

AMERICAN UNIVERSITY OF BEIRUT

EVALUATION OF MILD TRAUMATIC BRAIN INJURY
MANAGEMENT IN THE EMERGENCY DEPARTMENT AT
AUBMC

by
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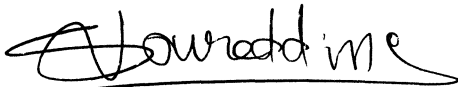
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AN ABSTRACT OF THE PROJECT OF

Maha Antoine Habre for Master of Science
Major: Nursing, Adult Track
Minor: Education

Title: Evaluation of Mild Traumatic Brain Injury Management in the Emergency Department at AUBMC

The purposes of this study were to: a) obtain a baseline estimate of the incidence of Traumatic Brain Injury (TBI) emergencies at the AUBMC Emergency Department (ED) from February 1 to July 31, 2010, b) explore the current emergency management of adult Mild TBI patients, c) compare the clinical management to international guidelines, and d) propose recommendations for improvement of Mild TBI management.

Using a cross-sectional descriptive design, 121 medical records of adult AUBMC ED patients with confirmed or suspected traumatic brain injury were reviewed. Reclassification based on CDC guidelines showed that 98 were mild injury.

The sample had more males (62.8%) than females (37.2%). The most common mechanism of injury was fall (42.1%), followed by motor vehicle collisions (20.7%). Five of the 121 patients had the severity of their injury classified. The most frequently reported symptoms were headache (55%), dizziness (30%), anxiety/nervousness (21%), and nausea (20%).

Patients with obvious symptoms of loss of consciousness or post-traumatic amnesia were mostly managed in accordance with international guidelines. Forty six percent of patients with subtle symptoms like paresthesias did not obtain a brain CT scan as recommended by the guidelines. The frequency of subtle symptoms did not differ between those who had a brain CT done in the ED and those who did. Ninety two out of the 98 mild TBI cases had no documentation of reassessment of Glasgow Coma Scale or neurological status prior to disposition. Seventy four of the 98 cases were not given appropriate discharge instructions for mild TBI management.

Gender, age, and most frequent symptoms distributions of the TBI cases were similar to the literature. Management guidelines on obtaining brain CT scans were accurately followed in patients with obvious symptoms. Guidelines on accurate assessments, discharge, and follow-up instructions were not adhered to.

In order to improve the emergency management of mild TBI patients at AUBMC, it is recommended that the following be utilized: an assessment checklist for head trauma patients, a TBI classification system, an evidence-based guideline to obtain brain CT scans in mild TBI, and a uniform discharge instructions sheet for all mild TBI patients.

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CHAPTER I

BACKGROUND AND SIGNIFICANCE

Traumatic Brain Injury (TBI) is a common cause for patient presentations to Emergency Departments (EDs), and it is the leading cause of death in North America. In the United States, TBI accounts for 30.5% of injury-related deaths annually (Center for Disease Control and prevention [CDC], 2011). Of all TBI cases presenting to EDs, 80 % survive and are discharged home. Around 75% of all yearly TBIs are of mild severity, also known as concussions (CDC, 2011). Aside from mortality, TBIs are associated with high costs and loss of productive years secondary to chronic neurological disability (Ling, Marshall, & Moore, 2010). Post-concussion symptoms as well as cognitive deficits may last up to one year after mild TBI, requiring regular neurological and psychological follow-ups (Bay, 2011).

Traumatic brain injuries are mainly caused by motor-vehicle or traffic accidents, falls, direct head strikes, and assault (Rutland-Brown, Langlois, Thomas, & Xi, 2006). In Lebanon, out of 801 victims of road crashes reviewed by the MedNet insurance company from 1997 to 2004, 20% suffered injuries to the head (El-Zein, 2004). According to a report of the Security Forces in Lebanon, in 2010 alone, 4583 motor vehicle accidents occurred, in which 549 people died and 6517 were injured. The type of injury was not specified in the report. It is noted that 64.64% of those injured were aged between 18 and 44 years and 74.94% of the injured were males (Youth Association for Social Awareness YASA, 2011).

Traumatic brain injuries have been typically classified into three categories: mild, moderate, and severe, based on Glasgow Coma Scale scores and, when present, duration of both loss of consciousness and/or post-traumatic amnesia (CDC, 2011). The Glasgow coma scale assesses three different dimensions, which are eye opening, motor and sensory responses and its' score can range from 3 to 15; the higher the score, the better the level of consciousness. The Center for Disease Control and Prevention (2011), classifies TBI by severity, based on Glasgow Coma Scale (GCS), initial loss of consciousness (LOC), and initial post-traumatic amnesia (PTA) as revealed in Table 1.

Severity	GCS	LOC	PTA
Mild	13-15	< 30 min	< 1 hour
Moderate	9-12	30-60 min	1-24 hours
Severe	3-8	> 1 hr	> 24 hours

Table 1: CDC Classification of TBI

Patients with severe traumatic brain injuries, usually present comatose or obtunded with a $GCS \leq 8$, loss of consciousness lasting more than an hour, and post-traumatic amnesia lasting more than 24 hours (CDC, 2011). Their injuries are mostly associated with structural damage in the brain tissues and significant neurological injury. Such patients require advanced trauma life support, early stabilization, and neurosurgical assessment and interventions in order to maintain intracranial pressure as normal as possible and prevent secondary injuries (Ling, Marshall, & Moore, 2010). Severe TBIs are highly associated with high mortality rates and long-term disabilities (Jaffee et al, 2009).

Moderate traumatic brain injuries are those patients with a GCS of 9-12 (Ling et al., 2010). They may have loss of consciousness of 30 to 60 minutes duration and post-traumatic amnesia of one to 24 hours (CDC, 2011). Patients with moderate TBI present with neurologic deficits and prolonged loss of consciousness after head trauma. Therefore, it is recommended that a neurosurgeon assesses them acutely, and they usually require hospital admission and frequent follow-up visits and rehabilitation while recovering (Jaffee et al., 2009).

Mild traumatic brain injuries are defined as neurometabolic dysfunction arising from acceleration/deceleration injury to the brain from a direct or indirect forceful impact without structural damage (Bay, 2011) with a Glasgow Coma Scale (GCS) score of 13-15 (Ling et al., 2010) . Mild TBI may include short loss of consciousness of less than 30 minutes and post-traumatic amnesia that resolves within one hour (CDC, 2011, Jaffee et al., 2009).

Mild TBI is often missed or undiagnosed in emergency departments. However, consequences of mild TBI are significant on the physical, cognitive, and emotional aspects of the injured (Bay, 2011). This is why accurate assessment and documentation of the level of TBI is crucial to provide the appropriate treatment and prevent complications. For example, the CDC recommends that ED personnel assess specific symptoms as indicators of mild TBI. Patient education about what symptoms to expect and which ones to report in case of mild TBI is important for the recognition of late signs that may require urgent neurological consultation.

Since there is lack of research about the emergency care of mild TBI in Lebanon, in this study baseline descriptive data on the TBI emergency care at the

American University of Beirut Medical Center was gathered, focusing mostly on Mild TBI management. Therefore, the purpose of this project was to examine the clinical management, disposition, and discharge instructions that mild TBI patients are receiving in the ED at AUBMC.

CHAPTER II

LITERATURE REVIEW

Traumatic brain injury may be due to a penetrating or blunt trauma. Penetrating head trauma usually results in moderate to severe TBI. Blunt head trauma is also called closed head injury (CDC, 2011). There are two phases to the brain damage associated with TBI. Primary injury is the direct tissue and skull deformation. Primary injury may be sufficient to cause death. The second phase is secondary injury, starting right after the first phase; this phase is prolonged/delayed. Secondary injury is characterized by neuronal and glial injury secondary to increased intra-cranial pressure, hypoxia, inflammation, and ischemia (Ling et al., 2010). Secondary injury may be minimized and avoided with quick and proper pre-hospital management.

In most TBI cases, assessment and physical examination at the ED includes: Glasgow Coma Scale, mental status exam, pain assessment, CT scan of the head, blood alcohol level, blood tests like coagulation profile or drug levels, and less frequently Magnetic Resonance Imaging (MRI) (Bazarian, McClung, Cheng, Flecher, & Schneider, 2005). According to the American College of Radiology Appropriateness Criteria (ACR, 2009), X-ray or non-contrast CT scan of the cervical spine is recommended in mild TBI with focal neurologic deficit, and in moderate and severe TBI to rule out cervical spine injury. Complete blood count may be tested to rule out other non-TBI causes of symptoms like anemia causing persistent dizziness. Brain imaging (CT or MRI) is not recommended if 72 hours have passed from the time the

trauma occurred unless the patient has worsening symptoms (The National Institute for Health and Clinical Excellence, 2007).

For moderate to severe TBI, advanced trauma life support is initiated starting with adequate oxygenation and blood pressure support (targeting Systolic BP > 90mmHg), continuous monitoring of vital signs, continuous neurologic exam, blood tests and neuro-imaging as discussed above, as well as assessment for other injuries. Treatment includes managing increased intra-cranial pressure and preventing cerebral herniation through head of bed elevation, hyperventilation, and osmotic intravenous therapy. Neurosurgery consultation must be done promptly for fast surgical treatment in large hematomas and CT evidence of mass effect. Therapeutic hypothermia and hyperosmolar treatment have been investigated; yet there is no sufficient evidence to support those measures (Froelich & Hartl, 2008, Rupich, 2009).

The acute assessment of mild TBI includes evaluation of its most common symptoms: headache, sonophobia, photophobia, tinnitus, nausea, blurred vision, diplopia, seizures, syncope, neck rigidity, foreign body existing in the ears, eyes, or nose, papilledema, cranial nerves function deficit, abnormal Romberg's sign, cerebrospinal fluid (CSF) leak from nose or ears, hemotympanum, hearing loss, apnea, difficulty focusing, dizziness, vertigo, imbalance in gait, coordination disturbance, memory loss or lapse, decreased concentration and attention, forgetfulness, slowed thinking processes, fatigue, anxiety, tension, mood swings, and anger. Late signs of mild TBI include worsening headaches, seizures, syncope, fever, neck rigidity, papilledema, deficit in cranial nerve functions, nystagmus, hearing loss, apnea, nightmares, difficulty falling/staying asleep, and increased sleepiness indicating

progression into a more severe injury. Behavioral deterioration of mild TBI might follow as well such as, depression, excessive alcohol use, violent behavior, and suicidal/homicidal ideation. All these symptoms, if existing, need a neurology specialist's assessment (Jaffee et al., 2009).

Besides the assessment of the above-mentioned clinical symptoms, a non-contrast CT scan of the brain may be required as a diagnostic tool of the severity of the TBI. Guidelines on when to obtain a brain CT scan when suspecting mild TBI vary.

In 2008, the American College of Emergency Physicians and CDC updated their guidelines for CT scanning in Mild TBI. Those guidelines state that as a Level A recommendation, a head trauma patient with any loss of consciousness or post-traumatic amnesia and one or more of the following: headache, vomiting, age > 60 years, drug or alcohol intoxication, short term memory deficit, evidence of trauma above the clavicle, post traumatic seizure, GCS score < 15, coagulopathy, and/or neurological deficit, is recommended to have a CT of the brain done. As a Level B recommendation, any head trauma patient with no loss of consciousness nor post-traumatic amnesia but with one or more of the following: severe headache, vomiting, age > 64 years, physical sign of basilar skull fracture, GCS score < 15, dangerous mechanism of injury e.g. ejection, coagulopathy, and/or neurological deficit, is also recommended to undergo brain CT scanning (Jagoda et al., 2008).

The European guidelines for non-contrast brain CT scanning in mild TBI recommend that every head trauma patient with a GCS score of 13 or 14 must undergo a brain CT (Vos et al., 2002). A non-contrast brain CT scan is also recommended for a GCS score of 15 with loss of consciousness of less than 30 minutes, post-traumatic

amnesia (PTA) of less than 60 minutes, or any of the following risk factors:
unclear/ambiguous accident history, continued PTA, retrograde amnesia > 30 min,
trauma above clavicles, severe headache, vomiting, focal neurologic deficit, seizure, age
> 60 years, coagulation disorders, and a high-energy accident (Vos et al., 2002).

The Australian Motor Accident Authority (2008) guidelines tend to be more specific. For a GCS score of 13 in a head trauma patient, regardless of other clinical symptoms, a CT scan of the brain must be obtained with close clinical observation of the patient. A brain CT scan with prolonged clinical observation are also recommended for any patient with an initial GCS score of 14 or more and one or more of the following risk factors: persistent GCS score < 15 at two hours post-injury, deterioration of GCS, focal neurologic deficit, clinical suspicion of a skull fracture, prolonged loss of consciousness of more than five minutes, PTA of more than 30 minutes, post-traumatic seizure, persistent abnormal alertness/behavior/cognition, persistent abnormal Abbreviated Westmead Post-Traumatic Amnesia Scale (A-WPTAS) score < 18/18, two or more vomiting occasions, persistent severe headache, known coagulopathy (medications, alcoholic), age > 65 years, a multi-system trauma, a dangerous mechanism of injury, clinically obvious drug or alcohol intoxication, a history of neurosurgery or neurological impairment, and delayed presentation or re-presentation (Motor Accident Authority, 2008). Hourly clinical observation for at least four hours post-injury without a brain CT is recommended by the Australian Motor Accident Authority (MAA) guidelines in the cases of an initial GCS score of 14 or more with all of the following: a GCS score of 15 at two hours post-injury, no focal neurological deficit, no clinical suspicion of a skull fracture, brief LOC of < five min, brief PTA of < 30min, no post-traumatic seizure, normal A-WPTAS score of 18/18, no/mild nausea or

single vomiting episode, mild or no headache, no known coagulopathy, age < 65 years, isolated head injury without a dangerous mechanism, no drug or alcohol ingestion, and no history of neurosurgery or neurological impairment. However, after the four hours of clinical observation post-injury, a CT of brain is recommended if there is no clinical improvement. Otherwise, the patient may be assessed for clinical and social safety to discharge home (MAA, 2008).

The National Institute of Health and Clinical Excellence (NICE) in the United Kingdom recommends a non-contrast CT scan of the brain for TBI patients with any of the following: GCS score of 14, vomiting, age > 64 years, physical sign of a basilar skull fracture, amnesia of more than 30 minutes, post-traumatic seizure, dangerous injury mechanism (e.g. ejection), coagulopathy, and neurological deficit (Jagoda et al., 2009).

Moreover, the World Federation of Neurosurgical Societies (WFNS) recommends that a non-contrast brain CT be done in the cases with one or more of the following: GCS score of 14, vomiting, suspected skull fracture, amnesia, loss of consciousness, headache, history of epilepsy or of neurosurgery, drug or alcohol abuse, coagulopathy, and neurological deficit (Jagoda et al., 2009).

Table 2 is a visual summary of combined international guidelines showing the most common criteria of when to obtain a brain CT scan for a mild TBI patient. The main difference was that the Australian guidelines include more specific criteria that other guidelines do not consider, such as persistent abnormal alertness, cognition and behavior, multi-system trauma, and a delayed presentation or re-presentation. Only the

WFNS and the Australian guidelines consider a previous history of neurosurgery among the criteria to obtain a scan.

Since by definition mild TBI does not include structural damage (Bay, 2011), any patient presenting to the ED with a TBI that is suspected to be mild and fits the neuro-imaging criteria, yet the brain CT scan reveals abnormality or brain changes, is to be admitted to the hospital, assessed by a neurosurgeon and treated accordingly. Patients who have normal brain CT scans and those who do not fit the criteria for scanning must be assessed for clinical and social safety to discharge. Accordingly, they are either discharged home or admitted for further observation (Jagoda et al, 2009, MAA, 2008).

Criteria	CDC		NICE	European	WFNS	Australian		
	Level A	Level B		GCS=15	13≤GCS<15	GCS<15	GCS=15	
Subdivisions	+	-						
LOC	Or +	-	✓	✓	✓	✓ >5min		
PTA					✓	✓ >30min		
GCS	<15	<15	≥14	=15	+	=14	<15 at 2hrs post-injury/ deterioration	=15 at 2hrs post-injury + no improvement after 4hrs
Headache	✓	✓		✓		✓		
Vomiting	✓	✓	✓	✓		✓	✓ ≥2x	
Age	✓ >60	✓ >64	✓ >64	✓ >60			✓ >65	
Drug/ETOH	✓					✓ abuse	✓	
Decreased Short-Term Memory	✓			✓ >30min			✓ A-WPTAS <18/18	
Trauma above clavicle	✓			✓				
Post-Traumatic Seizure	✓		✓	✓		✓ History of epilepsy	✓	
Coagulopathy	✓	✓	✓	✓		✓	✓	
Neurologic deficit	✓	✓	✓	✓		✓	✓	
Suspicion of basilar skull fracture		✓	✓			✓ suspicion of any skull fracture	✓	
Dangerous mechanism		✓	✓	✓ high-energy accident			✓	
History of neurosurgery						✓	✓	
Persistent abnormal alertness/behavior/cognition							✓	
Multi-system trauma							✓	
Delayed presentation or re-presentation							✓	

Table 2: Combined Guidelines Grid. CDC: Center for Disease Control and Prevention, NICE: National Institute of Health and Clinical Excellence, UK, WFNS: World Federation of Neurosurgical Societies, Australian guidelines are those of the Motor Accident Authority (2008), LOC: Loss of Consciousness, PTA: Post-Traumatic Amnesia, GCS: Glasgow Coma Scale, ETOH: ethanol/alcohol

Treatment in the Emergency Department for mild TBI-associated injuries may include: wound care, IV fluids, and analgesia (preferably non-opioid). To date, there is no acute treatment for mild TBI, only close observation and behavioral modifications like rest, reduction of anxiety and fatigue, avoidance of excessive physical effort and sports, and avoidance of alcohol consumption (Bazarian et al., 2005, Bergman & Bay, 2010). Disposition guidelines also vary.

The Australian MAA (2008) guidelines state that if no CT brain is indicated, hourly clinical observation for at least four hours post-injury must take place prior to re-assessment for discharge. The European guidelines recommend repeating the neurological exam either every 15 to 30 minutes or every one to two hours based on clinical condition and CT result prior to disposition from the ED (Vos et al., 2002). On the other hand, the American College of Emergency Physicians and the Center for Disease Control and Prevention state that if the brain CT scan is negative there is minimal risk to discharge home. However, if the patient is known to have coagulopathy or neurosurgical history, the risk of home discharge is unknown. Among all the guidelines, there is no consensus on the duration of observation and frequency of reassessments of mild TBI patients prior to disposition and after discharge.

The National Institute for Health and Clinical Excellence (2007) recommends that all mild TBI patients who do not undergo neuro-imaging must be reassessed by the trauma specialist one hour after the initial assessment to assure that neuro-imaging is not needed. If the GCS score is 15, such patient may be discharged home accompanied by an adult after proper discharge instructions are given and on condition that the patient shows no evidence of alcohol intoxication, has no other injuries, is not in shock, and no other severe injuries are suspected. However, admission for 24 hours of observation prior to discharge is recommended for those aged 65 or older, or have

period of loss of consciousness (LOC) and/or Post Traumatic Amnesia (PTA) or episodic memory loss of events that occurred 30 minutes prior to trauma, or if the TBI is the result of a severe mechanism of injury such as ejection despite a normal GCS score of 15 (NICE, 2007).

As for those patients who present with mild TBI, undergo neuro-imaging, and their GCS score does not return to 15 after imaging regardless of the CT scan result, it is recommended that they be admitted. After 24 hours of observation, if the GCS score did not return to 15, a repeat brain CT scan must be done. Only those with a GCS score of 15 and negative CT are to be discharged home accompanied and instructed on post-concussive signs and symptoms (NICE, 2007).

Combining all the reviewed guidelines on home discharge of mild TBI patients from the ED, it is well agreed on that the decision to discharge a mild TBI patient home must be well documented and coupled with appropriate written/printed discharge instructions. Those instructions must be given to the patient and his/her immediate caregiver in print and in verbal forms. Mild TBI discharge instructions should include: warning signs of worsening condition in order to seek urgent medical attention, post-concussive symptoms that may be expected, when and how to return to usual activity/work/sports, proper referral instructions (within one week in case of persistent symptoms), and injury prevention information (CDC, 2011, Jagoda et al., 2009, MAA, 2008, NICE, 2007, Vos et al., 2002).

As indicated in the literature, mild TBI patients require specific emergency management and discharge according to guidelines to ensure excellent and safe quality care. Hence, it was important to assess whether these mild TBI emergency management evidence-based guidelines are being followed at AUBMC.

The purposes of this study are to: (a) obtain an estimated baseline data on the incidence of TBI emergencies at AUBMC, (b) explore the current management of adult Mild TBI patients (≥ 18 years old) at AUBMC's ED from February 1 to July 31, 2010, (c) compare the clinical management of mild TBI at AUBMC's ED to international guidelines, and (d) propose recommendations for improvement of Mild TBI management at AUBMC's ED.

CHAPTER III

METHODS

A cross-sectional descriptive study design was used in this project. The medical records of AUBMC's Emergency Department adult patients who presented from February 01 to July 31, 2010 with confirmed or suspected traumatic brain injury were reviewed. The review was conducted after the approval of both the Institutional Review Board and the Hospital Administration of AUBMC was obtained in July of 2011.

A. Data Collection

Cases were selected using only the medical records numbers and admission diagnosis of all adults (≥ 18 years old) that presented to AUBMC's ED during the period of February 01 to July 31, 2010. This time period was chosen since it covers both winter and summer seasons, which are known to be associated with an increased incidence of accidents. Inclusion criteria included: Age ≥ 18 years, presented to AUBMC's ED between February 01 and July 31, 2010, Admission Diagnosis (chief complaint) documented on the ER chart is : "head trauma", "trauma to head", "major trauma", "multiple trauma", "polytrauma", "fell down on face/head", "scalp/forehead laceration", "MVA with head trauma/LOC", "headache S/P trauma/MVA/fall", "fell from 3rd floor", or "fell from 8th floor", and documentation inside the ED chart with any of the above chief complaints reveals head trauma. The admission diagnoses listed in the inclusion criteria were reached after primary sorting of all adult ED records that presented in the selected time frame to AUBMC's ED. Because of the variability of

documented admission diagnoses on the medical records, any diagnosis that confirms or suspects a head injury was selected and thus listed in the inclusion criteria. Exclusion criteria included: TBI patients transferred from other institutions and all pediatric TBI patients' records.

Data collection was paper-less from the electronic health records, saved on a password-protected computer. Data was collected on all assessment, diagnostics, interventions, and management done at the ED for the selected patients according to the TBI data collection sheet, which included 89 variables (see Appendix 1). The variables included demographic information, signs and symptoms of TBI, mechanism of injury, time and mode of presentation to the ED, documentation of assessments, diagnostic tools used and results, consultations, diagnoses, disposition, instructions on discharge and follow-up given, length of stay in the ED, and any re-presentation for TBI-related symptoms.

B. Sample Selection

The sample was selected as follows: First, a list of all AUBMC's ED adult patient admissions from the selected time period (February 1, 2010 to July 31, 2010) was collected from the Medical Records Department. Those were 16,356 record case numbers and their admitting diagnosis reported on an Excel Sheet. Sorting through the Excel sheet, 12,605 records were found to have Medical, Ophthalmological, Obstetrical, Gynecological, or Ear, Nose, & Throat ED admitting diagnoses and were therefore excluded. Therefore, a sample of 3,751 records remained. Of those, 3,576 records did not meet the inclusion criteria for the specific admitting diagnoses or chief complaints listed earlier. Upon the latter's exclusion, the remaining sample of medical records to be reviewed was 175.

After gathering the 175 relevant case numbers, access to their complete medical charts (including radiology and laboratory results) was obtained through the electronic health records (EHR) and hospital information system (HIS) of the Medical Records Department. The cases identified for review were assigned code numbers for the study's purposes. The identifying information of the patients whose charts were selected (names, case numbers, & dates of birth) were not collected on the data sheet; only code numbers were documented in order to ensure anonymity.

The record review process of the triage and medical assessment sheets of the 175 cases showed that 54 records had missing/unusable information and had to be excluded. Eight of the 54 records were not scanned in the electronic health record, hence unavailable for review. Seventeen records had documentation of "head trauma denied" or "no head trauma" in the assessment, which was contradictory to the ED admitting diagnosis. Twenty four records had missing documentation with no mention of possible or actual acute head trauma whatsoever except on the ED admitting diagnosis found on the cover page of the "ER Sheet". Five records were for transfer patients from other hospitals, which were therefore excluded, as it is an exclusion criterion. Therefore, the final sample that was completely reviewed became 121 records.

C. Data Analysis

Data was entered into a created TBI data collection sheet (see appendix) using the 19th edition of the Statistical Package for the Social Sciences program (SPSS). Missing data was coded and percent missing was calculated for all variables. Descriptive statistics were used to describe the distribution of the study population characteristics and all variables collected. For continuous variables, mean, median,

standard deviation and range were calculated. For categorical variables, percentages and frequencies were measured to describe the ED's practices. Since the primary purpose of this study is descriptive, bivariate analyses of symptoms and decision to obtain a brain CT scan were attempted but were found insignificant. Because AUBMC is a Joint Commission International (JCI) accredited institution that follows the American guidelines and JCI Standards of care, all clinical management was compared to the guidelines of the CDC (2011).

CHAPTER IV

PROJECT FINDINGS

The sample of 121 TBI patients who presented to the AUBMC ED between February and July 2010 consisted of 62.8% male patients and 37.2% female patients. The age distribution revealed two peaks; 48.8% were young adults aged 18 to 40 years, and 31.4% were older adults aged 60 years or more. The remaining 19.8% were middle aged adults (41-59 years old).

The most common mechanism of injury reported by the 121 patients was fall (42.1%), followed by motor vehicle accident (20.7%), then strikes against/bumping into something (16.5%), followed by assaults (10.7%) and sports-related (3.3%), with 6.6% who had no mechanism of injury documented (missing data).

The review also showed that the months with the highest TBI incidence were July (24%), April (20.7%), and February (19%). The incidence in March, May, and June 2010 were 13.2%, 12.4%, and 10.7%, respectively.

Complete neurological assessment (including GCS, reflexes, motor power, and sensory assessment) was documented in 57% of the 121 cases only. Forty three percent had an incomplete documentation of their neurologic assessments.

When examining the classification, only five of the 121 cases were classified to have mild TBI or concussion. The remaining 116 cases were only documented and diagnosed to have “head trauma”, with no severity class specified in the records. In order to describe the Emergency Department’s management of mild TBI specifically, the non-classified cases were re-classified according to the CDC classification guidelines and based on their initial Glasgow Coma Scale (GCS) score, taking into

consideration the documented loss of consciousness (LOC) and post-traumatic amnesia (PTA). Table 3 shows the initial GCS score distribution in the sample. Table 4 summarizes the frequency of LOC and PTA in those TBI patients with documented GCS score.

	Frequency	Percent
GCS=9	1	.8
GCS=12	2	1.7
GCS=15	99	81.8
GCS not documented	19	15.7
Total	121	100.0

Table 3: Initial Glasgow Coma Scale on ED Assessment Forms

	LOC		PTA	
	Frequency	Percent	Frequency	Percent
Yes	16	15.7	16	15.7
No	80	78.4	70	68.6
Not documented	6	5.9	16	15.7
Total	102	100.0	102	100.0

Table 4: Initial LOC and PTA in Cases with a Documented GCS

Therefore, the complete classification and re-classification of the TBI cases became as follows: from the 121 TBI patients, 98 were of mild severity, three were of moderate severity. No patient was classifiable as severe TBI. Those results are shown in table 5.

	Frequency	Percent
Moderate TBI	3	2.9
Mild TBI/Concussion	98	96.1
cannot confirm TBI class*	1	1.0
Total	102	100.0

Table 5: TBI Severity in Sample (* 1 case was not confirmed to have a TBI due to an incomplete neurological assessment.)

When examining the mild TBI records (n=98), the most frequent symptoms reported by the patients were headache (experienced by 55% of the Mild TBI cases), followed by dizziness (30%), anxiety/nervousness (21%), and nausea (20%). Table 6 shows the distribution of symptoms in the mild TBI sample. It is important to note that some subtle symptoms such as fatigue and difficulty concentrating were missing in the assessment documentation. The most common symptoms that were missed are paresthesias and feeling slowed down.

Symptom	Yes	No	Not documented	Percent
Headache	54	39	5	55
Dizziness	29	62	7	30
Anxiety/Nervousness	21	68	9	21
Nausea	20	70	8	20
Lightheadedness	19	64	15	19
Difficulty Concentrating	15	65	18	15
Fatigue	13	66	19	13
Feeling Slowed Down	11	67	20	11
Drowsiness	11	75	12	11
Irritability	10	79	9	10
Vomiting	9	82	7	9
Imbalance/unsteady gait	9	77	12	9
Increased Emotions	7	76	15	7
Mood Swings/Depression	4	82	12	4
Paresthesias	1	74	23	1

Table 6: Symptoms Distribution in Mild TBI Sample (n=98)

The sensory changes, visual and auditory, that may indicate focal neurological deficit in mild TBI cases were not frequently documented in the mild TBI patients. (Refer to Tables 7 and 8 for the distribution of those symptoms).

Visual Changes	Symptom Frequency	Percent
Blurry Vision	7	7
Diplopia	1	1
Light Sensitivity	0	0
No Changes	72	73
Not Documented	18	18
Total	98	

Table 7: Visual Changes as Documented in the Mild TBI Sample

Auditory Changes	Symptom Frequency	Percent
Hearing Loss	0	0
Tinnitus	1	1
Noise Sensitivity	0	0
No Changes	78	80
Not Documented	19	19
Total	98	

Table 8: Auditory Changes as Documented in the Mild TBI Sample

A. Brain CT Findings

The CDC's Level A guidelines recommend the performance of a brain CT scan in mild TBI patients who present with loss of consciousness (LOC) or post-traumatic amnesia (PTA), in addition to one or more of the following specific symptoms; headache, vomiting, age > 60 years, drug or alcohol intoxication, short term memory deficit, evidence of trauma above the clavicle, post traumatic seizure, GCS score < 15, coagulopathy, and/or neurological deficit. At the AUBMC ED, 16 out of 98 mild TBI patients had LOC and 15 had PTA.

Of the 16 patients with mild TBI who presented to the ED with LOC, 13 had a brain CT, two did not, and one refused and signed Against Medical Advice (AMA). Ten of the 13 patients had normal CT scan results. Two of them were seen by a neurosurgeon at the Emergency Department (ED), after which one was admitted to the hospital for further observation. Therefore, nine patients with normal CT scan were discharged home within one to four hours of ED presentation. On the other hand, three of the 13 mild TBI patients had brain CT abnormalities; subarachnoid bleed and skull fracture, small subdural hematoma, and small contusion or bleed. Those three cases were admitted to the hospital: one to the Neurology Intensive Care Unit, and two to an open unit/floor.

When reviewing the ED records of the three patients who had LOC but did not undergo a brain CT scan, the following findings were found; none of these patients was seen by a neurosurgeon, two had an incomplete neurological assessment documented and two were not given any follow-up instructions. One was told to return to the ED if “change in level of consciousness” or “excess vomiting” were experienced. Two were discharged home, and one left AMA.

Of the 15 mild TBI patients who reported PTA, 11 had a brain CT, two did not, and two refused and signed AMA. Seven of the 11 mild TBI patients had normal brain CT results. Of those seven, one was seen by a neurosurgeon and admitted for further observation, and six were discharged home. Of the four patients who had abnormal brain CT results, three were the same patients who had LOC as well; and their management was described earlier. The fourth patient who had an abnormal CT scan, results showed subarachnoid hemorrhage and a large subglial hematoma. Because there was no available in-hospital bed for admission, this patient was seen by a neurosurgeon and observed for around 15 hours in the ED. His/her brain CT scan was repeated prior

to his discharge home. The repeated brain CT scan showed no changes, and the patient was safely discharged home to follow up with the neurosurgeon consulted.

As for those patients with PTA who did not have a CT scan, none was seen by a neurosurgeon; two had incomplete documentation of their neurological assessment. Two were not given follow up instructions at all. Only two were instructed to return to the ED “if change in level of consciousness”, “excess vomiting” occurred, or in case of “alarming symptoms”. Also, two of those patients left AMA, and two were discharged home from the ED.

When reviewing the ED records of those patients who meet the Level B recommendations of the CDC guidelines, 47 of the 98 patient records were found to fit the criteria for doing brain CT scan. Of those 47, twenty three mild TBI patients (48.9%) had a brain CT scan, 22 cases (46.8%) did not, and two patients (4.3%) refused and signed AMA.

Of the 23 mild TBI patients who had a brain CT scan done, three had abnormal brain CT results and were admitted to the hospital. Of the 20 patients with normal brain CT scan, 16 were discharged home within 0.5 to 4.25 hours of ED stay, two were admitted to the hospital for further monitoring, one was transferred to another hospital, and one had unknown disposition or incomplete documentation.

Of the 22 mild TBI patients who did not have a brain CT scan done, 21 were discharged home within 0.5 to 4 hours; and one left Against Medical Advice. All 22 patients had no documentation of re-assessment prior to discharge. Three of those patients had positive coagulopathy, and three had incomplete neurological assessments documentation. One of these patients returned to the ED for a TBI-related chief complaint.

When comparing the symptoms of the two groups who fit the CDC Level B recommendations for brain CT scan (Figure 1), it is noted that the frequencies of the symptoms between those who had a CT of the brain done in the ED and those who did not have a CT of the brain were similar. Nausea, dizziness, fatigue, and vomiting occurred similarly in both groups. Moreover, headache was the reported symptom with the highest frequency in both groups; yet, headache was more frequent among those who did not have a brain CT than those who were scanned, though this difference did not reach statistical significance.

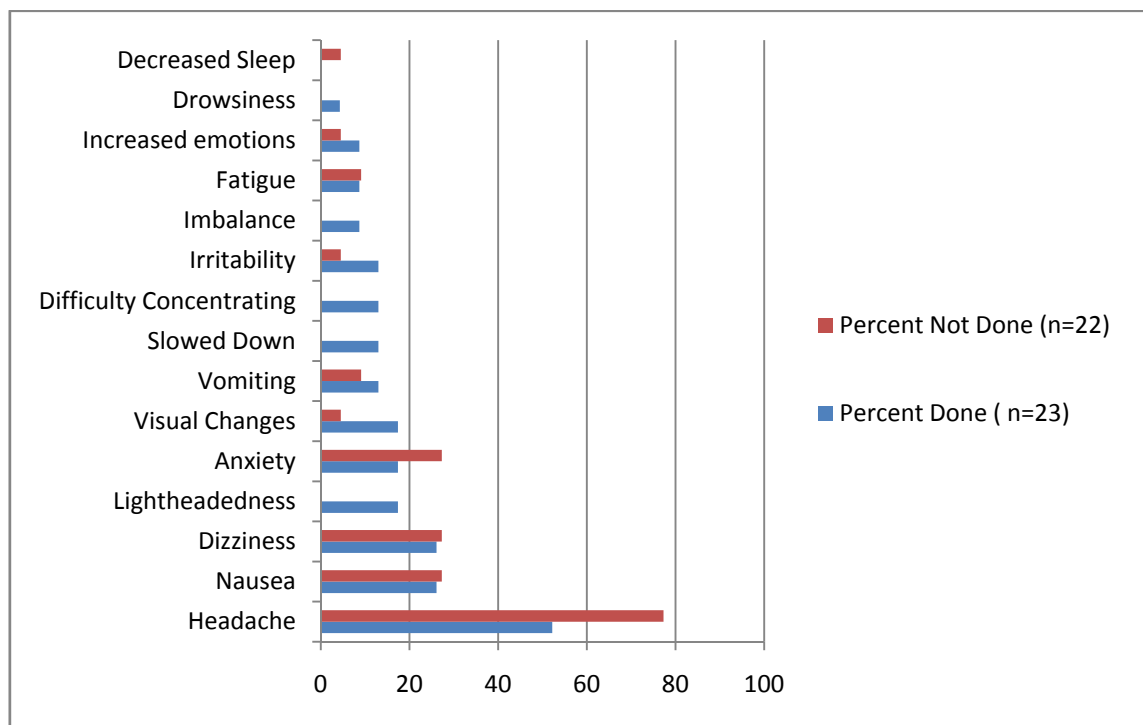


Figure 1: Percent of Symptoms by Brain CT Status

B. Reassessment and Disposition Findings

Of the 98 records that were reviewed, 12 mild TBI patients were seen by a neurosurgeon at the ED, 58 (59.18%) had complete documentation of neurological assessment (including GCS, reflexes, motor power, and sensory assessment); 40 patients had incomplete documentation of their assessment. Moreover, 92 out of the 98

records (93.88%) had no documentation of reassessment of Glasgow Coma Scale or neurologic status (neither by the nurses nor by the physicians) prior to their disposition out of the ED.

The distribution of the patients' disposition was as follows: 79 were discharged home, one was admitted to the Neurologic Intensive Care Unit, nine were admitted to an open unit, seven left AMA, one was transferred to another health care facility, and one record had missing disposition documentation. It is important to note that five of the 98 patients returned to the ED for TBI-related chief complaints.

The discharge instructions that were documented in the ED records of those who were discharged home, transferred, or left AMA, were as follows: 14 patients were given no discharge instructions, 40 were told to "return if worse", and this is documented by ticking a box on the ED discharge instructions form, 20 patients were instructed on medications use and wound care only, and six patients were given accurate follow-up instructions with a primary physician or a neurologist. Only six of the 98 patients (6.12%) were given accurate home discharge instructions on observation and expected consequences (with a family member receiving instructions as well) that was documented on the ED discharge sheet.

CHAPTER V

CONCLUSION AND DISCUSSION OF FINDINGS

This study aimed at examining the incidence, severity and management patterns of patients who presented with TBI to the ED at AUBMC between February and July 2010. The findings of this study are concurrent with the literature in terms of sample distribution. The TBI sample reviewed had more males than females; also, the two most frequent age groups were also young and older adults (CDC, 2011). In addition, the most frequently observed symptoms were headache followed by dizziness, nausea, lightheadedness and anxiety (CDC, 2011).

On the other hand, contrary to what is commonly reported in the literature (CDC, 2011, Rutland-Brown et al., 2006), the most common mechanism of injury in the reviewed TBI records was fall followed by Motor Vehicle Collisions (MVCs). According to Rutland-Brown et al. (2006), the most common mechanism of injury that leads to mild TBI is MVC followed by all others causes. A possible explanation is that MVCs in Lebanon are causing more severe injuries or are fatal, hence these victims are not presenting to the ED. Another explanation is that most MVCs that lead to severe TBI may be rerouted to other hospitals and not presenting to the AUBMC ED. This might also explain the higher incidence of mild TBI in this sample of patients; around 96 % of the classifiable TBI patients were mild compared to 75 % reported in the literature (CDC, 2011). This higher incidence of mild TBI may also be due to improper documentation considering the number of records with missing information; therefore, the more severe TBIs were possibly not captured for analysis and review.

In general, according to the documentation in the ED records reviewed, TBIs were not classified at AUBMC's ED except in few cases. The 43% incomplete neurological assessment documentation may explain the lack of classification. It is also noted that subtle symptoms, such as slowed down and sensory deficits, were not documented for all cases.

The majority of the mild TBI patients who fit the CDC Level A criteria for obtaining a brain CT scan were in fact scanned (CDC, 2011, Rutland-Brown et al., 2006). However, from those who met the CDC's Level B criteria for brain CT scan, 46.8 % were not scanned regardless of their symptoms frequencies. The lack of use of guidelines may be a factor for incomplete assessments and lack of classification, which may lead to negative patient outcomes and possibly wrong diagnosis. Among those who were scanned according to level B recommendations, few had abnormal CT findings. A similar number of patients in the group who were not scanned though they should have may have had abnormal findings and was missed, thus jeopardizing their health. Considering the similarity in the symptoms documented between patients who were scanned and those who were not, it becomes obvious that level B guidelines are not being followed when deciding the indication for CT of brain for mild TBI patients. Although the findings are more favorable, that is guidelines seem to be followed, when considering level A guidelines for when to do a CT scan, the fact that some patients did not have their GCS, LOC and PTA documented raises concern about the criteria used for ordering CT of the brain in this patient population.

The discharge instructions findings showed a large gap; 92 of the 98 mild TBI patients had no clear documentation of safe discharge such as a repeated GCS and neurological re-assessment to rule out deterioration prior to disposition. Thirty four patients were not given discharge instructions about possible post-concussive symptoms

nor possible deterioration signs that require immediate medical attention. Forty patients of the 98 were told to “return if worse” with no documented definitions of what the “worse” may be (symptoms that may be expected and alarming symptoms that must be reassessed for) and how to “return” and who should ensure that. A very small percentage were given full and appropriate, written, discharge and follow-up instructions in the presence of an adult family member or significant other, as the international guidelines recommend for safe discharge. Though only five cases returned to the AUBMC ED for TBI-related chief complaints, the lack of appropriate discharge instructions can lead to poor patient outcomes that may not have been captured in this study. Other patients may have deteriorated and sought medical later at the ED in AUBMC after the study period and not captured; still others may have gone to other EDs.

A. Strengths and Limitations

While this project is a descriptive study that is not testing any hypotheses, its findings lead to hypotheses generation and identified needs for future research on TBI and ED processes at AUBMC and in Lebanon. This project is expected to serve as a basis for future nursing and medical research in the area of mild traumatic brain injury. If a mild TBI management and discharge guideline was adopted as a performance improvement intervention at the AUBMC ED based on the findings of this project, a follow up study may be repeated to evaluate the success of such an intervention on performance improvement and patient outcomes.

This study may not be considered a comprehensive description of TBI management at AUBMC’s ED due to possible missed cases that could not be captured in the sample. It is so because of the lack of a coding system for chief complaints or ED

admission diagnoses, and discrepancies in documentation between chief complaints and the ED records. For example, in a specific case, the chief complaint documented on triage may be “headache status post trauma”, whereas the admission diagnosis printed on the ED sheet was “headache” only; such a case can be easily missed as a case of TBI. Discrepancies have also been found inside the record itself; whereby for the same presentation, the triage sheet had a documented loss of consciousness, and the adult assessment chart documents stated “no loss of consciousness”. The person who fills the initial diagnosis often is not a health professional who takes the chief complaint from whoever comes with the patient and does the ED papers; this partially explains this discrepancy. Such records with discrepancies have been considered unusable data and were excluded from analysis. Another limitation to this study is the inability to access all records listed by the medical records department due to lack of availability in the Electronic Health Record system. Moreover, because all reviewed records are scanned copies of the ED sheets, poor documentation was due sometimes to unclear handwriting. Differences in documentation were also noted among different physicians whether in assessment, classification and diagnosis, or management.

B. Recommendations

In view of this project’s findings, and in order to promote safer care of mild TBI patients at AUBMC, the following is recommended. To start with, a final diagnosis ought to be included in the electronic health record so that identification of the TBI cases in future studies would be more complete. An assessment checklist that includes all symptoms of mild TBI, evident and subtle, is recommended for a more accurate assessment of mild TBI. This assessment sheet can be used for the assessment of all ED patients presenting with trauma to the head. The CDC has developed a similar checklist

entitled “Acute Concussion Evaluation” (refer to Appendix 2). It is also recommended that a TBI classification system be followed in order to guide the management needed for each patient. The severity classification system of mild, moderate, and severe TBI is the most commonly used internationally and specifically by the American College of Emergency Physicians.

Moreover, adopting a guideline for CT scan for mild TBI will ensure accurate diagnosis and prevent missed cases in the ED. The recommended guideline could be a combination of all guidelines as previously stated in the combined guidelines grid, basing the decision to do a CT scan of the brain on the criteria commonly advocated by most professional organizations. Last but not least, establishing a uniform discharge instructions and follow-up sheet similar to the one developed by the CDC (refer to Appendix 3) will ensure a safer discharge for mild TBI patients from AUBMC’s ED.

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APPENDIX 1

DATA COLLECTION SHEET

List of Collected Variables:

1. Code_Number
2. Date_of_ED_presentation
3. Month
4. Age
5. AGE_threegrps
6. Age_Group
7. Gender
8. Chief_Complaint
9. Triage_Chief_Complaint
10. Time_of_Injury
11. Triage_Time
12. Transport_to_ED
13. Initial_BP
14. Initial_HR
15. Initial_RR
16. Initial_T
17. Initial_SpO2
18. Initial_Dxt
19. Initial_GCS
20. TBIclassbasedonGCS

21. Repeated_GCS
22. Repeated_GCS_howmuch
23. classTBIrepeatedGCS
24. TBIguidelinesclass
25. Neuro_status_documentation
26. unconsciousness
27. time_of_unconsciousness
28. unconsciousness_duration
29. headache
30. nausea
31. dizziness
32. vomiting
33. imbalance_unsteady
34. visual_changes
35. auditory_changes
36. fatigue
37. numbness_tingling_paresthasias
38. feeling_mentally_foggy_lightheaded
39. feeling_slowed_down
40. difficulty_concentrating
41. PTA_difficulty_remembering_STMloss
42. irritability
43. mood_swings_depressed_sad
44. anxiety_nervousness
45. increased_emotions

46. drowsiness
47. decreased_sleep
48. increased_sleep
49. trouble_falling_asleep
50. alcohol_level
51. Med_Surg_Hx
52. usual_meds
53. on_anticoag_antiplatelets
54. CT_brain_done
55. time_of_CT_brain_report
56. C_spine_CT_done
57. CT_BRAIN_NORMAL
58. CT_brain_result
59. c_spine_CT_result
60. CT_brain_repeated
61. repeat_CT_time
62. neurosurgery_consult
63. time_neurosurgery_consult
64. neuroexam_findings_byconsult
65. blood_tests
66. other_assessment
67. MD_diagnosis_documented
68. ventriculostomy
69. OR_craniotomy
70. oxygen_administered

71. mechanical_ventilation
72. IV_fluids
73. pain_mngmt
74. analgesia_type
75. Mannitol_osmoticIV
76. MRI
77. other_interventions
78. reassessment_time_frame
79. disposition
80. total_ED_stay
81. ED_stay_hrs
82. discharge_instructions_documented
83. discharge_note_criteria_documented
84. follow_up_instructions
85. incomplete_neuro_assessment
86. notes_comments
87. came_back_to_ER_TBI_related
88. date_time_of_representation
89. Weekday_of_ED_Presentation

APPENDIX 2

ACUTE CONCUSSION EVALUATION

APPENDIX 3

TAKE-HOME INSTRUCTIONS