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Unusual Brain Trauma Injury

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Abstract

Unusual head trauma is rare with various mechanisms of occurrence. The injuries can be similar to those of road accidents but sometimes with significant complexities. The objective was to determine the frequency of this pathology in our practice, describe the different mechanisms and report the craniocerebral lesions caused by this type of trauma. **Materials and Method:** This was a descriptive study with retrospective collection spread over a period of 3 years. After selecting the files, the patients and/or their companions were contacted by telephone to inquire about them and then returned to the consultation for reassessment. Disease history and information were obtained from patients' medical records. **Result:** The frequency of this pathology was 1.78% and his incidence was 0.4 cases per month. The average age of the patients was 13.47 years. All the victims were male. 41.17% of patients were in school. The mechanisms of trauma were the hoof blow 47.1%, the horn blow 29.4% and the stone blow 11.7% respectively. 23.5% of patients were confused and 11.7% children were in coma. One patient presented an anisocoria. The motor deficit was present in 5 cases. CT-scan made it possible to highlight a skull depressing fracture 58.8% and confirm a craniocerebral wound in 35.3%. The average time between patient admission to hospital and completion of surgery was 24.5 hours. The surgery had consisted of the trimming of craniocerebral wounds, exploration, duroplasty and lifting of skull depressing fracture. After 15 months of follow-up, the evolution was favorable in 53.3%, the morbidity was 33.4% and the mortality 17.6%. **Conclusion:** These are rare but serious conditions because they are fatal and disabling. An early and multidisciplinary management can hope to have a good favorable.

Keywords

Brain Trauma Injury, Insolite, Unusual, Skull Depressing Fracture, Hoof Kick, Horn Blows, Stone Bows, Motorcycle Gear Lever

1. Introduction

Unusual head trauma is characterized by the presence of craniocerebral lesions following head trauma of insolite mechanism. The vast majority of head injuries occur following road accidents [1] and falls from height [2]. Unusual head injuries, although rare, have a different mechanism and are responsible for significant mortality and morbidity. These are most often penetrating head trauma caused by non-projectile objects. Penetrating head injuries are among the most severe injuries with a higher incidence of morbidity and mortality, accounting for approximately 0.4% of all injuries [3]. Penetrating traumatic brain injury is a severe type of traumatism brain injury with a high rate of mortality [4]. The objective was to determine the frequency of this pathology in our practice, describe the different mechanisms and report the craniocerebral lesions caused by this type of trauma.

2. Materials and Method

This was a descriptive study with retrospective collection spread over a period of 3 years from January 2020 to December 2022. It focused on patients treated in the department for head trauma in whom the mechanism is extraordinary (unusual) in our practical. After selecting the files, the patients and/or their companions were contacted by telephone to inquire about them and then returned to the consultation for reassessment. Disease history and information were obtained from patients' medical records. Details of the surgery were taken from the operating room register. The epidemiological, clinical, radiological and therapeutic data were recorded on a digitized survey sheet and processed in Excel.

3. Results

During the 3-year study period, 953 cases of head trauma were recorded in our department, including 17 patients with unusual head injuries. This makes a frequency of 1.78%. The 17 cases spread over 36 months have an incidence of 0.4 cases per month. The average age of the patients was 13.47 years with extremes of 6 and 17 years. **Table 1** shows the distribution of patients by age. All the victims were male. Seven patients were in school (41.17%). 58.83% of the patients were made up of apprentice mechanics (3 cases), apprentice drivers (5 cases) and young wanderers without fixed activities (2 cases).

Concerning the mechanism of trauma, the hoof blow represented 47.1% of cases; these were patients who received a blow to the head from a horse's hoof (5 cases) and a donkey (1 case). Five patients (29.4%) had received blows to the head from a bull's horn. In a patient who was a passenger in a cart, it overturned and landed on the patient's head. In another teenage motorcyclist, he fell from the motorcycle and the gear lever was buried in his head (**Figure 1(a)**, **Figure 1(b)**). **Graph 1** shows the distribution of patients according to the mechanism of occurrence of head trauma.

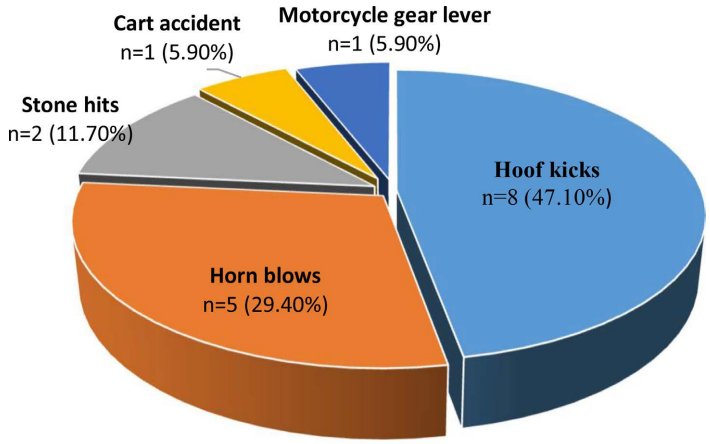
Clinically, on admission, 11 patients (64.7%) had normal consciousness. Four

Table 1. Distribution of patients according to age.

Age (year)	Number	Fréquency (%)
6	1	5.9
8	1	5.9
10	1	5.9
12	2	11.7
13	1	5.9
14	3	17.6
15	4	23.5
16	1	5.9
17	3	17.6

Figure 1. Appearance of lesions on clinical examination. (a) Superior view of head injury penetrating through motorcycle gear lever; (b) Profile view of head injury penetrating through motorcycle gear lever; (c) Bilateral periorbital ecchymosis; (d) Frontal traumatic injury from hoof blow

patients were confused (23.5%) and two children were in coma (11.7%). In Table 2, we have the distribution of patients according to the Glasgow score at admission. Headache was found in 15 patients (88.2%). It varied in intensity from moderate to severe. The pupils were normal size, equal, concentric and reactive in 94.1% of cases. One patient presented an anisocoria (5.9%). The motor deficit was absent in 10 patients (58.8%), present in 5 cases and not evaluable in 2



Graph 1. Distribution of patients according to the mechanism of occurrence of head trauma.

Table 2. We have the distribution of patients according to the Glasgow score at admission.

Glasgow Score	Number	Frequency (%)
15	11	64.7
12	4	23.5
8	2	11.7

patients. Patients with motor deficits presented non-proportional hemiplegia in 23.5% (4 cases) and hemiparesis in 1 case (5.9%). Edema of the face (face) found in 6 patients (35.3%) and bilateral periorbital ecchymosis in another (**Figure 1(c)**). A scalp wound was noted in 9 patients. It was located in the frontal region in 5 patients or 29.4% (**Figure 1(d)**) and parietal in 23.5%. In two patients, there was the presence of foreign bodies including a stone and a motorcycle gear lever.

Computed tomography (CT-scan) was performed in all patients. It made it possible to highlight a skull depressing fracture in 10 patients or 58.8% (**Figure 2**), an extradural hematoma in one patient (**Figure 3**) and to confirm a craniocerebral wound in 6 patients (35.3%) (**Figure 4**). It was an opened depressed skull fracture in 35.3% of cases. **Table 3** shows the characteristics of the radiological lesions according to the mechanism of trauma. Brain contusion was the main associated intracranial injury.

The surgical indication was made urgently in all patients. Surgery was performed in 15 patients. The patient with the extradural hematoma is admitted to intensive care, intubated with respiratory assistance. His surgery was reported because of anemia (hemoglobin level of 6 g/dl). A patient with a craniocerebral wound died before being admitted to the operating room. The average time between patient admission to hospital and completion of surgery was 24.5 hours with extremes of 6 and 48 hours. The surgery had consisted of the trimming of craniocerebral wounds, exploration with or without removal of bone splinters. Dura mater plasty (duroplasty) was performed in 3 patients. This was an autologous duroplasty using epicranium. For opened skull depressed fractures,

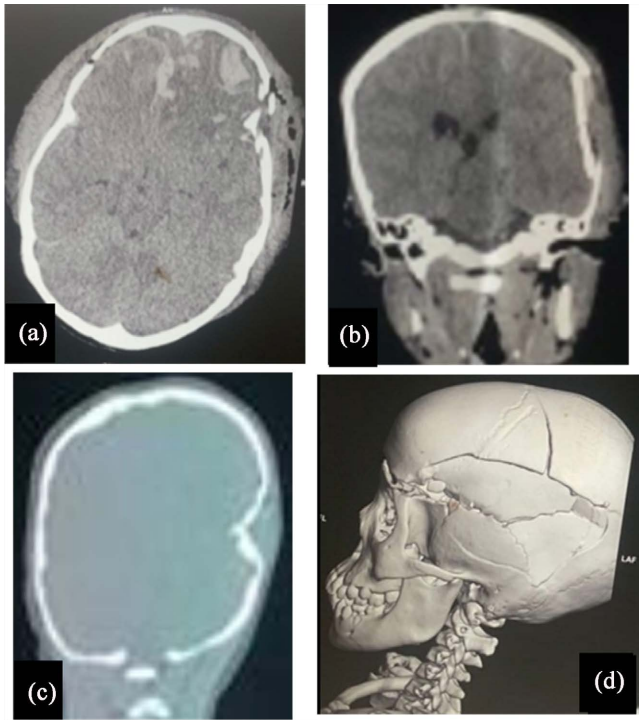


Figure 2. Skull depressing fracture on brain CT-scan. (a) Axial section, parenchymal window, bi-frontal fracture with cerebral contusion; (b) Coronal reconstruction, left fronto-temporal shoulder fracture; (c) Coronal reconstruction, bony window, left parieto-temporal depressing fracture; (d) 3D reconstruction, left fronto-parieto-temporal fracture.

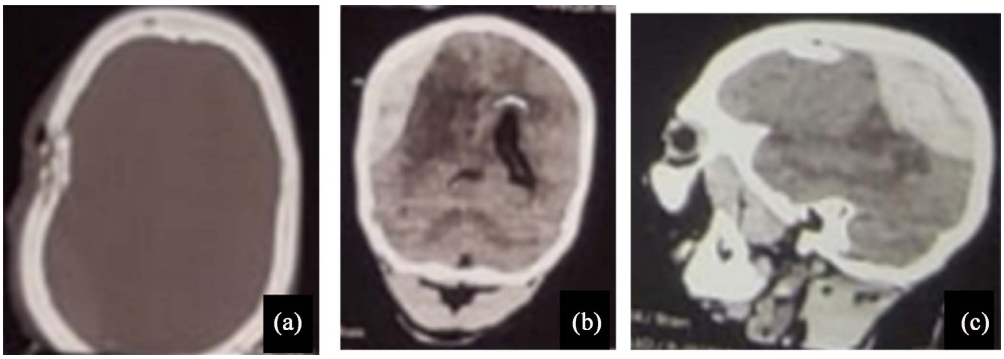


Figure 3. Brain CT scan. (a) Axial section, bony window, right frontal skull fracture; (b) Coronal reconstruction, right hemispheric extradural hematoma with mass effect; (c) Sagittal reconstruction, parietal front extradural hematoma.

trimming of the scalp wound and lifting of the arch were carried out. A simple lifting of the closed depressed fracture was done in the event of a closed skull depressing fracture. The data concerning the surgery have been put in **Table 4**.

Regarding medical treatment, patients with craniocerebral wounds and cases of open fractures received a dose of tetanus vaccine and antibiotic treatment based on 3rd generation cephalosporin (ceftriaxone) combined with an imidazole (metronidazole) intravenous route during 10 days. Paracetamol was the analgesic of choice used in all patients. It was associated with a nonsteroidal

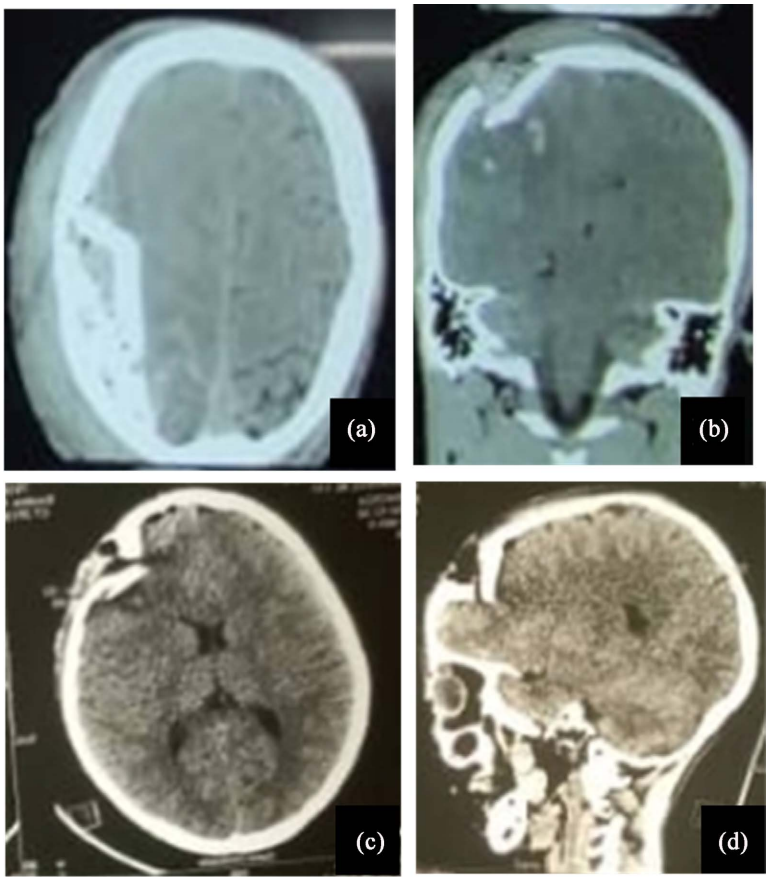


Figure 4. Craniocerebral wound on brain CT-scan. (a) Axial section, parenchymal window, right fronto-parietal craniocerebral wound with depressing skull fracture; (b) Coronal reconstruction, right frontoparietal craniocerebral wound with brain contusion; (c) Axial section, parenchymal window, right cranio-frontal wound; (d) Sagittal reconstruction, frontal craniocerebral wound.

Table 3. Distribution of craniocerebral lesions on CT-scan according to the mechanisms of trauma.

Mechanism	Number	Lesions in CT-scan	Number
Hoof kick	8	Craniocerebral wound, brain contusions	4
		Opened depressed skull fracture, brain contusions	2
		Closed depressed skull fracture, brain contusions	1
horn blow	5	Right parieto-temporal extradural hematoma	1
		Opened depressed skull fracture, brain contusions	3
		Closed depressed skull fracture, brain contusions	2
Stone blow	2	Opened depressed skull fracture, brain contusions	1
		Closed depressed skull fracture	1
Cart accident	1	Craniocerebral wound, brain contusions	1
Motorcycle gear lever	1	Craniocerebral wound, brain contusions	1

Table 4. Distribution of patients according to the surgical technique adopted.

Diagnosis	Number	Operating technique	Number
Craniocerebral wound	6	Trimming, craniotomy, placement of Surgicel®, without dura mater plasty	3
		Trimming, craniotomy, dura mater plasty	2
		Trimming, foreign body removal, dura mater plasty	1
Opened depressed skull fracture	5	Trimming, exploration, lifting of depressed skull fracture	5
Closed depressed skull fracture	4	Simple lifting of depressed skull fracture	4

anti-inflammatory drug (Diclofenac) in 7 patients (46.7%). Prevention through the administration of tetanus vaccine was carried out in 6 patients (35.3%). One patient was taking antiepileptic medication such as sodium valproate at a dose of 30 mg/kg per day. Motor rehabilitation by physiotherapy was instituted in 5 patients (33.3%). At 3 months of evolution, mortality was 11.7%. Two patients had an infectious complication. There was a case of brain abscess and a case of bacterial meningitis. This infectious complication was successfully treated with antibiotics. On follow-up at (at) 6 months, the motor deficit was persistent in 4 patients with hemiparesis types (26.7%) and one patient was still under antiepileptic treatment. A case of postmeningitic hydrocephalus was diagnosed (6.7%) and a ventriculoperitoneal shunt has been placed. In 9 patients, or 60% of cases, the outcome was good. They did not present any sensory or motor neurological disorders. After 15 months of follow-up, one patient was lost to follow-up, the morbidity was 33.4% with 4 cases of hemiparesis and one patient under antiepileptic treatment. There was one additional case of death involving 3 patients. The evolution was favorable in 8 patients or 53.3%. Mortality was 17.6%.

4. Discussion

Unusual head trauma constitutes an entity whose management is done on a case-by-case basis because of the diversity of mechanisms and the great variability of craniocerebral injuries. Very little work has focused on the subject. The articles found relate to the different mechanisms but taken separately. The first work on head trauma from a hoof blow was reported on an 8-year-old child in 1937. At the time, CT-scan was not available and the diagnosis of the intracranial lesion was made based on operative findings [5]. All other cases of hoof strike were reported among other causes of head trauma [6] [7] [8]. The rarity means that there is very little work devoted to it. Trauma affected the children and adolescents in our series. Bunevicius *et al.* reported a case of head trauma from a horn blow in an adult [9]. We infer that these types of trauma can occur at any age. But in the majority of cases children are victims [5] [10]. In the study by Caglayan *et al.* 29% of injuries were attributed to a cow attack, head injuries ac-

counted for 18% of all injuries [11]. The attack on a bovine resulting in head trauma by horn blows has been reported by other authors but in clinical case articles [9] [10]. Stone injuries can be fatal [12] [13]. The stone, animated by a certain kinetic energy, penetrates the skull; the immediate consequence can be vascular lesions such as hematoma or brain lesions. Later an infection may set in. Craniocerebral lesions caused by a motorcycle gear lever are an unusual case; we have not found a similar case in the literature. On the physiopathological level, we can remember that when a blow is delivered to an immobile head by a mobile object, the lesions are primarily local or locoregional depending on the velocity of the traumatic agent and the impact surface. The greater this velocity, the surface area of application of the blow is small and the trauma will be penetrating [14] as was the case in trauma caused by blows from horns, hooves, stones and the gear lever of a motorcycle. When the blow is violent enough, the skull tends to deform. If its elasticity is exceeded it fractures locally, a fracture of the internal table occurs, then a fracture of the external table. When the blunt mass is driven at a high velocity with a limited impact surface, a circumscribed cranial depression will occur (depressed skull fracture) **Figure 2**. This will lead to greater displacements at the level of the internal table in adults. It will be responsible for fractures or craniocerebral injuries **Figure 4**. Immediate complications constitute neurological disorders. This may involve impaired consciousness due to concussion (34.2% in our series) and/or focal neurological deficits due to direct contusion lesions of the brain [8] (29.4% in our study). Subsequently, complications can be infectious [12] [13]. They represented 11.7% in our cohort, resulting in a case of cerebrospinal fluid hydrodymania disorder and epilepsy [13]. Antibiotic therapy is invaluable. The administration of broad-spectrum antibiotic therapy combining two molecules was the attitude adopted by our department. Penetrating lesions caused by non-sterile foreign bodies tend to become infected and lead to intracranial suppurations and meningitis. Prophylactic treatment with broad-spectrum antibiotics crossing the blood-brain barrier is necessary to minimize these complications [15]. On the other hand, there is no consensus on the choice of antibiotic molecules to use. In 1998, the International Brain Injury Association, the Brain Injury Association, the American Association of Neurological Surgeons, and the Congress of Neurological Surgeons collaborated on a set of guidelines for treating penetrating brain trauma injutry and recommended broad-spectrum antibiotics without details regarding which antibiotic to administer, nor the duration of antibiotic used in such cases [16] [17]. La sérothérapie antitétanique doit être systématique en cas de doute sur le statut vaccinal du patient [18]. In our series, 6 patients with a wound connecting the endocranium and the external environment (with or without opening of the dura mater) had received anti-tetanus vaccine. Because *Clostridium tetani* is a sporadic germ that can be found in soil, dust and manure; given the context of the trauma, the risk of wound contamination was significant, which required anti-tetanus prevention. One case of hydrocephalus was treated during the study. La chirurgie est un temps

esssentiel dans la prise en charge des traumatismes crannies insolite puisse qu'ils sont très souvent associés à des fractures embarrures ou à des plaies cranio-cérébrales. Skull depressing fracture surgery in skull depressing fracture consists of straightening the part of skull depressed. Concerning craniocerebral wounds, duroplasty is the rule [18]. In our series duroplasty was done with the epicranium. In addition to the epicranium, duroplasty can be performed with the fascia lata or with the aponeurotic galea of the temporalis muscle [18]. In Europe the use of freeze-dried dura mater is common practice during duroplasty. The severity of unusual head trauma is linked to secondary cerebral insults of systemic origin responsible for focal or diffuse cerebral suffering because direct brain lesions are not rare and also to infection of the central nervous system by penetration of foreigner's bodies inside the skull. Head injuries can cause death. This is linked to the severity and extent of craniocerebral lesions. The mortality rate was 17.6% in our series. Penetrating traumatic brain injury is a severe type of trauma brain injury with a high rate of mortality [4].

5. Conclusion

The rarity of unusual head trauma should not lead us to ignore their seriousness. They are deadly and disabling. Early multidisciplinary treatment can lead to better results.

Declarations

Patient was informed and his consent was obtained before submission of this case report.

Approval of Ethic committee of Teaching hospital of Fes has been obtained.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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