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**Review Article**

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# Management of Traumatic Brain Injury: A review Update

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**Abstract**

Traumatic Brain Injury leads to serious consequences. Approximately half of all deaths is related to traumatic injury and the main cause of head trauma. Extradural haematomas (EDH) develops in all major head injuries. A head injury patient who is only temporary loss of consciousness and is left asleep may sometimes be found dead in the bed next morning due to extradural haematoma. Extradural haematoma which lies in between the inner surface of skull and stripes of dural membrane, are nearly always caused by, and located near a skull fracture. The collection takes several forms in terms of size, location, speed of development and effects they exert on patient. Immediate management is necessary to decrease the bad consequences. In this review the management of traumatic brain injury is highlighted. [J Shaheed Suhrawardy Med Coll, 2014;6(2): 87-89]

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## Introduction

Traumatic brain injury is a serious health problem in all nations[1]. It is a significant factor and it is approximately half of all deaths related to trauma and the main cause of head trauma includes road traffic accident, assaults, fall from height, sports injuries, and industrial accidents[2]. Extradural haematomas (EDH) develops in 1-3% of all major head injuries and are most common in the young male in the second and third decades of life[3]. Yong[4] found extradural haematoma (EDH) in 2% of all serious head injuries, uncommon in infants and associated with skull fracture in 40-85%. Khwaja and Hormbrey[5] also observed that EDH is 1-2% of all head trauma cases which is less common in aged >55 years with a mortality of 10-30%. Traumatic brain injury patient who has only temporary loss of consciousness and is asleep may die in the bed next morning because of slowly developing extradural haematoma[2]. The earliest neurosurgical abnormality other than disturbance of consciousness is pupil abnormality, which amounts to 90.0% for mydriasis on the side of haematoma. It provides an important finding and helps in the localization of haematoma[6]. Extradural haematoma usually forms within an hour from the time of injury. Immediate management is necessary to decrease the bad consequences.

Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness[7]. The definition of TBI has not been consistent and tends to vary according to specialties and circumstances. Often, the term brain injury is used synonymously with head injury, which may not be associated with neurologic deficits. The definition also has been problematic with variations in inclusion criteria[7]. The most widely used definition and division of the severity of head injury is based on the level of consciousness as defined by the GCS introduced in 1974. The GCS is an algebraic scale based on motor response, verbal response, and eye opening[5].

## Mechanisms of Brain Injury

Traumatic brain injury is usually the consequence of impact to the head, during which energy (impulse) is transmitted to the head, which undergoes sudden acceleration, deceleration or rotation[8]. Head trauma can be closed, blunt, if the skull remains intact, or penetrating if the skull and often the dura are penetrated by sharp objects including gunshot, knives, screwdrivers, arrows, darts[9]. Focal damage, or contact

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injuries, such as skull fracture, extradural haematoma, contusion-related subdural haematoma, cortical contusion, are produced by direct collisional forces acting on the skull, resulting in compression of underlying tissue (coup) or of tissue remote from the site of the impact (contre coup). Impact to the head per se is not mandatory to evoke brain dysfunction or brain damage. Except for skull fracture and extradural haematoma, all types of brain injury can be produced by angular acceleration of the head without impact, provided there is a period of loss of consciousness[10]. Thus, shear forces generated in the brain upon sudden rotation may cause damage to axons and blood vessels[11]. Controversy exists on whether diffuse brain dysfunction can occur in TBI without there being structural damage[12]. This has considerable consequences for the terminology used and is a frequent source of problems in forensic and insurance issues after TBI.

**Classification of Traumatic Brain Injury**

Brain damage after head injury can also be classified by its time course[13-14]. In the literature of head injury one often encounters the concept of primary and secondary brain injuries. Primary injury is the damage to the nervous system, which takes place at the moment of injury. The mechanical forces transmitted to the brain result in deformation of the brain substance and thus till direct injuries to the central nervous system tissue and to the vessels. The result is injuries such as; diffuse axonal injuries (DAI), bleedings, intracerebral haematomas, subdural or extradural haematomas, and contusions[15]. The primary brain injuries are considered to be irreversible. The secondary injuries are complications to the sustained primary injuries. These injuries are the result of hypoxic and or ischaemic changes to the injured brain, which can result in ischaemia, oedema formation, rising of ICP, developing of contusions, and hydrocephalus. The secondary brain damages are potentially reversible if they are observed and adequately treated. The treatment guidelines for TBI, which have been developed, are aiming at the treatment or prevention of secondary brain injuries. The strategies are aiming at secure the oxygenation and perfusion to the brain, especially to the injured parts of the brain. Hypoxia and hypotension, as an indication of secondary brain injury, occurring from the accident through to the resuscitation is shown to be associated with higher mortality and mortality in subjects with TBI[16].

**Management of Traumatic Brain Injury**

The grading according to GCS should be performed after resuscitation and the best response should be noted[17]. In modern care for head injury subjects are often intubated and sedated early to minimize the risk for hypoxia and secondary brain injuries. This makes the use of a post-resuscitation GCS very difficult as the subject has to be woken to be adequately scored. Several authors use the GCS at intubation and sedation for the GCS scoring[14-16]. The most commonly used definition for the grading of the severity of a head injury is based on the head injury severity score[17]. It defines TBI as a subject with GCS 8 or worse. The GCS system allows for the classification of head injuries in different groups.

**Clinical observation**

The necessity and duration of neurological observation after TBI among patients in category 1 can be discharged home with head injury warning instructions if CT findings are normal[18]. Patients in categories 2 or 3 should preferably be admitted to hospital for observation, although the necessity of this can be questioned in some patients in category 2 like patients older than 60 years of age who are not on anticoagulation therapy[19]. Scandinavian guidelines recommend an observation period of minimally 12 h, where as other guidelines recommend a period of 24 h or longer[20]. The main goal of clinical observation is to detect, at an early stage, the development of extradural or subdural haematoma or diffuse cerebral oedema. A secondary goal is to determine the duration of post traumatic amnesia (PTA). An extradural haematoma usually develops within 6 h, and thus the initial CT may be false negative when performed very early within 1 h[21]. Repeated neurological observation is therefore obligatory for the timely detection of clinical deterioration and other neurological deficits such as sensory deficits, frontal lobe signs, cerebellar symptoms, and many more[18].

**Bed rest**

No randomized trials exist on the value and duration of bed rest and on the duration of sick leave after TBI[22]. A survey among various European hospitals showed major differences in management with regard to the ordering and duration of bed rest, home observation, sick leave and follow-up. A study in which patients were randomized for complete bed rest for a period of 6 days versus no bed rest showed no treatment effect on the number of post-traumatic complaints and quality of life 6 months after the trauma[23-24].

**General principles**

Most clinicians are agreed on the general principles of early management: maintenance of adequate and stable cerebral perfusion, adequate oxygenation, avoidance of hyper- and hypocapnia and avoidance of hyper- and hypoglycaemia, while avoiding iatrogenic injury. The implementation of these principles in clinical practice differs from centre to centre, based largely on historical tradition, local practice, and a lack of clear evidence of benefit of any one therapeutic approach[12,20].

**Imaging**

CT is the preferred modality for initial assessment of TBI, over skull radiography and magnetic resonance imaging (MRI). Although MRI can demonstrate more subtle lesions, particularly with diffuse injuries, it is largely impractical in the acute setting[23]. The risk of finding radiological or clinically significant injuries on CT increases with severity of injury. As a consequence of this, various groups have created decision trees to define which patients with minor head injuries should undergo CT scanning[25].

**Other injuries**

Head injury is the cause of death in around one-third of patients dying after trauma, and major extra-cranial injuries are found in 50% of patients with severe TBI[23]. Early work suggested that significant extra-cranial injury resulted in significantly higher mortality for patients with TBI. The assumption is that improved care of the injured patient after the introduction of Advance Trauma Life Support (ATLS) and head injury guidelines has lessened the impact of secondary insults as a result of systemic trauma. So the ATLS priorities of resuscitation and control of haemorrhage still apply for patients with TBI[24].

**Follow-up**

It has been shown that regular specialized outpatient follow-up visits are effective in reducing social morbidity and the severity of symptoms after TBI. In a large randomized controlled trial, patients with a PTA shorter than 7 days and who received specialist intervention had significantly less social disability and fewer post-concussion symptoms 6 months after injury than those who did not receive the service[16].

**Conclusion**

The most commonly used outcome scale in neurosurgery is the Glasgow outcome scale (GOS). The scale is based on the overall social capability of the patient. It takes in to account neurological as well as mental deficits without listing them. The scale has been proven functional and is recommended world wide for the follow up after head injury.

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