

Unusual mode of firearm injury from the recoiled rear end of a gun barrel

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ABSTRACT

Atypical gunshot wounds are caused by a diverse set of parameters relating to weapons and ammunition. We report a previously-unreported and atypical mode of gunshot wound produced by a detached rear end of the barrel of a gun following accidental gun fire, and discuss the difficulties in the management. A 36-year-old man presented to the emergency department with an alleged history of injury on the forehead with the rear end of a gun barrel following accidental gunfire while cleaning the nozzle. Since the time of injury, the patient was in an altered sensorium and had weakness on the right side of the body. There was minimal but continuous bleeding from the wound, with extrusion of brain matter. Skull radiograph showed that the rear end of the barrel had entered the left frontal bone, with associated depressed fracture of the frontal bone. The patient underwent a bicoronal, bifrontal craniotomy with a T-shaped extension towards the barrel to facilitate the reflection of the scalp flap and to avoid any movement of the barrel as it might further injure the brain. Necrotic brain, dura and bone pieces were removed. The patient was doing well at follow-up except for mild residual motor deficits. This case illustrates that while working with limited facilities, particularly in underdeveloped countries, a careful clinical assessment, interpretation of available images and a judicious operative approach can help to save the patient.

Keywords: cerebral trauma, firearm injury, gunshot wound, skull trauma

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INTRODUCTION

Firearm injuries are a major cause of premature death and disability in developed countries.⁽¹⁻⁴⁾ The lifetime medical costs of gunshot injuries are billions of US dollars a year; with the majority of these costs stemming from criminal assaults.⁽⁵⁾ Atypical gunshot wounds are caused by a diverse set of parameters relating to weapons and ammunition. The documentation of such cases help to explain future interpretation of wounds.^(6,7) We report a previously unreported and atypical mode of gunshot wound produced by the detached rear end



Fig. 1 Clinical photograph shows the rear end of the gun barrel in the left side of the forehead. Note the facial burns, continuous oozing and brain matter extruding from the wound.

of the barrel of a gun following accidental gun fire, and discuss the difficulties in the management of this case, particularly with limited available resources.

CASE REPORT

A 36-year-old man presented to the emergency department with an alleged history of accidental gunshot injury on the forehead with the rear end of the gun barrel while cleaning the nozzle. Since the time of the incident, the patient was in an altered sensorium and had weakness on the right side of the body. The general and systemic examinations were unremarkable. Neurologically, the patient was opening his eyes to pain, aphasia and had right-sided hemiparesis of grade III/V. Pupils were bilaterally equal and reactive to light. Local examination revealed that the rear end of the barrel was *in situ* and there was evidence of facial burns (Fig. 1). There was minimal but continuous bleeding from the wound, with extrusion of brain matter. Skull radiograph showed that the rear end of barrel piece had entered the left frontal bone, and was associated with depressed fracture of the frontal bone (Fig. 2). When the patient presented to us, the computed tomography (CT) machine was not functioning. The nearest CT facility had a travel time of six hours.

As it was a life-threatening injury and the patient was bleeding continuously from the wound, based on

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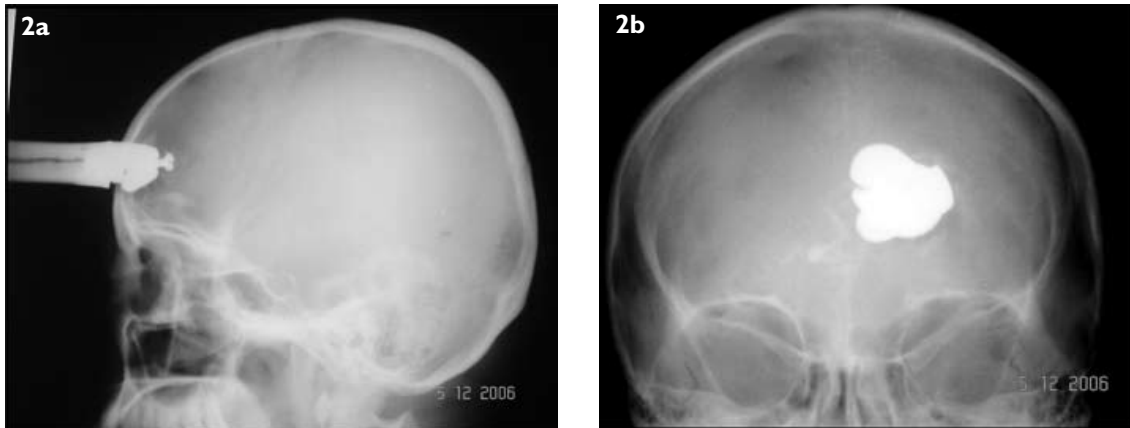


Fig. 2 Lateral and anteroposterior skull radiographs show fracture of the frontal bone and depth of the metal object. Note the proximity of the object to the midline.

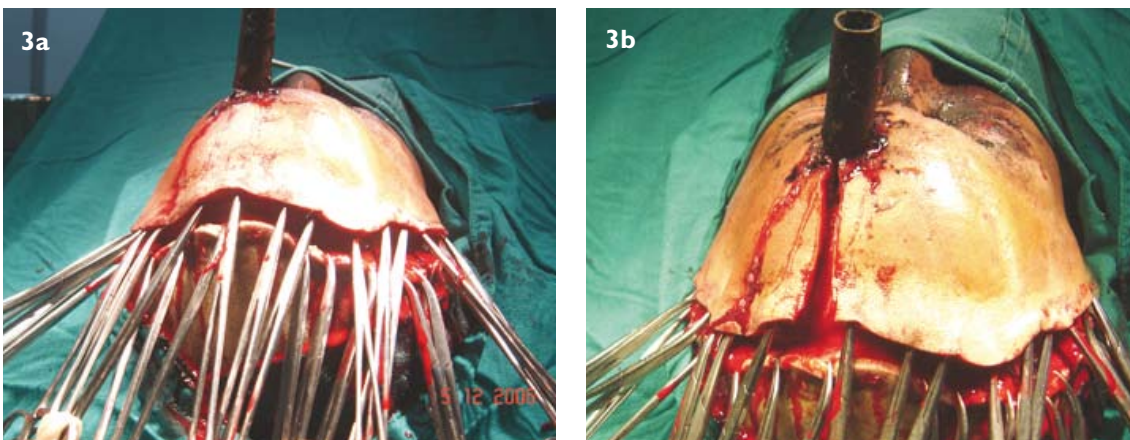


Fig. 3 Operative photographs show (a) a large bicoronal flap and (b) T-shaped extension.

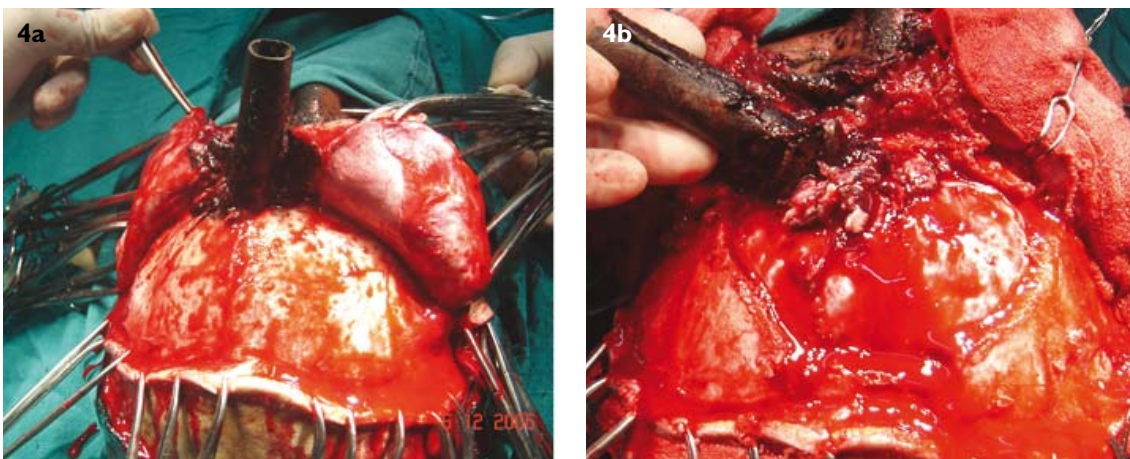


Fig. 4 Operative photographs show exposure of the metal object with T-shaped extension and bifrontal craniotomy. Note the necrotic brain matter, dura and proximity to the dural sinus.

radiographical findings, he was planned for emergency exploration. A bicoronal skin incision was made and a large scalp flap was raised to gain a wide exposure. A T-shaped extension was made towards the barrel to facilitate the reflection of the scalp flap, and to avoid any movement of the barrel as it might further injure the brain (Fig. 3). Bifrontal craniotomy with five burr holes was performed, and the barrel piece was delivered safely (Fig. 4). Necrotic brain tissue, the dura and the bone pieces were removed; and the wound was thoroughly irrigated with hydrogen peroxide and normal saline. Following this, the brain was noted

to be lax and pulsatile. After achieving haemostasis, the dural defect was closed with the pericranial graft (Fig. 5). The bone flap was replaced and the defect in the bone was covered with bone dust collected while making the burr holes (Fig. 6). Wound margins were freshened and the T-shaped extension was closed with subcuticular sutures (Fig. 7). The recovered barrel piece showed a crack in the cylinder and dislodgement of the posterior cap (Fig. 8). Once the condition of the patient was stabilised, we performed a postoperative CT which showed fracture of the crista galli and a small intracerebral haematoma on the opposite side (Fig. 9).

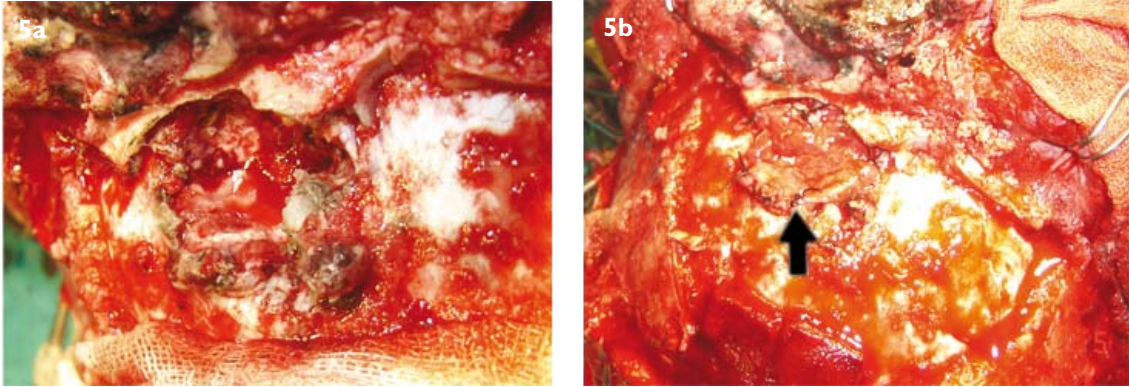


Fig. 5 Operative photographs show that the wound was debrided and the defect was closed with a pericranial graft (arrow).

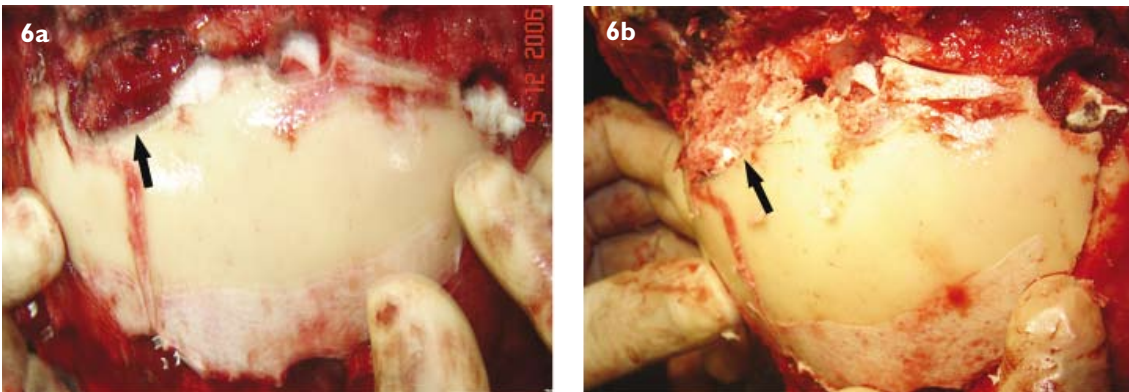


Fig. 6 Operative photographs show that the bone flap was replaced and the defect was closed with bone dust (arrow).

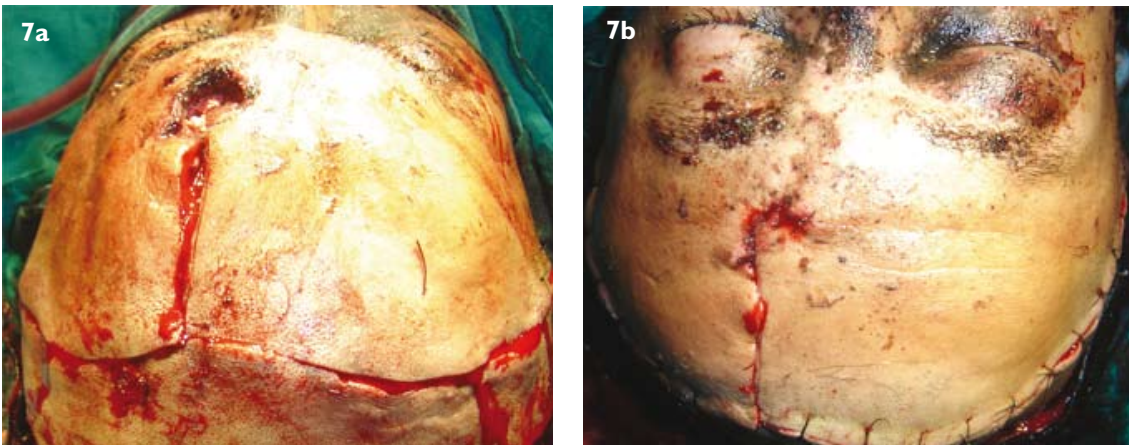


Fig. 7 Operative photographs show that the margins of the wound were refreshed and the T-shaped extension was closed with subcuticular sutures for a good cosmetic outcome.

The brain parenchyma was almost normal, with small infarction of the frontal lobe on the same side (Fig. 10); this correlated well with the lax and pulsatile brain intraoperatively. The patient was doing well at follow-up, except for mild residual motor deficits.

DISCUSSION

In a gun, a cylinder index error can be caused by a misalignment between the cylinder chamber and the barrel forcing cone. For proper functioning, the cylinder chamber and the barrel forcing cone should be held in alignment by the union of the ratchet and the latch pin.⁽⁷⁾ As described in the literature, we also

proposed that in this case, misalignment, caused by wear of the ratchet and latch pin, allowed play in the cylinder.⁽⁷⁾ In our case, the poor quality of an old and weak weapon resulted in the disruption of the barrel tube and detachment from the base which recoiled and hit the head. The nature and severity of a firearm wound depends on the characteristics of the bullet, mass and velocity of the bullet, its orientation and the tissues through which it travels. In the literature, two major mechanisms of wounding have been described: crushing and stretching of tissue. Understanding the mechanisms by which bullets disrupt tissues helps physicians to evaluate the severity of the injury and



Fig. 8 Photographs show the removed rear end of the gun barrel. Note the breach in the tube and in the rear end.

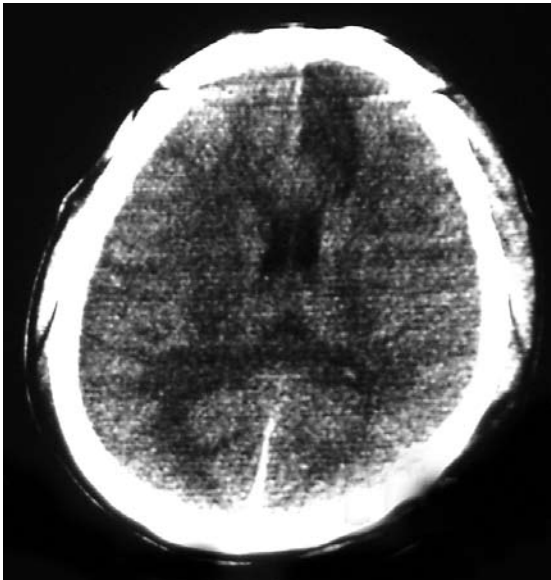


Fig. 10 Postoperative follow-up axial CT image shows a small ipsilateral frontal infarction that was responsible for the patient's motor deficits.

facilitate the treatment of wounds.⁽⁸⁾ In our case, the rear end of the gun barrel acted as a bullet and caused both crushing and shearing injuries. The projectile fired from the firearm provided a high velocity to the detached rear end, and this high velocity projectile could cause a large and devastating wound with enough velocity to disrupt the bone and brain parenchyma, and hence produced clinical features of diffuse injury.^(9,10)

Gunshot wounds are always contaminated, presented in emergencies and require lifesaving and stabilising treatment.^(9,10) After initial resuscitation, the treatment plan is aimed at preventing possible complications, such as infections and functional disturbances.^(9,10) In this unusual case, we followed the time-tested principles of neurosurgery. The treatment consisted of bleeding control, removal of barrel fragment, and wound debridement without further injury to the brain. This case illustrates that gunshot emergencies presented in underdeveloped countries

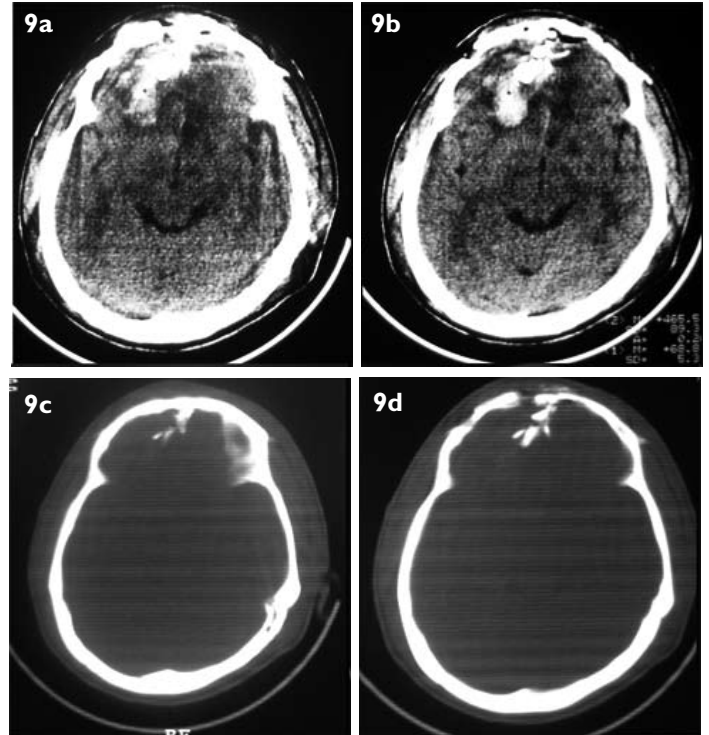


Fig. 9 Postoperative follow-up axial CT images show a small contralateral frontal intracerebral haematoma and fracture of crista galli (further ipsilateral exploration would have been a disaster).

with limited facilities, can result in a positive outcome, with a careful clinical assessment and interpretation of available images, and a judicious operative approach. This case also illustrates that the explosive energy transfer in the discharge of a bullet, resulting in recoil forces, was strong enough to drive the gun barrel through the skull at short range.

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