

CASE REPORT

The removal of four penetrating nails in the head following assault: a case report and technical note

Danjuma SALE¹, Gyang BOT², Nasiru J ISMAIL³

AFFILIATIONS

¹Ahmadu Bello University
Teaching Hospital Shika Zaria
Kaduna State, NIGERIA

²Jos University Teaching
Hospital, Jos, Plateau State
NIGERIA

³Regional Centre for
Neurosurgery
Usmanu Danfodio University
Teaching Hospital Sokoto
Sokoto State, NIGERIA

ABSTRACT

Penetrating head injury with nail guns is common, especially in patients with psychiatric disorders. Such injuries with carpenter nails following assaults are rare. They are usually extracted via craniotomy, or pulled out, under local anaesthesia. We present the case of a 35-year old man who had penetrating head injury with four nails following assault by five unknown assailants. He lost consciousness immediately, which he regained after 7 hours. At admission, his Glasgow Coma Score was 12/15, and skull x-ray and cranial computed tomography demonstrated the nails in the intracranial cavity. He had emergency burr hole extraction of the nails under general anaesthesia, and made a full recovery without developing any complication 3 years after the injury.

CORRESPONDING

AUTHOR

Danjuma SALE
Ahmadu Bello University
Teaching Hospital Shika Zaria
Kaduna State, NIGERIA

Email: doplass@yahoo.com

Phone: +234 806 943 2297

Keywords: Carpenter nails, head injury, infection, surgery

Received: 23rd January, 2015

Accepted: 20th February, 2015

DISCLOSURES: NONE

INTRODUCTION

Penetrating head injury with nail guns is common especially in patients with psychiatric disorders. Suicidal attempt is implicated in most non-accidental cases. Such

injuries with carpenter nails following assault are rare, with only few cases reported globally.¹⁻⁴

The reported approach for the removal of nails that penetrate the skull and brain is

either through a craniotomy or removal under local anaesthesia.¹⁻⁵ Double concentric craniotomy has, also, been used.⁶

In this report we describe the removal of 4 nails via adjacent burr holes with a good outcome and without adverse effects, in a resource limited country. The burr holes facilitated the removal of the nails with minimal disruption of adjacent tissues.

CASE REPORT

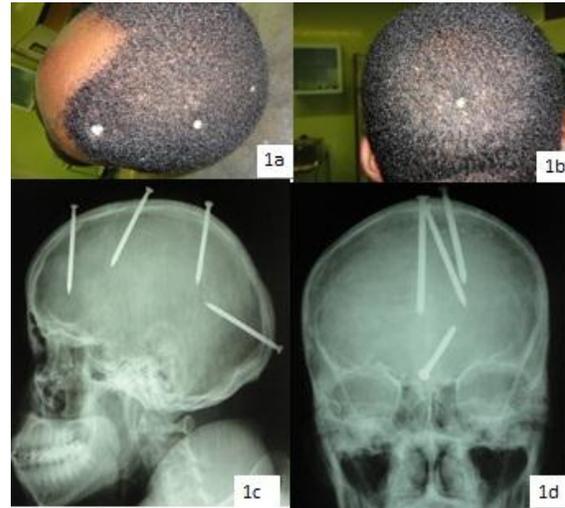
A 35-year old man was referred from a Federal Medical Centre with nails driven into the head following assault by unknown assailants. He was attacked while coming back from school, in the late hours of the day, by five men who overpowered him and drove four nails into his head. He lost consciousness after the first nail was driven into his head, and became lucid in the early hours of the next day. He, then, found his way to the house of a neighbour from where he was taken to the referring hospital.

At presentation, his Glasgow Coma Score (GCS) was 12/15 (eye opening response 4, best verbal response 2, best motor response 6). There were four nails driven through his head, the most anterior was 1cm on the left of the midline just posterior to his hairline, and the next was 8cm from the first and 4cm from the midline on the left. Another nail was 5cm from the second and just on the left of the midline, and the most posterior was located 1cm above and lateral to the external occipital protuberance (Figures 1a and 1b). Other neurological and systemic examinations were normal.

Skull x-ray studies done showed four nails penetrating into the intracranial cavity, (Figures 1c and 1d), and computed tomography (CT) scan of the brain also revealed the same findings with normal brain

parenchyma. Angiography or computed tomographic angiography was not done due to non-availability of the service in our centre.

Figures 1a and 1b, clinical image; 1c lateral and 1d, antero-posterior views of skull x-ray studies of the patient showing the nails.



His biochemical and haematological parameters were within normal limits.

He was placed on intravenous ceftriaxone 1g 12-hourly, per-os carbamazepine 200mg twice daily, and accelerated tetanus immunization.

He, subsequently, had emergency multiple burr holes and extraction of the nails on the fourth day of admission, the delay being the fallout from financial and logistic constraints.

SURGICAL TECHNIQUE

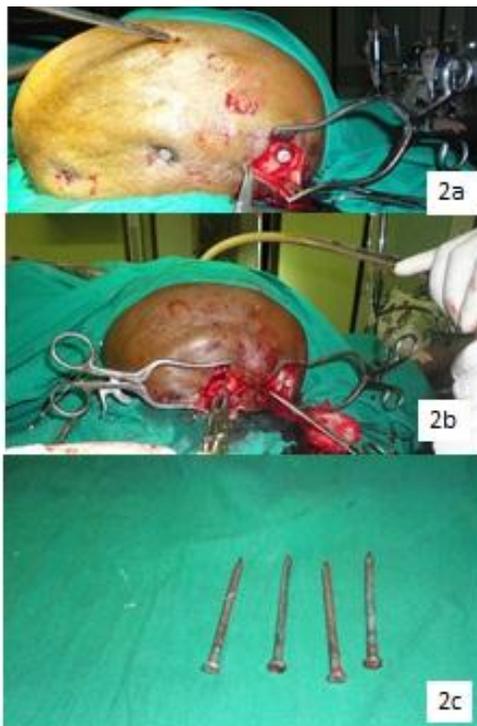
The patient was placed in the supine position under general anaesthesia with endotracheal intubation. The scalp was shaven and his head was placed on a horse-shoe head holder to allow for manipulation during surgery. The whole scalp was prepared with povidone iodine.

Through a 3cm scalp incision centered around each nail in the sagittal plane the calvarium was exposed and burr holes were drilled

5mm adjacent to the point of entry of each nail. These nails were freed by nibbling the bone around them starting from the site of the burr hole, and were sequentially extracted. The order of removal was determined by the proximity of the nails to the midline with those closest to it removed last.

Prior to the commencement of the operation preparation was also made for craniotomy in the event of untoward bleeding. The bleeding was, however, very minimal, and so, the nail tracts were irrigated with normal saline and the scalp wounds were closed (Figures 2a-c show some intra-operative pictures).

Figures 2a and 2b, intraoperative pictures of the patient showing part of the steps for the extraction of the nails; 2c, showing the four nails after extraction.



OUTCOME

His Glasgow Coma Score improved to 15/15 on the 2nd post-operative day and a detailed

history of mechanism of injury was obtained from him. Psychiatric evaluation revealed normal findings.

On the 6th post-operative day, he complained of headache, he had no fever, vomiting or convulsion. A repeat CT brain scan showed normal findings. His headache resolved with analgesics, and he was discharged on the 12th post-operative day following full recovery, returning to his normal daily activities, subsequently. He was well on his last follow up 3years after the incident and procedure.

DISCUSSION

Penetrating injury of the skull, historically, has been used as a punishment for criminals and more recently, has been reported as a self-injury in patients with underlying psychiatric disturbances.¹

The most commonly reported source of penetration are mainly from nail guns, with suicidal intents, in developed countries.^{2,4,7,8} Other reported sources of penetrating head injury especially in civilian lives are arrows, asbestos, ball pen, scissors, screw driver, dart, among others.⁹⁻¹³ Literature on penetrating injury from assault with hammer and carpenter nails is scanty.

Our index patient was attacked by 5 unknown masked assailants who overpowered him; he lost consciousness after the first nail and did not regain it until about 7hours later. When he presented at the hospital, his verbal response was incomprehensible, and so, a detailed history of the mechanism of injury could best be obtained after his recovery of full consciousness.

Radiological investigation is the key to identifying the nails and their trajectories. The patient had initial skull x-ray studies on admission, and later, cranial CT. Our main

concern was to determine the relationship of the tracts and superior sagittal sinus due to the fact that two of the nails were close to the midline and the nail at the occipital region was in close proximity to the torcula.

Development of pseudo aneurysms has been reported as a complication of penetrating nail injury and, so, angiography has been advised to rule out vascular involvement. This was not done due to non-availability of the facilities in our centre.

The main challenge of the management of such cases lies in the technique for the removal of the nail. Most reported cases in which intracranial nails were removed fall into one of two treatment categories, viz. i) emergency craniotomy ii) removal of the nail(s) after a local anesthetic agent has been infiltrated in the awake patient.

In the majority of reported cases in which a local anesthetic was used only a single nail was removed.⁵ Removal by craniotomy allows for easy control of bleeding but required more extensive surgery. During extraction under local anaesthesia, life-threatening bleeding may occur which may be difficult to control.

Spennatto, *et al*, used double, concentric craniotomy in a patient in which the nail penetrated the skull and brain; a small craniotomy (1 x 1 cm) just around the head of the nail, and a concentric larger fronto-parietal bone flap, involving the first craniotomy, were performed. The larger bone flap was elevated first, whereas the small bone flap with the nail infixed was carefully elevated along the axis of the nail, under direct vision of the nail tract. They concluded that double concentric craniotomy is the only technique that permits for the removal of a foreign body that has penetrated both the skull and brain, under direct vision, without transmitting any undue forces to the

underlying structures. The technique readily allows for the control of bleeding.⁶ In our patient, the nails were removed via 4 burr holes which were placed adjacent to the nails, under general anaesthesia. The occipital nail was removed last.

Preparation was, also, made for craniotomy in case of serious uncontrolled bleeding, however, there was only minimal bleeding which stopped after irrigation of the nail tract with normal saline. Post-operative CT brain scan did not show intracranial haemorrhage.

In 40% of cases, penetrating skull injuries are fatal because of damage to critical structures, vascular disruption, concussion blast injury, or meningitis.⁵ Nevertheless, there is a growing proportion of patients who survive such injuries, are discharged from the hospital in stable condition, and often return to work.⁵

Our index patient made full recovery and was discharged home. He had since returned to his normal work and had no neurological complications, 3 years after his injury.

This is the first report of assault with multiple nails from our centre and involved only a single patient and, thus, our method of extraction needs to be validated in subsequent studies with more patients and randomization.

CONCLUSION

Penetrating multiple nail cranial injuries pose a great challenge to management. Adjacent burr holes and nail extraction may be a treatment of choice in carefully selected patients. However, the technique needs to be studied further, in a larger population of patients.

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