that a patient with multiple traumas should be assumed to have cervical spine injury especially if the patient loses consciousness when present in the ER. It is stressed that cervical spine injury requires continuous immobilization of the patient’s entire body using a semi-rigid collar as well as a backpack with tape and straps before and during transfer to a definitive care facility. The understanding of the mechanism of injury is the most important as the forces transferred are significantly different causing different injuries. A serial case reported by Walter and Adkins found that there was no significant difference between the patients that have a bullet removed from the neck and patients that have a bullet left in the cervical cord. In both cases, there was no improvement to the neurologic outcome. Kupcha recommends doing selective wound management and observation of retained intracanal bullet fragments in a patient with complete lesion. Surgical decompression after the injury is not recommended. We report a case of 14 year old boy who was treated at Sanglah Hospital referred from an out-of-island Type C Hospital with a spinal cord injury - American Spinal Injury Association A (SCI ASIA A) caused by a gunshot wound in the cervical. Surgical decompression and bullet removal was performed as well as fusion stabilization. He is then treated in the intensive care unit for 48 hours with a slight improvement in motoric of upper and lower extremities.

INTRODUCTION

In the United States, a penetrating trauma on the spinal cord is about 15% of the total incidence of spinal cord injury annually. Grossman et al. found that the incidence of cervical spine trauma and cervical spinal cord injury nationally in the United States in 1999 ranged from 2% to 5%. Penetrating trauma of the spinal cord is the third leading cause of spinal cord injury, following a motor vehicle accident, and an accident from falling from heights. Several medical advances have been achieved that allow patients with spinal cord injury to have a longer life chance. Some of these advances include the discovery of antibiotics, as well as the modern and rapidly growing ATLS system. To date, knowledge of the pathophysiology of the penetrating trauma of the spinal cord continues to grow but treatment options and trauma management remain limited.

CASE REPORT

A 14-year-old boy on 10 February 2017 was shot by a wind rifle causing paralysis in both hands and weakness in both legs, accompanied by a sense of tingling and numbness on all four extremities. The patient underwent superficial exploration and suture of the wound. The patient was admitted to Sanglah Hospital on February 16, 2017.

The patient was referred to Sanglah Hospital on February 16, 2017. During a general examination of breathing, thoracoabdominal respiration was found. During a general examination of breathing, thoracoabdominal respiration was found. Neurological examination showed full consciousness and intact cranial nerve function, but there were tetraparesis and hyperreflexia. After a thorough and stable evaluation, the patient was given methyl-prednisolone to prevent further trauma to the spinal cord as an initial treatment in the ER. The patient was also given cefazoline. The patient underwent a computed tomography scan (CT scan) of the neck showing a corpus alienum with a density of metal on the cervical canal as high as corpus vertebrae C3 with no apparent abnormalities in the cervical vertebrae system.

The patient then underwent right hemilaminectomy surgery and cutting of the spinous process,
CASE REPORT

extraction of the corpus alienum bullet, and fusion stabilization at C3 to C4. During the operation, we obtained a bullet located between C3-C4. There was a laceration of the parietal dura mater. After the bullet was removed, the spinal cord was decompressed and pulsed well. The defects in the dura mater were covered with a glue fibrin.

After the surgery, the patient was treated in the intensive care unit for 48 hours without the aid of a ventilator. The patient was treated in collaboration with a team from the medical rehabilitation unit. Three days post operation the patient had an improvement in his motor function on both lower extremities with a motor power degree of 3. The bladder and bowel functions had also improved as the patient could feel and hold urine.

The patient was discharged on day 7 postoperatively with a good general condition, good consciousness, second-degree motor power in both upper limbs, and third-degree motor power in both lower extremities. The patient was given a wheelchair and scheduled for extensive motor rehabilitation by the medical rehabilitation unit.

DISCUSSION

Despite a great deal of literature on the trauma of spinal cord injuries, a thorough review of unique mechanical and biological factors that affect the outcome is lacking. The pathophysiology of a gunshot injury to the spine is very complicated. The most important factor that affects tissue damage depends on the amount of energy delivered to the affected tissue. Bullets with low and high speeds can cause enormous neural damage because the bullet

Figure 1 Lateral cross table and anterior-posterior cervical radiograph of a 14-year-old boy after being shot by a wind rifle in the neck. The bullet can be seen as high as C3-C4. There was no apparent fracture in the spinal cervical system

Figure 2A-B CT cervical scans from a 14-year-old boy after being shot by a wind rifle on the neck. In CT scan, we find a corpus alienum metal bullet in the vertebral canal of cervical vertebrae level C3. There was no visible of compression / listhesis / nor bone discontinuity

Figure 3 During operation picture. Screw installation of the spine after bone extraction

Figure 4 Photo of the corpus alienum bullet after successful extraction
that cause contusions of the spinal cord without any vertebral fracture or direct trauma fractures are very rare. Bullets that travel at high speed in the paravertebral plane cause a chuda contusion mostly due to the shock waves generated from the trajectory of the bullet. Another possibility is secondary to the excessive weakness of the ligaments resulting in hypermobilization of the cord, most commonly found in children.5

Generally, a bullet can cause damage by directly destroying the surrounding tissue on its path or secondary damage by generating shock waves to create the cavitation process of the tissue it passes through.6,7 In America, only about 20% of gunshot affect the cervical spinal cord and only 5% affect the cervical axis.8 Non-missile trauma is often seen in everyday life with objects such as knives, wooden material, screwdrivers, and wind bullets with handling challenges similar to missile trauma. The spinal cord in the thoracic and cervical regions are most frequently affected.7 Unfortunately, the number of gunshot wounds affecting the spinal cord has increased in recent decades. In developed countries, penetrating injuries are caused by the increased of gunshots, while stab wounds caused by knives are more common in South Africa, which accounts for 25% of all spinal cord injuries.1

Figure 5 Systemic Management Protocol of Spinal Gunshot Wound6

Initial treatment of patients with spinal cord injury should follow the protocol of ATLS as the basis of trauma resuscitation. Once systemic stabilization is achieved, a detailed history including trauma mechanisms, weapons used, distance from gunshot, and the number of shots should be recorded. Neurological examination should be performed to determine the level and characteristics of trauma. Accurate classification of whether complete or incomplete spinal cord injury should be performed using the American Spinal Injury Association-SCI Score. It should be noted that the risk of death of a gunshot patient increases with the severity of the neurological deficit.7 Wounds should be classified as an entry wound and exit wound and recorded in which region. The wounds should also be inspected for any leakage of cerebrospinal fluid, bullets, and another corpus alienum. The temptation to remove the corpus alienum should be avoided, as it can serve as a plug in the blood vessels and prevent severe bleeding. Extraction of the corpus alienum should be performed in the operating room.

Gunshot injury in the cervical area is often associated with airway and vascular lesions that often require intubation or tracheostomy with or without neck exploration. Most gunshot wounds often cause complete neurological deficit rather than incomplete.8
Regular plain X-ray examination of spinal cord should be performed in a patient with a spinal cord injury. They should be evaluated for fractures in the spine and also bone fragments in the spine canal and in the neural foramen. Currently, most centres in developed countries and urban area use CT scan and MRI as an investigation tool.

CT scan is a very important additional diagnostic tool in the assessment process of a gunshot in the spinal cord. The accurate identification of fractures, the location of bone fragments and vertebral discs, the location of the corpus alienum, and hematoma can be performed by using a CT scan. MRI scan may also be helpful in assessing the stability of the spine. MRI is extremely dangerous as a diagnostic tool in cases where the type of bullet is not known especially when the bullet is with a ferromagnetic component, so it is not recommended to use MRI as the first modality in cases of penetrating spinal cord injury caused by gunshot.

Pre-hospital management is an important factor in determining the mortality and morbidity of patients with spinal cord injuries from gunshot wounds. Basic life support is the first factor to be performed in the field. Stabilization of the cervical spine during the initial management of the victims is still debated and controversial among trauma surgeons and neurosurgeons in the United States. Most literature recommends that all patients with spinal cord injuries should be immobilized, and even ATLS does not provide an explanation of the difference in handling between blunt and penetrating trauma of the neck. In general, ATLS states “... each patient with suspect of spinal injury should be immobilized at the above and below of the sites suspected trauma until the suspicion of a spinal injury may be excluded”. In addition, ATLS emphasizes “... cervical trauma requires continuous immobilization of all patient with semi-rigid cervical collar, backboard, tape, and tight binding before and during the delivery process to health facilities with definitive treatment.” In a study conducted by Barkana and colleagues, it was concluded that penetrating cervical trauma rarely causes cervical spine damage leading to instability without completely destroyed the cord. Life-threatening complications can occur and can be missed if the neck is covered by a stabilization tool (collar neck). For a gunshot injury with the absence of a clear neurological deficit, there is no place for using of a collar neck or any neck stabilization tool. The neck stabilization tool is used when there is a neurological deficit or when it is difficult to make a diagnosis (the unconscious patient), in which case it is essential to open the anterior portion of the stabilizer every few minutes at least in the initial phase of treatment.

Despite the lack of clear guidelines about surgical exploration, a general consensus exists which suggests; GSW should be managed conservatively despite the type of cord injury, except in condition like:

1. Persistent cerebrospinal fluid fistula
2. Progressive neurological disorders and deficits
3. Persistent pain due to compression of nerve roots
4. Shifting position of the bullets
5. Instability of the spinal column
6. The bullet in the lumbar canal causes cauda equina syndrome

Result studies from the NASCIS (National Acute SCI Study) II and III led to the adoption of methyl-prednisolone for patients with spinal cord injury within 8 hours post-trauma. But several studies in the following years resulted in conflicting conclusions and questioned the validity of the conclusions made by NASCIS study.

Spinal infection is a complication that used to be quite frequent, but with the presence of antibiotics, the rate of infection has drastically decreased. Administration of broad-spectrum intravenous antibiotics for 7-14 days significantly reduces infections compared with only 48-72 hours of antibiotics.

CONCLUSION

Gunshot injury in the spine is a very complex trauma. A concept of gunshot spine injury of the spine with the understanding of pathophysiology, bullet type and trauma, prognostic factors, and management strategies becomes very important. Spinal gunshot injury without vertebral fractures should not be underestimated and should be handled appropriately and not excessively. Considering the prognosis of gunshot injury in the spine is not very good, a conservative approach with appropriate protocols should be followed. The unstable spine must be operated and non-surgically or surgically stabilized to prevent further trauma from spinal cord injury. Surgical exploration, when indicated should be performed on a team (radiological and neurological) basis.

REFERENCES


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