

# School of hard knocks

Head injuries can be very scary, especially when they occur in the young and the elderly.

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**W**HEN a star is snuffed out, much light is shed on the circumstances surrounding their demise. Indeed, anyone following the story of Natasha Richardson's untimely exit stage left would by now be familiar with the term "epidural haematoma" and the danger even a beginners' ski slope can pose.

However, it is not on alpine slopes alone that one should guard against head injury, nor are fatal epidural haematomas the most common traumatic brain injury one can sustain.

So this week, *Fit For Life* presents a follow-up to and some perspective on the recent coverage with an overview of traumatic brain injury in everyday life.

Assisting us are Hospital Sungai Buloh Head of Anaesthesiology and Intensive Care, neuro-anaesthesiologist Dr Lim Wee Leong and UMMC division head and consultant neurosurgeon Assoc Prof Vickneswaran Mathaneswaram.

## What is traumatic brain injury (TBI)?

TBI occurs as a result of extreme physical assaults on the head and brain, eg an impact strong enough to dislodge the brain within the

precious cargo our bodies carry. As such, our bodies reserve for them the honour of their own fluid-filled chambers in which to float, protected from harmful impact. While babies *in utero* bob in a sac of amniotic fluid within the womb, the brain bobs in a bath of cerebrospinal fluid within a sac called the dura inside the skull.

As a floating object, the brain can be displaced and thrown against the skull by direct blows to or impact against the head; a sudden movement or momentum change (eg whiplash sustained in a motor accident); or violent shaking of the head (eg in Shaken Infant Syndrome or when headbanging excessively to music – please refer to the accompanying sidebar, *Headbanging - Stairway to Heaven?*).

In general, injuries that cause a short loss of consciousness are called **concussions**. Impact to the head can also cause bruising of the brain, where blood vessels tear and bleed inside the skull. Such bruises are called **contusions**.

If bleeding continues unimpeded, blood can pool and clot in the spaces between the brain, the membranes that line it (the meninges), and the skull. This, as explained in the column Tell Me About, last week, is known as a **haematoma**. Intra-cerebral bleeds (bleeding inside the brain itself) are also



## ASSESSING HEAD INJURIES WITH THE GLASGOW COMA SCORE

Physicians use the Glasgow Coma Score (GCS) to assess the severity of a patient's head injury by repeatedly assessing his level of consciousness as a measure of his ability to open his eyes, communicate verbally and move.

- The maximum of 15 indicates a minor injury
- Scores between 14 and 13 indicate mild injury
- Scores below 12 indicate moderate to severe injury, with the minimum of 3 describing a patient that is completely unresponsive to any stimuli

Originally developed in 1974, the GCS has undergone various revisions and modifications to improve its predictive ability and to extend it to use to assess infants (non-speaking) and young children. Studies have shown that lower GCSs are associated with higher mortality rates among patients hospitalised for head injuries. For example, in Malaysia, a patient who arrives at a hospital with a GCS of 3 is looking at a mortality rate if between 90 and 100% (ie he has a 9 or 10 out of 10 chance of dying), according to Hospital Sungai Buloh Head of Anaesthesiology and Intensive Care, neuro-anaesthesiologist Dr Lim Wee Leong. For patients arriving with GCSs above 9 though, the mortality rate is above 10%.



Score	Glasgow Coma Score for adults	Modified GCS for children under 5	Modified GCS for infants		
<b>Eye-opening</b>  	4	Can open eyes spontaneously	Similar to adults		
	3	Can open eyes on verbal command			
	2	Opens eyes only in response to painful stimuli			
	1	Does not open eyes in response to any stimulus			
	5	Oriented and speaks coherently		Oriented, uses appropriate words	Coos and babbles
<b>Verbal response (communication)</b>  	4	Disoriented but can speak coherently	Confused, uses inappropriate words	Cries irritably	
	3	Uses inappropriate words or incoherent language	Cries and/or screams	Cries in response to pain	
	2	Makes incomprehensible or non-specific sounds	Makes incomprehensible words or non-specific sounds	Moans in response to pain	
	1	No verbal response at all	No verbal response at all	No verbal response at all	
	<b>Motor response</b>	6	Can move arms and legs in	Obeys commands	Moves spontaneously and

to dislodge the brain within the skull or break the skull itself, or a violent shaking of the head that pulls nerve fibres and blood vessels inside the brain apart.

Such injuries can impair brain function in the short- and long-term, depending on their location and severity, as well as the age and general health of the injured person.

In the short-term, persons with mild TBI may experience a loss of consciousness, confusion, headaches, dizziness, a ringing in the ears, memory loss, fatigue, lethargy and trouble concentrating, ie a mild disruption of any given brain function.

Persons with moderate or severe TBI may experience worsening headaches, vomiting or nausea, slurred speech, a loss of coordination, weakness in the extremities, seizures, coma or death.

In the long-term, persons who have sustained TBI have been shown to stand a higher chance of experiencing permanent brain dysfunction (impaired cognition, sensory perception, and communication) and developing neurological diseases like epilepsy, Parkinsonism (symptoms of Parkinson's disease, but not the disease itself), Alzheimer's disease and dementia.

For example, a Danish study published in March by *The Lancet* showed that the risk of developing epilepsy in children and young adults more than doubles for more than 10 years after a mild TBI or skull fracture. In children and young adults who suffer a serious TBI, the risk was seven times higher than normal.

To understand how TBI can affect the brain so profoundly, let's take a closer look at the basic structure of the brain.

## Brain anatomy and TBI

Brains and babies are the most

fragile, eg an infant's head can bleed inside the brain itself) can also occur if a very high force of impact is directed at the head.

Finally, like any bone, the skull can break, or **fracture**, if sufficient impact is sustained.

The three major management issues Dr Lim faces in cases of severe head injury are brain swelling (eg when a haematoma blocks the normal flow of cerebrospinal fluid); raised pressure in the skull (raised intracranial pressure); and oxygen starvation (hypoxic brain injury).

As the skull is a rigid enclosed structure, a swelling and bleeding brain will raise the pressure inside it. Unless this is relieved, the increased pressure will constrict the brain's blood vessels and slow the flow of blood through them. Without an adequate supply of oxygen-bearing blood, the cells of the brain will die.


## TBI or just a bump on the head?

When a patient loses consciousness as a result of a head injury, the course of action is clear and they are usually brought to a doctor. Problems occur, warns Prof Vickneswaran, when patients sustain significant knocks but remain alert and insist they are "fine".

"These are patients who may go home with a headache and decide to take a nap and do not wake up," he says.

Nine out of 10 TBIs are mild, concedes Dr Lim, light concussions that generally do not get reported as the injured persons don't bother to see a physician. However, while such mild injuries do resolve themselves, not seeking medical attention is a mistake.

"No matter how mild a head injury is, it must be assessed by a physician," he stresses.

	6	Obey commands	Moves spontaneously and purposefully
	5-2	Shows movement in response to a variety of stimuli, including pain	Similar to adults
	1	No movement in response to stimuli	No movement in response to stimuli

### References:

1. A Review of the Predictive Ability of Glasgow Coma Scale Scores in Head-Injured Patients, *J Neurosci Nurs* (2007)

2. GCS table adapted from information taken from US Department of Health and Human Services National Guideline Clearinghouse, World Health Organisation and [medicinenet.com](http://medicinenet.com)

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## How to tell all is not well

"We all bump our heads, so one has to consider how severe was the bump, are they truly feeling fine?" says Prof Vickneswaran.

Ideally, anyone who sustains a "good-sized bump" should be examined by a physician or hospital accident and emergency department and be observed – either at the hospital or at home, depending on the severity of the injury – for at least 24 hours.

"Also, don't go to sleep without anyone knowing if you already don't feel completely well after a bump," advises Prof Vickneswaran.

The initial examination and observation period are important as it is usually the change in a patient's condition that indicates the injury may be serious, or have serious complications, especially if the patient does not display any symptoms initially.

For adults observed at home, warning signs include:

- Persistent and/or worsening headache
- Progressive confusion
- Nausea and vomiting
- Progressive weakness on one side of the body

For infants and children, parents should additionally watch out for

irritability, persistent, unexplained crying, and becoming inactive or not responsive.

Should any of these signs develop, they must go to a hospital immediately for further checks, which will most likely involve a CT scan of their brains.

For patients observed by a physician, warning signs include unequal pupil dilation; changes in their level of consciousness for the worse or a level of consciousness that does not improve; and/or vomiting.

A patient's level of consciousness is typically measured by the Glasgow Coma Score (GCS) (please refer to the accompanying table, *Assessing Head Injuries with the Glasgow Coma Score* for more information).

## Special cases

**Elderly persons** need to be wary for much longer (between four and six weeks), points out Prof Vickneswaran, as they may slowly develop another problem called chronic subdural haematoma (the brain shrinks with age, causing it to pull away from the dura, making it easier to tear the veins between them when the head is shaken or stirred).

**Those with bleeding problems or those on blood thinners** should

be more careful and consider formal observation ie at a hospital or have someone look after them for the next 24 hours or so if they take a significant knock to their heads.

**Shaken Baby Syndrome (SBS)** is a form of criminal abuse and, sadly, fairly common in Malaysia, says Prof Vickneswaran. SBS occurs when the abuser aggressively shakes a baby or young child, causing blood vessels and nerves to tear within the skull due to the whip-lashlike motion.

Signs of SBS include those mentioned above as well as changes in eating patterns, difficulty breathing and seizures. Outcomes include life-long disability, coma and death.

In instances where children are looked after by a caretaker, parents are advised to watch out for such occurrences and signs of abuse like fractures and unexplained bruising. Instances in which the parents themselves are the abusers are another, complicated, issue altogether – one for another discussion.

## In charge of heads

Persons who sustain head injuries can expect to see:

- Their normal healthcare provider/general practitioner, for first

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aid, or emergency medicine physicians, the first line of response at a hospital

- Neurosurgeons, who will operate on them
- Intensive care specialists
- A range of therapists during the rehabilitation process, as they may have been bed-ridden for a prolonged period

### #1 cause: road traffic accidents

According to Dr Lim, the leading cause of traumatic brain injury (TBI) in Malaysia is road traffic accidents. Falls from heights and industrial accidents come in second, and violent injuries (being beaten up by thugs, for example) third.

"The young who want to show off on motorbikes or those who have just learnt to drive, with less than three years driving (experience) – they are the most at risk population," he says.

Of the 6000 people who die every year in road traffic accidents, one third die purely from traumatic brain injuries.

The majority of these people, according to Royal Malaysia Police statistics, are young, male motorcyclists travelling on trunk roads.

"Motorcyclists are suicidal in Malaysia, enforcement is almost non-existent. Traffic lights seem optional these days..." notes Prof Vickneswaran.

On the subject of the media coverage of Richardson's death, he adds: "This focus is because a celebrity died and really she should not have as the condition is theoretically treatable, so there is lots of interest.

"But daily people die on our roads from more severe forms of head injury and often management is sub-optimal and primary prevention on the roads is almost non-existent and worsening by the day."

Statistically, your best chance of preventing a TBI is to be more careful on road:

- Buckle up in the front and back seat
  - Wear helmets when riding a motorcycle
  - Drive at a reasonable speed
  - Don't drink and drive
  - Don't get distracted while driving/riding, eg by smsing
  - Be wary of, and make it a point to report, reckless bus/lorry/truck drivers
- It doesn't take a genius to figure those out, or that the school of hard knocks is one you won't graduate from smarter!

### References:

1. HealthDay article: Head Injury While Young Ups Epilepsy Risk; [http://www.nlm.nih.gov/medlineplus/news/fullstory\\_80929.html](http://www.nlm.nih.gov/medlineplus/news/fullstory_80929.html)
2. Living with Brain Injury, Brain Injury Association of America; <http://www.biausa.org/education.htm>
3. Predictive Ability of Glasgow Coma Scale, J Neurosci Nurs (2007)