



Penetrating Vertebral-Medullary Wound by Ballistic Weapon: A Clinical Cases and Literature Reviewer

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Introduction: Penetrating trauma by vertebromedullary ballistic weapon is a rare pathology in Cameroon, it may be related to the existence of armed conflict zones, it may be responsible for CSF leakage, spinal instability and/or partial or complete neurological deficits. The controversial question is when to operate on penetrating ballistic spinal injury with complete neurological deficit.

Clinical Case: We report the clinical case of a patient victim of a close range shooting of a real ball gun, in the paraspinal region opposite D8, by confusion of his status to the enemy in armed conflict zone in Cameroon. Followed Fränkel A paraplegia of D8 level of cerebrospinal fluid with CT scan of spine, stability of spine and insertion of Ball under upper plateau of D8. He was operated on to close the gap and remove the ball. The situation of the ball destroying the posterior 2/3 of the

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vertebral body of D8 and located in the anterior 1/3 of the body of D8 motivated the stabilization of the spine by the osteosynthesis material, the operative follow-up was marked by the absence of infection, but without any recovery of the neurological deficit.

Conclusion: Penetrating gunshot wounds of the spine are rare in Cameroon, CSF leakage and spinal instability are emergency surgical indications, extraction of the bullet in a patient with a complete neurological deficit remains controversial, but the bullet should be extracted when there is an operative indication, in case of high risk of spinal instability, the patient should benefit from a spondylodesis.

Keywords: Wound; vertebro medullary; BALL; CSF leak; surgery.

1. INTRODUCTION

A trauma is said to be penetrating when the penetrating agent crosses the skin to reach the underlying anatomical structures. It is thus opposed to closed trauma [1] at the level of the spine. The penetration crosses the spine reaching the dura mater or the meninges, the spinal cord and/or the nerve roots. Penetrating injuries are mainly caused by knives and firearms, rarely by work accidents, road accidents, falls, etc. The degree of injury depends on the type of weapon. Bullet wounds represent the second most frequent cause of spinal cord injury after vehicular trauma in developed countries [1,2]; Gunshot injury, which was predominant in military population, is now increasingly seen in civilian population [3], the incidence of penetrating injuries to the spine has increased lately, and caused 13%e17% of all spine injuries; it is rare in Cameroon and its occurrence is linked to the existence of conflict zones and the burrs of weapons, Although thoracic injuries are the most common following gunshot, cervical spine injuries may be the most destructive. The main prognostic factor considered for recovery is the initial neurological status [2,4,5]. In a systematic review of 1055 patients who underwent civil GSW, the estimated incidence of spinal cord injury at the cervical, thoracic and lumbosacral levels was 30%, 49% and 21%, respectively [6,7].

All ages are involved and even children in a study of 13 children in Miami showing the average age of 15.7 ± 1.6 years, with a male predominance 92% [8].

Firearm injuries are a very heterogeneous group, given the variety of weapon types. Bullets and pellets fired by individual handguns (pistols, revolvers) or shoulder weapons (assault rifles: Kalashnikov AK 47, Colt M16, FAMAS, etc.) are the projectiles most frequently involved in civilian practice. The injuries caused by a projectile (injury profile) depend on many factors [9,10,11]:

Energy of the projectile, Distance from the target, Cavitation phenomenon, Stability of the projectile, Nature of the projectile, Characteristics of the exposed tissue [9].

2. CASE PRESENTATION

We report here the case of a patient with a vertebrae-medullary wound from a Frankel A paraplegia weapon.

1 MU case, 34 years old, received at the Bafoussam CHR for paraplegia,

The history of the disease goes back to 4 days when the patient was shot in the back at the end of a very rebellious zone by a rebel for suspicion of complicity with the governmental weapon, followed by a brutal deficit of the lower limbs, motivating his transport in a first health structure where he received the first care before being referred to our health structure.

On admission he was an algic and anxious patient with a Fränkel A paraplegia of dorsal level D6 D7. He presented a right paravertebral entrance door with serosity that discoloured the yellow Betadine, suggesting a CSF leak on spinal trauma (Fig. 1). The exit door is not seen.

A lumbar CT scan was performed showing a fracture of the D8 lamina with a large fragment under the upper shelf of the vertebral body of intra canal bone and a bullet in the vertebral body of D8 (Fig. 2) with integrity of the anterior wall of the spine.

The leakage of CSF through the portal of exposure made the patient a surgical indication that allowed the closure of the dural breach after the extraction of the bullet.

The postoperative period is good with no particular complications.

Follow-up 4 months later shows complete healing with persistent paraplegia Fränkel A.



Fig. 1. Discolouration test of the pad (A) through the bullet entry point (B) shown by an arrow (C)

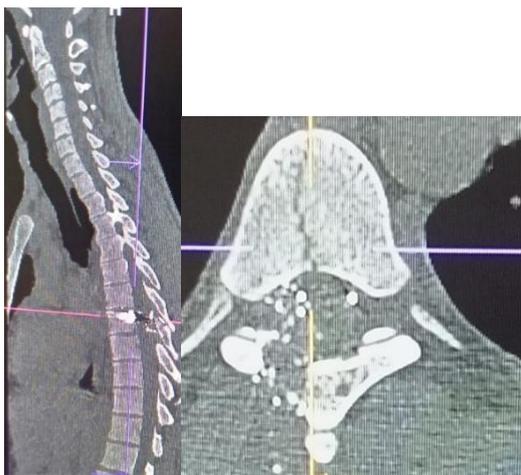


Fig. 2. Blade injury and bullet insertion under the upper vertebral body plateau of D8

3. DISCUSSION

The treatment of gunshot wounds to the spine is a subject of ongoing discussion and controversy [6-12]. Surgical intervention for gunshot injury to the spine carries a high rate of complications [2] Percutaneous endoscopic approach and Minimally invasive by tubular retractor and microscope system to spinal canal with a possibility to extract a bullet, decompression of nerve roots, defect closure of the dura mater is demonstrated to reduce these complications. [12,13]. Open surgery is a way that is always relevant today [14,15]. It takes into account the stability of the spine, neurological deficits, the risk of infection in case of CSF leakage or the relationship of the bullet path with the hollow organ of the abdomen [16].

The clear liquid flowing from the entrance door of our patient's bullet and discolouring the swab soaked in polyvidone-iodine, is similar to CSF, which attests to the leakage of CSF indicating

the existence of a dural wound with significant infectious risk;

Traumatic pneumorrhachis (air in the spinal canal) described in other patients with CSF leakage has not been described [17,18].

The following classification of injuries may be used from the point of view of treatment:

1. Injuries which have perforated the spinal theca.
2. Injuries which have not perforated the spinal theca.
3. Compression of the spinal cord, which may be produced by the passage of a bullet through the vertebrae without actual pressurisation of the missile or bone fragment. Our patient presents with a complete lower limb deficit Frankel A, with a posterior vertebral paramedian portal of entry with leakage of clear fluid which is probably CSF. This is the surgical indication. The spine appears stable after the trauma on CT. During the intraoperative extraction of the bullet, we noted that the bullet was in the anterior 1/3 of the vertebral body and therefore exposed it to a great risk of instability. This is what justified the D6D7-D9D10 spondylodesis performed on this patient. Stabilization surgery for patients with PSCI is not typically required since most penetrating injuries are not associated with instability of the spine [3,19]. However, debate continues over whether or not surgical decompression, including bone and projectile removal, in patients with penetrating spinal cord injury (PSCI) provides any benefit for neurological function compared with nonsurgical treatment. Some studies suggest little

benefit with increased risk of postoperative complications in patients with PSCI who undergo surgery [20,21]. Other studies suggest that surgery can be beneficial particularly for patients with incomplete PSCI or in patients experiencing progressive neurological decline [18,22,23].

The most serious complications occur in gunshot wounds with an abdominal or thoracic portal with injury to the hollow and noble organs, which can lead to septic complications after gunshot wounds of the spine, such as osteomyelitis, meningitis, and intrathoracic or intra-abdominal abscess, often lead to catastrophic consequences and to poor response to therapeutic management [24,25]. The risk that our patient may present is migration of the bullet into the medullary canal.

4. CONCLUSION

The wound of the rachis by ball with leakage of the cephalo rachidien liquid are rare in and are of neurosurgical urgency, it exposes to the redoubtable infections such as the meningitis and the traumatic pneumorrhaxie what represents an indication surgical of urgency. In the event of sand traumatism by ball by posterior see, associated with a completed deficit, the ablation of the ball is well discussed just like the stabilization of the rachis by the material of osteosynthesis. In the case of a very high risk of instability or post-traumatic instability due to the bullet, stabilisation with osteosynthesis material is essential.

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Andrew Brash, Dia R Halalmeh, Gary Rajah, Joshua Loya, Marc Moisi. Surgical

- intervention for lumbar foraminal gunshot wounds: A case report and review of the literature. *Cureus*. 2019;11(7):e5269.
2. Mir Ibrahim Sajid, Bushra Ahmad, Shaikh Danish Mahmood, Aneela Darbar. Gunshot injury to spine: An institutional experience of management and complications from a developing country. *Chinese Journal of Traumatology*. 2020;23:324-328.
3. Bono CM, Heary RF. Gunshot wounds to the spine. *Spine J*. 2004;4(2):230-240.
4. Patil R, Jaiswal G, Gupta TK. Gunshot wound causing complete spinal cord injury without mechanical violation of spinal axis: Case report with review of literature. *J Craniovertebral Junction Spine*. 2015;6:149. Available: <https://doi.org/10.4103/0974-8237.167855>
5. De Barros Filho TE, Cristante AF, Marcon RM, et al. Gunshot injuries in the spine. *Spinal Cord*. 2014;52:504-510. Available: <https://doi.org/10.1038/sc.2014.56>
6. Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE. Civilian gunshot injuries of the spinal cord: A systematic review of the current literature. *Clin Orthop Relat Res*. 2013;471:3945-3955.
7. Andrew Brash, Dia R Halalmeh, Gary Rajah, Joshua Loya, Marc Moisi. Intervention opératoire pour les blessures par balle foraminale lombaire: Rapport de cas et revue de la littérature. *Cureus*. 2019;11(7):e5269.
8. Victor M Lu, Victoria A Pinilla Escobar, Rebecca A Saberi, Gareth P Gilna, Joshua D Burks, Toba N Niazi, Chad M Thorson, Heather J. McCrea. Évolution clinique des blessures par balle pédiatriques impliquant la colonne vertébrale et la moelle épinière: L'expérience de Miami. *J Neurosurg Pediatr*. 2022;31(1):24-31.
9. Daban JL, Bensalah M, Hofmann C, Goudard Y, et al. Spécificités de la prise en charge des traumatismes pénétrants, joint session sfmu/sfar urgences digestives. *Urgence*. 2012;68:1-13.
10. McSwain NE, Jr. Blunt and penetrating chest injuries. *World Journal of Surgery*. 1992;16(5):924-9.
11. Fackler ML. Wound ballistics. A review of common misconceptions. *JAMA: The Journal of the American Medical Association*. 1988;259(18):2730-6.

12. Alfred J. Hull, F.R.C.S. Treatment of gunshotl WO-U,-NDS of the Spine. TnzBB ITIES L Medical Journal 1916:577- 580.
13. Maxim N. Kravtsov, Vadim A. Manukovsky, Gennadiy G. Bulshchenko, Saidmirze D. Mirzametov, Vadim A. Byvaltsev case report: Full-endoscopic surgery for bullet wounds of the Spine: A report of three cases. Front Surg. 2022;9:873365. DOI: 10.3389/fsurg.2022.873365
14. Rami Darwazeh, Mazhar Darwazeh, Mohammed Awad Elzain, Rasha Al-Kanash. Récupération mini-invasive d'une balle s'installant dans le canal rachidien thoracique chez un patient pédiatrique : Un rapport de cas, Rapports de cas Neurocirugia (Astur: Engl Ed). 2023;34(1): 44-47. DOI: 10.1016/j.neucie.2022.11.016.
15. Ibebuike KE. Fragment de balle intradurale lombaire retenu avec récupération neurologique après retrait retardé de la balle : Rapport de cas et revue de la littérature. Niger J Clin Pract. 2023;26(3): 358-361. DOI: 10,4103/njcp.njcp_324_22
16. Nimrod Rahamimov, Hani Mulla, Shay Freiman. Cerebrospinal fluid leakage and pneumocephalus secondary to spine stab wounds. J Orthopaed Traumatol. 2010;11: 57-59 DOI: 10.1007/s10195-009-0070-6
17. Goh BK, Yeo AW. Traumatic pneumorrhoea. J Trauma. 2005;58:875-879. DOI:10.1097/01.TA.0000158249.77176.9A
18. Marc D. Moisi, Jeni Page, Seymour Gahramanov, Rod J. Oskouian Global Spine J. Bullet fragment of the lumbar spine: The decision is more important than the incision. 2015;5(6):523-526. DOI: 10.1055/s-0035-1566231 PMID: PMC4671882PMID: 26682104
19. Jallo GI. Neurosurgical management of penetrating spinal injury. Surg Neurol. 1997;47(4):328-330.
20. 12-Comparative study of functional recovery for surgically explored and conservatively managed spinal cord missile injuries. Neurosurgery. 1996;39(6): 1133-1140.
21. Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE. Civilian gunshot injuries of the spinal cord: A systematic review of the current literature. Clin Orthop Relat Res. 2013;471(12):3945-3955.
22. Klimo P, Jr, Ragel BT, Rosner M, Gluf W, McCafferty R. Can surgery improve neurological function in penetrating spinal injury? A review of the military and civilian literature and treatment recommendations for military neurosurgeons. Neurosurg Focus. 2010;28(5):E4.
23. Splavski B, Vrankovic D, Saric G, Blagus G, Mursic B, Rukovanjski M. Early management of war missile spine and spinal cord injuries: Experience with 21 cases. Injury. 1996;27(10):699-702.
24. Velmahos Ann RG, D demetriades coll gunshot wounds of the spine: Should retained bullets be removed to prevent infection? Surg Engl. 1994;76:85-87.
25. Benzel EC, Hadden TA, Coleman JE. Civilian gunshot wounds to the spinal cord and cauda equina. Neurosurgery. 1987; 20:281-5.

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