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Case Report **Radiology**

Contribution of Computed Tomography in the Management of a Penetrating Knife Wound to the Skull: A Case Report and Review of the Literature

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Abstract

Introduction: Cranial wounds encephalic penetrating by stab are rare and repesent 0.4% of Head trauma. They are often observed in an attempt at autolysis in mentally ill people, or in physical aggression. We report here a case of an adolescent victim of attack by the penetration of a knife into his brain. ***Patient and method:*** This is a patient aged 17 years old, with no known medical history, admitted to the Emergency Reception Department of the Gabriel TOURE University Hospital for open head trauma following a physical attack with the penetration of a knife inside his headrane. The entire blade of the weapon was lodged in his brain parenchyma. The entry point was the right parietal bone. The patient had a Glasgow score of 15/15, with good hemodynamic status. The cranial scanner encephalic which was carried out a few minutes after his admission high lighted the presence of the knife blade at the level of parietal and temporal lobe of her hemisphere right. ***Result*:** The patient was operated successfully with extraction of a knife whose blade measured 6 to 7cm. A good postoperative evolution followed. Conscious and without motor deficit, he received a follow-up CT scan on day 7. Then he was released from the hospital with out patient follow-up. ***Conclusion*:** Cranial wounds-encephalic by penetration of a bladed weapon are very rare. The CT scan in emergency is the key examination to clarify the location, the number of foreign bodies, as well as brain lesions. They require rapid surgical treatment after CT evaluation. Their prognosis remains reserved regarding the severity of the head trauma, endocranial vascular lesions and infections.

Keywords: Head trauma, cranio-wounden cephalic, knife, CT scan.

INTRODUCTION

Head trauma is said to be penetrating when the damaging agent penetrates the skin to reach the underlying anatomical structures; at the brain level, penetration reaches the dura mater [1].

Cr traumahasnio-encephalic Penetrating injuries are relatively rare, accounting for approximately 0.4% of all head injuries [2, 6].

In the literature as well as in our service few studies have been carried out on this pathology. The CT scan is the reference examination and is of essential interest in cases of penetrating head trauma [4].

Cranioencephalic metallic foreign bodies with transcranial entry into the parietal bone are rare. The main risk is the occurrence of neurological complications, vascular, infectious, orbital, ENT depending on the size, nature, location of penetration and direction of the shock. Hemorrhages, vascular lesions major injuries and contusions can be causes of death at an early stage, while that epileptic seizures and infections are possible complications in later stages [10].

These traumas mainly occur during work accidents or suicide attempts and self-mutilation (psychiatric context) or assault [5, 2].

They generally have a good prognosis, but the management strategy must be rapid and decisive to

prevent essentially vascular and infectious complications which can, when they occur, worsen the prognosis.

Our objective is to study the radiological and evolutionary aspects of this patientin our context and to review the literature on penetrating cranioencephalic trauma.

We report a case of penetrating head trauma byknife occurring in a context of aggression [6].

CLINICAL CASE

This is a patient aged 17, male, with no known medical history, taken by the Bamako Civil Protection collection service to the emergency department of CHU-Gabriel TOURE with a knife implanted at the level of the right parietal bone of the skull following an attack. He was stabbed in the head with a knife following a fight.

Physical examination found a large open bleeding wound on the scalp at the point of impact, through which we noted the presence of a knife embedded in the skull. The presence of superficial wounds at the chest level was also noted.

Blood pressure was estimated at 159/92mm and the Glasgow Score was 15/15. SPO2 saturation was 96%. His conjunctivas were well colored. His temperature was 37.6°C. No motor or sensory deficits were noted.

The ENT and ophthalmological examination were unremarkable. No history psychiatric known.

CT Results

CT of the skull performed without IV injection of iodinated contrast product with contiguous axial cuts of 1.5 mm and sagittal and coronal reconstructions highlighted: the presence of a foreign body (CE) of metallic density (d= 7382 UH) shaped like a knife crossing the right parietal bone. Its blade measures intracranially 6.70 cm. It resulted in a laceration of the right parietal and temporal lobe of the brain, accompanied by significant linear pneumencephaly throughout the path of the weapon. We note the presence of a blade of hematoma sub-dural (HSD) right hemispherical. There is a large open fronto-parieto-occipital tear in the scalp and a bony gap adjacent to it.

Median structures, the ventricles and the posterior fossa are normal in appearance. No transventricular injury or injury crossing the median line was not observed. The patient underwent emergency neurosurgical intervention.

A follow-up CT scan of the brain on the 7th day after surgery showed that the pneumencephaly and subdural haematoma had decreased considerably in volume.

Figure A: A patient image on admission with a knife stuck in the skull

PRE-OPERATIVE SCANNOGRAPHIC IMAGES:

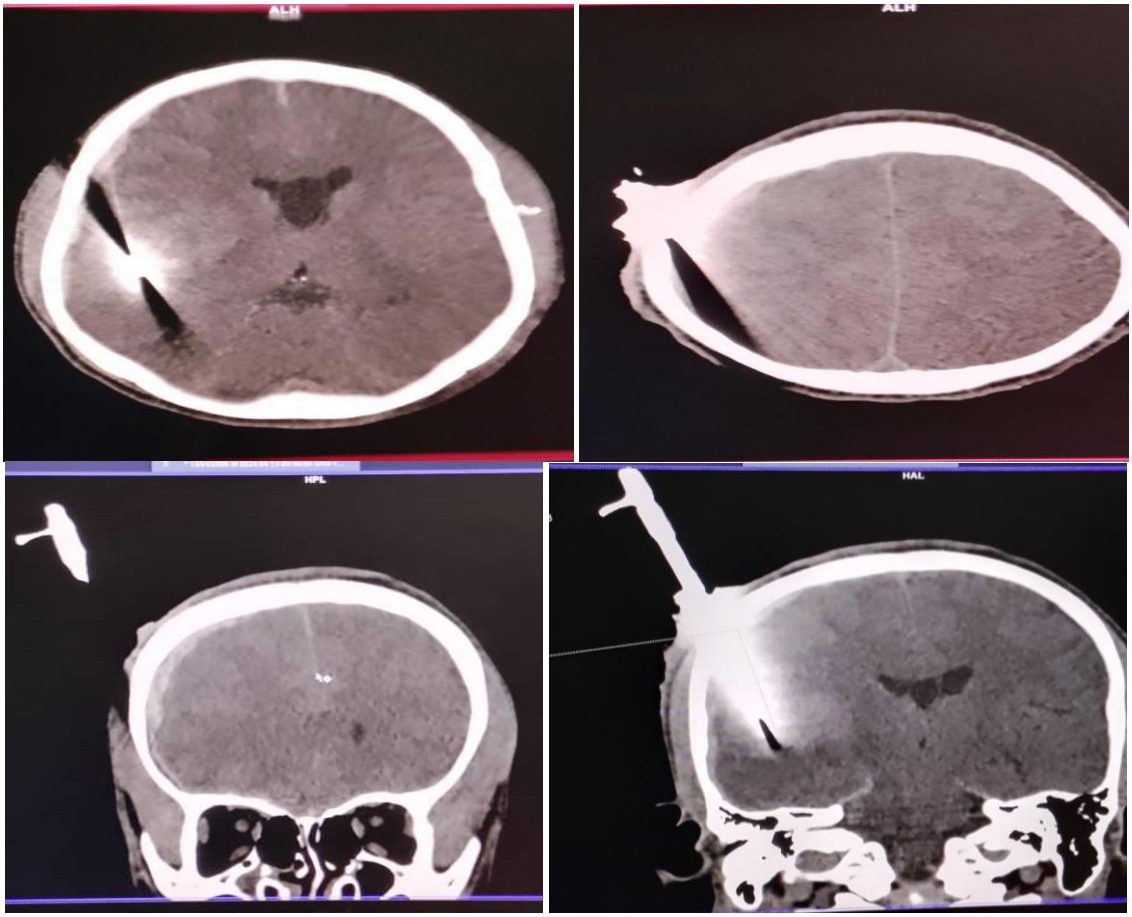

Figure B: Parenchymal window in axial and coronal section with presence of knife, pneumencephaly and acute SDH blade

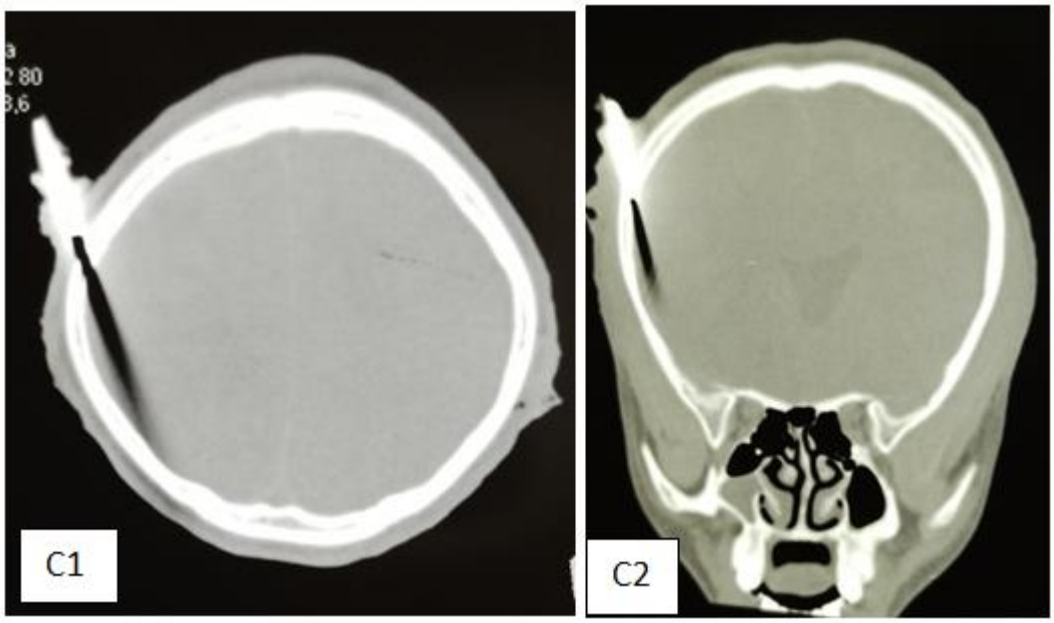

Figure C: Bone window in axial (C1) and coronal (C2) section

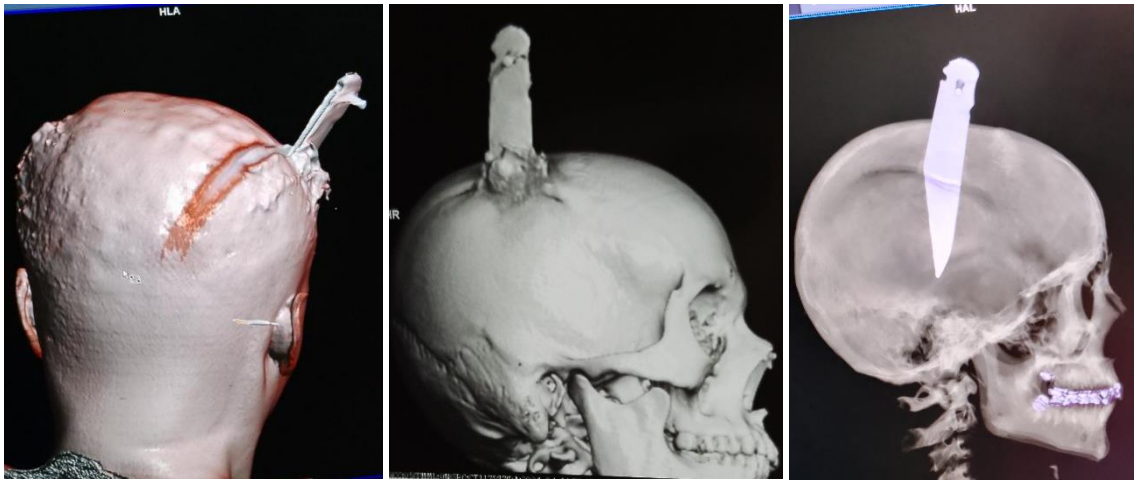

Figure D: 3D scan images

POST-OPERATIVE SCANNOGRAPHIC IMAGES: Check on D7.

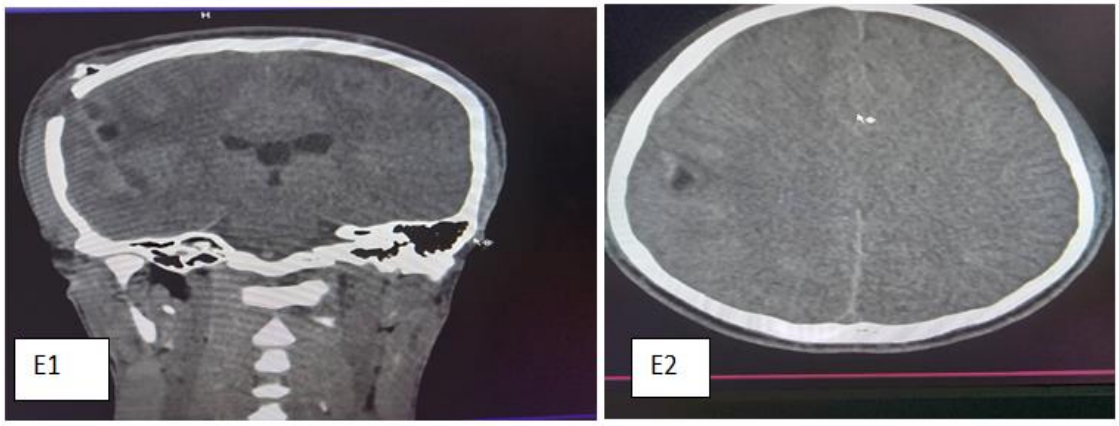

Figure E: Control CT, coronal section showing pneumencephaly in the path of the knife (E1) and control CT, axial section showing right parietal pneumencephaly (E2)

DISCUSSION

Penetrating head injuries are rare, accounting for around 0.4% of all head injuries [6].

They frequently occur during work accidents, attempts to autolysis in psychotics or homicide. Those caused by sharp objects are exceptional [2, 3]. The context of occurrence in our patient was an attempted homicide.

Feknous *et al*., confirmed in Algeria a rate of 0.4% [2]. In a study done by Goumantar and his colleagues at the university hospital Renaissance of N'Djamena in Chad on the taking control of cranioencephalic trauma penetrating, hes recorded 12 out of a total of 649 cases of traumacranio-encephalic.VS traumacranio-encedphapenetrating liquids represented 1.6% of all cranioencephalic trauma of this you inquiry summer [3, 11, 12]. This rate seems high due to the increase in inter-community armed conflicts, particularly between farmers and breeders which are rampant in this country. However 12 cases Chadians were recorded during 48 months, which represented 03 victims per year.

Our patient was aged 17. This age is lower that the average Chadian age which is estimated at 31.22 ± 8 years, with extremes of 14 and 70 years. He is even younger than the case of Feknous et al who is 42 years old [2, 3].

All the victims were male. The explanation is that young people are more exposed to stabbing injuries. They are fiery, often drug users and use his in front line in conflicts or fights [9].

Our patient lived in a working-class neighborhood of Bamako.There juvenile delinquency plaguing our suburbs is a phenomenon more and more worrying. Feknous *et al*., stated that their patientin Algeria was a city dweller, drug addict admitted to their department for attempted autolysis with a knife.

In Chad, only 25% of victims live in urban areas while the majority (75%) come from rural areas. The explanation is the persistence of armed conflicts between

farmers and breeders because of the management of space and access to natural resources. This phenomenon is frequently encountered in the countryside in countries of Sahel where bladed weapons like spears, handcrafted arrows and daggers are frequently used in community conflicts.

Penetrating Traumatic Brain Injury (PTBI) due to brawling was the reason for admission of our case. Goumantar F. T and al have confirmed that fighting was the leading cause of penetrating head trauma, with a rate of 81.2% [3].

A Nigerien study led by Mahamadou Aminou Sanda and his team reported a case of head trauma penetrating throughnail occurred in circumstances not yet clarified [7].

A 2019 Malian study has identified, since 2006, 23 cases of head trauma-encephalic penetrating by nail, including 5 non-secondary projectiles attacks physicals [8].

Most authors report cases of penetrating trauma linked to assaults [10-12].

Pathophysiologically, the penetration of the knife into the skull often causes initial localized brain lesions [6].

The initial clinical examination is fundamental in looking for a state of shock, minimal neurological disorders, often without impairment of consciousness. Mortality is low and would then be associated with damage to other organs or the occurrence of complications [6, 5].

The initial clinical examination of head trauma patients already predicts prognostic factors and perinvolves the development of a therapeutic strategy. It includes the research and evaluation of vital respiratory and circulatory distress that must be corrected before evaluating the neurological distress of which they may be the cause. The Glasgow score at admission would be correlated with the mortality rate [14].

The emergency brain scan allows the extent of the lesions to be identified, but should only be performed on a well-stabilized patient. The obsolete skull x-ray is currently abandoned in several countries of world. MRI is not always accessible and has many contra indications.

Fractures and/or indentations of the skull, intra- or extra-parenchymal hemorrhage, cerebral ischemia, cerebral edema and depth of penetration even if the object is removed are generally the lesions detected by brain CT. Evaluation of vascular structures is also mandatory, especially if the trajectory of the sharp object intersects that of the vessels [14-16].

In our study, the victim was stable with an estimated Glasgow score of 15 and underwent emergency surgical treatment with satisfactory results and a favourable postoperative course. Spalvski, B and al reported good results after surgical treatment [18].

Surgery should be performed as a matter of urgency, as there is 53% morbidity in cases of late surgery and 62% morbidity in cases that are not operated on. [10]

In our case, 12 hours after admission, the patient was operated on. The weapon was extracted; haemostasis was performed, followed by repair of the dura mater and closure with a drain. No complications were noted.

Our patient was rushed to hospital by the Civil Defence within an hour of being attacked and underwent a cranioencephalic CT scan within minutes. In the Chad series, no patient was admitted before the first 6 hours. The average admission time was 47 ± 8 hours, with extremes ranging from 8 hours to 128 hours [3]. This time saving can be explained by the fact that our victim lives in the Malian capital, where most of the country's infrastructure is concentrated. In Chad, most victims live in rural, remote and inaccessible areas of the country.

Our patient returned to hospital with a Glasgow score of 15 and a good haemodynamic state, unlike in Chad, where 05 cases had a GCS of 13 to 15 associated with various disorders.

On CT scan, our patient had an open right parietal fracture accompanied by pneumencephaly and a HSD lamina. In Chad, skull fracture was also the most frequent CT lesion, with 07 cases of open fracture, 05 cases of simple fracture and intracerebral lesions.

In the Chad study, surgery was performed in 8 patients within 6 hours of admission, i.e. 72.7% (8/11), and within 48 hours for all patients. Our patient was operated on 12 hours after admission. Although he still had a Glasgow score of 15 and good haemodynamic status, his surgery was delayed compared with the majority of Chadian patients. In Mali, hospital costs are generally borne by the patient's family. Surgery is often delayed for poor families or for patients not covered by insurance. They spend enough time to raise the financial means.

On the 7th day after his operation, a check-up scan was carried out and the patient was allowed to go home. Goumantar F. T *et al*., found an average hospital stay of 11 ± 6 days, with extremes of 2 days and 21 days.

In other studies, the complications mainly reported are vascular and infectious, but also post-epilepsy traumatic [9, 10]. Infection (cutaneous, osteomyelitis, meningitis, encephalitis) is most often

secondary to the presence of intracranial metal or bone fragments, or leakage of cerebrospinal fluid. Post-traumatic epilepsy occurs in 30 to 50% of penetrating head trauma; it may require prophylactic anticonvulsant treatment. Vascular complications can endanger the patient's life prognosis quickly (subarachnoid or ventricular hemorrhages, venous infarctions) or delayed up to several years (pseudoaneurysms) [5, 6, 19].

In terms of diagnosis, emergency brain scanning without injection of iodinated contrast, which is the key examination to clarify the location and number of stab wounds, as well as brain lesions, was the only examination carried out in our study.

Our patient has not benefited from CT angiography and cerebral angiography to date. Because the surgeon did not request or consider it necessary. We know that CT angiography or cerebral angiography, when possible, are important in determining the risk of vessel damage in the event of surgery [5, 6, 20].

However the contribution of CT angiography to diagnosis remains controversial because it is often limited by artifacts. Imagery by resonance magnetic (MRI) is not yet available at CHU Gabriel Touré in Bamako. Moreover, MRI also has a controversial role, because it can be dangerous in case of ferromagnetic objects [6].

Our patient received a control CT on day 7 after his intervention with a control CT. The coronal and axial section shows that the pneumencephaly and subdural hematoma have decreased considerably in size. Imaging is as important in the diagnosis as in the post-operative monitoring of penetrating head trauma. Brain CT remains the examination of choice to assess possible postoperative bleeding, or complete removal of the foreign body [19].

The Intraoperative computed tomography (IOCT) or intraoperative cerebral angiography, have the advantage of allowing much earlier control or prevention of complications hemorrhagic [21, 22].

As far as our patient is concerned, only the brain scan without injection of iodinated contrast product was performed for diagnosis and for post-operative follow-up. Treatment of penetrating head trauma is surgical. However, additional medical treatment may be necessary. It essentially includes systematic antitetanus prophylaxis, anticonvulsants, and antibiotic prophylaxis in penetrating head trauma by knife [1, 8, 9]. In our observation the patient received systematic tetanus prophylaxis and antibiotic prophylaxis. The patient was coma-free after 02 months, and anticonvulsant treatment had been stopped just one week after surgery. The surgeon removed the foreign body, performed haemostasis and then repaired the dura mater. The drain was closed.

CONCLUSION

This study suggests that penetrating head injuries caused by knives are rare. These injuries are particularly common in young males, and the main causes are fights and suicide attempts.

CT scans are the reference examination and are of vital importance. Improvements in neuro-resuscitation and imaging techniques have led to advances in the surgical treatment of cranioencephalic wounds. As a result, the prognosis is good.

Their seriousness lies in the functional and vital prognosis at stake.

Conflicts of Interest: The authors declare no conflict of interest.

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