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Anand Sharma,
A. Shukla,
Avinash Sharma

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Wandering intracranial bullet. A case report with review of the literature

Anand Sharma, A. Shukla, Avinash Sharma

Gajra Raja Medical College, Gwalior, Madhya Pradesh, INDIA

ABSTRACT

Multidirectional migration of bullets has been reported infrequently in the literature. The Surgical retrieval of an intracranial migrating bullet is suggested because of its capacity to produce an additional neurological deficit. Intraoperative image guidance using the C arm is indicated in all intracranial migrating metallic foreign bodies following gunshot injury. A rare case of migrating bullet fragment in its trajectory with the migration of metallic fragment in both cerebral hemispheres is reported, and relevant literature is reviewed.

INTRODUCTION

A bullet generally travels in a straight line after entering the body and following the dissipation of its energy, either exits or lodges. The initial movement of the bullet fragment follows the physical principles and power of moving pieces; the subsequent migrating of the bullet fragment in the intracranial compartment depends upon gravity, pulsatile force, coughing, sneezing and movement of the patient's head¹. We report a case of a bullet injury in which the metallic fragment was moving freely from its initial site in the left parietal to the opposite side and then traversing back to the original position, probably in the initial trajectory created by the force of a bullet. The bullet fragment in the present case migrated along the path of least resistance created at the initial impact. This differs from the other reported case where the fragment moved according to gravity and dependent position.

CASE REPORT

A 30-year-old male becomes unconscious after a gunshot injury to the head. Glasgow's coma scale on admission was E2V2M5 with left-side hemiparesis. His pupils were equally reactive, and his vitals were stable. The entry wound was situated on the right parietal bone; the exit wound could not be found. Cranial Non-contrast computerised tomography (NCCT) revealed a gunshot wound through the right parietal bone and underlying right parietal lobe, with underlying contusions, intraventricular bleed, and corpus callosum contusions. The single metallic foreign body was found over the left parietal lobe (**Figure 1**). Initially, the patient was managed conservatively with debridement and

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Corresponding author:
Anand Sharma

Gajra Raja Medical College, Gwalior,
Madhya Pradesh, India

dranandsharma100123@gmail.com

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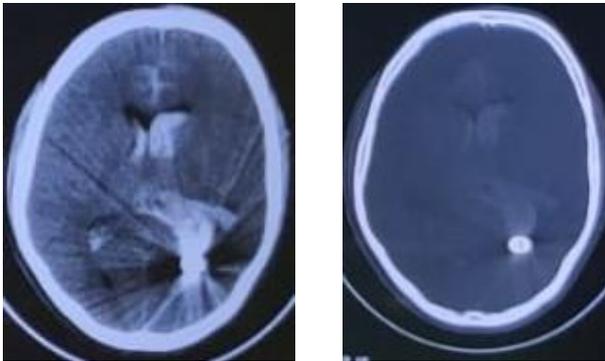
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primary closure of the cranial wound. Repeat NCCT head was done after two days to find the status of contusions, brain oedema, and location of metallic foreign body. Repeat NCCT head revealed resolving contusion. However, the single foreign metallic body was shifted to the right parietal lobe near the entry wound (**Figure 2**), thereby confirming the migration of the bullet fragment in the trajectory. Considering the bullet location and the entry wound, the patient was planned for bullet retrieval with wound debridement under image guidance. A fresh CT scan was done before shifting the patient to the operation theatre, and a repeat NCCT revealed the remigration of the bullet towards the left parietal lobe (**Figure 3**). Right parietal craniotomy was done with wound debridement and primary closure of dura matter using the pericranial patch. Intraoperatively bullet position was re-confirmed with the c-arm, and a left-side parietal craniotomy was done with the removal of the bullet. Post-operative CT showed resolving intraparenchymal contusion and intraventricular haemorrhage with no foreign body (**Figure 4**).



A.

B.

C.

Figure 1. Day 1: Initial NCCT head showing **A)** Metallic foreign body over left parietal lobe; **B)** bone widow with foreign body; **C)** Entry wound over right parietal bone.

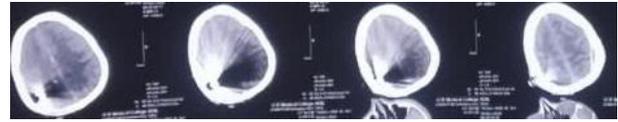
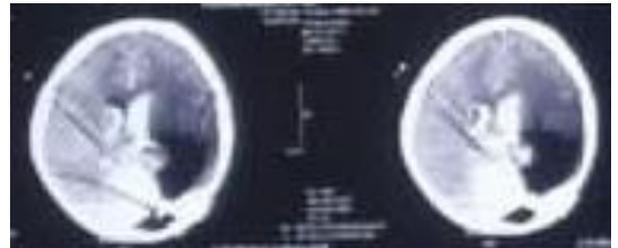


Figure 2. Day 3: NCCT head revealed entry wound over right parietal bone with metallic fragment over right parietal lobe, suggesting migration of bullet towards entry wound.



A.

B.

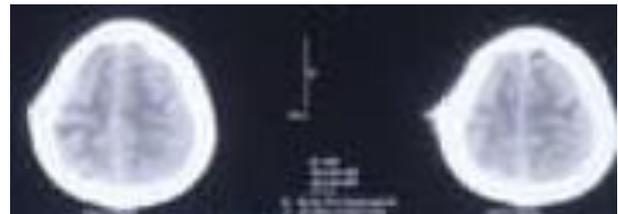


Figure 3. Day 4: NCCT head revealed remigration of bullet towards left parietal lobe.

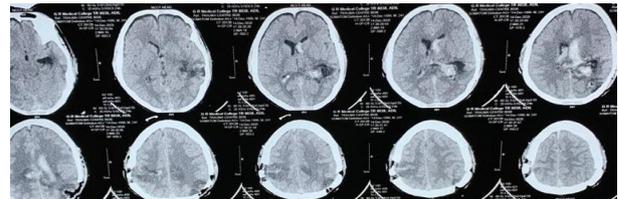


Figure 4. Postoperative NCCT head revealed post-operative changes with no foreign body with resolving contusions.

DISCUSSION

The bullet migration in the intracranial cavity has been reported previously by several authors. The metallic fragments following gunshot injuries have been reported to migrate in different cranial compartments depending upon the brain's and cerebrospinal fluid's gravity and pulsatile forces. Extensive migration of bullet fragments from the intracranial compartment to the spinal subarachnoid space has been reported in the literature 2,3. However, in the present case, the movement of the fragment across the cerebral hemisphere crossing the midline was noted in the direction of the initial trajectory, as pointed out in the first CT scan. The bullet initially impacted the right parietal region,

causing a fracture of the right parietal bone and lodging in the left parietal lobe involving injury to the ventricle system, causing an intraventricular bleed. The subsequent CT scan showed the bullet fragment shifted to the right parietal lobe at the original point of impact.

At the time of surgery, the bullet fragment was again turned to the left parietal lobe following the same trajectory. This is very clear that the metallic foreign body was moving freely to and fro in the same course. The hemispheric migration of bullet has been earlier reported by Umredkar et al. 4Yadav yr. et al. have reported supratentorial to infratentorial migration of bullet⁵. According to Rapp, at all. 4.2% of bullet fragments migrate⁶; other authors have found that less than 0.1% to 10% of bullets migrate inside the head.

The mechanism of migration of intra cerebral bullet is influenced by the following Factors: 1. cerebral softening, 2. the specific gravity of the bullet compared with brain tissue, 3. pulsatile force of the brain and the cerebral spinal fluid pulsatile waves, 4. the sink function of the cerebral ventricles. Hence, it is not only the firearm injury but also any foreign body with a different density than the brain and cerebrospinal fluid that will migrate intracerebrally. (4,7) Repeated bullet movement in the same injury tract is rare and makes our case unique. After reviewing the available English literature in detail, we have not found any similar issues. The least resistance can explain the movement of the bullet offered to the bullet fragment in the preformed trajectory.

CT is the imaging procedure of choice for evaluating these injuries; however, the migrating fragments require intraoperative image guidance to know the position of the bullet fragment in the operating theatre. The retained bullet complications include infection, haematoma formation, seizures, and abscess formation. Spontaneous bullet migration causing additional parenchymal damage because of migrating nature makes surgery difficult.

Surgical treatment of bullet injury is controversial and represents a dilemma for the neurosurgeon. Where feasible, the missile and bone fragments must be removed, but without enhancing the pre-existing neurological deficit. Kumar at all. Reported that removal of bullet should be done in the patients undergoing surgery for the vacation of haematoma if it is easily accessible and removal does not lead to

further deterioration of neurological structures⁸. Zofonte et al. reported two cases with neurological deterioration from spontaneous migration of bullet; postoperatively, the patient demonstrated significant functional recovery⁹; considering the potential of neurological deterioration due to migration of bullet in several compartments, including spinal subarachnoid, the surgery of retrieval of the bullet fragment is advisable, we have removed the bullet. However, few cases reports favour conservative treatment in which the bullet is lodged in safe areas without evidence of migration and additional neurological damage.

CONCLUSION

Spontaneous intratrjectory migration of bullet represents a rare complication and makes treatment more challenging. The Surgical retrieval of the intracranial migrating bullet is suggested because of its capacity to produce an additional neurological deficit. Intraoperative image guidance using the C arm is suggested in all intracranial migrating metallic foreign bodies following gunshot injury.

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