



Craniovertebral Junction Penetrating Injuries: A Case Report

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Abstract

Background: Penetrating craniovertebral junction (CVJ) injuries are rare. The mortality rate of these lesions is extremely high due to the complex anatomy of the region composed of a conglomerate of neurovascular structures. **Case Description:** The authors report an interesting case of a 32-year-old male patient presented with mild quadriparesis following stab wound inflicted by a rebar to the lateral left side of the CVJ. CT scan revealed metallic foreign body transgressing obliquely the brain stem before being stopped above and forward the right internal auditory canal. The patient was operated on in emergency and the weapon was carefully and totally removed. Hopefully, the follow-up was favorable and the patient's quadriparesis improved subsequently. **Conclusion:** CVJ stab wound injuries represent unusual neurosurgical emergency.

Subject Areas

Surgery & Surgical Specialties

Keywords

Penetrating Craniovertebral Junction, Central Nervous System, Quadriparesis

1. Introduction

Penetrating injuries of the CVJ in civilian context are very scary [1] [2]. Death usually occurs before that the patient reaches the neurosurgical emergency because of direct severe damage of the lower brain stem and/or disruption of the vertebral artery, producing immediately fatal subarachnoid hemorrhage. For these considerations, these dramatic and spectacular injuries represent a veritable challenge for the

clinician. To the best of our knowledge, this is the first case of CVJ and brainstem stab injury caused by a metallic skewer ever reported in the literature.

2. Patient and Observation

We report the case of a 32-year-old male who was admitted to the neurological emergency department following a stab wound to the craniovertebral junction (CVJ) that occurred one hour prior. The injury resulted from an assault with a rebar to the left mastoid region. Upon admission, the patient was neurologically conscious and hemodynamically stable. The weapon was firmly embedded in his body.

Neurological examination revealed a tetraparesia predominating in the left side. His muscular power in the left upper and lower limbs was grade 3/5, and 4/5 in the contralateral limbs. The knee-jerk reflexes were exaggerated in both lower limbs and planter reflex was indifferent. Sensory and cranial nerves examination were normal. There was no bowel/bladder disturbance. Computed tomography (CT) scan of the cervical spine and cranium revealed cylindrical metallic foreign body extending obliquely from the left side of C2 spinal level below the mastoid tip, penetrating between the basi-occiput and the posterior arch of C1 before reaching the intracranial space through the occipital condyle and transgressing the brain stem laterally. The weapon extremity stopped above and forwards the right internal auditory canal (**Figure 1**). There was no evidence of subarachnoid hemorrhage. The vertebral artery and basilar trunk lumens appeared to be normal, although the presence of significant metallic artifact on a CT angiogram.

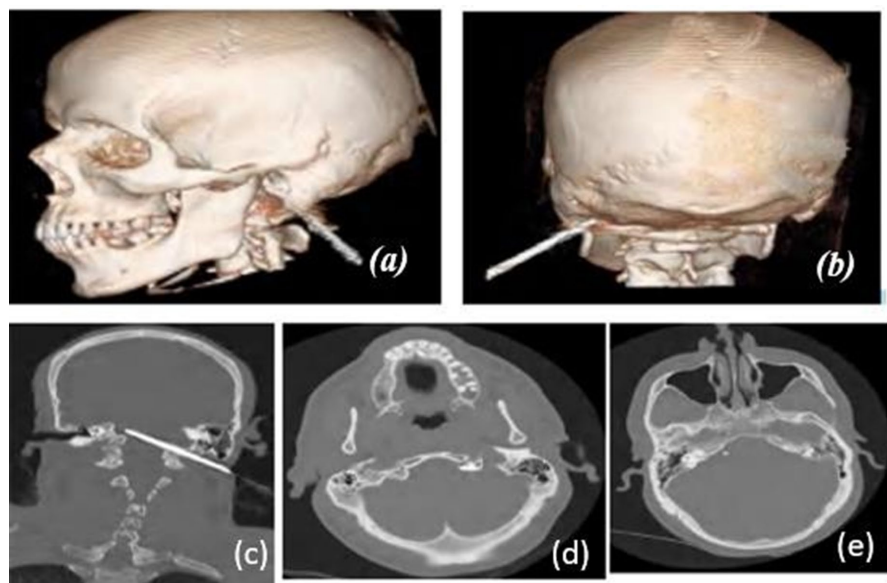


Figure 1. Computed tomography (CT) scan of the cervical spine and cranium revealed cylindrical metallic foreign body extending obliquely from the left side of C2 spinal level below the mastoid tip, penetrating between the basioccipital and the posterior arch of C1 before reaching the intracranial space through the occipital condyle and transgressing the brain stem laterally.

The indication to remove the raba was assumed. Under general anesthesia, the patient was rolled to his right side; then the weapon was gently removed with gouge forceps. There was no obviousness of CSF leak and the wound was sutured by only one stitch. The patient received prophylaxis for tetanus and broad-spectrum antibiotics (Penicillin M 60 mg/Kg/day).

Postoperatively, the neurological examination found a partial improvement on the left side muscular force (4/5). CT scan of control showed no evidence of hemorrhage or retained foreign body. Magnetic resonance imaging (MRI) of the CVJ was then performed and showed on T2-weighted sequences a high signal inside the brain stem corresponding to focal contusion at the level of medulla oblongata. In addition, we found a subocclusion of the left vertebral artery just after the emergence of the postero-inferior cerebellar artery (PICA) (**Figure 2**). However, there was no radiological influence on the posterior fossa vascularization. The patient was discharged 3 days later and was given a rehabilitation program. On the one-month follow-up, he was able to walk normally and his quadriparesis completely resolved.

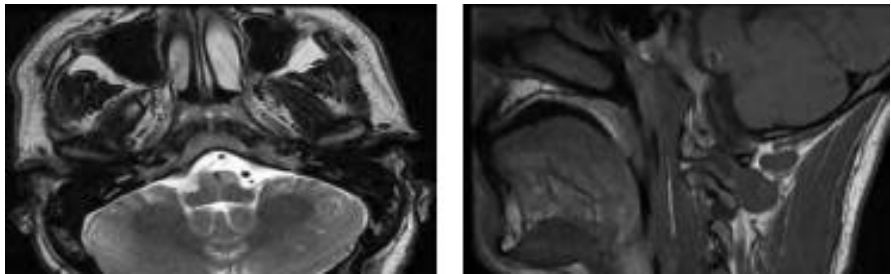


Figure 2. Magnetic resonance imaging (MRI) of the CVJ was then performed and showed on T2-weighted sequences a high signal inside the brain stem corresponding to focal contusion at the level of medulla oblongata. In addition, we found a sub occlusion of the left vertebral artery just after the emergence of the posterior-inferior cerebellar artery (PICA).

3. Discussion

Craniospinal penetrating injuries with retained foreign bodies are spectacular and relatively rare entities. In civilian practice, CVJ stab wound injuries are even more scary [2]. Death usually occurs before the patient's admission to the neurosurgical unit because of the complexity and importance of neurovascular structures involved in this anatomical region. The most common weapons causing stab wounds of the spinal cord are usually knives (72% - 84%) [3] [4], followed by axes, screwdrivers, bicycle spokes, scissors, garden forks, sickles, and sharpened objects [4].

However, CVJ stab wound injuries are mostly caused by thinner anecdotic objects like nail guns [5], scissors [1], chopsticks [6] [7], and radio antenna [7]. In the literature, most of reports are single cases. To date, the sole large series of CVJ stab wound injuries was described by de Villier and Grant in 1985 concerning 11 cases [8]. Conversely, knives were the cause in all cases, except one caused by a machete. Considering the vital function of the brainstem, this type of injury represents a distinctive entity characterized by a dramatic mortality rate and high morbidity. Besides, the vertebral and posterior inferior cerebellar arteries are extremely vulnerable because

of their complex course in this region [9] [10]. In fact, the triangle limited by the mastoid process, the occipital squama and C1 vertebra posterior arch constitute a favorable anatomical corridor that offers a low resistance to the weapon penetration. This channel leads directly to the upper spinal cord or brainstem, depending on the direction of the shot. Many other favorable routes were reported, such as transoral and transorbital. These corridors proffer a direct path to the CVJ via the oropharynx [11] [12] and superior orbital fissure (SOF) [6] [7] [11], respectively. CVJ stab wound injuries represent a clinical challenge because they have a diverse presentation profile varying from neck pain without neurological deficit [5] to severe troubles, including loss of consciousness, tetraparesis, cranial nerves palsy, and/or meningitis [2] [8] [13]. We believe that the severity of clinical symptoms is not correlated to the size of the weapon. Indeed, the disproportion between the dimensions of the foramen magnum (35.18 mm in sagittal and 29.73 in coronal planes) [14] and the medulla oblongata (10 to 14 mm in sagittal and 14 to 17 mm in coronal planes) [15] proffers a free space corresponding to the arachnoid cisterns. We present the case of a 32-year-old male admitted in neurological emergency with a history of CVJ stab wound, which occurred one hour before. In fact, the patient was assaulted with a skewer on the left mastoid tip region. On admission, the patient was hemodynamically stable and conscious neurologically. The weapon was steadily embedded in his body (**Figure 1** & **Figure 2**). were normal. There was no bowel/bladder disturbance. Penetrating craniovertebral junction (CVJ) injuries are uncommon causes of central nervous system disorder. The mortality rate of these lesions is extremely high due to the complex anatomy of the region composed of a conglomerate of neurovascular structures. Herein, the authors report an interesting case of a 32-year-old male patient presented with mild quadriparesis following stab injury inflicted by a metallic skewer to the lateral left side of the CVJ. CT scan revealed metallic foreign body transgressing obliquely the brain stem before being stopped above and forward the right internal auditory canal. The patient was operated on in emergency and the weapon was carefully and totally removed. Hopefully, the follow-up was favorable and the patient's quadriparesis improved subsequently. Therefore, a thicker weapon could enter easily into this safe space without causing severe damage, while a thinner weapon might pierce hazardously a vessel and cause severe stroke. CVJ stab wound injuries represent a neurosurgical emergency. The first line of treatment is stabilization of the vital functions and immobilization of the CVJ to minimize and prevent secondary fatal displacement. The second main concern before safe removal of the weapon is to perform accurate imaging studies. Indeed, CT scan coupled with angiography is essential in determining the exact location of the foreign body and potential vascular damage. They also indicate the direction in which the weapon might be safely removed without damaging neighboring neurovascular structures [10] [16] [17]. Surgical indication is unambiguous for retained weapons in the CVJ. However, the risk-benefit balance needs to be assessed for other patients. Similarly to spinal penetrating injuries treatment guidelines, surgery should be discussed in cases of persistent CSF leak, neurological

deterioration, and/or migration of small broken foreign body [16]-[18]. Magnetic resonance imaging (MRI) is generally performed to study the extent of neurological damage. However, it is fundamental to be sure that there is no retained metallic foreign body before to avoid migration and catastrophic damage. In our case, MRI allowed detection of a subocclusive vertebral artery injury. This type of injury carries a high risk of posterior circulation stroke. However, it is worthwhile to note that the vast majority of unilateral vertebral artery occlusions are well tolerated and do not result in cerebral ischemia [9]. Fortunately, our patient did not present any cerebral ischemia and he returned to work with no neurological deficit one month later.

4. Conclusion

CVJ stab wound injuries represent unusual neurosurgical emergency. It requires meticulous clinical and radiological assessment to establish an individual optimal treatment. Considering the high mortality rate contrasting with the excellent clinical improvement in survival patients, we believe that this type of injury matches well with the concept of “all-or-none” damage.

Conflicts of Interest

The authors declare no conflicts of interest.

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