UNUSUAL CAUSES OF HEAD INJURIES

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Abstract

Background: Although the patterns of common causes of head injury (HI) are well established all over the world, however, unusual causes of HI, incurred inadvertently to many patients, do occur every now and then.

Objective: To bring to the attention of the practicing neurosurgeon the possibility of an unusual pattern of HI. Furthermore, such injuries may endanger the patient's life.

Methods: A retrospective study of 30 HI cases encountered by the author between 1986 – 2003. The Accident and Emergency Hospital in Amara, The Teaching Hospital in Basrah, The Neurosurgical Hospital and The Teaching Hospital at Kadhimiyah, Baghdad. All had 3 standard plain skull X-ray projections: postero-anterior, lateral, and Townes views; occasionally, occipito-mental and orthopentgraphic views were done. Although few cases needed conventional angiographic examination, none of them had the test because of the non-availability of the contrast medium. Few patients had computerized tomography (CT) examination. All cases presented before magnetic resonance (MR) imaging was introduced into the country.

Results: Different age groups are represented. Although both sexes were affected, however, most of the victims were males (24, 80%), and most injuries were compound and of a penetrating nature; all calvarial regions are represented in this study. There was no death in this series as all patients made, in due course, an excellent recovery.

Conclusions and recommendations: Under certain situations, especially when the financial resources are limited, or up-date neuro-imaging machines are unavailable, plain skull X-ray films prove adequate investigative tool disclosing the extent of bony damages and state of penetration. Domestic animals and tools can, un-expectedly, be harmful; an educational program in this respect is helpful. A protective safety helmet may be mandatory in certain professions when the risk of having a HI is likely. Although most of our patients suffered a certain degree of transient morbidity, however, they were back to normal active life. The practicing neurosurgeon may face an unusual type of HI that may constitute a serious threat to the victim's life. Addressing the management of such events, an urgent non-hesitating attitude is to be practiced by following the standard lines of dealing with penetrating injuries.

Key words: Unusual causes of head injury, penetrating injury, plain skull X-ray.

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Introduction

Head injuries (HI) remains a socio-economic problem bothering both the communities and the health care providers. It affects all age groups, causes substantial morbidity and mortality and loss of financial resources. The pattern of HI can be quite varied depending on the circumstances and the environment. The aims of this study are to document these unfortunate domestic events, to bring to the attention of our colleagues such possible injuries, and to discuss them and some other similar reports in the literature.

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Table 1: Unusual causes of head injury

Injurious agent	Number			Site and side of injury
	♂	♀	Total	
A kick by a donkey's back limb	3	1	4	Rt. Temporal (3) Lt temporal (1)
A pull by a running cow; head of child collided with a ground stone	-	1	1	Rt Parietal
Rotating ceiling fans	7	4	١١	Rt frontal (4), Rt. temporal (1), Rt temporo-parietal (1), Lt temporal (1)
A fall of a rotating ceiling fans	1	-	١	Sagittal parietal
Moving pointed wooden stick (the patient was driving his pick-up)	1	-	١	Lt Temporal
Pointed metal bar	1	-	1	Bi-Parietal
Throwing a building brick	3	-	٣	Rt Parietal (2), Lt temporal (1)
A low velocity hunting shotgun (3 meters distance)	1	-	1	All scalp regions
High-speed revolving piece of metal cutter (a detached broken piece flew)	1	-	١	Lt Parieto-tomporal
A tire ring jumped off its catch	5	-	٥	All calvarial sites involved, mainly frontal
Hand gun explosion while firing a lightening bomb	1	-	١	Rt temporal
Total **%**	24 80%	6 20%	٣٠ 100%	-

Patients and methods

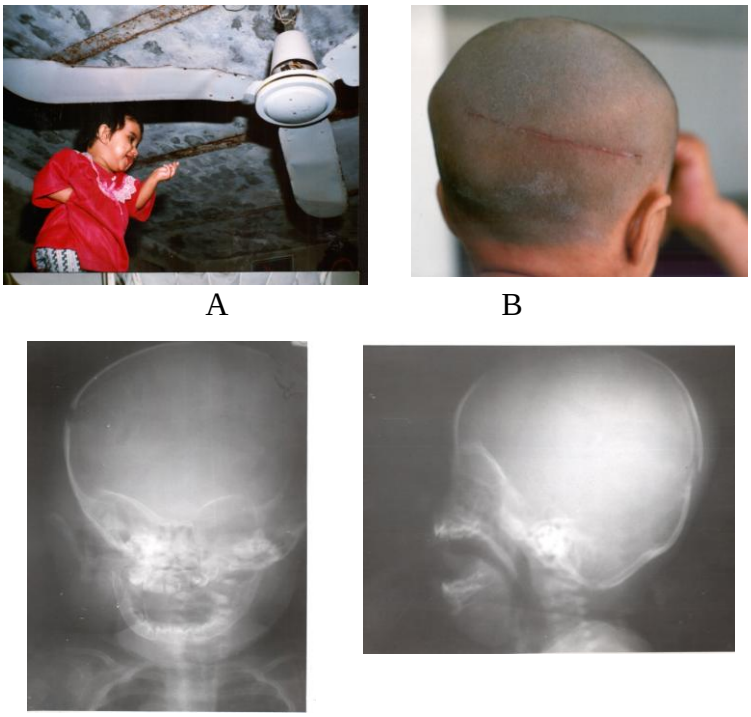
Most of the affected patients were males (24, 80%), being damaged mostly in the temporal region, and they were inadvertently injured by the following agents (Table 1):

1. A kick by a donkey's back limb.
2. A pull by a running cow (a rope was accidentally turned round the child patient).
3. Rotating ceiling fans (Figure 1, A-D).
4. A fall of a rotating ceiling fans.
5. Moving pointed wooden stick (Figure 2).
6. Pointed metal bar.
7. Flying detached high-speed revolving piece of metal cutter (Figure 3).
8. A building brick thrown on the head (Figure 4).
9. A low velocity hunting shotgun (Figure 5).
10. A jumping tire ring, accidentally released from its catching restraint frame while being repaired.
11. Hand gun explosion while firing a lightening bomb (Figure 6, A-C).

Except the shotgun event where the pellets penetrated the scalp tissue only without bony penetration, all other injuries were compound, most of the fractures were comminuted, scalp was lacerated and the dura was torn. Glasgow coma scale score ranged from 12 to 15.

Place and mechanism of injury

The accidents occurred at the farm, home, or at industrial sites. The injuries were the result of direct contact (contact phenomenon) between the injurious agent and the head as well as the inertial effects that follow; a dominant acceleration injuries profile, and to a lesser extent deceleration injuries.



A B C D

Figure 1: *A.* Simulation of a ceiling fan accident of a female infant. *B.* Parieto-occipital scalp wound of the same infant in picture A. *C.* Postero-anterior view and *D.* a lateral view of the infant in A to show the (fissure) skull fractures with wide separation.

Table 2: The most common causes of head injury

1. Road traffic accident, e.g., vehicular occupants, pedestrians, cyclists.
2. Falls, e.g., falls off roofs and balconies, downstaircase.
3. Assaults, e.g., with a crunch or metal bar.
4. Penetrating and perforating injuries, e.g., missiles, knives.
5. Industrial and occupational, e.g., at building sites.
6. Sport, e.g., horse riding.
7. Collapse of building, e.g., natural disasters, military conflicts.
8. Miscellaneous.

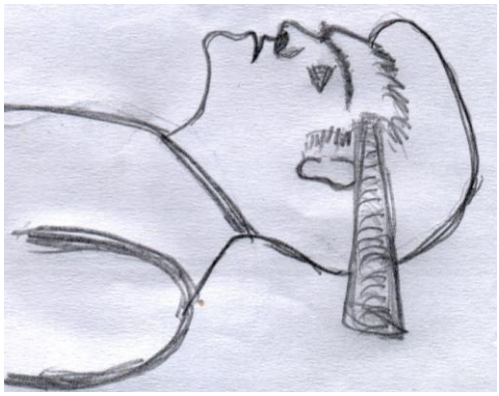
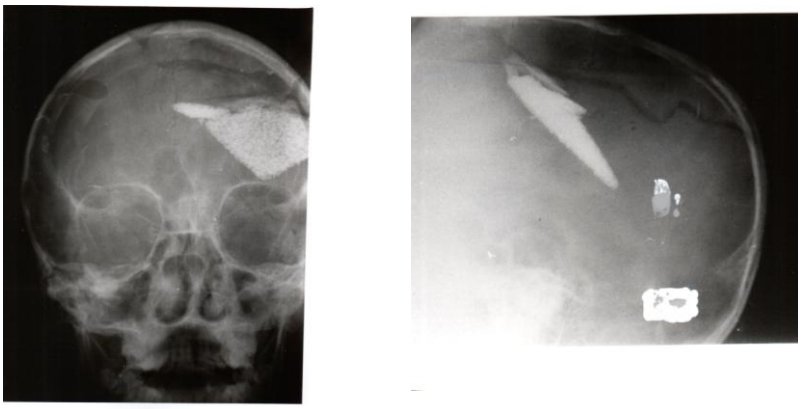


Figure 2: Diagram of the driver patient who had a left temporal depressed compound fracture by a penetrating pointed piece of wood protruding out of another moving vehicle.



A B

Figure 3. Flying detached high-speed revolving piece of metal cutter. A. Postero-anterior and B, lateral views.

Results

Seasonal Incidence

All injuries incurred by ceiling fans had occurred during the summer time, i.e., between June and September when the people had needed the fan for room ventilation during the warm summer weather. It would, probably, be worthwhile to mention that during those 4 months the students retire from school for the summer holiday. In our practice, we have not come across a similar accident outside the months mentioned above.

For other injuries they had occurred throughout different seasons.

Age and Sex

The age ranged from 6 months to 75 years (mean 12.5 years); they were 24 (80%) males and 6 (20%) females(Table 1).

Clinical Examination

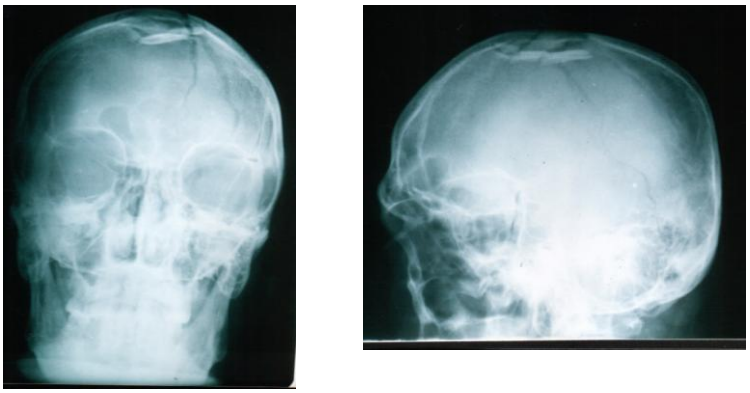
All patients had scalp wounds of variable configuration; no scalp region was exempted from being involved by a scalp wound (Table 1).

Although only 3 patients developed immediate post-traumatic unconsciousness, however, all other patients gave no history of loss of consciousness and were alert at the time when seen first; they remained so throughout their stay in the hospital; their neurological examination was unremarkable; the Glasgow Coma Scale score[1] at the time of admission was about 12 – 15. ; 3 had hemispheric weakness and cognitive impairment shortly after the trauma but had eventual recovery.

Few children developed attacks of focal progressing to generalized seizures. Eventually, in few days time, they had full recovery and were seizure free for the rest of follow-up period. None of the patients had extra-cranial injuries.

Radiological Examination

All patients had conventional plain skull radiography, postero-anterior, lateral, and Townes views that were quite practically adequate to investigate the status of bone and penetration. During the early years of the study period, the computerized tomography scanning machine was unavailable at the first two places. Although few cases needed conventional angiographic examination, none of them had the test because of the non-availability of the contrast medium. Few patients had CT examination. All cases presented before MR imaging was introduced into the country.

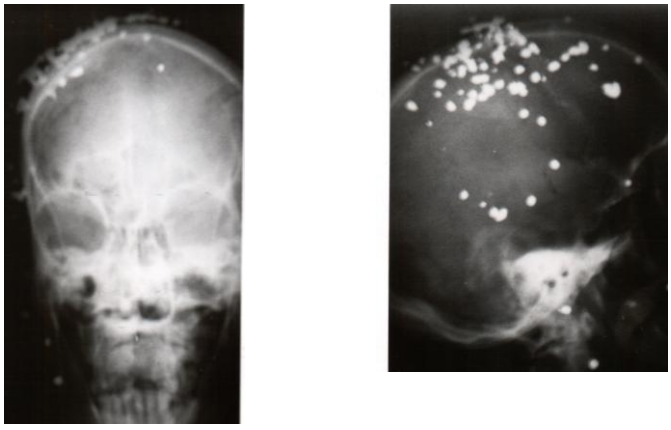


A B

Figure 4: A compound comminuted depressed skull fracture from which more (fissure) fractures radiate, may result from collision of a building brick that has sharp edges and corners with the head of the victim: A. Postero-anterior view. B lateral view.

Treatment and Outcome

After giving the medications, mentioned above, all, except the patient in figure 5 who signed his own discharge, underwent surgical procedures for wound debridement, removal of foreign bodies and depressed and comminuted pieces of bone and had dural closure; the post-operative recovery was uneventful; luckily, there was neither significant wound nor intracranial infection. All patients left hospital well, few had transient motor and mental sequels, all eventually resolved; none of the patients had cerebrospinal fluid leak; those attending kindergarten and school had normal performance; others were back to normal life activity. There was no mortality among this series.



A. Postero-anterior view. B. Lateral view.

Figure 5: Plain skull X-ray of a patient with a low-velocity "hunting" shot-gun injury to the head of a 75-year-old man, while sleeping. There was no skull penetration although the shot range was about 3 meters.

Figure 6 show few radiological pictures of plain skull X-ray and computerized tomography of the patient who was injured by explosion of a hand gun while firing a lightening bomb. A. Plain postero-anterior view to show a metal fragment at the right temporal region, the site of a compound comminuted depressed fracture with dural tear. B. A lateral view. C. A post-operative CT axial pictures to show the site of craniectomy and the extensive haemorrhagic contusion of the right temporal lobe. There are also few air bubbles. The patient's recovery was full after one month from date of injury.

A B C

Figure 6: Few radiological pictures of plain skull X-ray and computerized tomography. A. Plain postero-anterior view. B. A lateral view. C. A post-operative CT axial pictures.

Discussion

HI remains a challenge to health care providers. It has a substantial impact on the National Health Service and budgets[2]. With the successful control of many childhood diseases, trauma remains, more than any other entity, the primary cause of mortality in childhood[3]. Although precise figures are not available, trauma to the brain and it's coverings ranks as one of the leading causes of mortality and long-term morbidity in the pediatric population[3].

The most common causes of head injuries are well known (Table 2). However, the practicing neurosurgeon may come across an unusual pattern of head trauma, such as those mentioned here, which predominantly resulted, biomechanically, from contact phenomena, though part of them had been caused by a superimposing acceleration (inertial) effects inducing surface strains and their resultant subdural haematoma (as in the case of the rotating fan)[4,5].

In the context of HI, from a biomechanical point of view, many variables interact in deciding the pattern, extent and distribution of primary injury sustained by the cranial bones, soft tissues covering and contents of intracranial cavity. One of these variables, is the force of the injurious agent; this force is in itself the product of many elements, namely the change of angular momentum, the time interval (duration of contact between the injurious agent and the head), weight and size of the agent used.

Table 1 shows briefly those unusual patterns of HI. All were dealt with using the available diagnostic and operating facilities; the outcome was very satisfactory. For example, the cases of the non-missile penetrating injuries, such as those in figures 2 and 3 and the penetrating metal bar, all presented to the author's practice before the MR imaging, which includes MR angiography facility, was introduced into the country; moreover, because of the economic embargo, the contrast material for conventional angiography was not available. Extreme care was exhibited during handling the patients to ensure stabilizing the embedded pieces until the latter were removed in the operating room via craniectomy rather than craniotomy; fortunately, there was no vascular injury and the patients made an excellent recovery.

The author thinks most of them are preventable by foreseen anticipation of possible risks, adequate care taking, family supervision, community education, and wearing helmets in professions such as those dealing with high-speed-revolving metal cutting or while repairing tiers.

Authors elsewhere have also written on some unusual modes of HI. Mlay et al

reported HI- skull fractures in children following fall of coconut fruits on top of their heads or fall off mothers' back[6]. In Finland, Koskinen reported that HI might follow snowmobile trauma and that helmets were protective[7]. Infant walker-related head injuries have been reported[8]; similarly, stroller safety has been questioned[9].

In New Zealand, discussing the injuries occurring during trampoline shows, Chalmers et al concluded that, although existing trampoline standards addressed many of the issues raised by their research, measures to reduce the impact of falls from trampolines to the ground and to prohibit the provision of trampolines as 'play equipment' are required[10].

Similarly, Lillehei et al analyzing the mechanisms of injury and death in a commercial airline disaster and proposing preventative safety measures based on that analysis have concluded that head trauma was the most common fatal blunt injury, followed by injuries to the chest and the abdomen; the blunt injuries were remarkably similar to the deceleration injuries seen in high-speed motor vehicle crashes. The use of a lap belt restraint system alone is not adequate to protect passengers against these forces as shown convincingly in the automotive industry literature[11].

What impact a better passenger restraint system may have had on survival in this disaster is unknown, however, at a minimum, it would have significantly improved survival for 6 of 28 passengers dying of isolated blunt head trauma[11]. Minor alterations in aircraft design (secure bolting of passenger seats to the airplane superstructure) and passenger restraints (3-point lap and shoulder harness system) is proposed to positively influence survival during an airplane crash at negligible increased airline expense or passenger inconvenience[11].

The author thinks that due to the tremendous amount of variation of different nations and communities in their habits, customs, natural geography, and other life aspects, other enumerable patterns of HI may evolve every now and then and that authors may continue to report, on, at least, some of these unfamiliar modes of head trauma.

Conclusions

This should bring to the attention of the members of the medical profession and publics the risk of domestic animals and home and work tools when, under certain circumstances, these may be responsible for "compound, with / without penetration" HI that can be life threatening. Educational program may help in this respect. A protective safety helmet may be mandatory in certain professions when the risk of having a HI is likely. The therapeutic approach to managing such injuries should follow, without hesitation, the standard lines that, hopefully, include using the most recent investigative armamentarium, well-equipped operating theaters, a proper decision making, and adequate well-trained staff.

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