

Rare high cervical gunshot injury presenting as Brown - Sequard syndrome: Management dilemmas

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Abstract: Spinal trauma due to missile/gunshot injuries has been well reported in the literature and has remained the domain of military warfare more often. The chief neurosurgical concern in these types of firearm injuries is the degree of damage sustained during the bullet traversing through the neural tissue and the after effects of the same in long term. Sometimes, though their management can be tricky and may pose certain management dilemmas. We report an interesting case of a penetrating bullet injury to cervical spine at C2 vertebral level presenting as Brown Sequard syndrome. Not only the site was unusual, this patient also posed few treatment related issues. The clinical presentation, imaging and the management of the patient are discussed along with relevant literature regarding gunshot injuries to spine.

Keywords: missile injury; penetrating cervical injury

INTRODUCTION

Penetrating bullet injuries to spine have been on the rise recently. Most of these are encountered in the military warfare, but in today's times, homicides also account for significant number of such potentially lethal injuries in civilian life. Neurological insult due to these can occur primarily due to the damage caused by the bullet (low or high velocity) itself during its course through the neural tissue or it can result in delayed deterioration due to risks of bullet migration, spinal instability or infection/meningitis. We report a case of a gunshot injury to high cervical spine at C2 vertebral level where the patient developed a Brown Sequard syndrome and cerebro-spinal fluid leak from the entry wound. The bullet was removed due to impending risk of meningitis and due to the incomplete nature of injury at a critical cervical cord region. The patient had an uneventful post operative period and did well later on. The case history along with its management dilemmas are discussed along with recent updates from the literature.

CASE HISTORY

A 27 year old male was admitted in the emergency ward with a history of gunshot injury 48 hours back. He was admitted at another hospital and was referred to us 24 later. He had sustained two bullets; one entering from

the front on the left side of neck and one from the back of neck near the midline, and was not able to move his right half of the body. There were no bowel and bladder complaints. On examination, he was afebrile with stable vitals and had some difficulty in vocalization. Power in the left upper and lower limbs was MRC grade 5/5 and grade 0/5 in the right upper and lower limbs. Sensations to pinprick were more affected on the left side with a sensory level at C2-C3 dermatomes, and areflexia on the right side. Plantars were mute on the right and were flexors on the left. There was a cerebro-spinal fluid (CSF) leak from the wound at the back which was sutured. He was given steroids at the previous centre and was started on antibiotic prophylaxis. Computed Tomography (CT) cervical spine (Figure 1) revealed one bullet lodged in the right half of canal at C2 vertebral level and the second within the subcutaneous tissue of the neck on the left side. As the ferromagnetic property of the bullet was not known, Magnetic Resonance Imaging (MRI) for assessment of the cord injury was not possible and it was decided to retrieve the bullets as one of them was within the canal. The patient was placed in prone position

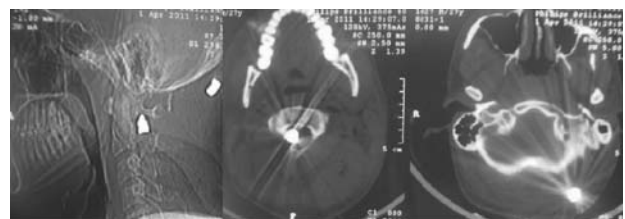


Fig 1: Sagittal and axial CT images showing bullets in the spinal bony canal at C2 level and in the subcutaneous tissues of occipital region

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and the levels of the 2 bullets were confirmed by image intensifier to rule out any delayed migration (Figure 2). Midline suboccipital approach was taken to expose the subocciput and C1-C3 laminae. The right lamina of C2 was fractured (showcasing the trajectory of the bullet). C2 laminectomy was done to retrieve the first bullet. The dura and the neural tissue were oedematous and shattered at many places. The bullets were removed and the cord was adequately decompressed as it started pulsating well. The dura was closed with an artificial graft (G patch, Surgiwear®) and fibrin glue. He was electively ventilated for 24 hours and was gradually weaned off the ventilator as his respiratory efforts were adequate. Though the power on the right was still grade 0, he regained power on the left side in the post operative period to MRC grade IV in both upper and lower limbs. Post operative Magnetic MRI showed extensive cord oedema on T2 weighted images extending from cervico-medullary junction to C6 (Figure 3). The post

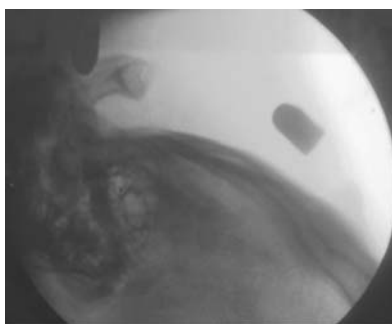


Fig 2: Intra-operative image intensifier picture confirming the position of bullets.



Fig 3: Post operative MRI showing cord signals from cervico-medullary junction to C6 vertebral level. Axial images showing the C2 laminectomy defect and preserved cord substance at the affected level.

laminectomy changes were also seen along with relatively well defined cord substance at C2 level. He did not develop signs of sepsis and the wound was healthy after suture removal. The patient was mobilized and was discharged after proper rehabilitation.

DISCUSSION

Gunshot injuries are devastating as both low and high velocity bullets can cause significant neural damage as they pass through the tissues. It is well known that the degree of damage depends upon the properties of the bullet and those of tissues receiving it. The bullet transfers its energy to the tissue depending on its mass and the velocity ($\text{Energy} = \text{mass} \times \text{velocity}^2$). The bullet produces a sonic pressure wave, a permanent and a temporary cavity. The temporary cavity created by the bullet depends on the elasticity of the tissue and thus soft tissues like spinal cord, lungs are vulnerable to more damage than bones. Gunshot injuries to atlanto-axial spine are rare. Only few cases have been reported in the literature^{1,2}. Only 20% of spinal gunshot injuries involve cervical cord and only 5% involve the axis³. Although, involvement of C1-C2 region was itself thought provoking, this case had other management issues as well. One was the cerebro-spinal fluid (CSF) leaking from the entry wound at the back of neck. Dural repair was thus mandatory. The location of the bullet required a posterior approach for its removal although C2 laminectomy would have predisposed the patient to instability. As the ferromagnetic properties of the bullet were not known, MRI was ruled out although few reports suggest that low velocity bullets having copper jackets are non-ferromagnetic and hence MRI may be performed⁴. CT spine showed both the bullets and only right lamina fracture (entry point) was evident and thus the injury was considered stable. This patient developed a Brown Sequard Syndrome and survived despite the involvement of an eloquent area.

The indications (although debatable) for bullet retrieval in the past have been:

1. Progressive clinical deterioration of patient with an incomplete injury of cord⁵
2. Migration of bullet within the canal^{4,6,7}
3. Dural leaks and impending risk of meningitis
4. Possible copper and lead toxicity^{8,9,10}

In the most recent military and civilian literature review regarding penetrating spinal injuries, Klimo et

al¹¹ have tried to echo these indications in an emphatic way, although still the data remains inadequate. The final word still remains that decompressive laminectomy should be attempted for patients with incomplete injuries and if unstable, instrumentation should also be done. If there is no CSF leak, exploration should not be attempted till a fair trial of conservative management with antibiotic cover (covering gram positives, gram negatives and anaerobes) has been given. Also, Levy et al¹² have analyzed that steroids do not offer any significant advantage in penetrating injuries to spine (as compared to blunt trauma) and thus must be avoided. Gupta et al¹³ reported a similar case where the bullet had lodged behind the atlas arch and there was no dural breach. The patient was neurologically intact and the bullet was not removed till there was pus discharge from the track despite antibiotic coverage, 7 days after the injury. The bullet was retrieved by the far lateral approach. We had to do C2 laminectomy in our patient so as to remove the bullet in this incomplete injury at an eloquent area of spine and also to seal off the dura to prevent risk of meningitis. The patient improved gradually and there was no CSF leak. As C2 spine is essential for nuchal muscular attachments and forms an essential element for providing posterior stability, the patient must be examined for any instability/kyphosis during the follow up and should be kept in close surveillance with serial dynamic x-rays.

CONCLUSION

Thus, high cervical gunshot injuries can be a difficult proposition sometimes and can lead to some serious management dilemmas. Incomplete injuries in eloquent areas like atlanto-axial region and impending risk of meningitis in case of a CSF leak are few of them. But, the literature seems to be more certain now that, these are clear indications for bullet removal and decompression laminectomy. Methodical technique and the “first do no harm” principle will eventually provide a favourable outcome if the neurosurgeon has the requisite skill.

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