

Literature Study: Factors Affecting Prognostics of Head Injury Patients

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ABSTRACT: Head injury is often referred to as “the silent epidemic” remains a public health problem and is the largest contributor to mortality and record among all injuries. The aim of this study was to identify the prognostic factors in head injury patients based on a literature study. The research design used in this study was a literature study with a sample of 15 journals, Google Scholar (n=3), Pubmed (n=4), proQuet(n=4), Science Direct (n=4). The results of this study are that there are factors that influence the prognostication of head injury patients including age (11 journals), GCS (Glasgow Coma Scale) (11 journals), gender (3 journals), and hematoma (4 journals). Prognostic factors of head injury were found in 15 journals, including age, GCS (Glasgow Coma Scale), gender, and hematoma.

Keywords: head injury, prognostic

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INTRODUCTION

Head injury is a serious health problem and a major factor in death and disability (Skaansar et al., 2020). According to Riskesdas (2018), the prevalence of head injuries in Indonesia is 11.9%. Head injury cases often occur in productive ages 14-24 years. According to a report by the World Health Organization (WHO), there are consistently around 1.2 million people who die due to accidents and suffer head injuries. In America, head injury cases reached 1.7 million cases per year, 275,000 were treated and 52,000 died. In Indonesia, head injury cases are estimated to reach around 500,000 cases every year. Of this total, 10% of patients died before being admitted to the clinic. In patients who come to the emergency department, 80% are minor injuries, 10% are moderate injuries, and 10% are classified as severe head injuries (Aucone et al., 2016).

Based on the data, it was found that the cause of death in Indonesia which ranks fourth is the case of head injury (Ramadhan et al., 2020). According to Dewa n et al., (2019) Head injury is often referred to as "the silent epidemic", it remains a public health problem and is the largest contributor to death and disability among all injuries. Head injury cases are quite large due to the large number of traffic accidents and disturbances in unsafe workplaces, such as mining work, construction workers and others. Neglecting to comply with traffic guidelines, especially with advances in motor vehicle technology, has resulted in an increase in the rate of head injuries. The result is cerebral hemorrhage or swelling or damage to the brain.

There are various ways to assess the severity of head injury patients, such as using the Glasgow Coma Scale (GCS) (Taufiq et al., 2019). GCS is an important indicator to survey the seriousness of the head injury by evaluating the eye reaction, verbal, motor response of the patient (Siahaya et al., 2020). Head injuries can be categorized into 3, namely mild, moderate, and severe head injuries using the Glasgow coma scale (GCS) (Sunil, 2016). Based on the results of the GCS scores, head injuries are categorized into 3, namely: mild head injury (GCS 13-15), moderate (9-12), severe (GCS 3-8) (Siahaya et al., 2020). Low scores indicate more severe physical problems and get a higher risk of death (Taufiq et al., 2019).

In a study according to Ramadhan et al., (2020) Head injuries can cause physiological, psychological, physical, social and emotional impacts, and can cause intracranial drainage and brain injuries, including subdural, subarachnoid, epidural, intraventricular, and intracerebral hemorrhage. Head injuries can be fatal, leading to disability and even death. A primary brain injury can lead to an event that causes the injury some time after the head injury, which is called a secondary brain injury. Secondary brain injury can be exacerbated by problems with pathological processes that can reduce oxygen and metabolism. These secondary injuries include hypoxia, hypotension, and increased intracranial pressure factors due to mass injury. This results in mortality in patients with head injuries.

The process of head injury affects the prognosis of patients with injuries due to high-speed motor accidents, thereby triggering a diffuse axonal injury

that has a fairly good prognosis. Patients who continue to experience an increase in intracranial pressure factors so that it is not controlled will have a worse outcome. Damage to the brain, such as midline shift and pressure on the basal cisterns, can result in mortality in patients with head injuries. Bleeding events in the cerebrum such as epidural, subarachnoid, subdural, intracerebral and intraventricular hemorrhages also occur in triggers of mortality in patients with head injuries. Accordingly, the more factors that cause death are found in head injury patients, the higher the mortality rate (Ramadhan et al., 2020). The purpose of this study was to identify the prognostic factors in head injury patients based on a literature study.

THEORETICAL REVIEW

Brain Anatomy and Physiology *brain*

According to Dafriani (2019) The brain is a very network that has billions of neurons that make the ability to think, process, and produce information. The brain works as the control center of the body.

Head Injury Concept *Definition of Head Injury*

Head injury is a neurological disease that causes damage to brain tissue which includes trauma to organs such as the scalp, brain, and skull. This disease is most often encountered and usually occurs in cases of accidents. Injuries caused by impact or trauma can be the cause of death or mortality.

Mechanism of Head Injury

The mechanism of head injury is the cause or mechanism that can cause a head injury, be it a minor head injury, moderate head injury, or severe head injury. The mechanism of head injury is mostly caused by traffic accidents, followed by patients falling from a height, patients being hit or falling objects, victims of violence such as being hit on the head, and sports. Classification Head injuries can be classified into three types, namely mild head injury, moderate head injury, and severe head injury. Head injury The most common is mild head injury, which is about 80-90% of the total incidence of head injury. The mortality rate for minor head injuries is the lowest. Cases of moderate head injury accounted for 10% of the total incidence of head injury and the average number of cases treated in the ICU of the hospital. Cases of severe head injuries account for 10% of all head injuries. Severe head injuries are treated as complications so that the death rate is the highest (Fitriana, 2018).

Etiology

The incidence of head injuries can be related to the progress of a country. The highest cause in developed countries is falls, while in developed countries it is motor vehicle accidents. The cause of head injuries due to sports is more common in developed countries because people in developed countries apply regular exercise in their daily lives, compared to developing countries, which

spend more time working than exercising. Another cause that can cause head injuries is work, but work risks are rarely the reason for head injuries because they are more careful when working (Li et al., 2016)

Clinical Manifestations

One of the developments of decreasing the condition of head injury is the occurrence of subdural hematoma. Acute subdural hematoma is one of the most common types of traumatic intracranial hematoma, accounting for about 24% of cases of severe head injury and has the highest mortality rate ranging from 30-90% because most severe head injuries have the highest mortality. This hematoma can occur through three mechanisms, namely damage to parenchymal wound bleeding, cortical vessel surface, and tearing of the venous bridge from the cortex to the dural venous sinus. The clinical presentation of an acute subdural hematoma is a gradual change in the level of consciousness of a head injury patient, pupillary changes, increased restlessness, and hemiparesis indicating the side of the lesion (Prahladu et al., 2017).

Pathophysiology

Primary Damage

Head trauma can alter the function of vital brain centers significantly direct and can be a cause of fatal complications in later life despite the relatively small volume of brain tissue damaged. Primary brain injury is the initial damage to the brain occurring at the site of the trauma. This damage is irreversible and cannot be treated with therapeutic medication. Then additional damage can occur due to poor perfusion and reduced oxygen delivery, followed by subsequent pathological processes such as activation of inflammation and coagulation with the development of microthrombosis, apoptosis and brain edema. This process will cause secondary brain damage, which is a potential condition for therapeutic intervention (Nekludov, 2016).

Secondary Damage

One of the secondary factors in head injury is hypotension. Hypotension is a predictor of mortality in head injury. Level Mortality was differentiated based on the presence of hypotension or without hypotension. Low blood pressure or hypotension can increase the risk of death in people with head injuries. Hypotension is caused by substantial blood loss resulting from extracranial injury. Patients with head injuries are sought to prevent low blood pressure. If the patient is not hypotensive, the risk of mortality can be reduced. Hypotension occurs when the systolic blood pressure is less than 90 mmHg. Hypotension produces a passive pressure response (Rahmah and Rahmayani, 2021).

Supporting investigation

Laboratory examinations as a supporting examination in patients with traumatic head injuries, including (Orintarya, 2020):

1. Prothrombin plasma mass
2. Peripheral blood platelet count

3. Activated partial thromboplastin period
4. Thrombin period
5. Plasma fibrinogen levels

Examination of head injuries can be done in various ways, including: others with CT scans, skull photos, MRI, laboratory tests, cerebral angiography, X-rays, and others. The usual examination is an MRI or CT scan (Fachruddin, 2020)

Complications

Complications are common during the treatment of head injury patients in hospital. Complications can worsen the prognosis of death. Mortality of patients with head injury associated with complications occurred more than 14 days after illness. Complications or injuries related to head injuries include pneumonia, pulmonary embolism, multiorgan failure syndrome, and sepsis (Rahmah and Rahmayani, 2021).

Management

Management can be done pharmacologically or non-pharmacologically in patients with head injuries. Headache is one of the complaints experienced by patients with head injuries. One of the forms of pain management is the distraction technique. Distraction techniques reduce the patient's attention to the pain that is felt by providing other stimuli. One application of distraction techniques is auditory distraction, either by means of meditation or listening to soothing nature sounds so that patients can relax more. This technique can release endorphins in the body and patients can feel comfortable so that patients are less aware of pain and can be more tolerant of pain (Saputri and Afni, 2019).

Head Injury Prognostic

Head Injury Prognostic Concept

Prognosis is the prediction of disease progression, in this case namely head injury. Prognosis can be used as a determinant of pattern treatment. Hyponatremia is one of the factors that can worsen the prognosis of head injury patients. Hyponatremia is a lack of sodium levels in the body. Hyponatremia is associated with head injury during hospitalization because sodium functions in body metabolism and controls body water levels. The prognosis of a head injury patient is life or death depending on the patient's condition. The prognosis of death in head injury patients still cannot be overcome by surgery, especially in the patient's poor level of consciousness (Kusumaningtyas et al., 2018)

Factors Affecting Prognostic Head Injury

Age

Adult age, which is less than or equal to 55 years, has a higher risk of death compared to elderly people over 77 years due to head injury. The reason is that adults (maximum 55 years) have frequent driving activities and are

prone to drug use. This can increase the risk of death in head injury patients (Llompert-Pou et al., 2016). The age range of people with head injuries is very wide, from children to the elderly. Increasing age makes complications in patients with head injuries easier to occur. In the elderly there is a decrease in organ function which exacerbates complications from injury. However, age is not always associated with mortality in head injuries (Rahmah and Rahmayani, 2021).

Gender

One of the factors associated with head injury is gender. For example, at Saiful Anwar Hospital, there were 96 patients with severe head injuries. Patients with male sex amounted to 67 people or about 69.8% more than female patients, which only amounted to 29 people. Meanwhile, more severe head injury patients who died were male, namely 14 and only 10 were female. Head injuries are mostly experienced by men because they are related to their activities, such as the high number of traffic accidents experienced by men (Risanto, 2016). Glasgow Coma Scale (GCS) One way to assess the prognosis of head injury is by using the GCS. This assessment consists of an assessment of verbal, motor, and eye response. GCS score has a relationship with mortality experienced by head injury patients. A GCS score of less than 5 is associated with a mortality prognosis of 85% in vegetative conditions. The GCS score also has a large prognostic value (Kholifah et al., 2020).

The total GCS score can be used to categorize head injury patients into several groups. A total score of 13-15 indicates that the patient has a mild head injury, a GCS score of 9-12 indicates that the patient has a moderate head injury and a GCS score of 3-8 indicates that the patient has a severe head injury. There are three parameters used to measure GCS, namely eye opening, motor response and verbal response. The maximum (normal) value of each parameter is unlock eye (E) = 4, best motor response (M) = 6, and verbal response (V) = 5. GCS assessment methods include check, rate, and observe (Bhaskar, 2017).

Other Organ Trauma

Trauma to other organs usually accompanies a head injury. The most common cause of head injury is traffic accidents that cause the patient to be dragged or thrown from the scene, resulting in lacerations, abrasions, or trauma to organs other than the patient's head. In Iraq there were 6306 injured patients with an ISS value of more than 9. ISS stands for injury severity score (Reihani et al., 2016).

Pre-Hospital Length

Pre-hospital length is the time for the patient to be treated, between the occurrence of trauma until the patient can arrive at the hospital. Trauma occurs when the patient experiences something that can cause a head injury, such as a fall or accident. Management of the pre-hospital phase can be a determinant of the severity of the patient's condition. It can also be said with the first treatment so as not to get worse the injury suffered by the patient. Prompt and appropriate pre-hospital care can reduce the risk of death or disability of the

patient. The effect of this pre-hospital length is very large for the patient's condition (Afni, 2018).

METHODOLOGY

The results of data analysis in this study using this research method using the literature study research method or literature review by collecting and analyzing the essence of previous research that has been written by researchers through several references from google Scholar , Science Direct , Pubmed , Proquest. Researchers conducted a journal search using 4 English keywords, namely the English keywords used (Factor) AND ((Head Injury) OR (Traumatic Brain Injury)) AND ((Prognostic) OR (Prognosis)) AND (Adult). After that enter the stage screening namely the stage to select the appropriate criteria in this study.

This research conducted screening by reading it over and over again related to the topic in this study to find criteria that match the research. The next stage is the study quality stage, at this stage the quality test of the selected journals is carried out using the JBI (Cross Sectional Studies, Cohort Studies, The Clinical trial) with the aim of obtaining quality journals and in accordance with the research topic. Thus obtaining as many as 15 journals consisting of 3 journals from google Scholar , 4 journals from ScienceDirect, 4 journals from pubmed, and 4 journals from Proquest

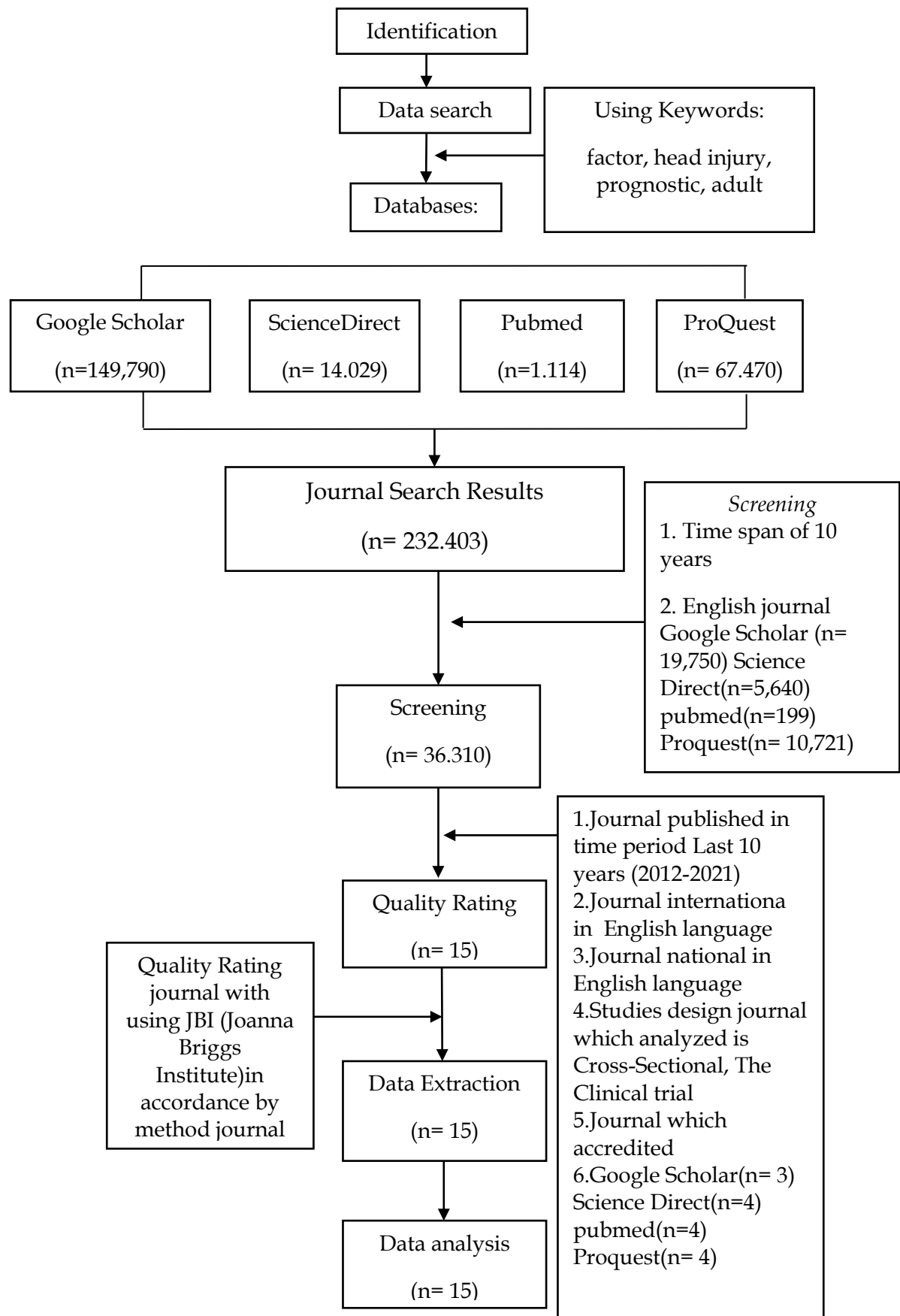


Figure 1. Stages of Literature

RESULTS

The characteristics of the journals analyzed in 15 accredited journals are described by the researchers into 2 characteristics, namely the country and the journal method

Table 1. Journal characteristics

Journal characteristics	N
Journal characteristics	2
Benua	
Asia (China, Qatar, Indonesia, India, Iran,)	7
Amerika (Amerika Serikat, Kanada)	3
Afrika (Ethiopia, Tunisia, Nigeria)	3
Eropa (Autria, Germany)	2
Design Studies	
Cohort studies	9
Cross sectional studies	4
The Clinical trial	2

Table 2. Composing Code

Code	Description
Age	As we age, the cells in the body will age and affect the health of the body.
Glasgow Coma Scale (GCS)	GCS score equal to or less than 8 was defined as severe head injury, GCS score for moderate head injury was 9-13, and GCS score for mild head injury was 14-15.
Gender	Gender is categorized into male and female
Hematoma	A large collection of extravasation of blood due to trauma, causing a palpable mass

At this stage, coding of all data from 15 journals in the transcript can be made semantically, namely direct depictions that appear in the data, and there are 4 main codes from the literature used, namely age, GCS, gender, and hematoma.

Table 3. Searching for Themes

Theme	Description
Age factor influence patient prognostic head injury	Of the 15 journals analyzed, it was found that 11 out of 15 discussed the age factor. One of them in the study of Assele et al, which is an independent predictor of time of

	death is age over 65 years (Assele et al., 2021).
GCS factor influence patient prognostic head injury	Of the 15 journals analyzed, it was found that 11 out of 15 discussed the GCS factor. In research journals Salottolo et al., mention that the GCS focuses on important functions of the central nervous system and consists of verbal, motor, and eye-opening responses. The GCS category, defined as mild (score, 13-15), moderate (score, 9-12), or severe (score, 3-8) using the GCS score on arrival to the Emergency Department (Salottolo et al., 2014).
Gender factor influence injury prognostic head	3 out of 15 journals mention gender as a prognostic factor in head injury. One of them is the research journal of Heydari et al, which found that the two sexes differed significantly in terms of trauma severity as measured by the emergency severity index and GCS (Heydari et al., 2020).
Hematoma factor influence injury prognostic head	4 of 15 journals mention hematoma factors that influence the prognostic of head injury. The investigators found a subdural hematoma that correlated with mortality which was explained by the frequent presence of other lesions such as bruising and meningeal hemorrhage. Posttraumatic meningeal hemorrhage is also thought to be correlated with mortality (Imen et al., 2015).

The final step in data analysis is to find a theme by linking the code into a theme

DISCUSSION

1. Age factors affect the prognosis of head injury patients

The current literature has shown that age influences the severity of head injury and mortality. It is recognized that advanced age is one of the main prognostic factors and has a significant influence on mortality after TBI (Ostermann et al., 2018). From 2002 to 2006, the Centers for Disease Control and Prevention estimated that hospitalizations increased by 34% and TBI-related deaths by 27% in the population aged 65 years or older. This study shows that age affects the relationship between the anatomic severity of TBI as measured by Abbreviated Injury Scale (AIS) (Salottolo et al., 2014).

According to Assele et al., (2021) The risk of death in patients over the age of 65 is higher than in those aged 18. These findings are consistent with other studies in which older people tend to have decreased immunity, are less likely to respond adequately to treatment, and are at increased risk of infection. From some of the studies above, it was found that age had a prognostic effect on head injury patients. Age above 65 years is more at risk because it can cause injury and indirectly extracranial injury

2. GCS factors affect the prognosis of head injury patients

TBI severity and altered level of consciousness were assessed using the GCS (motor score 1-6, verbal score 1-5, and eye score 1-4). In the research journal Salottolo et al., (2014) mentionsthat the GCS focuses on important functions of the central nervous system and consists of verbal, motor, and eye-opening responses. The GCS category, defined as mild (score, 13-15), moderate (score, 9-12), or severe (score, 3-8) using the GCS score on arrival at the Emergency Department. Unconsciousness was defined as a score of ≤ 8 . GCS parameters and bilateral pupil size and reactivity were evaluated prior to resuscitation at the scene and at hospital admission. Neurological outcomes were categorized into 1 of 5 levels using the Glasgow Outcome Scale (GOS): 1 death, 2 vegetative state (unable to interact with environment, unresponsive,) 3 severe disability (able to follow commands, unable to live independently), 4 disability moderate (able to live independently), and 5 good recovery (able to return to activities). A GCS score of 4 or 5 indicates good results (Imen et al., 2015).

From some of the studies above, it was found that GCS factors affect prognostication in head injury patientsbecause a low GCS indicates a higher degree of brain damage. Low GCS is a risk factor that is quite frequent in each study, showing the significance of these risk factors for the expansion of intracranial injuries and resulting in head injury patients (Wirawan et al., 2020)

3. Gender factors influence the prognostic of head injury

According to Heydari et al., (2020) found the two sexes were significantly different in terms of trauma severity as measured by the emergency severity index and GCS. This study found that intracranial lesions were significantly associated with male gender and trauma severity, i.e., moderate to severe head injury (Heydari et al., 2020). Most head injury sufferers in several places are male from several results. The high number of male sufferers is due to the high mobilization carried out by men. In fact, the number of men is 2 to 3 times more than women. So it can be known the prognostic percentage of death in each sex.

According to research by Rawis et al., (2016)In the distribution of CKS and CKB patients in ICU and HCU by gender, 33 male (83%) male CKS and CKB were found and 7 (18%). The results of the study obtained by Andriessen et al., from 508 head injury patients, including 129 moderate head injury patients and 339 head injury patients, mostly depended on the male gender, which was 70 people. Several factors that can influence the level of moderate and severe head injury in men, namely physical work and work in men are more at risk than women, for example construction workers and motorcycle riders. There are differences between male and female brains in terms of neuronal density, weight, and brain structure. The volume of the nerve center (hypothalamus) and white matter is greater in men, while the cortical gray matter in women is more, the volume is more prominent in areas related to the volume of the hippocampus and white matter associated

with interhemisphere connectivity. These differences in structure lead to varying responses and recovery after head injury between males and females.

4. Hematoma factors affect the prognostic of head injury

In a research journal from Imen et al., (2015) mentioned CT findings have been shown to influence outcome, which guides further management. The investigators found a subdural hematoma that correlated with mortality which was explained by the frequent presence of other lesions such as bruising and meningeal hemorrhage. Post-traumatic meningeal hemorrhage is also thought to correlate with mortality. Subdural hematoma is a collection of blood below the dura mater but outside the cerebrum and arachnoid layers (Meagher et al., 2013).

The clinical features of an acute subdural hematoma are a continuous decrease in level of consciousness, increased anxiety, pupillary changes and hemiparesis indicating the side of the lesion (Prahladu et al, 2017). The most prominent area for hematoma formation is in the temporal region, followed by the frontal region, with the most well-known trigger being tearing of the central meningeal supply line. The appearance of a hematoma in each area usually shows typical clinical symptoms, on the temporal side there is usually a contralateral hemiparesis which is moderate and ipsilateral pupillary dilation, in the frontal area it is generally preceded by a decrease in consciousness, and in the back fossa there is a change in the signs that are very necessary. can cause respiratory problems (Untoro et al., 2019).

CONCLUSIONS AND RECOMMENDATIONS

From the results of the study conducted an analysis of 15 journals, the researchers obtained results regarding the factors that influence prognostication in head injury patients. The factors found in the 15 journals included age, GCS, gender, and hematoma.

FURTHER STUDY

This study has several limitations or shortcomings experienced by researchers while conducting research, including:

- 1) The results of the search for journals discussing factors that influence prognostication in head injury patients are very limited.
- 2) To get journals that are in accordance with the topic under study, researchers need quite a long time so that the journals obtained are in accordance with the topic.

This research still has many shortcomings from various aspects, including research content, writing procedures, use of language, as well as in analyzing journals and in searching for journals. The researcher hopes that future researchers can look for better and more qualified journals and pay more attention to the content, procedures and use of language in research.

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