

# Traumatic brain injury (TBI): morbidity, mortality and economic implications

PERSPECTIVES

## Abstract

Traumatism, in general, result in high costs for health systems worldwide. They consist of the leading cause of death in young adults, primarily males. Traumatic brain injury (TBI) represents good part of this spending, reaching globally significant mortality rate, around 1.5 million victims a year. Only in the United States (US) attendances related to traumatic brain injuries in emergency departments revolve around 1.35 million annually, plus about 275,000 hospitalizations and 52,000 deaths. In Brazil, only in 2012 was spent over one billion dollars with hospitalizations related to external causes, including TBI. Mild TBI (Glasgow Coma Scale (GCS) 14-15) occur in about 80% of the total demand, moderate (GCS 9-13) in 10% and serious (GCS 3-8) in 10%. Regarding mortality rate, this is relatively low compared to the total number, since much of fatal outcomes fits in the moderate to severe groups. One of lesions a valuable prognostic factor related to the TBI is the subdural hematoma (SDH), responsible for complications in up to 45% of cases of TBI, expressing mortality between 60-80% depending on the implemented workup and may even reach 90% when in delay of appropriate treatment. The acute subdural hematoma (ASDH) thus represents a neurosurgical emergency, taking most of these patients to be subjected to urgent evacuation of the hematoma by craniotomy, which also is not without risks, with several reports in literature of new contralateral hematoma formation after craniotomy for evacuation of hematoma, further aggravating the patient's prognosis. For best results of the TBI is needed better understanding of the pathophysiology, identification of newer parameters of brain function and development of innovative therapeutic modalities. According to the Centers for Disease Control and Prevention (CDC), under the Department of Health and Human Services, population data on TBI are fundamental for understanding its impact on the society and know the profile of patients and the mechanisms trauma, to assist in the formulation of prevention strategies and in setting priorities for research and support services to patients living with traumatic brain injury.

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The traumatic brain injury (TBI), among the various concepts found in the literature, can be defined as cerebral insult not degenerative or congenital nature, due to external mechanical force that possibly leads to permanent or temporary disabilities of cognitive, physical and psychosocial functions with or without altered level of consciousness [1]. It is estimated that the cause of millions of medical care around the world, expressing significant mortality worldwide reaching around 1.5 million people each year, thus representing a major cause of death and disability global [2].

Following the global trend, traumatic brain injuries are associated, on average, approximately 1.35 million medical care in emergency departments (ED) only in the United States (US), silted 275,000 hospitalizations and 52,000 deaths annually, representing approximately one-third (30.5%) of all deaths in this country to traumatic injury. In fact, TBI contributes significantly to the health care spending in USA, both directly and indirectly, with values close to 76.5 billion dollars spent only in 20003.

In terms of low and middle income countries, the costs of TBI are much higher, since comprise approximately 85% of the world population and, according to the World Health Organization (WHO), 90% of global deaths related to these lesions [2].

In Brazil only in 2012 was spent by the Sistema Único de Saúde (SUS), the public health system under the Ministry of Health of this country, in favor to care of external causes including the TBI, a value of over one billion reais in 998,994 hospitalizations, where average per admission was around R\$ 1,079.6; with an average of hospital stay about 5.3 days and 2.48% mortality rate, not taking into account outpatients expenses, medications, rehabilitation or loss by a separation of activities [4].

All over the worlds, hall be admitted around 100-350 patients per 100 000 inhabitants per year in hospital services because of TBI. Of these, about 80% are mild TBI victims [Glasgow Coma Scale

(GCS) 14-15], 10% moderate (GCS 9-13) and 10% severe (GCS <9). It is estimated that the formation of post-traumatic intracranial hematoma related to such TBI's is respectively 1-3%, 3-12% and 25-45% [5].

With regard to mortality TBI, it is relatively low compared to the total number of attendances in the emergency services, revolving around 0.2%. This value is justified by the fact that the majority of fatal outcomes fit them lesion groups with moderate to severe intensity, and represents only 5% of that group attendances [6]. Despite the relatively low lethality, trauma is the leading cause of death in range age 45 and 50% of these are due to TBI [7]. In Brazil, the estimated incidence of the TBI varies from 26.2 to 45.6 / 100,000 inhabitants, expressing mortality of 33.3% for patients with severe TBI [8].

According to the Guideline of attention to rehabilitation of patients with traumatic brain injury, published by the Ministry of Health, TBI in Brazil is responsible for high mortality rates, being more prevalent in young adults, male, where the main cause is to accidents with means of transport. In accordance with data obtained by the Departamento de Informática do Sistema Único de Saúde (DataSUS) of Brazil, between the period January 2005 to September 2006, there was a total of approximately 49,000 hospitalizations resulting from TBI, and 21,541 belonging only to the metropolitan area São Paulo, verified in this period the mortality rate for the cases of 9.63%; in 2011, were reported 547,468 hospitalizations due to external causes variables, that the TBI included, resulting in 12,800 deaths in total, representing 2.34% of the mortality rate in the year [9].

One of the lesion under the TBI is acute subdural hematoma (ASDH), defined as an acute hemorrhagic collection in the space between the dura and arachnoid membranes, most commonly due to head trauma with laceration of cortical veins bridge crossing the subdural space and drain into

the dural sinus. However arterial rupture may also result in ASDH, where injuries are mostly small cortical arteries <1mm diameter. Less common causes include rupture of the aneurysm, vascular malformation or spontaneous hemorrhage with severe coagulopathy [10]. It is known that ASDH is responsible for complications up to 45% of cases of TBI [11].

According to Ali Seifi et al. (2014), with data for a period of 23 years (1988-2007), had been identified in the United States a total of 1,583,255 admissions with a diagnosis of subdural hematoma (SDH), which are predominantly male (59%). The data showed increase statistical important in incidence of hospitalizations for SDH, from 13 per 100,000 inhabitants in 1988 to 38 per 100,000 inhabitants in 2011; we observed a concomitant increase in the prevalence of status epilepticus associated with SDH, from 0.5% in 1988 to 0.7% in 2011 [12].

ASDH occurs in 11% of TBI generally more prevalent than epidural hematoma (EDH), another injury associated with the TBI that only occurs in 2.7 to 4% of patients [13].

Acute subdural hematoma (ASDH) traumatic represents a neurosurgical emergency, taking most of these patients undergoing urgent evacuation of the hematoma by craniotomy. Are excluded from those with poor general condition or with irreversible brain damage. It features variable mortality, despite the implemented therapeutic [14].

Acute subdural hematoma (ASDH) remains important aggravating factor in trauma patients with mortality rates ranging from 45% to 63%. Death occurs in 74% of patients with a GCS score of 3-5 for at least 6 hours, whereas patients with a score of 6-8 GCS have a mortality of 39%. The mortality rate also varies with the length of time due to the treatment and approaches 90% if surgery occurs more than 4 hours after trauma; however, 19-22% of patients survive on ASDH with a good recovery or moderate disabilities [15].

Mortality rates traditionally listed for patients with ASDH requiring surgery vary between 40-68% and rises when related variables - increasing age, low value initial ECG and association with other brain injury or systemic lesions. For example, when used in combination with epidural hematoma (EDH), has a higher mortality rate value independently of surgery or not [5].

Decompressive craniotomy is an effective and favorable technique to rapidly reduce intracranial pressure (ICP) in patients with ASDH, but can release the buffering effect and result in changes in the brain that exposes these patients to the risk of complications caused by the distant intracranial hemorrhage development after evacuation initial ASDH as epidural hematoma contralateral and intraparenchymal hematoma, which have received considerable attention in the literature. However, the contralateral ASDH is worthy of more attention, since this rare complication can lead to life-threatening diseases if not recognized [16].

Besides the immediate primary lesions due to the deformation of the brain occasioned at the time of mechanical impact, which is not favorable to therapy, is followed a plurality of secondary events delayed that remain cause neuronal damage and ultimately lead to a secondary expansion of the primary lesion [11].

The TBI is a serious disease with significant morbidity, mortality and economic implications. The basis of their acute treatment follows a line running from to resuscitation and transport from the incident site to a tertiary care, appropriate imaging diagnosis and intensive monitoring with minimum order and prevention of secondary damage. For best results of TBI is needed better understanding the pathophysiology, identification of newer parameters of brain function and development of innovative therapeutic modalities [18]. With significant volume of incidence and prevalence estimated between 100-1000 cases per 100,000 inhabitants, TBI represents so important public health problem

[19]. Some complications not perceptible as easily as changes in thinking, feeling, language or emotions, makes the TBI are often referred to as the "silent epidemic", beyond the limited awareness among the public about traumatic brain injuries. According to the Centers for Disease Control and Prevention (CDC), linked to Department of Health and Human Services, USA, population data on TBI are fundamental for understanding its impact on the population of this country. Knowing the profile of these patients as well as the trauma mechanisms can help formulate prevention strategies, define the research priorities and support services for patients living with traumatic brain injury [3].

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