



## INTRASPINAL MIGRATION OF A BULLET IN SPINAL CANAL- A CASE REPORT AND LITERATURE REVIEW

### SPİNAL KANALDAKİ BİR MERMINİN İNTASPİNAL MGRASYONU: OLGU SUNUMU VE LİTERATÜRÜN GÖZDEN GEÇİRİLMESİ

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#### SUMMARY:

The incidence of spinal cord injury from gunshot wounds in penetrating trauma continues to increase with the violent nature of society. Intraspinally migratory missiles represent a very rare subset of the gunshot wounds to the spine. The appropriate course of action in patients with migratory bullets in spinal canal remains unclear, because the number of cases described in the literature is not sufficient to provide a basis on which to make a definitive therapeutic decision. We are reporting a case of intraspinal migration of bullet from D10 region to L5-S1 disc space resulting in neurological deficit.

Plain radiography and CT-scan confirmed the intraspinal migration of the bullet. Removal of the intraspinal bullet was planned, but patient refused surgery. A thorough review of the literature about approach in such special situations is also presented.

**Key words:** Intraspinally bullet, migration, spine

**Level of evidence:** Case report, Level IV

#### ÖZET

Penetre travmalardan ateşli silah yaralanması insidansı, toplumun karmaşık yapısı nedeniyle artış göstermeye devam etmektedir. İntraspinal migratör mermiler, omurganın ateşli silahlarla yaralanmaları içinde nadir görülmektedir. Spinal kanal içinde migratör mermili bir hastada ne yapılacağı konusundaki seçenekler kesin değildir, çünkü literatürde tanımlanmış bir çok vakadan kesin bir tedaviye ait bilgi edinilememektedir.

Direkt radyografiler ve BT ile intraspinal migratör bir merminin tespiti edilen bu çalışmada sunulan bir hastada intra spinal yerleşimli merminin çıkartılmak istenmiş fakat aile tarafında bu öneri ret edilmiştir. Literatür bilgisi ışığında bu durum ve tedavi seçenekleri gözden geçirilmiştir.

**Anahtar Kelimeler:** İntraspinal merminin migrasyonu, omurganın ateşli silah yaralanmaları

**Kanıt Düzeyi:** Olgu sunumu, Düzey IV

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## INTRODUCTION:

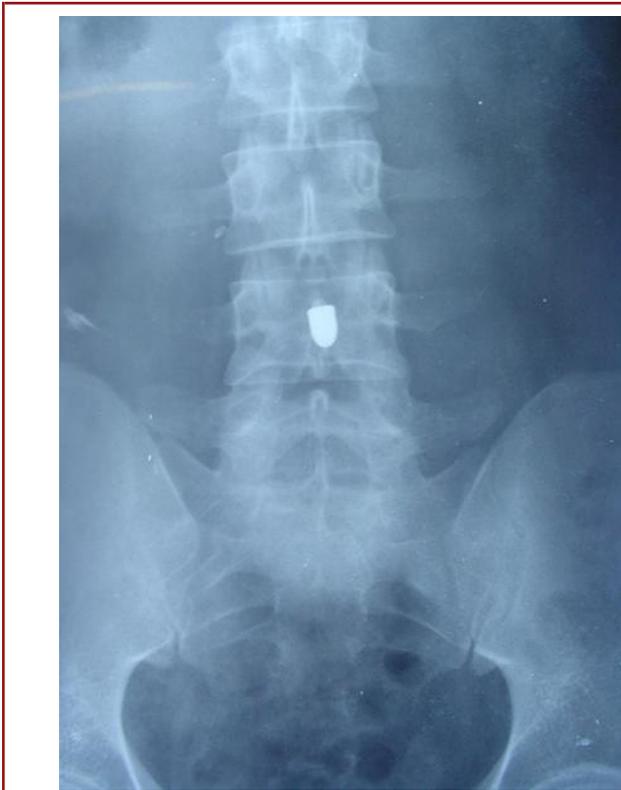
The incidence of spinal cord injury from gunshot wounds in penetrating trauma continues to increase with the violent nature of society<sup>3</sup>. However, intrathecal migration of the bullet is a rare phenomenon<sup>4</sup>. From the smooth shiny surface of bullet the ease of migration within the spinal fluid can be appreciated<sup>24</sup>. The appropriate course of action in patients with migratory bullets in spinal canal remains unclear, because the number of cases described in the literature is not sufficient to provide a basis on which to make a definitive therapeutic decision<sup>4</sup>. We are reporting a case of intraspinal migration of the bullet during change of the position of the patient for radiographs and resulting in neurological deficit due to mass effect. A thorough review of the literature about therapeutic approach in such special situations is also presented.

## CASE REPORT:

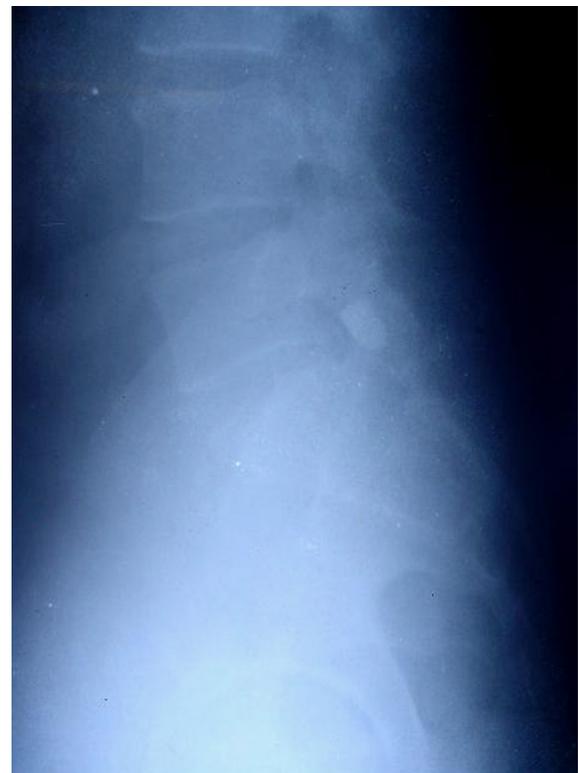
A twenty-five year male was admitted to our tertiary level institute after suffering a gunshot injury in the back at a very close range by 32 caliber handgun. He complained of back pain, radiating to right lower limb; and weakness & numbness

of both feet. The physical examination revealed entry wound on back at D10 spinous process level, 2 cm lateral to midline on right side and decreased lumbar lordosis. Neurological examination showed Frankel 2+/ 3 grade motor deficit in bilateral lower limbs. There was hypoesthesia in the L5 and S1 dermatomes to light touch. Patient also had incontinence of urine. All deep tendon reflexes of both lower limbs were absent. Tone of the anal sphincter was decreased. Anteroposterior radiograph of the lumbar spine showed a metallic bullet lying in the in the region of middle of L 4 vertebra (Fig.1) whereas to our surprise, the lateral radiograph of the lumbar spine showed the bullet lying in spinal canal at L5-S1 disc space (Fig.2), revealing migration of the bullet during change of the position of the patient for radiographs. 40 CT-scan confirmed the metallic bullet lying in the centre of spinal canal at L5-S1 disc space (Fig.3 and Fig. 4) and fracture of the right lamina of the tenth thoracic vertebra.

A decision to remove the bullet was made in anticipation for neurological improvement; to prevent further neurological deficit; and of the possibility of it later leading to infection or lead/ copper intoxication. But patient refused for surgery for reasons not in our hands.



**Figure-1.** Anteroposterior radiograph of the lumbar spine showing the bullet lodged within spinal canal at the L4 level.



**Figure-2.** Lateral radiograph of the lumbar spine showing the bullet lodged within spinal canal at the L5-S1 intervertebral disc level. Bullet lies with base upwards.



**Figure-3.** CT-scan saggital section shows bullet lying at L5-S1 intervertebral disc level and in the spinal canal (Black arrow).



**Figure-4.** CT-scan axial section shows bullet lying in the spinal canal (Black arrow).

## DISCUSSION:

Intraspinal/ Intrathecal migratory missiles represent a very rare subset of the gunshot wounds to the spine<sup>4,22</sup>. Intrathecal gunshot injury may or may not result in neurological deficit to the patient<sup>2,15</sup>. Either the direct path of the bullet or the concussive effects cause injury to the spine and spinal column<sup>18</sup>.

Avci et al reported cranial migration of the bullet caused by prone position of the patient during laminectomy<sup>1</sup>. Singh et al also reported cranial migration along with its craniocaudal rotation during its removal<sup>24</sup>. Caudal migration of the bullet is also reported<sup>17,29,30</sup>. As the spinal cord expands at T10, it has been thought that migration of the bullet in spinal canal above this level does not occur<sup>20</sup>. Oktem et al, however, reported a bullet traversing the length of the spinal canal<sup>23</sup>. Similarly Tanguy et al reported migration of the bullet from C7 to sacral region<sup>29</sup>.

The patient may suffer from symptoms related to mass effect of the retained bullet as reported in the present case and other reports<sup>1,22,24</sup>. It can present even with delayed onset of symptoms<sup>1,2,5,10,11,17,25,29</sup>. Migration of the bullet with subsequent meningitis has been reported, though the cultures of the bullet and CSF were negative<sup>29</sup>. There is risk of acute lead intoxication or Plumbism if lead bullets are retained in areas where the pH of the tissue tends towards the acidic side<sup>7</sup> and lead intoxication also has been reported from retained bullet fragments within the intervertebral disc space<sup>10,28</sup>. Chronic inflammation caused by metal breakdown products of the bullet may contribute to hyperaesthesia in the segments of spine with retained bullet fragments and formation of the syringiform cyst<sup>8</sup>. Spinal cord necrosis around copper fragments implanted within the dura has also been reported in animal studies<sup>31</sup>.

Treatment depends on the physician's ability to understand mechanism of injury, principles of medical management, diagnostic imaging, and surgical options<sup>22</sup>. After the patient is stabilized, the spinal injury should be thoroughly evaluated. A complete neurological examination must be performed to document motor function, reflexes, and sensation at the time of injury and periodic examination, preferably by the same physician is needed to assess any deterioration in neurologic function<sup>22</sup>. Anteroposterior and lateral radiographs determine the level of bullet location and/or fracture. Computed tomography is the investigation of choice, as it allows for more precise localization of the bullet fragments within the spinal canal<sup>3,22</sup>. Missiles used for low-velocity shotguns are usually copper jacketed and do not have ferromagnetic properties<sup>16</sup>. Therefore, MRI can be used in low-velocity shotgun injuries without any change in the neurological status or patient discomfort<sup>16</sup>. Spine injuries without neurologic signs are not uncommon among patients with gunshot wounds. Complete

radiographic spine imaging is therefore recommended to ensure that spine injuries are not missed in this population<sup>19</sup>.

The appropriate course of action in patients with migratory bullets in spinal canal remains unclear and their treatment should be individualized<sup>22</sup>. However, certain principles of management of intrathecal bullets have been outlined<sup>3,22,32</sup> and evolve around spine stability, aggressive rehabilitation, and preservation of neurologic function<sup>18</sup>. Fractures are usually inherently stable and rarely require stabilization<sup>3</sup>. Antibiotics should be continued for a minimum of 7 days in cases of wounds that perforate the colon and injure the spine<sup>22</sup>. The role of steroids in gunshot injuries of the spine has been retrospectively evaluated in nonrandomized studies<sup>12,21</sup>. No significant neurological benefits were detectable from intravenously administered steroids after a gunshot wound to the spine<sup>12,21</sup>. Both infectious and noninfectious complication rates were higher in the groups receiving steroids<sup>12</sup>. Retained bullets rarely cause problems of delayed infection, late neurologic decline, or lead toxicity, eliminating the need for prophylactic bullet removal<sup>33</sup>.

Decompression and removal of intracanal bullets at T12 and below may improve motor function<sup>3,16,22,32,33</sup>. The bullet in the dural sac at the level of the cauda equina must be removed<sup>28</sup>. 60% of the patients with cauda equina syndrome and 53% of that with lesions in the lumbar region improved their neurological status after laminectomy<sup>9</sup>. New-onset or progressive neurologic deterioration, an intracanal copper bullet and lead intoxication are the other indications for surgical decompression and removal of the bullet<sup>1,3,22</sup>. Role of laminectomy in spinal cord injury from gunshot wounds depends on the neurological status of patient, and the location of bullet.

In incomplete injury, role of laminectomy is controversial. Since the prognosis for recovery depended on the initial neural deficit, laminectomy had no beneficial effect in complete or incomplete injuries in the study of Heiden et al.<sup>13</sup> 101 Stauffer et al.<sup>26</sup> reported incidence of wound infection and spinal fistulae to be 10% of such patients who had underwent laminectomies.

Spinal instability also complicated the patients who had multiple level laminectomies<sup>26</sup>. However, laminectomy and removal of metallic foreign bodies have been performed to reduce the risk of infection in the spinal canal and to prevent toxic effects of dissolved metals on uninjured parts of the central nervous system<sup>24,30</sup>.

The timing of laminectomy for gunshot injuries of the thoracolumbar and lumbosacral spine (early versus delayed surgery) is not essential to neurological recovery<sup>6</sup>. However, adequate debridement of these injuries, performed as soon as the patient is stable from any associated injuries, may help to

mitigate the late sequelae of arachnoiditis, infection, and pain syndromes in the lower extremities<sup>6</sup>.

Problems during surgical removal of bullet have been reported<sup>11</sup>. We have earlier published a case report of spontaneous migration of intradural bullet during surgery and reported practical technical tricks to remove such mobile foreign bodies<sup>24</sup>. Patient positioning can influence bullet location which can be useful in surgical planning<sup>2,24</sup>. The surgeon must identify the exact location of the bullet after positioning the patient and should not rely on preoperative X-ray/ other investigations only<sup>24</sup>. Use of intra-operative fluoroscopy is recommended to localize the migratory bullet<sup>1,22,24,26</sup>. The surgeon may be able to bring the bullet to the desired level by changing inclination of the operative table, if migration of the bullet occurs during surgery<sup>24</sup>. The bullet may need to be fixed while removing it, to prevent further migration<sup>24,26</sup>. Retention of the bullet in the canal is not considered to be a significant adverse occurrence if asymptomatic<sup>14,33</sup>, however it is not true for migratory and symptomatic bullets<sup>22,24</sup>. In future there is a potential risk of complications of neurological deficits due to mechanical or irritative effects, infection and plumbism in the present case as bullet is lying intraspinal.

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