UNIVERSITI PUTRA MALAYSIA

ASSOCIATION BETWEEN INTRACRANIAL BLEEDING ON PLAIN COMPUTED TOMOGRAPHY (CT) BRAIN WITH GLASGOW COMA SCALE AMONG TRAUMATIC BRAIN PATIENTS IN HOSPITAL SERDANG

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Abstract

Background: Intracranial bleeding is a serious public health problem [1] and an important consequence of traumatic brain injury and believed to be the leading cause of morbidity and mortality in the world for individuals under the age of 45 [2].

Aims: To determine the association between intracranial bleeding (ICB) on plain CT brain with Glasgow Coma Scale (GCS) among traumatic brain patients in Hospital Serdang.

Methods: This was a cross sectional study using secondary data which involved all adult patients of the age group of 18 and above who undergo plain head computed tomography (CT) examination in Hospital Serdang following head trauma from January 2011 to December 2012. Data from their medical reports were recorded and analysed.

Results: From our study, the only significant p-value is for intraventricular haemorrhage with 0.019. Meanwhile, the other ICBs do not have significant value. For the association between epidural haemorrhage (EPH) and GCS, the p-value is 0.237. For association between subdural haemorrhage (SDH) and GCS, the p-value was 0.495. Meanwhile, for

the association between subarachnoid (SAH) and intraparenchymal haemorrhage (IPH) with GCS, the p-value obtained was 0.233 and 0.062 respectively. The p-value was 1.000 for the association between diffuse axonal injury (DAI) and GCS. Overall, there was no significant association between EPH, SDH, SAH, IPH and DAI with Glasgow Coma Scale except for IVH.

Conclusion: In conclusion, this study shows that most of intracranial bleeding did not have significant association with Glasgow Coma Scale except for intraventricular haemorrhage. Overall, the null hypothesis is not rejected.

Keywords: *Intracranial bleeding, traumatic brain injury, Glasgow Coma Scale, CT scan*

PERKAITAN ANTARA PENDARAHAN INTRAKRANIAL ATAS TOMOGRAFI BERKOMPUTER (CT) OTAK BIASA DENGAN GLASGOW COMA SCALE DI KALANGAN PESAKIT OTAK TRAUMA DALAM HOSPITAL SERDANG

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ABSTRAK

Latar belakang

Pendarahan intrakranial adalah perkara yang biasa terjadi dan serius yang berlaku berpunca daripada kecederaan trauma otak. Kelaziman ini boleh dikatakan tinggi kerana ia meliputi lebih daripada separuh daripada semua kecederaan trauma otak.

Objektif

Objektif utama adalah untuk mengkaji hubungan antara pendarahan intrakranial dengan *Glasgow Coma Scale* di kalangan pesakit kecederaan trauma otak yang dirujuk kepada Unit Radiologi Hospital Serdang dari Januari 2011 hingga Disember 2012.

Cara-cara

Ini adalah satu kajian keratan rentas menggunakan data sekunder yang melibatkan semua pesakit dewasa dari umur 18 tahun dan ke atas, yang menjalani pemeriksaan kepala CT di Hospital Serdang berikutan trauma kepala dari Januari 2011 hingga Disember 2012. Data daripada laporan perubatan telah direkodkan dan dianalisis.

Keputusan

Dari kajian kami, satu-satunya nilai-p yang signifikan adalah untuk pendarahan *Intraventricular* sahaja dengan 0.019. Sementara itu, ICBs lain tidak mempunyai nilai p

yang signifikan. Untuk hubungan antara *epidural* pendarahan (EPH) dan GCS, p-nilai adalah 0.237. Bagi perkaitan antara pendarahan *subdural* (SDH) dan GCS, p-nilai adalah 0.495. Sementara itu, bagi hubungan antara *subarachnoid* (SAH) dan pendarahan *intraparenchymal* (IPH) dengan GCS, nilai p yang diperolehi ialah 0.233 dan 0.062 masing-masing. P-nilai adalah 1.000 untuk perkaitan antara *diffuse axonal injury* (DAI) dan GCS. Secara keseluruhannya, tidak ada persatuan yang ketara antara EPH, SDH, SAH, IPH dan DAI dengan *Glasgow Coma Scale* kecuali IVH.

Konklusi

Kesimpulannya, kita mendapati bahawa kebanyakan pendarahan intrakranial tidak mempunyai perkaitan dengan *Glasgow Coma Scale* kecuali pendarahan *intraventricular*. Oleh itu , kita gagal untuk menolak hipotesis *null*. Oleh itu, tidak ada perkaitan antara pendarahan intrakranial dan *Glasgow Coma Scale*.

Kata kunci

Pendarahan intrakranial, kecederaan otak trauma, *Glasgow Coma Scale*, CT scan

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LIST OF ABBREVIATIONS

TBI	=	Traumatic Brain Injury
ICB	=	Intracranial Bleeding
GCS	=	Glasgow Coma Scale
MVA	=	Motor-Vehicle Accident
EDH	=	Epidural Haemorrhage
SDH	=	Subdural Haemorrhage
SAH	=	Subarachnoid Haemorrhage
IPH	=	Intraparenchymal Haemorrhage
IVH	=	Intraventricular Haemorrhage
DAI	=	Diffuse Axonal Injury
AIS	=	Abbreviated Injury Scale

CHAPTER 1

INTRODUCTION

Intracranial bleeding is a common and serious consequence of traumatic brain injury. Intracranial bleeding can be classified according to location, into epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and diffuse axonal injury (Pablo P. et al., 2009).

According to Malaysia National Trauma Database (January 2008 – December 2008), the percentage of intracranial injury was 50.78% or 813 cases out of 1601 cases of all traumatic brain injuries for major trauma cases. The prevalence is consider high since it occupied more the half of all traumatic brain injuries (Malaysia National Trauma Database, 2008).

Glasgow Coma Scale (GCS) is used widely in assessment of coma and impaired consciousness since it is reliable yet easy to be used (Teasdale G. and Jennat B., 1974). Our local data on head injury especially intracranial bleeding is lacking and needs to be updated. This is because the latest report available in National Trauma Database is in year 2008. Thus, this study may provide some local data related to GCS in staging intracranial bleeding which may provide some idea on the health care burden to the hospital.

1.1 Problem statement

Intracranial bleeding such as epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and diffuse axonal injury is a serious common health problem worldwide and Glasgow Coma Scale (GCS) usually used to assess the patient's level of consciousness (Youmans J. et al., 2004) (Jennet B., et al., 1975). However, the

results obtained from intracranial bleeding patient will be varies from patient to patient due to heterogeneity of patients (Kuo J.R., et al., 2010). Therefore, we are conducting this study in order for us to know the association between intracranial bleeding and GCS.

1.2 Objectives

1.2.1 General Objective

To study the association between intracranial bleeding with Glasgow Coma Scale among traumatic brain injury patients referred to Radiology Unit of Hospital Serdang from January 2011 to December 2012.

1.2.2 Specific objectives

1. To determine the association of Glasgow Coma Scale with epidural haemorrhage
2. To determine the association of Glasgow Coma Scale with subdural haemorrhage
3. To determine the association of Glasgow Coma Scale with subarachnoid haemorrhage
4. To determine the association of Glasgow Coma Scale with intraparenchymal haemorrhage
5. To determine the association of Glasgow Coma Scale with intraventricular haemorrhage
6. To determine the association of Glasgow Coma Scale with diffuse axonal injury

1.3 Research Hypothesis

Alternative hypothesis: There is association between intracranial bleeding on plain CT brain and Glasgow Coma Scale.

Null hypothesis: There is no association between intracranial bleeding on plain CT brain and Glasgow Coma Scale.

1.4 Conceptual Framework

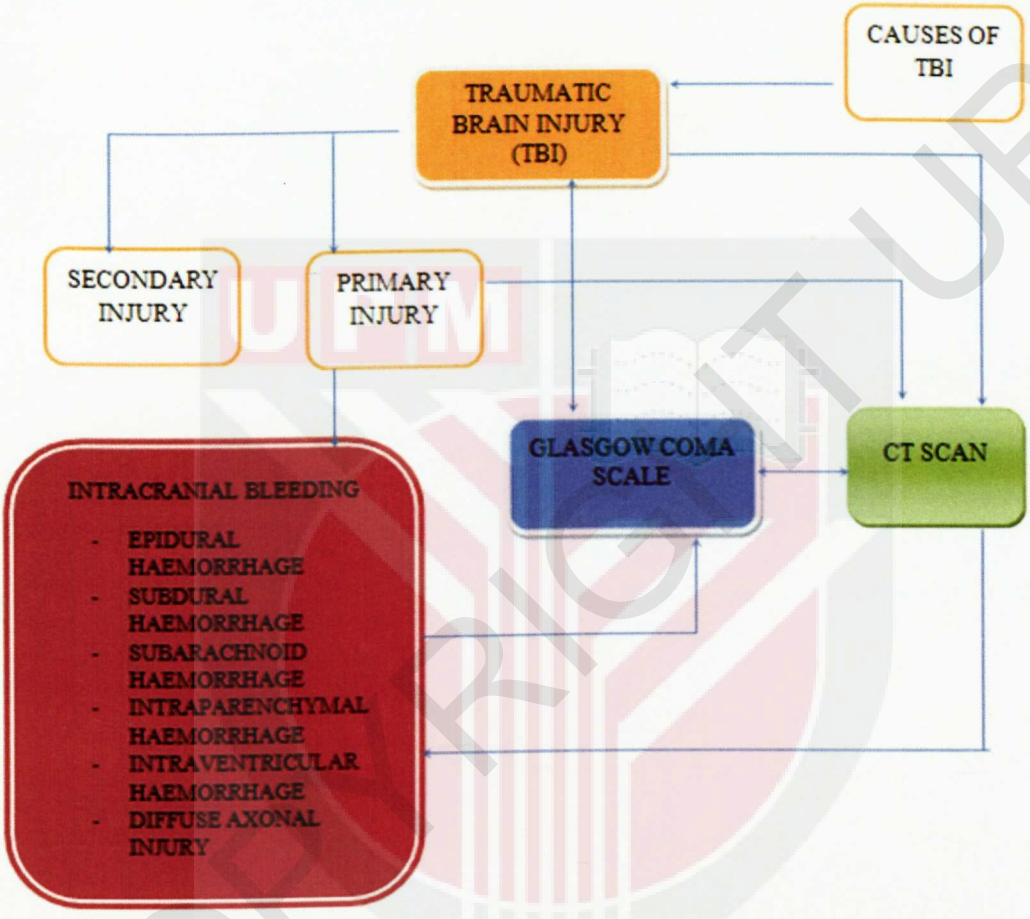

Figure 1 : Conceptual Framework

In our study, we wanted to find the association between intracranial bleeding and Glasgow Coma Scale. Intracranial bleeding is one of the consequences of traumatic brain injury (TBI) which can be caused by many reasons. Effects of TBI can be divided to two types; primary injury and secondary injury. Intracranial bleeding is one of the primary injury types and only can be seen by CT scan. There were 6 six subtypes of intracranial bleeding that we used as independent variables in this study which were epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage,

intraparenchymal haemorrhage, intraventricular haemorrhage and diffuse axonal injury. Meanwhile, Glasgow Coma Scale is one of few ways to assess the condition of traumatic brain patients.

CHAPTER 2

LITERATURE REVIEW

2.1 Traumatic Brain Injury

According to third report of Malaysia National Trauma Database in year 2008, percentage of intracranial injury was 50.78% or 813 cases out of 1601 cases of all traumatic brain injuries (National Trauma Database, 2008). Among all intracranial injuries, subdural haemorrhage has the highest percentage that is 43.74% or 395 cases out of 1246 cases. The second highest was subarachnoid haemorrhage which is 21.59% or 195 out of 1246 cases. While the percentage of epidural haemorrhage was not high as compare to subdural haemorrhage and subarachnoid haemorrhage, since its percentage was only 5.76% or 52 out of 1246 cases (National Trauma Database, 2008). The percentage of focal brain injury or intraventricular injury is the lowest among all causes of intracranial injury that is 8 cases out of 1246 cases or 0.89 % (National Trauma Database, 2008).

Traumatic brain injury is considered to be a serious public health problem (Langlois JA et al., 2004) and believed to be the leading cause of morbidity and mortality in the world for individuals under the age of 45 (Werner C. et al., 2004). In most cases, the leading causes of traumatic brain injury are falls (28%), motor vehicle accidents (20%), being struck by or against object (19%), and assaults (11%) (Langlois JA et al., 2004) .The leading causes in adults and children (10-18 years) are different. In adults, the leading causes are motor vehicle accidents and falling down. While in children, the most common cause is falling down and follows by motor vehicle accidents (Youmans J., 2004).

In Malaysia, according to Report of National Trauma Database in 2009, most of the trauma cases are due to road traffic accidents (70.1%), followed by falls from

heights (8.3%), assaults (5.2%) and industrial accidents (1.6%). Among all cases, 39.3% of patients who were injured at home died, followed by those injured at industrial / construction sites (37.5%) and road/highway injuries at 27.6%.

2.2 Definition of Traumatic Brain Injury

Different journals or articles have difference definition of traumatic brain injury (TBI) and usually there are no universally accepted diagnosis criteria for TBI. TBI has many terms which are similar to its meaning such as brain concussion, head injury, closed head injury or even simply mild head injury (Kruijk JR, et al., 2001). Another commonly seen definition is "Traumatic brain injury is defined as a blow to the head that results in diminished abilities subsequent to the injury and that requires rehabilitation and intervention … [and] is primarily caused by the motor vehicle accidents and violent crimes.(Ellis DW et al., 1989)"

According to Centres for Disease Control and Prevention (CDC), "A TBI is caused by a bump, blow or jolt to the head or a penetrating head injury that disrupts the normal function of the brain. Not all blows or jolts to the head result in a TBI. The severity of a TBI may range from mild, i.e., a brief change in mental status or consciousness to severe, i.e., an extended period of unconsciousness or amnesia after the injury." (National Centre for Injury Prevention and Control, 2003)

Another problem is about the underestimation. Traumatic brain injury is always referred as silent epidemic because the impact of TBI is often not visible. In United States, Mild Traumatic Brain Injury accounts for 75% of all Traumatic Brain Injury. However, it is clearly mentioned that the consequences of Mild TBI is not mild (Julie L. G., 2003).

The causes of traumatic brain injury are fall, motor-vehicle accident(traffic), assaults, being struck by against an object, (Brown AW et al., 2008) sports-related injury (J. Oestern et al., 2011), firearm use, blast injuries for active duties, violence such armed conflicts and terrorists activities (Andrew et al., 2008). Most of the authors have mentioned that motor-vehicle accident is the leading cause of traumatic brain injury (Redelmeier et al., 2003). Besides, there are also some authors that mentioned, injury related to fall also become the first leading cause of traumatic brain injury (Langlois JA et al.,2004).

Intracranial bleeding is one of the subtypes of CT findings in traumatic brain injury. Intracranial bleeding is a term used to define many conditions characterised by the extravascular blood accumulation within different intracranial spaces for examples epidural hemorrhage, subdural hemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and diffuse axonal injury (Dr Yuranga W. et al., 2011).

2.3 Primaries and Secondary Injury in TBI

Traditionally, the damage to the brain caused by traumatic brain injury is divided into primary and secondary injuries. Primary injury is the injury that occurs as a direct result of traumatic impact, which means at the moment of impact, the injury will occur. Examples of primary injuries are the epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and traumatic/diffuse axonal injury (Youmans J et al., 2004).

Secondary injury is the injury that develops minutes to days after the primary trauma. Triggered by the primary traumatic event, it can lead to cerebral swelling and

herniation following through a series cascade of events. Examples of secondary injuries are cerebral swelling, cerebral herniation, cerebral ischemia and infarction.

2.4 Types of Intracranial Bleeding

Intracranial bleeding falls under the category of primary injury of traumatic brain injury (K.A. Tong., et al., 2006). And there are six subtypes of intracranial bleeding which are epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage and traumatic/diffuse axonal injury (J. K. Jane., et al 2011).

Epidural haemorrhage is the injury or laceration to middle meningeal artery, spheno-parietal sinus or sigmois sinus and leads the dura to strip away from skull (Bullock M.R. et al., 2006). If the laceration is in middle meningeal artery, the hematoma most commonly occur in the temporal or temporo-parietal regions, (Bullock M.R. et al., 2006), while if the laceration is in spheno-parietal sinus, it occur in middle cranial fossa and posterior fossa if laceration in sigmoid sinus (Gean AD et al., 2010).

Subdural haemorrhage occur in case of injury to superficial bridging vein that will results in bleeding between meningeal layer of dura and arachnoid (Aiken A.H. et al., 2010). As the bridging veins progressively stretched and injured, blood may accumulate in this space (Aiken A.H. et al., 2010).

Subarachnoid haemorrhage may occur in case of direct laceration of small cortical vessels traversing the subarachnoid space or even redistribution of intraventricular haemorrhage exiting the fourth ventricular outflow foramen. It also can occur in event of direct extension from cortical contusion (Servadei F. et al., 2002).

Intraparenchymal haemorrhage can be divided into contusion or diffuse axonal injury which can be haemorrhagic or non-haemorrhagic or both (K.A. Tong., et al., 2006). Diffuse axonal injury (DAI) is a specific type of primary traumatic injury (Meythaler J.M. et al., 2001). Diffuse axonal Injury is the injury over a more widespread area. This injury is not the result of a blow to the head. But, it results from the brain moving back and forth in the skull. It is as result of acceleration or deceleration (Timothy R., 2011). In patients with DAI, 80% has demonstrated multiple area of injury on CT scan (Timothy R., 2011). The pathology of DAI is histologically characterized by widespread damage to the axons of brainstem, corpus callosum, parasagittal white matter of cerebral cortex and grey matter junction of cerebral cortex (Meythellar J.M. et al., 2001). Severe DAI is associated with prolonged unconsciousness and poor outcome (Douglas H. et al., 2000).

2.5 Glasgow Coma Scale

Glasgow Coma Scale (GCS) is a 15 point grading scale that is being used to assess a patient's level of consciousness. The classification of clinical severity of Traumatic Brain Injury is based on GCS system (Langlois JA et al., 2004). GCS neurological scale allows the evaluation of level of consciousness through the assessment of eye, motor and also verbal responses of the patients that being evaluated by the physicians. According to Teasdale and Jennett, GCS is used for facilitating the neurologic assessment of patients. The GCS was designed to provide an easy to use tool for the inexperienced care providers, for their lack of evaluation skill (S.H. Faro et al., 2012).

GCS had become a great tool initially because the CT scan was not available yet. For better assessment of an individual's severity, the three components should be reported separately (Andrew et al., 2008). The score is determined by the summation

of the three scores from respective categories. The maximum score is 15(no impairment), while the minimum score is 3(worst).

Patient with mild head injuries are defined with GCS of 13-15. The moderate head injury is defined as GCS of 9-12 while for severe head injury is defined as GCS less than 8. Usually, the severity distribution is approximately 80% of mild, 10% of moderate and 10% severe. Majority of the patients are classified as having mild traumatic brain injury when they are presented in Emergency Department (Julie L. G., 2003).

Some investigators have suggested that any score below 15 requires imaging test (Jagoda AS et al., 2002). Whereas, other investigators have suggested that imaging test should not be done unless the score is below 13. There are investigators mentioned that patient with GCS score of 14 points or less and patients with GCS score of 15 but presence of risk factors are need to be scanned (Bullock MR et al., 2006).

Table I : Glasgow Coma Scale

GLASGOW COMA SCALE (GCS)		
Eye Opening (E)	Motor Response (M)	Verbal Response (V)
- Spontaneous (4) - To voice (3) - To painful stimuli (2) - None (1)	- Follows commands (6) - Localizes (5) - Withdraws (4) - Abnormal flexion (3) - Extension (2) - None (1)	- Oriented (5) - Confused (4) - Inappropriate word (3) - Moaning (2) - None (1)

Extract from Gustilo RB, Anderson JT. Prevention of infection in the treatment of 1025 open fractures of long bones. J Bone Joint Surg.

The Glasgow Coma Scale is determined with all summation from each category.

GCS = E + M + V.

2.6 Role of Imaging

Imaging plays a very critical role in diagnosis of traumatic brain injury since the intracranial injury cannot be seen by the naked eyes or even some imaging modalities. In order to identify whether there is a TBI within short duration yet accurate, non-contrast CT scan is always the modality choice (Jane J. et al., 2011). According to K.A Tong et al., (2006) the roles of imaging of brain include to determine the necessity of immediate surgical intervention, identify the benefit of early therapy to the patient and also to measure the rehabilitation therapy to the post-traumatic patient. Abnormalities or pathologies that can be identified through imaging especially CT scan include epidural haemorrhage, intraparenchymal haemorrhage, intraventricular haemorrhage, subarachnoid haemorrhage, extracranial haemorrhage, cortical contusion and traumatic axonal injury (Perron et al.,2008)(Jane J. et al., 2011).

Besides, imaging of brain also plays an important role in prediction of progression of brain injury. There is a study indicates that massive intraventricular haemorrhage and subarachnoid haemorrhage are associated with poor prognosis (Dennis J. et al., 2009). While a study conducted by Lannoo and colleagues find that, intracerebral haemorrhage, subdural haemorrhage and subarachnoid haemorrhage were predictive of mortality but to lesser extent to morbidity (Lannoo E et al., 2000).

On the other hand, CT scanning is very useful for localizing the source of the bleeding. For the diagnosis of Subarachnoid Haemorrhage and localizing of bleeding site, CT scan allows for some degree of prognostic, particularly in probability for the development of vasospasm in brain (Jeffrey J.P. et al., 2011). Detection of these lesions can never be confirmed by naked eyes or even physical examination.

CHAPTER 3

MATERIALS AND METHODS

3.1 Study Location

The study was carried out in Radiology Department of Hospital Serdang.

3.2 Study Design

The study design that was used is cross sectional study using secondary data. The data of traumatic brain injury patients that we used is from January 2011 to December 2012.

3.3 Sampling

3.3.1 Study Population

The study population involved all traumatic brain injury patients on diagnosis of intracranial bleeding admitted to Hospital Serdang from January 2011 to December 2012.

3.3.2 Study sample

The inclusion criteria are all adult patients of the age group of 18 and above who underwent plain head CT examination in Hospital Serdang following head trauma. The exclusion criteria are all patients with age group less than 18 and patients who underwent plain head CT examination on other reason such as stroke or meningitis.

3.3.3 Sampling frame

- **Study populations:** All traumatic brain injury patients on diagnosis of intracranial bleeding admitted to Hospital Serdang from January 2011 to December 2012.
- **Study unit:** One traumatic brain injury adult patient with diagnosis of intracranial bleeding admitted to Hospital Serdang from year January 2011 to December 2012.

3.3.4 Sampling unit

Traumatic brain injury adult patient with diagnosis of intracranial bleeding admitted to Hospital Serdang from year January 2011 to December 2012.

3.3.5 Sampling method

The sampling method that used in this research was the simple random sampling method. It was used to choose samples of traumatic brain injury patients on diagnosis of intracranial bleeding who underwent CT scan from the list of medical records in database of Radiology Department of Hospital Serdang.

3.3.6 Sample size

$$n = \frac{z^2 P(1-P)}{d^2}$$

$$n = \frac{1.96^2 x 0.5078\ (1-0.5078)}{0.05^2}$$

$$n = 384$$

Where:

n = sample size of the study population

Z = number of standard errors away from mean = 1.96

P = estimated prevalence = 0.5078 (50.78% according to Malaysia National Trauma Database in 2008)

d = margin of error = 0.05 (5%)

Therefore, sample size (n) is 384.

3.4 Instruments and data collection

3.4.1 Data instrument

The data had been collected by using pro-forma. The pro-forma consists of seven sections, which are:

a) Socio-demographic data (Age at diagnosis, Gender, Ethnicity)
b) Mechanism of injury (Falls, Motor-vehicle accidents, Assault, Being struck by object, Suicide and others)
c) Subtypes of intracranial bleeding (Epidural haemorrhage, Subdural haemorrhage, Subarachnoid haemorrhage, Intraparenchymal haemorrhage, Intraventricular haemorrhage, Diffuse axonal injury)
d) Other findings in CT Scan examination (Midline shift, Effacement of basal cistern, Herniation, Cerebral oedema, Hydrocephalus and Skull fracture)
e) Glasgow Coma Scale (GCS) score
f) Degree of severity based on GCS score (Mild, Moderate, Severe)
g) Patient's outcome (Discharged, Died, and others)

3.4.2 Data collection technique

The data used for this study is secondary data. Data had been collected from database of patient's records of Radiology Department of Hospital Serdang. Data was chosen based on the inclusion and exclusion criteria. We use certain key words to find the patients' data. The first key word that we used is CT brain. The second key word is the each date from January 2011 to December 2012. We obtain the information from the admission note, generic progress note, discharge note and the CT scan report itself. Information had been entered into a pro-forma for further analysis.

3.4.3 Quality control

In order to obtain accurate data, the pro-forma had been checked by our supervisor before it is being used to obtain the data. The data was recorded in the pro-forma. All the data was collected and handled confidentially.

3.5 Data analysis

Data was analysed by using Statistical Package for Social Sciences Program (SPSS) version 21. The frequency and central tendency such as mean, median and mode were analysed using descriptive analysis. The association between intracranial bleeding and Glasgow Coma Scale was analysed using Chi Square test and Fischer Exact test. In order to find mean of the total number of intracranial bleeding, we used one-way ANOVA test.

3.6 Study ethics

This study was conducted after obtaining ethical approval from the following institutions:

a) Medical Ethics Committee of Faculty of Medicine and Health Sciences, University Putra Malaysia (JKEUPM)

b) The National Institute of Health (NIH)

c) National Medical Research Register (NMRR)

a) Clinical Research Centre (CRC) of Hospital Serdang

3.7 Variables

Dependent : Glasgow Coma Scale

Independent : Subtypes of Intracranial bleeding ; Epidural haemorrhage, Subdural haemorrhage, Subarachnoid haemorrhage, Intraparenchymal haemorrhage, Intraventricular haemorrhage, Diffuse axonal injury.

3.8 Terms definition

Computed Tomography scan	A medical imaging procedure that utilizes computer-processed X-rays to produce tomographic images or 'slices' of specific areas of body. The *Greek* word *tomos* means ''slice'' and *graphein* means ''write''.
Traumatic brain injury	Non-degenerative and non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness. The severity is measured by Glasgow Coma Scale and divided to mild, moderate and severe type.
Intracranial bleeding	Haemorrhage or bleeding within the skull and occurs when a blood vessel within the skull is ruptured or leaks.
Adults	A person who has reached age of 18 years old and above.

CHAPTER 4

RESULTS

4.1 Response rate

384 patients who underwent CT brain examination from January 2011 to December 2102 were diagnosed with intracranial bleeding. As only secondary data from the hospital online database system were used in the data collection, all the cases that were selected via simple random sampling method were included in this study. Thus, the response rate is 100%.

4.2 Descriptive statistics

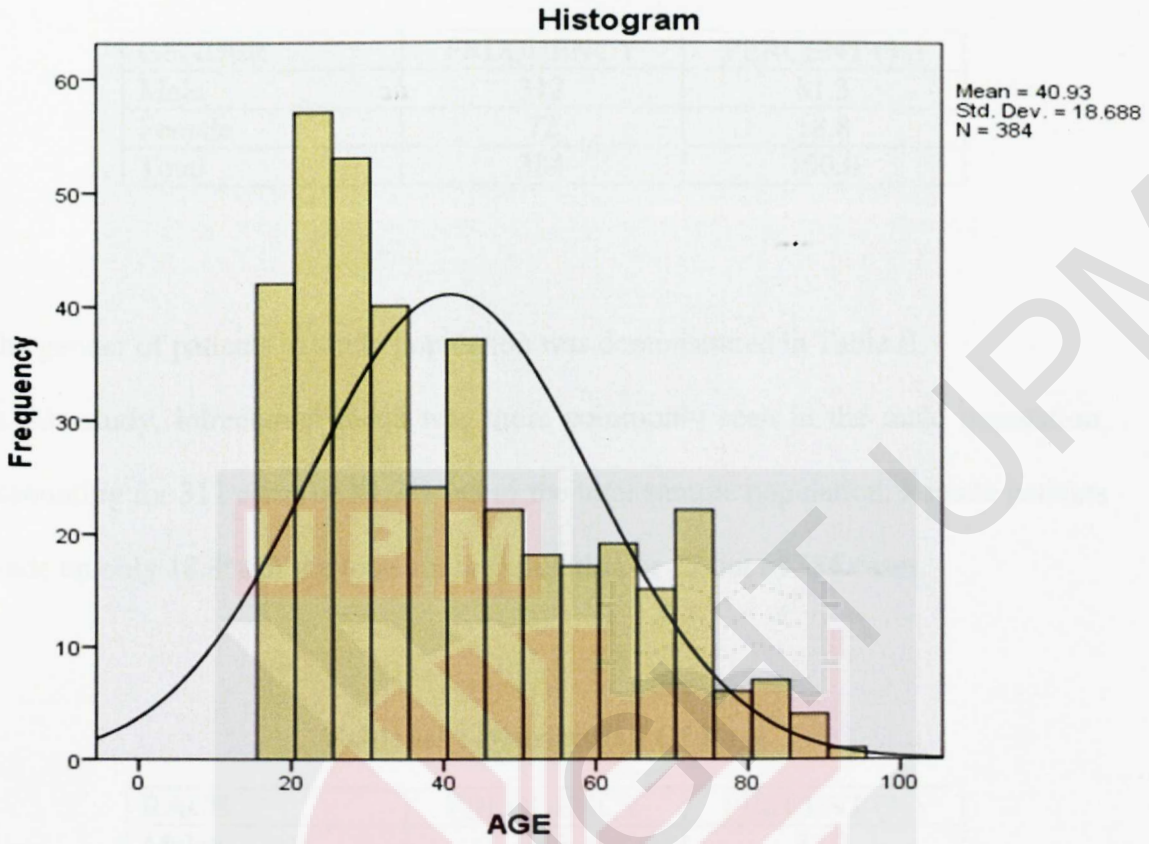

Figure 2 : Distribution Of Age

The distribution of age of patients in the sample population was demonstrated in Figure 2. There were 384 patients with diagnosis of intracranial bleeding of those who underwent plain CT brain examination as taken from Hospital Serdang's database from January 2011 to December 2012. The mean of age found was 40.93. Meanwhile, the standard deviation was 18.688. The sample population was assumed almost normally distributed based on the skewness and kurtosis values of 0.704 and -0.570 respectively as well as the normal distribution curve and histogram.

Table II : Distribution Of Gender

GENDER	FREQUENCY	PERCENT (%)
Male	312	81.3
Female	72	18.8
Total	384	100.0

The gender of patients in study population was demonstrated in Table II.

In this study, intracranial bleed was more commonly seen in the male population, accounting for 312 cases or 81.3% out of the total sample population. Female patients made up only 18.8% of the total study population or 72 out of 384 cases.

Table III : Distribution Of Race

RACE	FREQUENCY	PERCENT (%)
Malay	143	37.2
Chinese	94	24.5
Indian	74	19.3
Others	73	19.0
Total	384	100.0

The ethnicity of patients in study population was demonstrated in Table III.

Out of 384 total patients with diagnosis of intracranial bleed which underwent plain CT brain examination as taken from database Hospital Serdang, the dominating ethnic was Malay comprising of 143 patients or 37.2% of the total, followed by Chinese with 94 patients or 24.5% of total and Indian with 74 patients or 19.3% of total. 73 patients or 19% of the total cases were made up of various nationality namely from Bangladesh, Myanmar, Indonesia and Thailand.

Table IV : Distribution Of Mechanism Of Injury

MECHANISM OF INJURY	FREQUENCY	PERCENT (%)
Motor Vehicle Accident	215	56.0
Fall	115	29.9
Assault	31	8.1
Being Struck By Object	11	2.9
Suicide	2	0.5
Others	10	2.6
Total	384	100.0

There were 6 categories under mechanism of injury which were fall, motor vehicle accident (MVA), assault, being struck by object, suicide and others. The most common cause of intracranial bleed as seen in this study was MVA accounting for 56.0% of the cases or 215 patients out of the total 384. Fall is the second most common mechanism of injury which was found in 115 out of the total 384 patients or 29.9%, followed by assault, found in 31 patients or 8.1% of the total and being struck by object in 11 patients or 2.9% of the total.

The others category comprised of other causes not listed above such as knocked head on the wall formed the second lowest of the intracranial bleeding samples, which were found in 10 patients or 2.6% of the total. The least common mechanism of injury causing intracranial bleed as seen in this study was suicidal attempt which found in 2 out of 384 total patients or 0.5%.

Table V : Distribution Of Total Count Of Intracranial Bleeding

TOTAL COUNT OF INTRACRANAL BLEEDING	FREQUENCY	PERCENT (%)
1	202	52.6
2	114	29.7
3	56	14.6
4	11	2.9
5	1	0.3
Total	384	100.0

There were 384 patients with diagnosis of intracranial bleed of those who underwent plain CT brain examination as taken from Hospital Serdang database from January 2011 to December 2012.

Single intracranial bleed was detected on plain CT brain in the majority of the study population accounting for 202 out of 384 cases or 52.6%. Multiple intracranial bleeds was seen in 182 (47.4%) patients. Of these, 114 (29.7%) patients have two intracranial bleeds, 56 (14.6%) have three intracranial bleeds, 11 (2.86%) have four intracranial bleeds. Only one patient (0.26%) was detected to have five intracranial bleeds on CT scan in this study.

Table VI : Distribution And Percentage Of Intracranial Bleeding

INTRACRANIAL BLEEDING	FREQUENCY	PERCENTAGE (%)
Epidural Haemorrhage	77	20.1
Subdural Haemorrhage	238	62.0
Subarachnoid Haemorrhage	157	40.9
Intraparenchymal Haemorrhage	156	40.6
Intraventricular Haemorrhage	11	2.9
Diffuse Axonal Injury	8	2.1

The highest frequency of intracranial bleeding from our studies was subdural haemorrhage with 62.0% and the second highest was subarachnoid haemorrhage with 40.9%. This statistics was followed by intraparenchymal haemorrhage which account for 40.6% and epidural haemorrhage which occupied 20.1%. Other intracranial bleedings such as intraventricular haemorrhage and diffuse axonal injury only occupied small percentage that was 2.9% and 2.1% respectively.

4.3 Inferential statistics

Table VII : Age Group In Relation To Mechanism Of Injury In Event Of Intracranial Bleeding

AGE GROUP	MECHANISM OF INJURY					
	FALL	MVA	ASSAULT	STRUCK BY OBJECT	SUICIDE	OTHERS
18-27	13	95	10	3	0	0
28-37	15	47	9	5	1	0
38-47	19	28	9	1	1	3
48-57	16	18	0	2	0	5
58-67	16	18	2	0	0	0
68-77	22	8	1	0	0	1
78-87	11	1	0	0	0	1
88-97	3	0	0	0	0	0
TOTAL	**115**	**215**	**31**	**11**	**2**	**10**

In the younger age groups, MVA was responsible for the majority of the cases of intracranial bleed. However, in the older age groups, fall was seen to dominate as the most common cause of intracranial bleed.

Since the p-value is 0.000 which is less than 0.05, it is significant. Thus, there is a significant association between age group and mechanism of injury.

Table VIII : Association Between Subtypes of Intracranial Bleeding And Degree Of Severity

	Pearson Chi-Square Asymp Sig. (2-sided)	Fisher's Exact Test Exact Sig. (2-sided)
Epidural Haemorrhage	0.237	-
Subdural Haemorrhage	0.495	-
Subarachnoid Haemorrhage	0.233	-
Intraparenchymal Haemorrhage	0.062	-
Intraventricular Haemorrhage	-	0.019
Diffuse Axonal Injury	-	1.000

As the p-value of epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage and diffuse axonal injury were more than 0.05, the data is not significant. Thus there is no significant association between epidural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intraparenchymal haemorrhage and diffuse axonal injury with GCS score.

Since the p-value for intraventricular haemorrhage is the only one that less than 0.05, the data is significant. Thus, there is significant association between intraventricular haemorrhage with GCS score.

Table IX : Degree Of Severity In Relation To Outcome In Event Of Intracranial Bleeding

			OUTCOME			TOTAL
			DISCHARGED	DIED	OTHERS	
severity	Mild	Count	191	5	36	232
		% within severity	82.3%	2.2%	15.5%	100.0%
	Moderate	Count	42	5	19	66
		% within severity	63.6%	7.6%	28.8%	100.0%
	Severe	Count	35	33	18	86
		% within severity	40.7%	38.4%	20.9%	100.0%
	TOTAL	Count	268	43	73	384
		% within severity	69.8%	11.2%	19.0%	100.0%

From 384 total data, 232 patients had mild degree of severity, 66 patients had moderate degree of severity and 86 patients had severe degree of severity.

Out of the 232 patients under mild category of severity, 191 patients or 82.3% were discharged, 5 died and 36 were referred to Neurosurgical Department of General Hospital Kuala Lumpur (GHKL) for further management.

For all 66 patients in moderate condition, 42 patients were discharged, 5 died and 19 were transferred to GHKL.

Meanwhile for severe condition, 35 patients were discharged, 33 patients died and 18 patients were referred to GHKL for follow-up and further management.

Since the p-value is less than 0.05, therefore the data is significant. Thus, it can be concluded that there is a significant association between severity of patient's condition and outcome of the patient.

Table X : Association Between Subdural Haemorrhage And Epidural Haemorrhage With Skull Fracture

	Pearson Chi-Square Asymp Sig. (2-sided)	Fisher's Exact Test Exact Sig. (2-sided)
Subdural Haemorrhage	0.028	0.035
Epidural Haemorrhage	0.000	0.000

127 out of 238 patients with subdural haemorrhage were found to have associated skull fractures. Since the p-value is 0.035 which is less than 0.05, it is significant. Thus, there is association between subdural haemorrhage and skull fracture.

Of the 77 patients with epidural haemorrhage, 53 were found to have associated skull fractures. Since the p-value is 0.000 which is less than 0.05, it is significant. Thus, there is a significant association between epidural haemorrhage and skull fracture.

Table XI : Mean Of Severity

One-way ANOVA

Descriptive

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval For Mean		Minimum	Maximum
					Lower bound	Upper bound		
1	202	1.50	0.781	0.055	1.40	1.61	1	3
2	114	1.69	0.853	0.080	1.53	1.85	1	3
3	56	1.89	0.908	0.121	1.65	2.14	1	3
4	11	1.55	0.688	0.207	1.08	2.01	1	3
5	1	2.00	.	.	.	.	2	2
Total	384	1.62	0.828	0.042	1.54	1.70	1	3

From the mean available in the table XII, we could see that the mean increase from 1.50 for 1 intracranial bleed to 1.89 for 3 intracranial bleeds. Then at 4 intracranial bleeds, the mean dropped to 1.55 and increase back to 2.00 at 5 intracranial bleeds.

Table XII : Test Of Homogeneity Of Variances

Levene Statistics	df1	df2	Sig.
3.835[a]	3	379	0.010

a. Groups with only one case are ignored in computing the test of homogeneity of variance for **ANOVA**

	Sum of squares	df	Mean square	F	Sig.
Between groups	7.656	4	1.914	2.846	0.024
Within groups	254.834	379	0.672		
Total	262.490	383	-		

For the between groups significant level, at degree of freedom of 4, F value is 2.846, the p-value is 0.024 which is lower than 0.05. Thus, it is significant.

CHAPTER 5

DISCUSSIONS

5.1 Distribution of Age, Gender, Race and Mechanism of Injury

According to our study, the mean of age is 40.93. The median is 35.50, while the mode is 23. The minimum age of our study sample is 18, meanwhile the maximum age is 94. According to our research, the age distribution for the patients was mostly younger generation. This might be the reason why our mode is 23. This may reflect that the youth were lacking awareness on road safety. In additional, younger generation are the one who considered as most proactive generation.

From our study, we found that 81.3% of our samples were dominated by male population. Meanwhile, the female population only accounts for 18.7% from total population. This indicates that males are more likely to be engaged or involved in physical activities such as sports, driving or working in outdoor areas. According to Pablo P. et al, about three quarters of the patients in their study were males. Our study also shows similar trend to the one conducted by this team.

For the race, the first rank was dominated by Malay group for 37.2%, followed by Chinese group for 24.5% and the third group was Indian group by 19.3%. The last group was Others which makes up 19% of the total. They were made up of various nationality namely from Bangladesh, Myanmar, Indonesian and Thailand. Our data collection was done in the Radiology department of Hospital Serdang which is located in the Selangor state. Currently, Selangor is considered as developed and still developing state and there are a lot of developing projects in the surrounding areas that required foreign workers. Thus, most of the patients in Others category were the workers involved in accidents in the workplace such as construction area.

There were six mechanisms of injuries that were being studied in our research which were motor vehicle accident (MVA), fall, assault, being struck by object, suicide and others. MVA accounts for more than half of the total cases with 56%. This was followed by fall and assaults at second and third places with 29.9% and 8.1% respectively from the total. At fourth and fifth places were those patients who were categorised under being struck by objects at 2.9% and those who fall under the category of others such as head knocked on the wall at 2.6% from total. The last category was the suicides for 0.5%. As mentioned in the Report of National Trauma Database in 2009, it was stated that the leading cause for the intracranial bleeding was road traffic accidents by 70.1% from total population of major trauma cases. According to a study by Youmans J. (2004), the leading causes for intracranial bleeding in adults were motor vehicle accidents and falling down. Thus, the results obtained from our study are comparable with previous findings.

5.2 Distribution of Intracranial Bleeding

The highest frequency of intracranial bleeding from our studies was subdural haemorrhage (SDH) with 62.0% and the second highest was subarachnoid haemorrhage (SAH) with 40.9%. This statistic was followed by intraparenchymal haemorrhage (IPH) which account for 40.6% and epidural haemorrhage (EDH) which occupied 20.1%. Other intracranial bleeding such as intraventricular haemorrhage (IVH) and diffuse axonal injury (DAI) only accounts for small percentage that was 2.9% and 2.1% respectively. According to statistic stated by National Trauma Database (2008), SDH has the highest percentage that was 43.74%. The second highest was SAH which was 21.59%. While the percentage of EDH was not high as compared to SDH and SAH, which was only 5.76%. The percentage of focal brain injury or intraventricular injury was the lowest among all causes of intracranial injury

that was 0.89 %. Therefore, our results are comparable with the National trauma database with SDH as the most frequent intracranial bleeding while the second highest was SAH.

Among patients who presented with intracranial bleeding, some of them presented with more than one type of intracranial bleeding, ranging from 1 to 5. According to our study, more than half of our study samples presented with only one type of intracranial bleeding or 52.6%. 29.7% of them presented with 2 types of intracranial bleedings followed by 14.6% of them presented with 3 types of intracranial bleedings. Meanwhile, only 2.9% of our study samples presented with 4 types of intracranial bleeding and only 1 study sample presented with 5 types of intracranial bleeding.

5.3 Association between Age Group and Mechanism of Injury

The pattern of mechanism of injury for age group 18 to 67 is similar. The most common mechanism was the motor vehicle accident (MVA). This is likely due to fact that most people in this age group are usually going places using motorized vehicles such as cars or motorcycles. However, it is noted that the trend for MVA was decreasing with increasing age. One could suggest this is likely because with increasing age, people become more cautious and probably become more aware of road safety.

The second most common mechanism of injury for age group 18 to 67 was fall as this age group represented those actively involved in their works and outdoor activities, in which there was a high chance of getting injury. Both assault and being struck by object were also very common mechanisms that caused intracranial bleeding. Besides, there were 2 study samples from age group 28 to 47 involved in suicide because this was the period in which they were facing the most stress from the aspect of works, financial, family and society.

On the other hand, age group of 68 to 97 also showed similar pattern of mechanism of injury as the most common mechanism was fall. Since this age group was categorized as elderly and their fall was mainly due to their body weakness. However, there was 8 studies sample from age group 68 to 77 involved in MVA because they still have the ability to drive. Since the p-value is 0.000 which is less than 0.05, it is significant. Thus, there is a significant association between age group and mechanism of injury.

5.4 Association between Intracranial Bleeding and Glasgow Coma Scale

From total of 384 patients, 77 patients were presented with the EDH. Most of the patients were having mild severity with 63.6%. Other 20.8% of the patients presented with moderate severity and 15.6% for the severe category. In the Chi-Square table, the p-value is 0.237 which is more than 0.05. Therefore, it is not significant and there is no association between EDH and GCS score.

238 patients were presented with SDH. Most of the patients were presented as mild by 58.8%. Followed by severe category by 24.4% and lastly by moderate category by 16.8%. In the Chi-Square table, the p-value is 0.495 which is more than 0.05. Therefore, it is not significant and there is no association between SDH and GCS score.

From 384 patients, the patients that presented with SAH were 157 patients. From that number, 57.3% were presented as mild. 26.8% of patients were presented as severe and followed by moderate group by 15.9%. According to the Chi-Square table, the p-value is 0.233, which is more than 0.05 ($p > 0.05$), the data is not significant. Thus there is no association between SAH and GCS score.

In total, there were 156 out of 384 patients diagnosed with IPH. From 156 patients, 53.8% of patients were having mild degree of severity. Meanwhile, for the moderate and severe degree, there were 21.8% and 24.4% patients respectively. As the p-value is 0.062, which is more than 0.05, the data is not significant. Thus there is no association between IPH and GCS score.

There were only 11 patients diagnosed with IVH out of total 384 patients with intracranial bleeding. From those patients, severe category is ranked as highest group with percentage of 54.5%, followed by moderate group for 27.3% and lastly mild

group with 18.2%. As the p-value is 0.019, which is less than 0.05, the data is significant. Therefore, there is an association between IVH and GCS score.

For DAI, there were only 8 patients diagnosed with DAI out of total 384 patients. Only 12.5% of patients were having mild degree of severity. Meanwhile, for the moderate degree of severity, there were 62.5% of patients which was the highest. Another 25% of patients were categorized as severe degree of severity. As the p-value is 1.000, which is more than 0.05, the data is not significant. Thus there is no association between DAI and GCS score.

Based on our study, the highest degree of severity for EDH, SDH, SAH, and IPH were categorized as mild, IVH was categorized as severe meanwhile DAI was categorized as moderate. Based on information from Pablo P. et al., he found that median GCS for all TBI patients in his research was 13 or mild. For EDH and IPH, the median GCS was both 11 and moderate. Meanwhile, the median GCS for SDH was 10 or moderate. For SAH, the median GCS was lowest among the intracranial bleeding mentioned, that was only 8 or severe. So, as an overall, our findings of association between intracranial bleeding and GCS is mostly were not comparable.

According to a research done by Pablo P. et al., he had been using two types of score which were GCS and Abbreviated Injury Scale (AIS). The purpose of GCS was for evaluation of severity of ICB. Meanwhile, the AIS was used to determine the extent of ICB and categorized the bleeding as absent, present-small, present-large, or unspecified size. AIS also can be affected by the volume of blood of ICB. From this information, the determination of the extent of ICB could influence the findings. In this study, the extent of ICB such as the size, volume and depth of the bleed was not

assessed. This might be the reason why our findings were not comparable with previous study as our study does not include of the extent of ICB.

5.5 Association between Degree of Severity and Outcome of Patients

Based on our study, 232 out of 384 study samples were categorized as mild for their degree of severity. 82.3% of them were discharged, 2.2% died while 15.5% were transferred to other hospitals.

On the other hand, degree of severity of another 66 study samples were moderate. Out of these 66 peoples, 63.6% of them were discharged, 7.6% died and 28.8% were transferred to other hospitals.

However, the rest of our study samples or 86 people were categorized as severe for their degree of severity. Of these 86 peoples, 40.7% were discharged, 38.4% were dead and 20.9% were transferred to other hospitals.

From here we can see that most of the study samples that were categorized as mild or moderate were discharged from hospital. Meanwhile, for those who were categorized as severe for their degree of severity, the outcome such as died and discharged were almost the same. In addition, the possibility of dying increases if the person is categorized under severe as compared to mild or moderate.

From Chi-square test, the p-value was less than 0.05 (0.000) or in other words, there was a significant association between degree of severity and outcome of the study sample. Previously, in a research conducted by Gotoh et al., where he prospectively examined the strength of GCS in 765 patients and discovered a strong correlation between the GCS score and outcome of the patients. The results from this study are comparable with Gotoh et al., findings.

According to Pablo P. et al., it was mentioned that the probability for SDH associated with death is much higher compared to EDH. Our findings were also comparable with the results of the previous publications. But in our study, we found that IVH had the highest percentage of associated with death compared to other intracranial bleeds which was 45.5%. This might be due to lack of enough sample size since we only had 11 patients with IVH for our study.

5.6 Association between Subdural Haemorrhage and Epidural Haemorrhage with Skull Fracture

From the total data of 384 patients, only 77 patients presented with EDH. Out of 77 epidural haemorrhagic patients, 68.8% presented with the skull fracture. Meanwhile, 31.2% did not present with skull fracture. According to the Chi- Square test, p-value is 0.000. Since the p-value is less than 0.05, it is significant. Thus, there is an association between the EDH and skull fracture, and it is comparable with previous studies (Inayat U. K. et al., 2008)

238 out of 384 patients presented with the SDH. 53.4% from the subdural haemorrhagic patients were presented with the skull fracture. Meanwhile 46.6% patients did not present with skull fracture. According to the Fisher's Exact test, the p-value is 0.035 which is less than 0.05. It indicates that it is significant. Thus, there is an association between the SDH and skull fracture which is comparable with the studies that have been done before. Overall, there is a significant association between skull fracture with SDH and EDH. According to Inayat UK et al., he also found a strong association between the skull fracture and the extradural hematoma.

According to Mendelow et al., patients who presented with a skull fracture had 190 times higher risk having intracranial haematoma compared to those presented without

a skull fracture. In our findings, 49% of the patients presented with skull fracture and 51% presented without skull fracture. In this study, the risk of developing intracranial hematoma is increased by 300-400 folds if a skull fracture is present.

5.7 Mean of Severity

From the mean available in the table, we could see that the mean increase from 1 to 3 intracranial bleeds. Then at 4 intracranial bleeds, the mean dropped and then increase back at 5 intracranial bleeds. We could conclude that the association of single, double or triple intracranial bleeding with degree of severity is significant, since increase in number of bleeding will increase the severity. Thus, the mean would increase. The association of 4 and 5 intracranial bleeding with severity is unjustified since the sample size is not enough.

For the between groups significant level, at df = 4, F value is 2.846, the p-value is 0.024 which is lower than 0.05. Thus, it is significant.

5.8 Limitation

There were some problems identified when conducting our study which might influence our study outcomes.

One of the limitations of this research was lacking of accurate and reliable local data to become our benchmark. This was because most of the journal articles related to our research was more focused on international population. The data of the previous study on intracranial bleeding with GCS were also not enough which have caused comparison between ours with other studies difficult.

Besides that, some incomplete medical records made it hard to find any association which may be an important outcome for our study, in our case it was the association between intracranial bleeding with GCS score.

Another limitation that we faced in this study was financial limitation. Because of this limitation, the researchers could not travel and look at the data in other nearby hospitals. Thus, our study population was based only in one hospital that is Hospital Serdang. The data from Hospital Serdang might not be similar to data in those nearby hospitals. So the data that we had from this study could not be extrapolated to the general population.

Other than that, another raising issue was the transportation. None of the group members had any self-transport. So we decided to do our study at a walking distance hospital which is Hospital Serdang. Thus we could save our time and money spent on public transportation.

Besides, we were only focusing on adult patients from aged 18 and above. Thus, the paediatric patients were excluded from our research. Hence we would not get any data on paediatric patients who were involved in TBI cases.

Another than that, our limitation was we did not look at the extent of bleeding such as the size, the volume and the depth of the bleed. Other findings in the study such as midline shift and herniation which may have some bearing on the Glasgow Coma Scale of the patients at presentation were also not looked into. Thus, these more or less would affect the results of our findings and should be considered as factors that may contribute to the outcome of patients.

5.9 Conclusion

In conclusion, this study shows that most of intracranial bleeding did not have significant association with Glasgow Coma Scale except for intraventricular haemorrhage. Overall, the null hypothesis is not rejected. Thus, this study demonstrates that there was no significant association between intracranial bleeding and Glasgow Coma Scale.

5.10 Recommendation

Since the data in this study was only collected from the database in one hospital, that is Hospital Serdang, it is recommended for the further studies to look at the data from other hospitals as well which have with similar setting so that the finding would be more accurate and representative of the Malaysian population. This will increase the number of the samples size and also increase the strength of the results. Furthermore the duration of the studies should also be increased for example from 2008 until 2012. Larger sample size may represent the whole population more accurately. Other than these, Abbreviated Injury Scale should be included since it is used to determine other variables such as presence and size of bleeds. Besides that, the researcher also should include the variables such as midline shift, cerebral oedema, and effacement of basal cistern, hydrocephalus and herniation should to be taken into consideration to obtain more accurate results because the size of bleed and other findings may have effect on outcome of patients. We would also recommend the researcher to include the paediatric TBI patients in their study since there are many TBI cases that come from paediatric group.

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APPENDIX 1

NMRR APPROVAL LETTER

APPENDIX 2

NIH APPROVAL LETTER

NATIONAL INSTITUTES OF HEALTH (NIH) RECOMMENDATION FOR THE CONDUCT OF RESEARCH IN THE MINISTRY OF HEALTH MALAYSIA
PENGESAHAN INSTITUSI KEBANGSAAN NEGARA UNTUK MENJALANKAN PENYELIDIKAN DI KEMENTERIAN KESIHATAN

This is an auto-generated document. It is issued by one of the research institute under the National Institutes of Health (NIH). The institutes as follows: Institute for Medical Research (IMR), Institute for Public Health (IPH), Clinical research centre (CRC), Institute for health Management (IHM), Institute for Health System Research (IHSR) and Institute for Health Behavioural Research (IHBR).

Dokumen ini adalah cetakan berkomputer. Borang ini dikeluarkan oleh salah satu institusi dibawah National Institutes of Health (NIH) iaitu Institut Penyelidikan Perubatan (IMR), Institut Kesihatan Umum (IKU), Pusat Penyelidikan Klinikal (CRC), Institut Pengurusan Kesihatan (IPK), Institut Pengurusan Sistem Kesihatan (IPSK) dan Institut Penyelidikan Tingkahlaku Kesihatan (IPTK).

Unique NMRR *[Nombor Pendaftaran]*	NMRR-13-368-16161
Research Title *[Tajuk]*	Association between intracranial bleeding on plain CT brain with Glasgow Coma Scale among traumatic brain patients in Hospital Serdang.
Protocol Number if *[Nombor Protokol jika ada]*	

#	**Investigator Name** ***[Nama Penyelidikan]***	**Institution Name** ***[Nama Institusi]***
1	AHMAD AFKHAR FAKHRIZZAKI	Serdang Hospital
2	LOH LI SEN	Serdang Hospital
3	NOREEN SYAKIRAH BT MOHAMAD SANUSI	Serdang Hospital
4	NURUL WAHIDAH BINTI MOHAMED SUHAIBUDEEN	Serdang Hospital
5	Saiful Nizam Bin Abdul Rashid	Serdang Hospital

I have reviewed the above titled research, and has recommended to MREC* for its decision.

Saya telah menyemak penyelidikan yang bertajuk diatas, dan telah disyorkan untuk MREC bagi keputusannya.

Name of Director *[Nama pengarah]*	Dr Roslinah Ali
NIH Institute (IMR, IPH, CRC, IHM, IHSR, IHBR) *[Nama institusi di bawah NIH]*	Institute for Health Management (IHM)
Signature & Official Stamp *[Tandatangan dan Cop Rasmi]*	
Date *[Tarikh]*	23-05-2013

*Final approval is pending MREC decision.

APPENDIX 3

CRC APPROVAL LETTER

APPENDIX 4

PRO-FORMA

Section A: Socio-demographic Data	
Registration number	.....
Age	.....
Gender	☐ Male ☐ Female
Race	☐ Malay ☐ Chinese ☐ Indian ☐ Others

Section B : Mechanism of Injury
☐ Fall ☐ Motor Vehicle Accident ☐ Assault ☐ Being Struck by Object ☐ Suicide ☐ Others : Specify: _____

Section C: Subtype of Intracranial Bleeding

- ☐ Epidural Haemorrhage
- ☐ Subdural Haemorrhage
- ☐ Subarachnoid Haemorrhage
- ☐ Intraparenchymal Haemorrhage
- ☐ Intraventricular Haemorrhage
- ☐ Diffuse Axonal Injury

Section D : Others Findings

- ☐ Midline Shift
- ☐ Cerebral Oedema
- ☐ Hydrocephalus
- ☐ Herniation
- ☐ Effacement of Basal Cistern

Skull Fracture: YES / NO

Bones Involved:

_____

Section E:
GCS score: _____

Section F : Degree of severity based on GCS score
☐ Mild (15-13)
☐ Moderate (12-9)
☐ Severe (8-3)

Section G : Patient's outcome
☐ Discharged
☐ Died
☐ Others
:Specify: _____

APPENDIX 5

GANTT CHART

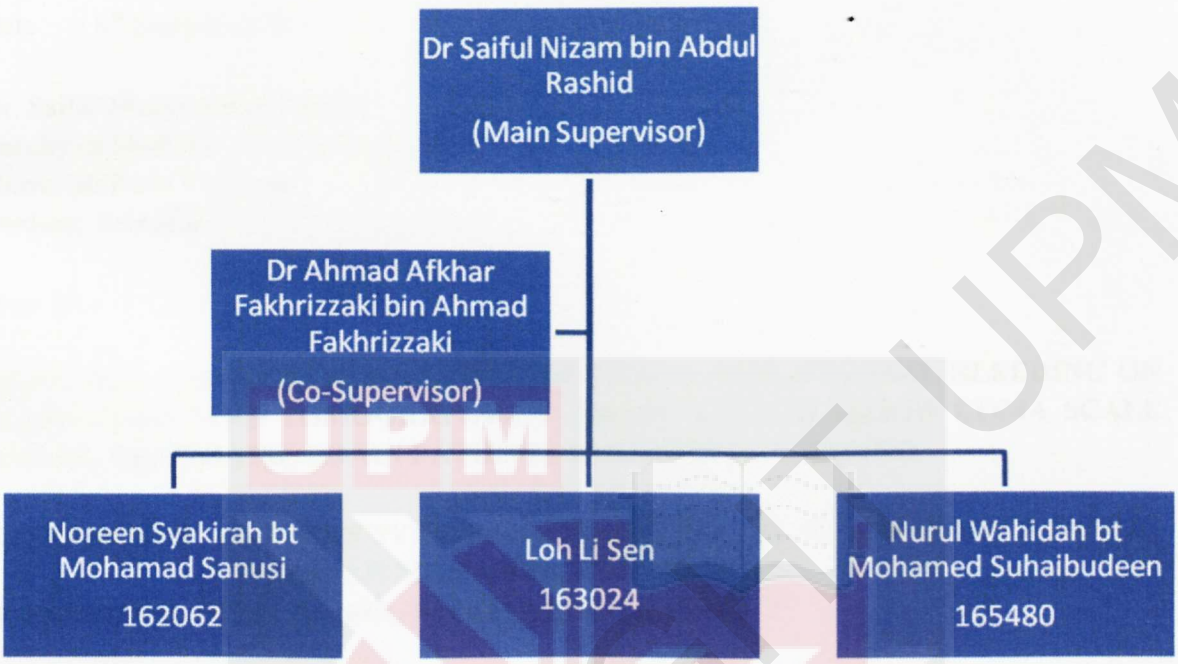
TITLE: ASSOCIATION BETWEEN INTRACRANIAL BLEEDING ON PLAIN COMPUTED TOMOGRAPHY (CT) BRAIN WITH GLASGOW COMA SCALE AMONG TRAUMATIC BRAIN PATIENTS IN HOSPITAL SERDANG

NO	Activities	2013						
		Mac	April	May	June	July	August	Sept
1	Preparation of draft proposal							
2	Submission of draft proposal							
3	Preparation, submission and presentation of final proposal							
4	Correction of proposal							
5	Preparation ethical approval and permission letters to organization							
6	Data collection and analysis							
7	Submission of data analysis and presentation							
8	Correction of data analysis							
9	Preparation of final report and scientific article							
10	Submission of project report and scientific article							
11	Preparation of final presentation							
12	Final presentation							
13	Correction of project report							
14	Submission of final report and scientific article							
15	Result							

Note: Each column under each month represents the respective week of the month

APPENDIX 6

RESEARCH TEAM 27



APPENDIX 7

Budget planning

Item	Quantity	Price
Photostat	400	RM 100.00
Printing	50	RM 150.00
Hard covers for final report	7 set	RM 150.00
Transportation	-	RM 100.00
TOTAL		**RM 500.00**

Attachment 2

JKEUPM Ref No. : FPSK_Mei (13)32

Members of the JKEUPM who reviewed the documents:

Prof. Dr. Lim Thiam Aun

Date of approval: 6/9/2013

Endorsed at JKEUPM Meeting on **6/9/2013**, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dr. Norlijah Othman	Paediatrics& Dean, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr Zamberi Sekawi	Medical Microbiologist & Deputy Dean of Research and Internationalization, Faculty of Medicine and Health Sciences	Male	√
Prof. Dato' Dr. Lye Munn Sann	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Tengku AizanAbd Hamid	Gerontologist & Director, Institute of Gerontology	Female	√
Prof. Dr. Lekhraj Rampal	Medical Statistician, Dept of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Elizabeth George	Pathologist, Dept of Pathology, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Lim ThiamAun	Anesthesiologist, Dept of Surgery, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Wan Omar Abdullah	Medical Parasitologist, Dept of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Patimah Ismail	Professor of Biomedicine, Dept of Biomedical Sciences, Faculty of Medicine and Health Sciences	Female	√
Assoc. Prof. Dr. Johnson Stanslas	Pharmacologist, Dept of Medicine, Faculty of Medicine and Health Sciences	Male	√
Assoc. Prof Dr. Mansor Abu Talib	Assoc. Professor of Guidance and Counselling, Dept of Human Development and Family Studies, Faculty of Human Ecology	Male	
Assoc. Prof. Dr. Noritah Omar (Lay Person)	Assoc. Professor of English Language, Dept of English Language, Faculty of Communication and Modern Languages	Female	
Dr. RojanahKahar (Lay Person)	Lecturer of Dept of Human Development and Family Studies, Faculty of Human Ecology	Female	√
Tan Sri Dato' Napsiah Omar (Lay Person)	Chairman, National Population and Family Development Board	Female	