Neurol Med Chir (Tokyo) 41, 499～501, 2001

Spontaneous Migration of a Bullet in the Cerebellum

—Case Report—

Yasunori FUJIMOTO, Hector Tomas CABRERA, Felix Hendrik PAHL, Almir Ferreira de ANDRADE, and Raul MARINO, Jr.

Division of Neurosurgery, University of São Paulo Medical School, São Paulo, Brazil

Abstract

A 15-year-old boy presented with a gunshot wound in the left cerebellar hemisphere. He was confused and left cerebellar signs were noted. The patient underwent the first surgery for debridement of the entry wound in the left parietal region and second surgery to remove the bullet. However, the bullet could not be located via a left unilateral suboccipital craniectomy in the park bench position, because it had migrated to the opposite side due to the effects of gravity in just a few hours. Skull radiography obtained just before the third surgery showed that the bullet had returned to the left side, and it was removed easily via the previous craniectomy in the sitting position. The clinical course suggests that in removing a bullet, skull radiography or computed tomography should be obtained just before surgery, or even intraoperatively, and that those findings should be the basis for the surgical procedure and operative position.

Key words: gunshot head injury, migration, bullet, surgery

Introduction

Gunshot head injuries are the most lethal type of traumatic brain injuries and their incidence has been increasing worldwide in the civilian population. Management of gunshot head injuries is still controversial in some points and surgical intervention is usually aimed at preventing secondary neurological damage. We describe a case in which migration of the bullet into the cerebellum made it difficult to remove the bullet.

Case Report

A 15-year-old boy was admitted to our hospital due to a head injury caused by falling from the stairs in a soccer stadium. He stated that he had felt a sudden headache and fell. On admission, he was confused and presented with left cerebellar signs and a wound in the left parietal region, which was sutured. Skull radiography showed a single undeformed bullet in the left posterior fossa. Computed tomography (CT) revealed an intact bullet in the left cerebellar hemisphere and hemorrhage along its trajectory, without hydrocephalus, but the metal artifacts obscured the damage to the cerebellar parenchyma (Figs. 1 and 2 *left*). Judging by the circumstances, the wound was made by the projectile, which had probably been fired into the air, and had entered the skull at the left parietal region, passing through the tentorium cerebelli.

The patient underwent a small left parietal craniotomy and the entry wound, dura mater, bone fragments, and contused brain tissue in the trajectory were debrided and dural closure was performed utilizing a patch graft of pericranium. Postoperative CT obtained 19 hours after admission showed dilated supratentorial ventricles and a slight turning of the bullet. The patient was drowsy and disoriented, and exhibited left sixth cranial nerve paresis. CT 8 hours later showed that the bullet had sunk posteriorly by 1 cm (Fig. 2 *center*). The patient showed new neurological deficits and the projectile appeared to be easily removable, so we decided to operate to remove the bullet.

Two hours after the third CT, the patient was

Received December 27, 2000; Accepted August 5, 2001

Author's present address: Y. Fujimoto, M.D., Department of Neurosurgery, Osaka University Graduate School of Medicine, Suita, Osaka, Japan.

transferred to the operating room and underwent a left unilateral suboccipital craniectomy in the park bench position. However, although the contused brain tissue was drained, the projectile was not found in the left cerebellar hemisphere. After the surgery, CT revealed that the bullet had migrated to the opposite side (Fig. 2 *right*).

A third operation was planned. Skull radiography was performed just before the transfer of the patient to the operating room, which revealed that the bullet had returned to the left side. The patient was placed in the sitting position and the 0.38 caliber bullet was removed through the previous unilateral suboccipital craniectomy. The projectile appeared nearly intact, measured 2 cm in length and weighed 10 g. The postoperative course was uneventful, and his neurological deficits improved.

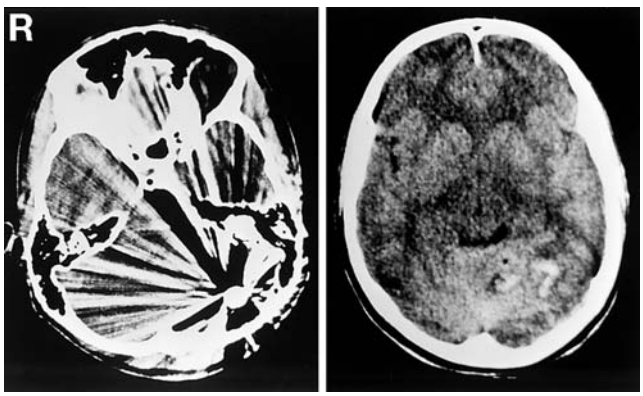

Fig. 1 Computed tomography scans showing the bullet in the left cerebellar hemisphere (*left*) and hemorrhage along its trajectory in the supratentorial brain tissue (*right*).

Discussion

Migration of bullets can occur under four types of conditions[7]: Bullets in the ventricular system, or in the subarachnoid space, which are free to move[1,5,6,8]; fragments in necrotic liquefied brain tissue, which move only to a limited extent in this cavity[2]; projectiles in a trajectory of destructive brain tissue, which can move in the reverse direction; and the slow sinking of intact heavy bullets by gravity.[5,7,10] The third type must be unlikely, because brain swelling may collapse the bullet trajectory.[7] In the present case, the second, third, and fourth types may have contributed to the movement of the bullet, which tumbled slightly in the necrotic cerebellar tissue in its cavity, and afterward moved posteriorly and stopped on the dura mater of the posterior fossa. Subsequently, the bullet migrated to the opposite side due to the effects of gravity in the park bench position during surgery, and finally returned to the left side, apparently through the same path (Fig. 3). The bullet was intact and undeformed, which seems to be the most important factor responsible for the fourth phenomenon. In the majority of cases of gunshot head injuries, bullets deform or fragment after impact, which makes migration in the cerebral parenchyma difficult due to the increased resistance.

Surgery for gunshot head injury is intended to

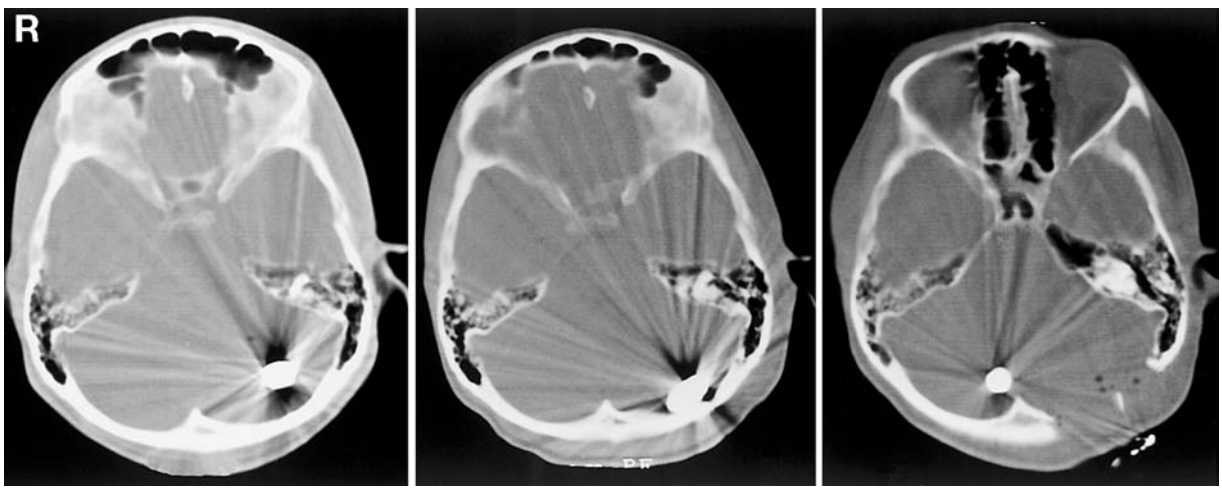

Fig. 2 Computed tomography scans using a bone algorithm showing the process of bullet migration. On admission, the bullet was located in the left posterior fossa (*left*). Before the second operation, the bullet had moved posteriorly (*center*). Later, migration of the bullet to the opposite side occurred (*right*).

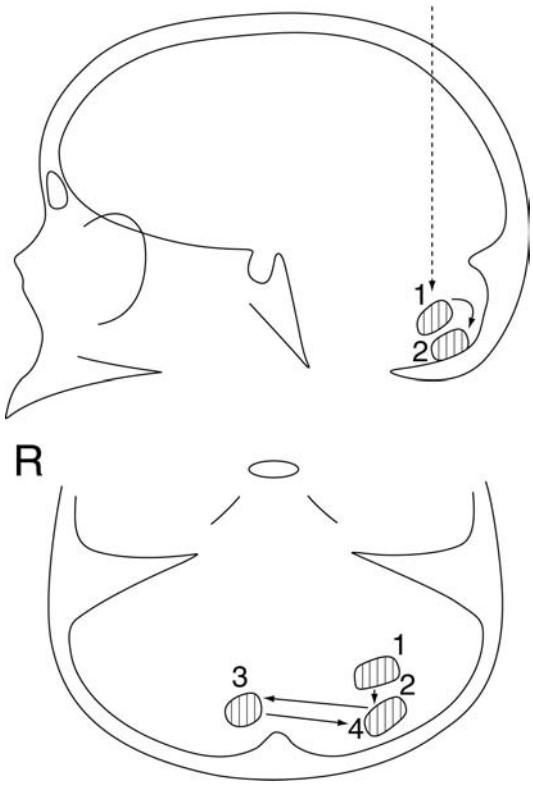

Fig. 3 Schematic drawing of the migration of the bullet. *Dashed arrow* indicates the trajectory of the bullet through the brain parenchyma into the posterior fossa. Locations of the bullet *1*, on admission; *2*, before the second surgery; *3*, during and after the second surgery; *4*, just before the third surgery.

achieve debridement of devitalized tissue in the entrance and exit wounds, the evacuation of all significant mass lesions, hemostasis, and meticulous dural and scalp closure.[9] The indication for surgery to remove bullets is controversial since the presence of retained bullets or bone fragments do not increase the intracranial infection rate,[3,9] and removal to prevent infection is not necessary. However, foreign bodies within the ventricular system should be removed, because hydrocephalus can result from obstruction of the foramen of Monro or the aqueduct of Sylvius.[4] Foreign bodies in the brain parenchyma should be removed only when they are easily accessible. Large and undeformed bodies, which are not easily accessible, require careful neurological observation and serial CT, because the objects may migrate, resulting in additional neurological deficits. Therefore, removal of the migrating bullets is advisable.

In the present case, removal of the bullet was indicated, because new neurological deficits had occurred due to obstructive hydrocephalus, and because the bullet had been located superficially in the posterior fossa. CT just before surgery is useful to determine the surgical procedure and the adequate operative position of patient, but intraoperative skull radiography or fluoroscopy and ultrasonography should also be performed to localize the bullet accurately.[5] Removal of the bullet in the cerebellum particularly requires the patient in the supine position before surgery, and the sitting position is recommended for the operation.

Acknowledgment

This work was supported by the Osaka Medical Research Foundation for Incurable Diseases, Osaka, Japan.

References

1) Arsil E, Tasçioglu AO: Spontaneous migration of an intracranial bullet to the cervical spinal canal causing Lhermitte's sign. *J Neurosurg* 56: 158–159, 1982
2) DesChamps GT, Morano JU: Intracranial bullet migration — A sign of brain abscess: Case report. *J Trauma* 31: 293–295, 1991
3) Kelly DF, Nikas DL, Becker DP: Diagnosis and treatment of moderate and severe head injuries in adults, *in* Youmans JR (*ed*): *Neurological Surgery*. Philadelphia, WB Saunders, 1996, pp 1618–1718
4) Lang EK: Acute hydrocephalus secondary to occlusion of the aqueduct by a bullet. *J LA State Med Soc* 121: 167–168, 1969
5) Milhorat TH, Elowitz EH, Johnson RW, Miller JI: Spontaneous movement of bullets in the brain. *Neurosurgery* 32: 140–143, 1993
6) Pereira WC, Da Rocha AG: [Migration of an intracranial projectile to the spinal canal]. *Arq Neuropsiquiatr* 24: 39–42, 1966 (Por, with Eng abstract)
7) Rengachary SS, Carey M, Templer J: The sinking bullet. *Neurosurgery* 30: 291–295, 1992
8) Small JM: Retained intraventricular foreign body. *Br J Surg* 32: 414–418, 1945
9) Trask TW, Narayan RK: Civilian penetrating head injury, *in* Narayan RK, Wilberger JE Jr, Povlishock JT (*eds*): *Neurotrauma*. New York, McGraw-Hill, 1996, pp 869–889
10) Wasserman SM, Cohen JA: Spontaneous migration of an intracranial bullet fragment. *Mt Sinai J Med* 46: 512–515, 1979

Address reprint requests to: Y. Fujimoto, M.D., Department of Neurosurgery, Osaka University Graduate School of Medicine, 2–2 Yamadaoka, Suita, Osaka 565–0871, Japan.