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HOMICIDAL HEAD PENETRATING INJURY WITH SCREW DRIVER

By

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ABSTRACT

Background: Penetrating injury to the head, with the exception of missile injuries, is rare owing to thickness of skull bones. Orbital and temporal areas are comparatively vulnerable to penetrating injuries due to their relative thinness.

Objective: We presented a case in which a man was killed by forcefully thrusting a screw driver through left temporal bone into his cranial cavity and injured the brain.

Case presentation: We presented a case of a 44-year-old man who was stabbed with a screw driver in his head. The screw driver was seen embedded in his head. Plain radiography and computed tomography (CT) of the head were done to assess the extent of brain damage.

Conclusion: In this study, we discussed the the peculiarity of this case which lays in the fact that screw driver as a stabbing weapon in the head is very rarely used. Skull bone, at site of injury, was very thin with less than 2 mm thickness and even transparent to light. This was unfortunate for both the assailant and the deceased. We also emphasized the indispensable role of imaging in the initial assessment of patients with head trauma.

Key words: Skull injury, head injury, penetrating wound, screw driver.

INTRODUCTION

Penetrating head injuries are a kind of localized, depressed fractures which are induced by pointed agents passing via both skull tables, the shape and size of which corresponds with the cross-section of the weapon. The most likely agents are daggers or knives. Cases are relatively rare. Usually, these injuries are not fatal. If the weapon is withdrawn, it may not leave obvious injury under hair cover. Also, external injures are not comparable to severe internal injuries or complications (**Polson et al., 1985**).

Nonmissile penetrating head injuries (NPHIs) in the civilian population are rare but potentially fatal (**Li et al., 2016).** Penetrating brain injury (PBI) may be caused by low-velocity or high-velocity objects. Several objects are known to cause such injury ranging from knives to rooster pecks (**Das et al., 2015).**

Penetrating head injury is a head injury in which dura mater is breached. It can be caused by high-velocity projectiles or low-velocity as knives driven into the brain. Low-velocity objects represent a smaller fraction of penetrating head

injuries. The causes may be from knives, nails, spikes, forks, scissors etc. (**Bodwal et al., 2013**).

Skull can be penetrated through its foramina and in areas where the bones are thin. Orbit and temporal regions constitute areas of thin bone which can be penetrated with relative ease (**Oki et al., 2010)**.

Injuries to temporal bony areas are more likely to result in major neurological deficits because of the thinness of the temporal squama, and the shorter distance to the deep brain stem and vascular structures Most deaths from penetrating traumas are caused by blood vessels damage which leads to hematoma, ischemia and biochemical cascade called the ischemic cascade. A biochemical cascade with release of numerous enzymes, phospholipids, glutamate calcium and free oxygen radicals propagates further cell damage (**Bodwal et al., 2013**).

Penetrating screw driver wounds to the head are very unusual and are rarely described in the literature. Here we represent a case of homicidal penetrating head injury with screw driver, a low velocity injury to an abnormally thin parietotemporal bone. In the instant case, a screw driver was thrusted into the cranial cavity of the deceased. X-ray, CT scan, or MRI (MRI can only be used when the penetrating object would not be magnetic, because MRI uses magnetism and could move the object, causing further injury). Studies with positron emission tomography (PET) and transcranial doppler imaging have shown that changes in cerebral blood flow, such as hypo-perfusion and vasospasm, can follow penetrating head injury. An ischemic cascade similar to the course of cellular and metabolic events that follow other head injuries may follow penetrating head injuries (**Blissitt, 2006).**

Penetrating head injuries due to the use of screwdrivers as wounding agents in acts of interpersonal violence seldom occur. The aim of this article was to update and summarize the relevant literature on penetrating craniocerebral screwdriver stab wounds and to report a new case of screwdriver assault.

CASE REPORT

A 44-year-old man presented to emergency department with penetrating head injury with transfixing screw driver after being hit by it in a fight with his colleague. CT brain scan of the head revealed metallic object penetrating the left parieto-occipital region extending infro-obliquely with its distal tip in cerebeller peduncle. Basal cistern was completely effaced indicating herniation, with bleeding in the third ventricle, left cerebellum and brain stem, as well as, brainstem shifting and ischemia. Surgical removal of the screwdriver and suturing of the external wound were done. The choice of conservative treatment was taken as Glasco coma score was 3/15 with dilated and fixed pupils. He finally died after 15 days post-traumatically.

External examination revealed sutured wound on the left side of the scalp above the left ear auricle **(Fig. 1)**. Also, there was another wound on the top of scalp, healing abrasions on the left ear auricle and on the left side of the neck, and many other abrasions on different areas of the body (left upper scapular region, lateral side of the left thigh, left knee and upper

right chest). It was noticed that the body was in a decomposed state (greenish discoloration of abdomen).

On dissection: There were 3 bruises under scalp indicating repeated hitting of the head with same weapon, but with only one penetrating injury at temporal area. There was a hole with a bone fragment, more or less of the same diameter of the screw driver with a similar circular tear of the dura opposite to the hole **(Fig.2)**. The brain was soft at the time of dissection as it was in a state of softening due to necrosis and decomposition because of lapsed time till autopsy was done. It was noted clearly that skull bone was very thin at site of injury of less than 2 mm thick, and even transparent to light **(Fig.3)**, which was unfortunate for both the assailant and the deceased. There was no need for extra-force to induce the fatal injury!! In **Fig. (4)**, computerized tomography (CT) scan of the brain with screw driver in situ was done. 3 dimensional multi detector computerized tomography (M.D.CT) scan of skull with screw driver in situ was seen in **(Fig.5)**.

Figure (1): Small Sutured wound on the left side of the scalp above the left ear auricle.

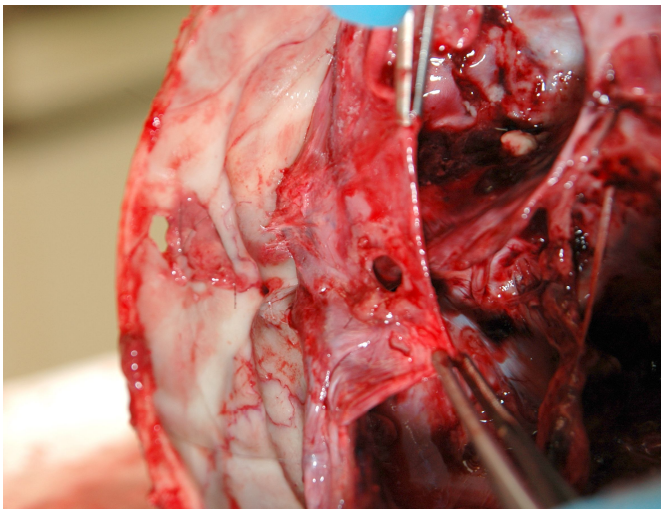

Figure (2): A hole with a bone fragment, more or less of the same diameter of the screw driver, with a similar circular tear of the dura opposite to the hole.

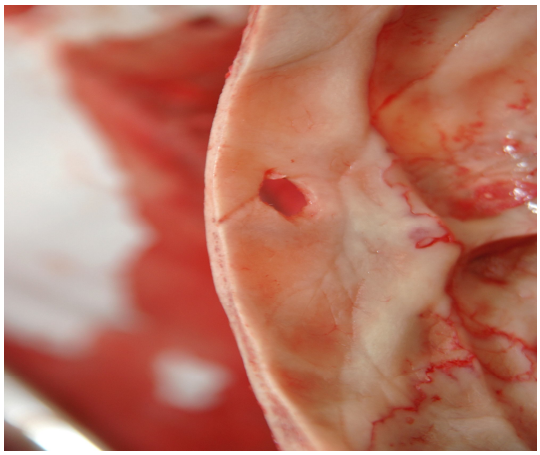

Figure (3): Skull bone was very thin at site of injury of less than 2 mm thick and even transparent to light.

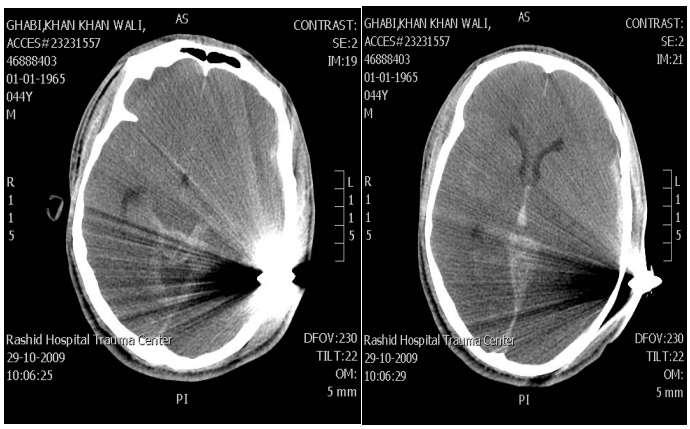

Figure (4): CT of brain with screw driver in situ

Figure (5): 3D M.D.CT of skull with screw driver in situ.

DISCUSSION

Cranium varies in thickness in adults and varies from place to place, the more vulnerable thin areas lie in the parieto-temporal, lateral frontal and lateral occipital zones, the thinnest in temporal bone where it may be 4 mm thick. The thickness of the skull is sometimes an issue in courtroom, about the special vulnerability of a victim **(Pekka and Knight, 2015).**

Skull bones and overlying muscles provide reasonable protection to the delicate brain tissue. Low-velocity penetrating wounds of the brain are uncommon as the skull and its coverings usually provide an effective protective barrier. However, skull can be penetrated through its foramina and in areas where the bones are thin. Orbit and temporal regions constitute areas of thin bone which can be penetrated with relative ease. Various stabbing objects such as long pointed objects or knives have been implicated in penetrating trauma to the skull responsible for homicidal, accidental and suicidal deaths resulting from the penetration of the cranium. A review of related cases across the world suggests a small number of cases (around 19) of penetrating injuries to the head. Out of these reported cases, 10 are homicidal, 3 are suicidal and the rest were accidental **(Bodwal et al., 2013).**

In our case, it was noted clearly that skull bone was very thin at site of injury, less than 2 mm thick and even transparent to light, which was unfortunate for both the assailant and the deceased. There was no need for extra-force to induce the fatal injury!! This peculiar thinning of temporal bone is an issue that must be taken into consideration by the judge in the courtroom.

Pavlidis et al. (2016) reviewed a number of studies to investigate the incidence, distribution, common findings, mechanism of injury, differential diagnostic criteria, complications, treatment, and prognosis of craniocerebral screw driver stab injuries. It was observed that the degree of traumatic severity depends on the cross sectional area of the screw driver and the anatomical region of injury.

Cranio-cerebral screw driver injuries were mainly cases of interpersonal violence with a mortality rate of approximately 47.6%. In 23.8% of the incidents, the trauma is overlooked on admission because of the small entry wound and, thus, the severity of the injury is not initially appreciated

A screwdriver being a tool is rarely used as a weapon. The majority of cases were extracted from medico-legal situations or were found among psychiatric patients. However, screwdrivers, because of their rigid structure and narrow tip, may forcefully penetrate the cranial bone and cause severe injuries within the brain substance or to the vascular bed **(Ambrosi et al., 2008).**

Tremendous force is required to in?ict intracranial stab injury because of thick skull bones. Although average thickness of skull is 6 mm, individual skull bones are of different thickness. Occipital bone is thickest at 15 mm, frontal bone is next with 8 mm, parietal bone is 7 mm and temporal bone is 4 mm. Orbital plates are papery thin and are liable to fracture easily. Skull is generally thinner where it is protected by thick muscles, and is thicker in the mid-frontal, mid-occipital, parieto-sphenoid and parieto-petrous buttresses. Forces usually cited to fracture human skull are 1100 lb/in (pound inch square) in the frontal bone, 550 lb/in in the parietal bone, and 225 lb/in at the zygoma Some authors evaluated that force required to penetrate the skull is about 5 times higher in the temporal region, and 11 times higher in the parietal region than the force needed to perforate the skin. During an actual episode of violence, a further requirement for effective penetration is that the head of the victim must be in a ?xed position **(Bodwal et al., 2013).**

Imaging is an indispensable part of the initial assessment and subsequent management of patients with head trauma. Initially, it is important for diagnosing the extent of injury (**Rincon et al., 2016).**

Early diagnosis is based on clinical evaluation, X ray skull, and CT scan. MRI can be dangerous in cases of retained ferromagnetic objects due to possible movement in response to the magnetic torque. Nonmissile injuries should undergo a preoperative angiogram to rule out any vascular injury **(Karim and Topno, 2010)**. Also, **Muhammad et al. (2012)** stated that radiographic assessment may consist of a CT scan, skull series, angiography, and magnetic resonance imaging. CT scans can detect the path and location of the embedded foreign body, bone or metal debris fragments and the extent of intracranial damage. CT remains the imaging modality of choice for initial assessment due to its ease of access, rapid acquisition, and for its sensitivity for detection of acute haemorrhagic lesions for surgical intervention **(Currie et al., 2016).** In our case 3 MDCT was used while screwdriver still in situ**.**

Stab wounds to the temporal fossa are more likely to produce major neurological deficits because of the thinness of the temporal squama, and the shorter distance to the brain stem and important vascular structures. Patients in whom the penetrating object is left in place have a significantly lower mortality than those in whom the objects are inserted and then removed 26% versus 11% respectively. Any cranial wound should be carefully

examined because a penetrating injury could be easily overlooked. The concentration of force into the small area at the tip of these rigid tools may enable penetration into the vault of the skull and if the screwdriver is withdrawn, then clinical examination later may miss the small entry wound, and the seriousness of the injury may not be appreciated properly **(Tutton et al., 2000)**.

It was very obvious in our case that skin injury by screwdriver was very small which could be easily missed, especially being covered by hair. Screwdrivers are fortunately only rarely used as weapons.

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جريمة قتل بمفك براغي إخترق الرأس

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خلفية البحث: تعتبر الإصابات المخترقة الرأس غير الناتجة عن المقذوفات من الإصابات النادرة الحدوث نظرا لسماكة عظام الجمجمة. ومن أقل عظام الجمجمة سماكة عظام محجر العين والعظم الصدغي مما يجعلهما أكثر الأماكن عرضة للإختراق.

الغرض من البحث: عرض حالة قُتل فيها رجل بمفك براغي إخترق العظم الصدغي الأيسر ودخل تجويف الجمجمة وأحدث إصابة قاتلة بالدماغ.

عرض الحالة: الحالة لرجل عمره ٤٤ عاما قتل بوخز الرأس بمفك براغي. وكان مفك البراغي مستقرا برأسه عند دخوله المستشفى. وتم فحصه بإجراء أشعة اكس وأشعة مقطعية لمعرفة مدى تضرر الدماغ من المفك المستقر برأسه.

الإستنتاج: إن إستعمال مفك براغي للقتل نادر الحدوث. ومن الملاحظ في هذه الحالة هشاشة ورفع سمك العظم الصدغي لجمجمة الضحية مما سهل إختراق المفك لعظم الرأس، حيث بلغ سمك عظم الصدغ ٢ مم فقط، (سوء حظ للقاتل والمقتول)، كما نؤكد من خلال البحث الدور الهام التشخيصي للأشعة في تقييم إصابات الرأس.