INCORPORATING POST TRAUMATIC AMNESIA ASSESSMENT IN MALAYSIAN EMERGENCY DEPARTMENT MILD TRAUMATIC BRAIN INJURY OBSERVATION AND DISPOSITION

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ABSTRACT

Mild traumatic brain injury (Mild-TBI) observation represents a large percentage of Emergency Department (ED) ward work in Malaysia. Despite numerous guidelines and protocols in-placed, the early assessment and identification of TBI induced cognitive impairments in ED's have been poorly described. Identification and duration of post-traumatic amnesia (PTA) provides prognostic information on the severity and outcome. Utilizing GCS alone is insufficient for such purposes.

Strategic PTA screening tools should be incorporated into the prospective assessment of TBI victims during ED presentation and observation. The A-WPTAS provides a rapid and comprehensive screening method for Mild-TBI induced cognitive impairments. Incorporating the screening assessment into "virgin" local practices may require certain amount of adaptation in order to achieve effective implementation. Aside from promoting awareness, it is essential that a clinical decision tree utilizing PTA assessment is created. The information gathered from A-WPTAS can greatly assist ED Doctors in providing effective clinical decision-making and disposition of patients. The authors believe that such interventions may be an effective risk-reduction modality in reducing premature discharge of patients with subtle cognitive impairments. In such instances, this can be debilitating both for the patient and family members. Un-diagnosed cognitive impairments as such, may gradually render the victim to socially deteriorate without having a "safety net" access back into the health care system.

This guideline acts as a tool to assist Emergency Departments in Malaysia as well as other Countries with similar systems to develop effective internal protocols that incorporate PTA screening in clinical decision-making and disposition of mild-TBI victims.

Keywords: Post Traumatic Amnesia, PTA, Mild Traumatic Brain Injury, Post Concussion Syndrome, Head Injury, Head Charting, Head Injury Observation, A-WPTAS, WPTAS, Mild -TBI, Emergency Observation Ward, Head injury Disposition

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INTRODUCTION

According to The World Health Organisation (WHO), trauma has been a major contributor to the top 10 causes of death globally [1]. In the year 2016, trauma recorded the 7th highest cause of death and 5th highest cause for admissions in Malaysian Ministry of Health Hospitals [2]. In 2007, the Malaysian National Trauma Database (NTrD) reported 76% of major trauma cases were attributed to road traffic related accidents and 91.5% were caused by blunt trauma of which, 90% of them sustained injuries to the head and neck [3]. Although there is no published data on the exact number of mild traumatic brain injury (TBI) cases, it is stated as one of the common reasons for trauma related Emergency Department (ED) visits in Malaysia [4]. While the ED clinical pathway is well established for the moderate to severely injured brain trauma, the challenge rests on the disposition of mild-TBI patients. The authors had set out to research on the significance of identifying cognitive impairments in mild-TBI and identify suitable screening tools that can be utilised for these purposes. Subsequently, the authors utilise these clinical findings and propose a manner of incorporating them into a useful clinical pathway, assisting clinical decision-making and disposition of mild-TBI cases amongst ED doctors.

BACKGROUND

Mild-TBI patients are routinely observed in ED observation wards. Glasgow Coma Scale (GCS), pupillary response, size, neurological deficits and clinical vital signs are the most commonly utilised parameters for neurological status assessment. These assessments are performed hourly and patients are observed for a minimum total of 6 hours, in accordance to the Malaysian Clinical Practice Guidelines for Early Management of Head Injury Patients, 2015 [4]. Patients who do not demonstrate clinical deterioration or develop indications for a CT Brain and fulfil all safe discharge criteria will subsequently be discharged from ED wards. Head injury discharge advice is provided in verbal and written note for patients and caregivers, advising to return if any deterioration or worsening symptoms occur. The criteria for discharge however rarely take into consideration the assessment of the patient's cognitive state. Mild-TBI induced acute cognitive impairment (information processing, memory retention, attention, executive functioning)[5] are most commonly manifested by the presence of post-traumatic amnesia, of which may not be identified by the mere assessment of a Glasgow Comma Scale (GCS) [6,7,8] and other commonly utilised vital sign parameters. A validated screening tool should be utilised as part of the ED clinical assessment. Pre-mature discharge of mild-TBI patients with undiagnosed cognitive impairments can be very debilitating both for the patient and the caregiver. This psycho-cognitive impairment may potentially contribute further morbidity to the patient.

TRAUMATIC BRAIN INJURY AND CLASSIFICATION

TBI is defined as an alteration in brain function or evidence of brain pathology caused by an external force [9]. Alteration in brain function includes symptoms such as, loss of consciousness, amnesia, disorientation, altered behaviour

and confusion. Over recent decades, there has been a change in nomenclature from what used to be commonly known as "head injury" has now been more precisely termed as "traumatic brain injury". Despite increased precision in highlighting the significance of the injury being attributed to the brain rather than to the cranio-facial structure, the terminologies surrounding clinical description of TBI remain vague and implicit [9]. Much confusion is attributed to the use of the term "cerebral concussion", its diagnostic criteria's and clinical significance. It's co-existence with the term "mild traumatic brain injury" has led to much debate, leading some authors suggesting for the cessation of the "concussion" terminology [10]. Over the years, we have witnessed committees and organisations forwarding various definitions and criteria's that describe the classifications of TBI [11,12,13]. However, the common ground still remains with GCS as one of the major components.

In the context of ED services, TBI definitions need to clearly define the severity of injury, assist in clinical management pathways, facilitate risk stratification, augment clinical decision and guide disposition of patients. The most commonly utilised classification for brain injury severity in Malaysian ED's is the Glasgow Coma Score. GCS 13-15 is categorized as mild, GCS 9-12 and GCS 3-8 is categorized as moderate and severe brain injury respectively [14]. However, there is a growing school of thought, which suggest that the GCS alone may not be adequate for such purposes [15]. The score may not be accurately derived in cases that involve severe injuries to the eyes, limbs, patients whom are intubated or in the event the components of the scores were not comprehensively documented. The classification methodology should incorporate various attainable parameters and not be isolated to a single variable. The recent 2015 Malaysian Clinical Practice Guidelines [4] has classified Post Traumatic Assessment (PTA) of < 24 hours and an LOC of < 30 minutes as one of the additional markers of mild-TBI Injury. However emphasis on PTA identification and screening hasn't been clearly described.

The Mayo TBI classification utilisers various indicators including GCS, LOC duration, neuroimaging as well as the presence and duration of PTA in classifying brain injury severity. The brain injury severity can be classified without the availability of the initial GCS. The classifications are divided into i) (Definite) Moderate-Severe TBI, ii) (Probable) Mild TBI and iii) (Possible) Mild TBI. Studies demonstrate that the Mayo system predicts Moderate-Severe TBI classification with an estimated sensitivity and specificity of 89% and 98% respectively [12]. The inclusion of PTA as a clinical variable in various brain injury classifications proves it's essential value in classifying brain injury severity, therefor emphasizing its' clinical importance for early identification during initial ED presentation.

POST TRAUMATIC AMNESIA

Post-Traumatic Amnesia is defined as the period in which an individual has either, no recollection of memory prior to the events leading to the head injury (Retrograde Amnesia) or the inability of the brain to continuously create and recall new formed memory (Anterograde Amnesia). PTA can occur as a sequel of mild-TBI. The duration of PTA has been defined as the

interval period between the point of injury and resumption of continuous normal memory [16]. The behavioural changes may be minimal, but most commonly, patients exhibit defective memory and confusion, which often is obvious to the patient's social circle. PTA studies also illustrate that impairment commonly occurs in the episodic memory while sparing procedural memory [16].

The pathophysiology of PTA is not well understood, however the hippocampus is known to play a central role in memory processing. Some studies demonstrate correlations between hippocampal injury and dis-connectivity with the posterior cingulate cortex as a probable cause [17]. Animal studies have demonstrated, metabolic vulnerability characterized by a breakdown between energy production and demand amongst the non-irreversibly damaged brain cells, to be a factor contributing to the cognitive impairment [18]. In the clinical context, it is well established that the functional and occupational outcome of brain injury is closely related to the duration of PTA [15,19,20] and the period of loss of consciousness (LOC) [15,20,21].

PTA is part of a cognitive spectrum, which is potentially impaired during traumatic brain injury. In mild-TBI, PTA termination is often abrupt. Mild-TBI can also potentially induce an array of constitutional symptoms that can co-exist with the cognitive impairments, cumulatively known as the "Post-Concussion Syndrome" or PCS [22]. Patients with PTA are at higher risk of developing PCS. Commonly, PCS symptoms improve within hours or days and complete recovery occurs within 3 months. In rare instances, it may exceed 6-12 months. The rate of recovery is slower for elder patients than compared to the younger, given the similar injury severities [23]. It is also critical that patients and care givers are educated regarding PCS symptoms (Reduced concentration 71%, irritability 66%, tiredness 64%, low mood 63%, memory problems 59%, headaches 59%, anxiety 58%,trouble thinking 57%, dizziness 52%, blurred or double vision 45%, sensitivity to bright light 40%) [23] that can arise from mild-TBI .It is also worth noting that these symptoms can occasionally present as a delayed clinical feature. Failure in understanding and coping with these primary symptoms may lead to the development of secondary symptoms, such as lack of self-esteem which is further exacerbated by anxiety and low mood. These ripple effects, if not appropriately addressed, can lead to psycho-social problems, failure at the workplace and a fall out from society.

PTA identification and duration provides clinical information on the injury severity and carries a prognostic value for the patient's expected outcome [6]. PTA durations exceeding 24 hours is a neuro-cognitive manifestation indicative of a serious underlying degree of brain injury, either likely moderate or severe depending on the extent of the PTA duration. Graham Teasdale in 1995 defined moderate-TBI as a GCS between 9-12 or an associated PTA duration of 1-24 hours. Severe-TBI was defined as a GCS of 3-8, or with a PTA period of 1-7 days. PTA durations of 1-4 weeks and > 4 weeks characterised severe and very severe head injuries respectively [24]. After performing a 10 year review on evidence based clinical practice guidelines for the management of mild-TBI, Tavender et al. in 2011 proposed that PTA should be

prospectively measured for all mild-TBI patients in ED [25]. The authors of this paper suggest PTA assessment should therefor be incorporated in the assessment of mild-TBI observation and also be made as one of the criteria's for safe ED discharges.

PTA ASSESSMENT TOOLS

The most common symptom of cognitive impairment is memory loss or amnesia. Identifying these findings in the context of recent head injury (PTA) would lead the clinician to consider the presence of possible underlying brain damage despite the presence of a fairly normal CT-brain and a full GCS.

The assessment of PTA requires the utility of a validated clinical tool. Amongst the formal available assessment test are the Westmed Post Traumatic Amnesia Scale (WPTAS)[26,27] the Mini Mental State Examination (MMSE)[28], and the Galveston Orientation and Amnesia Test (GOAT) [29]. In the ED, the time and resource factor needs to be taken into consideration. Formal PTA assessments (GOAT, MMSE, WPTAS) require specially trained individuals, take a considerable amount of time, requires additional resources and hence it may be inappropriate for an ED setting. The ideal tool should be readily incorporated into the existing clinical assessment, easily performed by medical staff, sensitive and effective for screening PTA in mild-TBI patients.

For this purpose, the authors suggest the utility of the abbreviated version of the WPTAS Scale, also known as the A-WPTAS, developed in Sydney, Australia in 2007 [30]. It is a validated score designed to assist in early identification of cognitive impairment following mild-TBI [7,8,30,31]. When compared amongst 82 mild-TBI and 88 non-brain injured patients, the A-WPTAS assessment was 8 times more likely to detect PTA in the mild-TBI group[8,31]. The ability to differentiate mild-TBI patients was also similar when compared to the more elaborate formal Revised-WPTAS test [32]. The A-WPTAS has successfully been utilized in many major trauma centers in countries including, Australia [33], New Zealand and Canada [34].

THE A-WPTAS ASSESSMENT

The A-WPTAS is a validated screening tool to assess PTA for the first 24 hours post injury. Patients subjected for A-WPTAS assessment are those whom have sustained closed mild-TBI, impact to the head resulting in confusion, disorientation, lost of memory, LOC and those observed in ED for head charting. This group of patients may or may have not had a CT brain Imaging done. A-WPTAS assessment requires the patient to be able to provide a response to verbal communication and demonstrate optimal scores on the motor and eye opening components of the GCS. The tool incorporates GCS component of "Motor", "Eye", an elaborated verbal assessment and a 3-picture card memory test. The 3-picture card test would assess the ability of the brain to retain new-formed memory. The verbal component of the GCS is scrutinised into 5 questions of which need to be answered accurately. Any one wrong answer would score a 4/5. Incomprehensible words and sounds would score a 3/5 and 2/5 respectively. The maximum total A-WPTAS score is 18, 15 from the GCS and another 3 from the picture card component. Patients who score 18/18 are deemed not to be in PTA or had

recovered from it. In the event that the patient fails the test, it is then repeated in a serial manner (each hour for 4 hours), enabling the medical team to gauge the approximate duration of PTA, which evidently is prognostic to the severity of underlying brain injury [15,19,20]. The A-WPTAS [30,31] suggests patients who are in persistent PTA to be considered for admission and formal cognitive / PTA assessment in the ward.

GCS & 5 Orientation Questions

The GCS eye and motor assessment is performed as it is. The verbal assessment is elaborated with the patient having to accurately answer 5 questions, also known as the "5 orientation questions".

i) What is your name?
ii) What is the name of this place?
iii) Why are you here?
iv) What month are we in?
v) What year are we in?

Q1. What is your name?

The patient needs to answer his or her full name. A right answer will score "1" and the wrong answer will score"0".

Q2. What is the name of this place?

The answer should be, e.g. Hospital Kuala Lumpur. If the patient answers, I don't know, then provide multiple choice e.g. Are you at home, at the hospital or at a hotel? If the patient answers, either home or hotel, then score them as "0". If the answer is "Hospital", then ask further, e.g. What is the name of this Hospital? If the answer is wrong, then the score is "0". If the patient answers "I don't know", provide 3 choices of hospitals, e.g. Is this Hospital Kuala Lumpur, Hospital Universiti Malaya, or Hospital Sungai Buloh? Correct answers after prompting will score "1" but will need to be prefixed with the letter "P" next to the score.

Q3. Why are you here?

The patient needs to know why they were brought to the hospital, e.g. injured in a car accident, or had a fall climbing the staircase or slipped and fell backwards on a wet floor etc. If patient doesn't spontaneously answer, or provides a wrong reason, the score is "0". If the patient answers "I don't know", the examiner needs to prompt with 3 options, which includes the correct answer. e.g. Are you here because you were injured in a car accident?, had a fall climbing the staircase? or slipped and fell backwards on a slippery floor? A correct answer will score "1" and a false answer scores "0". A correct answer with prompting will be prefixed with a "P" next to the score.

Q4. What month are we in?

The patient would need to state the correct month, e.g. July. If the patient answers the wrong month, then the score is "0". If the patient says the 7th month, the examiner needs to clarify, e.g. what is the name of the 7th month? The patient needs to answer July in order to score "1".

Q5. What year are we in?

The patient needs to know the correct year, e.g. 2018. A wrong answer will score "0". If the patient doesn't spontaneously answer or says I don't know, provide 3 years in sequence as a prompt, which includes the real answer. e.g Is this 2017, 2018 or 2019 ? A right answer will score "1" and prefixed with a "P".

If the patient scores "0" for any of the 5 orientation questions, the examiner needs to provide the patient with the correct answer. This is done before moving on to the next question.

3-Picture Card Test & 9-Picture Recognition Chart

After completing the 5 orientation questions, the patient is then provided with the 3-picture cards (Refer Fig.1). It should be clearly displayed and explained that this 3 cards are pictures of a cup, a bird and keys. The patient is then requested to repeat while identifying the pictures shown. The patient is told to remember these 3 items and will be asked to recall them in 1 hour's time.

After 1 hour, the 5 orientation questions are re-assessed. Subsequently, the patient is asked to verbally recall the 3 picture items that were previously displayed. If the patient is not able to recall all 3 items, the examiner will display the 9-picture recognition chart (Refer Fig.2). The 3 original pictures are part of the 9-picture recognition chart. The patient needs to name or point out the 3 original pictures. Every correct picture will score "1" mark. If they are unable to name all 3 correct cards, point out to the patient which cards were correct and incorrect. The process is then repeated with re-displaying the 3 picture cards (Fig.1) and repeating the test after 1 hour. If the patient scores A-WPTAS 18/18, the test is ceased, and patient is assumed to be out of "PTA" phase. Subsequently, the GCS assessment is continued as required.

MILD-TBI OBSERVATION CHART FOR EMERGENCY DEPARTMENTS

The A-WPTAS and GCS score should be charted in a comprehensively designed score sheet, which enables clinicians to rapidly assess PTA and neurological status at a glance. The authors provide an example of a proposed mild-TBI observation chart, incorporating GCS, A-WPTAS scores and relevant neurological parameters. (Refer Fig.3). This observation chart is adapted from A-WPTAS for use in Malaysian ED's. It contains the English as well as the Malay language translation for the 5 orientation questions. This chart can be similarly adapted for suitability and utilized in any other countries. (note: the Malay language translation has not been validated).

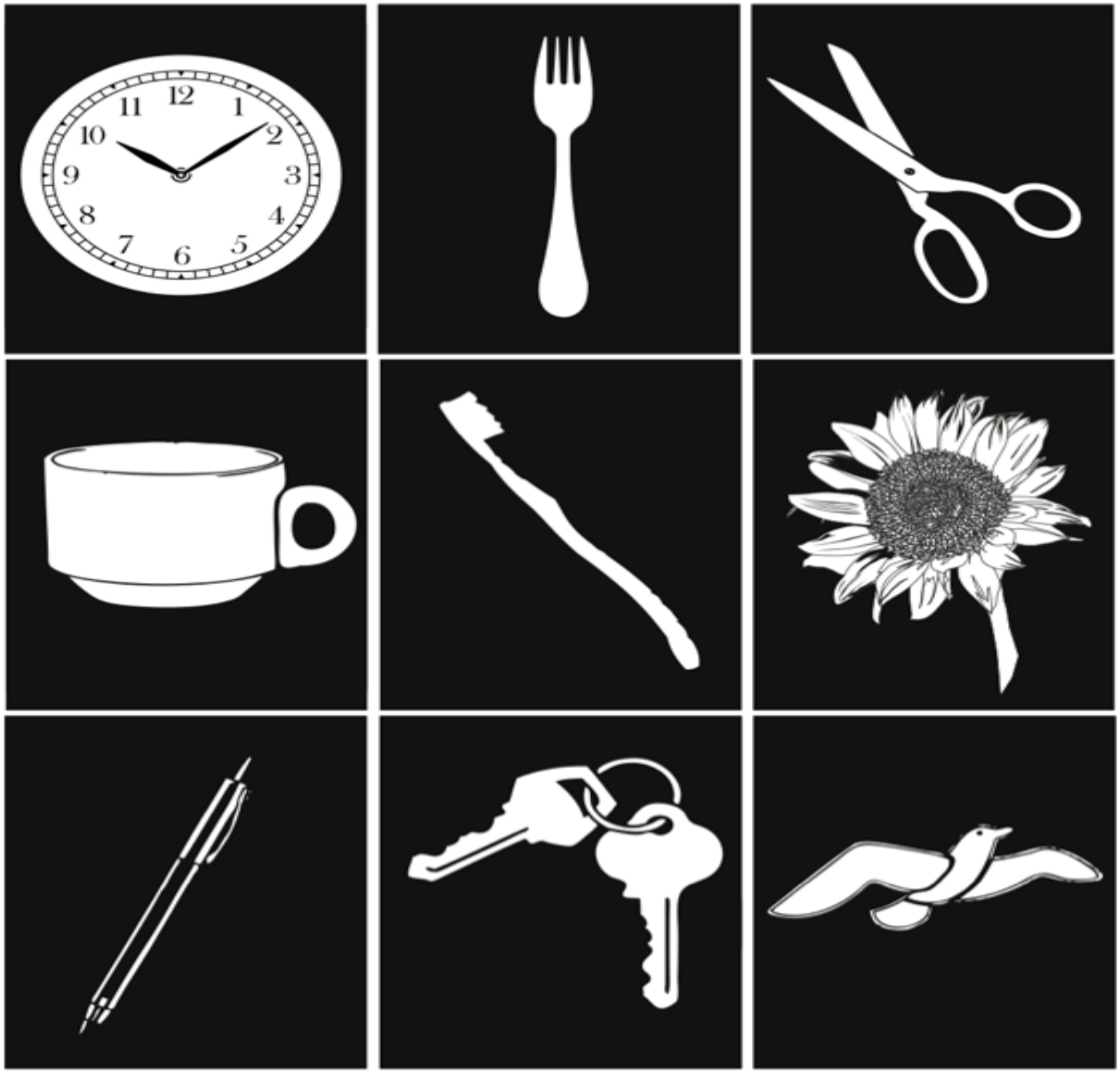
ADAPTING A-WPTAS ASSESSMENT TOOL IN MALAYSIAN EMERGENCY DEPARTMENTS

The authors understand the system, resources, expertise and local practices vary from one region to the other, and hence incorporating the A-WPTAS may require some degree of minor adaptations. The objective is to provide added clinical value for both the clinician and patient by assisting clinical decision-making, disposition and risk stratification. Successful incorporation of the A-WPTAS is only possible if it is coupled together with the implementation of a clearly defined mild-TBI clinical decision tree. The decision tree should incorporate information from A-WPTAS scoring tool to merge and augment existing practices, taking into consideration local clinical practice guidelines, structural / clinical resources, acceptable practices and available expertise. The implementation should focus upon, indications of performing CT Scans, criteria for ward

admissions / referrals, follow-up arrangements upon ED discharge and a marker of injury prognostication. The authors propose the mild-TBI observation and disposition clinical decision tree for Malaysian Emergency Departments (Refer fig.4). While minor adaptations in keeping to local CPG's are made, (number of suggested PTA assessments prior to ward disposition is 6,T0-T6 as compared to 4,T0-T4 in the original A-WPTAS recommendation), the core methodology of the A-WPTAS assessment remains un-altered. With similar implementation strategies, this cognitive screening assessment can be incorporated into Emergency Department protocols within other countries.

Adopted with permission from Shores & Lammel (2007)

Figure 1. 3-picture card. Cup, keys and bird. Pictures used for PTA screening in A-WPTAS assessment.



Adopted with permission from Shores & Lammel (2007)

Figure 2. 9-picture recognition chart. Pictures used for PTA screening in A-WPTAS assessment.

NAME		DATE		EMERGENCY DEPARTMENT MILD TRAUMATIC BRAIN INJURY OBSERVATION CHART (GCS & PTA ASSESSMENT)						
REG NUMBER		TIME OF ADMISSION								
IC NUMBER		TIME OF INJURY		T0 Time:	T1 Time:	T2 Time:	T3 Time:	T4 Time:	T5 Time:	T6 Time:
COMPONENT	RESPONSE		SCORE							
EYE OPENING	Spontaneously Opening		4							
	Open to Speech		3							
	Open to Pain		2							
	No Response		1							
MOTOR RESPONSE	Obeying to Command		6							
	Localising to Pain		5							
	Flexion Withdrawal		4							
	Abnormal Flexion		3							
	Extension		2							
	No Response		1							
VERBAL RESPONSE (English / Malay)	5 ORIENTATION QUESTIONS	Need to provide all accurate answers in order to score 5 points	5	✓ ✗	✓ ✗	✓ ✗	✓ ✗	✓ ✗	✓ ✗	✓ ✗
	i What is your name? / Apakah nama anda?									
	ii What is the name of this place? / Apakah nama tempat ini?									
	iii Why are you here? / Kenapa anda berada di sini?									
	iv What month are we in? / Bulan berapa kita berada?									
	v What year are we in? / Tahun berapa kita berada?									
	Confused		4							
	Inappropriate Words		3							
	Incomprehensible Sounds		2							
	No Response		1							
GCS	Total Glasgow Coma Score			/15	/15	/15	/15	/15	/15	/15
MEMORY ASSESSMENT	Picture 1 CUP / CAWAN	✓	✗	Show Pictures & Review in 1 hour						
	Picture 2 KEY / KUNCI	✓	✗							
	Picture 3 BIRD / BURUNG	✓	✗							
A-WPTAS	Total A-WPTAS Score				/18	/18	/18	/18	/18	/18
Post Traumatic Amnesia (PTA) Present?		✓	✗							
Pre-morbid or External Conditions That May Affect Assessment	Previous Cognitive impairment			Comments						
	Others			Comments						
Clinical Signs of Increase Intracranial Pressure (ICP) Note:										
Clinical Signs of Neurological Deficit / Limb Weakness Note:										
Pupil Size & Reactivity (S:Sluggish R:Reactive NR:Non-Reactive)				L R	L R	L R	L R	L R	L R	L R

Figure 3. Emergency Department mild-TBI observation chart. Incorporating GCS and A-WPTAS score for mild-TBI observation and disposition in Malaysian Emergency Departments.

EMERGENCY DEPARTMENT MILD-TBI OBSERVATION AND DISPOSITION CLINICAL DECISION TREE

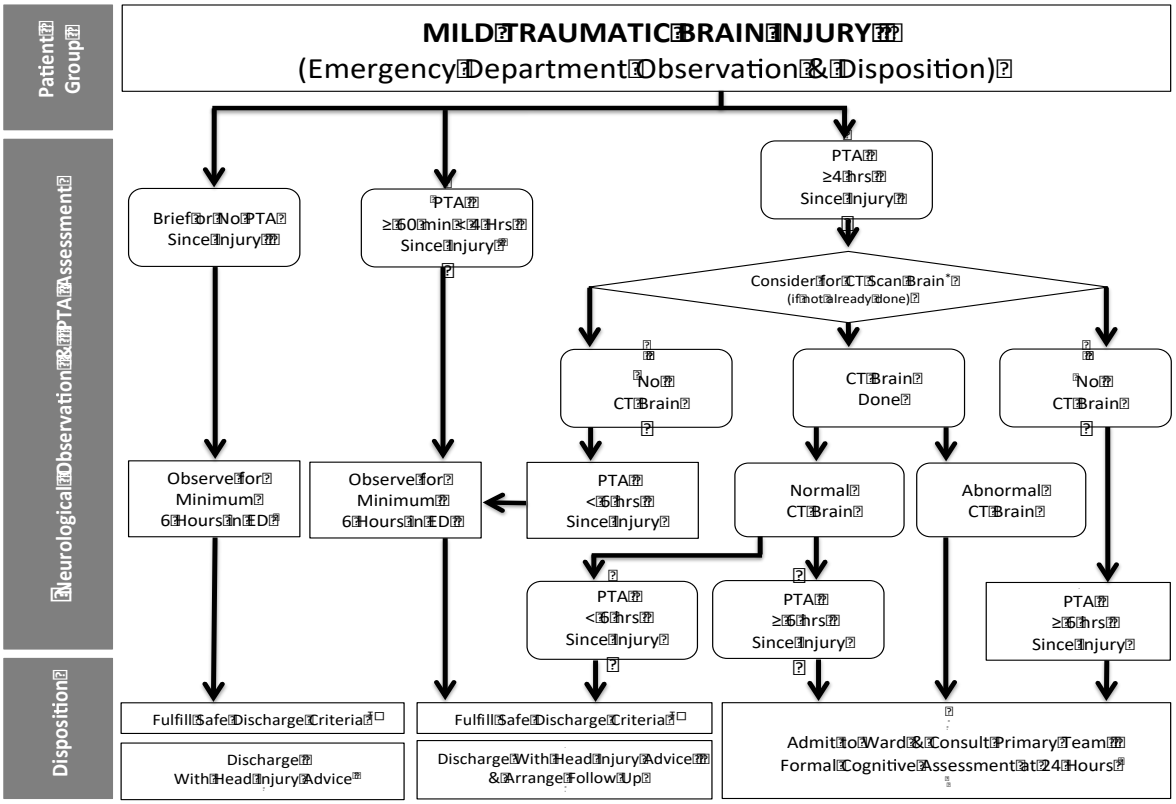
The cohort of patients subjected to this clinical decision tree are ED patients whom have sustained closed mild-TBI within the first 24 hours, sustained impact to the head resulting in confusion, disorientation, lost of memory, lost of consciousness (LOC) and observed in the ED for head charting. This group of patients may or may have not had a CT brain Imaging done. The A-WPTAS score should be interpreted within the limitations of any previous cognitive impairment, history of drug abuse, intoxication, medication or clinical factors that may affect the assessment. The A-WPTAS is not a diagnostic test but a validated screening tool for identifying PTA within the first 24 hours of injury (Refer fig.4).

Mild-TBI Patients with no indications of CT Brain who present with either brief (< 60 mins) or no PTA would be subjected to a minimum total of at least 6 hours observation in the Emergency Department. The minimum observation period is essentially to identify patients with signs and symptoms of increasing intracranial pressure (ie. recurrent vomiting, persistent severe headache or giddiness, blurring of vision, presence of neurology or reduction in conscious level). If present, these patients will be subjected to a CT scan of the brain and managed accordingly. Symptom free patients will be discharged if they fulfil all safe discharge criteria's (Refer Fig. 5). Head injury advice and written note should be provided to all discharged patients and caregivers, advising them to return to ED in the event they develop delayed or worsening symptoms.

Patients experiencing PTA for ≥ 60 mins < 4 hours should be subjected to the minimum 6 hours ED observation. Symptom free patients can similarly be discharged if they fulfil safe discharge criteria. However, this cohort of patients should be arranged for a follow-up appointment. They are at higher risk and therefore should be assessed for the presence of "post-concussion syndrome". Follow up appointments should be arranged within a week from discharge.

Patients with ≥ 4 hours of PTA should be considered for a CT-Brain if this is not already done. Abnormal CT Brain with presence of clinically significant intracranial lesions should be managed as indicated. Patients with a normal CT brain should be continuously assessed using the A-WPTAS score. A persistent PTA of ≥ 6 hours (from time of injury) is an indication for prolonged observation (ward admission) and formal cognitive assessment at 24 hours. Patients with < 6 hours of PTA and a normal CT-Brain can be considered for discharge if they fulfill all safe discharge criteria's. These patients are also at higher risk of developing "post-concussion syndrome" and therefore should have an arranged follow up appointment within a week from discharge. Without previous underlying cognitive impairments, a persistent PTA > 24 hours is indicative of an extensive brain injury. These patients would benefit from occupational therapy, neuro-rehabilitation and neuro-psychological referral.

Patients with ≥ 4 hours of PTA whom are not subjected to a CT-Scan should be continuously assessed using the A-WPTAS score. If PTA is persistent ≥ 6 hours from time of injury, the patient is subjected for prolonged observation (ward admission) and formal cognitive assessment at 24 hours. If PTA is < 6 hours since time of injury, the patient will be subjected to complete a minimum total of 6 hours observation in the ED (In-line with recommendations from the Malaysian Clinical Practice Guidelines for Early Management of Head Injury Patients, 2015). Subsequently, if they are symptom free and fulfill safe discharge criteria, they can be discharged with an arranged follow up appointment within a week.



* *The decision to perform CT Brain is dependent upon the availability of resources and sound clinical judgement*

Figure 4. Clinical decision tree incorporating post traumatic amnesia duration, monitoring and disposition plan for mild traumatic brain injury patients in Malaysian Emergency Departments.

₮ SAFE DISCHARGE CRITERIA'S	
SOCIAL FACTORS	**CLINICAL FACTORS**
Presence of a willing and responsible adult care taker	No clinical signs and symptoms of increasing intracranial pressure (e.g. recurrent vomiting, blurring of vision, persistent severe headache or giddiness)
Easy access to initiate an emergency response call (e.g. 999)	No focal neurological deficits or reduction in conscious level (GCS 15/15)
Living within reasonable distance / access to medical care	Normal CT-brain (if indicated)
Available transport and responsible person to facilitate transfer	Clinically well, able to tolerate orally and ambulating independently
Not under the influence of drugs or alcohol	Passed PTA Screening test in Emergency Department (Score 18/18 in A-WPTAS)
Note 1 *Clinical judgment is required with regards to discharge and follow up of elderly patients and patients with known coagulopathy or bleeding disorder due to increased risk of delayed subdural hematoma*	
Note 2 *Patients who do not fulfill the "Safe Discharge Criteria's" may be admitted for extended observation and primary team consult*	

Figure 5. Safe discharge criteria for Emergency Department mild-TBI observation and disposition (Incorporating A-WPTAS assessment tool).

CHALLENGERS OF IMPLEMENTING A-WPTAS IN EMERGENCY DEPARTMENTS

Development of evidence based clinical practice guidelines and expert clinical pathways have contributed greatly in translating good quality research into beneficial patient outcomes. However the challenge remains in changing practice behaviours in complex environments such as the Emergency Department [35,36] where healthcare providers are contend with care of a divers group constituting patients of varying ages, wide array of medical emergencies and a high turnover of cases. Implementing A-WPTAS holds no exclusion from all these challengers. The authors believe, successful implementation is largely dependent upon sound administrative strategies. It is vital that the entire implementation process is championed by elected ED personnel, either an Emergency Physician or a senior nursing staff. Rigorous efforts to address knowledge gaps amongst the department staff are crucial and can be advocated by multi-sessional training sessions and discussions. A clear framework delineating a strategic implementation time-line would greatly assist. In order to promote standardization and efficacy of practice, bed-side format tools and education materials should be made available especially during the initial phases of implementation. The entire strategy should be audited periodically and outcomes of the evaluation process be utilized for continuous improvement measures.

SUMMARY

It is essential that strategic PTA screening tools be incorporated into the prospective clinical assessment of traumatic brain injury victims during ED presentation and observation. The A-WPTAS provides a rapid and comprehensive screening method for mild-TBI induced cognitive impairments. Incorporating the screening assessment into "virgin" local practices may require a certain amount of adaptation in order to achieve effective implementation. Aside from promoting awareness, it is essential that a clinical decision tree utilising PTA assessment is created taking into consideration the recommendations of existing local guidelines. When coupled with a clearly defined clinical decision tree, the information gathered from A-WPTAS can greatly assist ED Doctors in providing effective clinical decision-making and disposition of patients. The authors believe that such interventions may be an effective risk reduction modality in reducing premature discharges of patients with subtle cognitive impairments, of which otherwise may go undetected. In such instances, this can be debilitating both for the patient and family members. Undiagnosed cognitive impairments as such, may gradually render the victim to socially deteriorate without having a "safety net" access back into the healthcare system. This guideline acts as a tool to assist Emergency Departments in Malaysia as well as other countries with similar systems to develop effective internal protocols that incorporate PTA screening in clinical decision-making and disposition of mild-TBI victims.

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