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MORTALITY PROFILE OF PATIENTS DECLARED AS BRAIN STEM DEAD IN RSUP DR. SARDJITO YEAR 2014-2022

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ABSTRAK

Kematian batang otak, yang ditandai dengan berhentinya seluruh aktivitas otak dan batang otak secara ireversibel, secara klinis ditunjukkan oleh koma dalam, tidak adanya refleks batang otak, dan apnea. Meskipun memiliki signifikansi yang krusial dalam pengambilan keputusan klinis dan etis, penelitian mengenai kematian batang otak di Indonesia masih sangat terbatas. Penelitian ini bertujuan untuk menggambarkan profil mortalitas pasien yang dinyatakan meninggal secara batang otak di RSUP Dr. Sardjito selama periode 2014 hingga 2022, dengan fokus pada karakteristik demografis, distribusi kasus, pola penatalaksanaan, dan praktik dokumentasi. Penelitian ini merupakan studi observasional deskriptif dengan desain potong lintang menggunakan data retrospektif dari rekam medis. Dari 73 pasien dengan cedera otak traumatik (TBI) yang dirawat di ICU dan menggunakan ventilator, lima pasien (6,85%) secara resmi dinyatakan meninggal batang otak, satu pasien tercatat sebagai suspek (1,4%), dan hanya satu kasus yang mencantumkan kematian batang otak sebagai penyebab resmi kematian (1,4%). Tidak ada kasus yang menunjukkan lesi struktural langsung pada batang otak. Rerata lama perawatan di ICU adalah 5,2 hari. Seluruh deklarasi kematian batang otak dilakukan sesuai prosedur standar dengan konfirmasi oleh spesialis anestesi dan neurologi. Temuan ini menunjukkan bahwa kematian batang otak merupakan kejadian langka namun signifikan akibat TBI berat, serta menekankan pentingnya intervensi dini dan perbaikan dokumentasi untuk mendukung praktik klinis dan kebijakan di masa depan.

Kata Kunci: Kematian Batang Otak, Cedera Otak Traumatik, Kecelakaan Lalu Lintas, Rekam Medis.

ABSTRACT

Brain stem death, characterized by the irreversible cessation of all brain and brain stem activity, presents clinically with deep coma, absence of brain stem reflexes, and apnea. Despite its critical significance in clinical and ethical decision-making, research on brain stem death in Indonesia remains limited. This study aims to describe the mortality profile of patients declared brain stem dead at RSUP Dr. Sardjito from 2014 to 2022, focusing on demographic characteristics, case distribution, management patterns, and documentation practices. A descriptive observational study with a cross-sectional design was conducted using retrospective data from medical records. Of 73 patients with traumatic brain injury (TBI) admitted to the ICU and requiring ventilator support, five (6.85%) were formally declared brain stem dead, one was recorded as suspected (1.4%), and only one had brain stem death documented as the official cause of death (1.4%). None *of the cases exhibited direct structural lesions of the brain stem. The mean ICU length of stay was 5.2 days. All declarations followed standardized procedures involving confirmation by both anesthesiologist and neurologist. These findings suggest that brain stem death is a rare but significant outcome of severe TBI and highlight the need for timely intervention and improved documentation to guide future clinical and policy approaches.*

Keyword: *Brain Stem Death, Traumatic Brain injury, Motor Vehicle Accidents, Medical Record*

INTRODUCTION

Death is a multifaceted process with cells and organs ceasing function at different rates. It triggers debates due to ethical, cultural, religious, and moral perspectives[1]. The concept of death has evolved from advancements in medical understanding, diverse cultural views, and societal and technological changes, leading to ongoing debates and refinements in its definition and understanding[2].

Brain stem death is the irreversible loss of all brain function, including the brain stem. Its symptoms include deep coma, absence of brain stem reflexes, and apnea. The brainstem is responsible for consciousness and spontaneous breathing, making brain stem death equivalent to clinical or conventional death. Some of the known etiology of brain stem death are infection, head trauma, intracranial pressure induced by intracranial lesions, brain hypoxia, vascular abnormalities, poisoning, and metabolic disturbances. The confirmation of brain stem death is significant in medical practice. Advancements in resuscitation, intensive care, and breathing machine technology have created challenges in differentiating between life and death[3]. In Indonesia, the Regulation of the Minister of Health of the Republic of Indonesia No. 37 of 2014 serves as the primary reference for diagnosing brain stem death patients[4].

A study conducted in Indonesia from 2018 to 2019, the first of its kind, assessed the knowledge and diagnosis of brain death among resident doctors. The study revealed that resident doctors possess adequate theoretical knowledge of brain death, but their understanding of the clinical examination of brain death is lacking[5]. Also, in many legal frameworks, brain stem death qualifies individuals as potential organ donors, notably in corneal transplantation[6]. In conclusion, a comprehensive understanding of brain stem death is crucial for medical professionals. It allows for accurate determination of death, consideration of ethical aspects, optimization of organ transplantation practices, specialized patient care, medical education, research, and fulfilment of legal obligations. Analysing the mortality profile of patients declared brain stem dead, particularly in RSUP Dr. Sardjito, can provide valuable insights into mortality outcomes, etiology, risk factors, and end-of-life decision-making.

METHOD

This study used a descriptive observational method with cross sectional approach. This study aimed to describe the mortality profile of patients declared brain stem dead. Specifically, it sought to examine the demographic characteristics associated with brainstem death cases and identify trends, patterns, and significant findings related to the documentation of these cases. The 100 data were obtained through the medical records of patients in RSUP Dr. Sardjito from 2014-2022. The statistical analysis process was carried out using the *Statistical Package for the Social Sciences* (SPSS) application (Version 27.0).

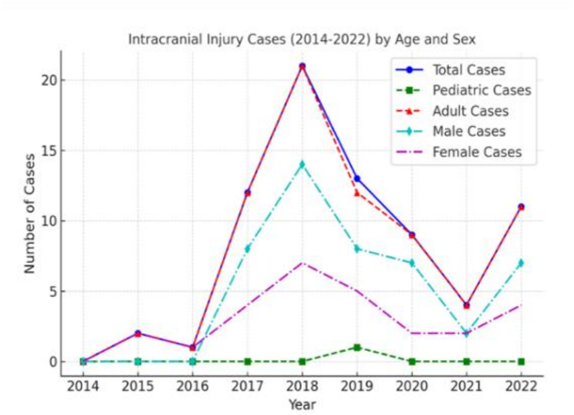
RESULT AND DISCUSSION

RESULT

This study was conducted in August 2024. A total of 100 intracranial injury patients were collected. To specify the search, only 73 patients were included, which all admitted due to trauma (traumatic brain injury).

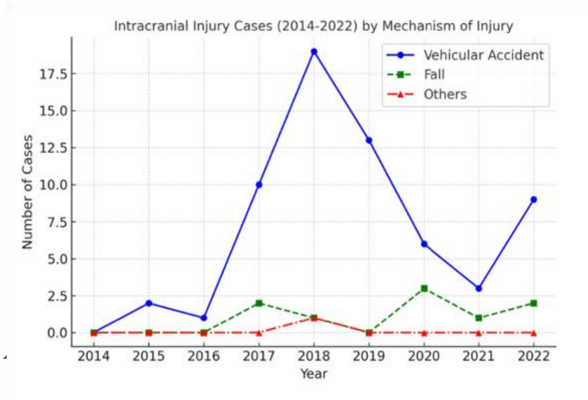
Intracranial Injury Patients

Figure 1. Graph Case Distribution of Intracranial Injury Patients Year 2014-2022 based on Age Category and Sex.



The number of 73 intracranial injured patients shown in Figure 1 were all traumatic-caused, therefore the researcher will refer to them as TBI patients for further discussion in this paper. From 2014 to 2022 the number of cases fluctuates, 98.6% of intracranial injury cases occurred in adults, with the highest frequency in 2018. Males accounted for 63.0% of cases, with the highest proportion in 2018. Pediatric cases were extremely rare (1.4%).

Figure 2. Graph Case Distribution of Intracranial Injury Patients Year 2014-2022 based on Mechanism of Injury



Motor vehicle accidents (MVA) were the most common cause of intracranial injury, accounting for 86.3% of cases from 2014 to 2022. Falls were the second most frequent mechanism, contributing to 12.3% of cases.

Brain Stem Death Patients

The data is composed based on the intracranial injury patients with brain stem death and suspected brain stem death reported as the cause of death, final diagnosis or differential diagnosis, or any declaration made on the ICU 24/7 monitoring sheets.

Table 1. Frequency Distribution of Brain Stem Dead Patients Year 2014-2022 Based on Age Category and Sex

Year	Number of cases [n (%)]	Age Category [n (%)]		Sex [n (%)]	
		Pediatric	Adult	Male	Female
2014	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2015	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2016	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2017	1 (20.0)	0 (0.0)	1 (20.0)	0 (0.0)	1 (20.0)
2018	2 (40.0)	0 (0.0)	2 (40.0)	1 (20.0)	1 (20.0)
2019	1 (20.0)	0 (0.0)	1 (20.0)	1 (20.0)	0 (0.0)
2020	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2021	1 (20.0)	0 (0.0)	1 (20.0)	1 (20.0)	0 (0.0)
2022	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	5 (100.0)	0 (0.0)	5 (100.0)	3 (60.0)	2 (40.0)

The distribution by year shows that brain stem death cases were reported in 2017, 2018, 2019, and 2021, with 1 case (20%) each in 2017, 2019, and 2021, and 2 cases (40%) in 2018. No cases were recorded in 2014, 2015, 2016, 2020, and 2022. In terms of sex distribution, there were 3 male patients (60%) and 2 female patients (40%). This indicates a slight predominance of male patients in this sample.

Table 2. Frequency Distribution of Brain Stem Dead Patients Year 2014-2022 Based on Mechanism of Injury

Year	Mechanism of Injury [n (%)]			Total [n (%)]
	Motor vehicle accidents	Fall	Others	
2017	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)
2018	2 (40.0)	0 (0.0)	0 (0.0)	2 (40.0)
2019	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)
2021	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)
Total	5 (100.0)	0 (0.0)	0 (0.0)	5 (100.0)

The frequency distribution of brain stem dead patients from 2017 to 2021, categorized by the mechanism of injury, is entirely attributable to MVA. Over this five-year period, there were no cases caused by falls or other types of injuries. In 2017, 2019, and 2021, there was one case each year, representing 20% of the total cases for each respective year. In 2018, two cases were recorded, accounting for 40% of the total.

Table 3. Frequency Distribution of Brain Stem Dead Patients Year 2014-2022 Based on Possible Conditions Leading to Brain Stem Death

Year	Possible Conditions Leading to Brain Stem Death [n (%)]			Total [n (%)]
	TBI	TBI + ICH	TBI + SAH + ICH	
2017	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)
2018	1 (20.0)	1 (20.0)	0 (0.0)	2 (40.0)
2019	1 (20.0)	0 (0.0)	0 (0.0)	1 (20.0)
2021	0 (0.0)	0 (0.0)	1 (20.0)	1 (20.0)
Total	3 (60.0)	1 (20.0)	1 (20.0)	5 (100.0)

Table 3 outlines the possible medical conditions that led to brain stem death among the patients. The most frequent condition was traumatic brain injury (TBI) alone, which accounted for three cases (60%) of the total. Other conditions observed were TBI combined with intracerebral hemorrhage (TBI + ICH) and TBI combined with subarachnoid hemorrhage and intracerebral hemorrhage (TBI + SAH + ICH), each accounting for one case (20%). The distribution by year shows a range of conditions, with 2017, 2018, and 2019 primarily featuring TBI cases, while 2021 presented one case with the combination of TBI + SAH + ICH.

Table 4. Frequency Distribution of Brain Stem Dead Patients Year 2014-2022 Based on Brain Stem Lesion

Year	Brain Stem Lesion [n (%)]		Total [n (%)]
	Present	Absent	
2017	0 (0.0)	1 (20.0)	1 (20.0)
2018	0 (0.0)	2 (40.0)	2 (40.0)
2019	0 (0.0)	1 (20.0)	1 (20.0)
2021	0 (0.0)	1 (20.0)	1 (20.0)
Total	0 (0.0)	5 (100.0)	5 (100.0)

Table 4 presents data on the presence or absence of brain stem lesions in brain stem dead patients from 2017 to 2021, none had a brain stem lesion.

Table 5. Frequency Distribution of Brain Stem Dead Patients Year 2014-2022 Based on Compliance to Regulation (Medical Examiner)

Year	Compliance to Regulation (Medical Examiner) [n (%)]		Total [n (%)]
	Yes	No	
2017	1 (20.0)	0 (0.0)	1 (20.0)
2018	2 (40.0)	0 (0.0)	2 (40.0)
2019	1 (20.0)	0 (0.0)	1 (20.0)
2021	1 (20.0)	0 (0.0)	1 (20.0)
Total	5 (100.0)	0 (0.0)	5 (100.0)

In each year, all cases (100%) were compliant with the regulation, with no cases recorded as non-compliant. This consistency highlights full adherence to the medical regulations regarding brain stem death throughout the study period.

Table 6. Length of Stay (LOS) in the Hospital for Patients Declared as Brain Stem Dead at RSUP Dr. Sardjito (2017–2021).

Patients Declared as Brain Stem Death	Lengths of Stay (days)
Patient #1 (2017)	4
Patient #2 (2018)	5
Patient #3 (2018)	7
Patient #4 (2019)	5
Patient #5 (2021)	5
Mean	5.2
Maximum	7
Minimum	4

Between 2017 and 2021, five brain stem dead patients had stays ranging from 4 to 7 days, with a mean of 5.2 days.

Intracranial Injury Correlation to Brain Stem Death

Table 7. Frequency Distribution of Brain Stem Death as the Recorded Cause of Death in Intracranial Injury Patients Year 2014-2022

Year	Cause of Death [n (%)]			Total [n (%)]
	Brain Stem Death	Susp. Brain Stem Death	Others	
2014	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
2015	0 (0.0)	0 (0.0)	2 (2.7)	2 (2.7)
2016	0 (0.0)	0 (0.0)	1 (1.4)	1 (1.4)
2017	0 (0.0)	0 (0.0)	12 (16.4)	12 (16.4)
2018	0 (0.0)	1 (1.4)	20 (27.4)	21 (28.8)
2019	0 (0.0)	0 (0.0)	13 (17.8)	13 (17.8)
2020	0 (0.0)	0 (0.0)	9 (12.3)	9 (12.3)
2021	1 (1.4)	0 (0.0)	3 (4.1)	4 (5.5)
2022	0 (0.0)	0 (0.0)	11 (15.1)	11 (15.1)
Total	1 (1.4)	1 (1.4)	72 (97.2)	73 (100.0)

in 2018, accounting for 28.8% of the total deaths, with all these cases classified under "Other" causes. Similarly, a significant number of deaths was recorded in 2019 (17.8%) and 2017 (16.4%), with "Other" causes continuing to dominate. In most years, deaths from intracranial injury were attributed to "Other" causes, including all reported deaths in 2015, 2017, 2019, and 2022.

Table 8. Frequency Distribution of Possible Conditions Leading to Brain Stem Death on Intracranial Injury Patients Year 2014-2022

Year	Possible Conditions Leading to Brain Stem Death [n (%)]								Total [n (%)]
	TBI	TBI + CPA + SAH + ICH	TBI + CPA + SAH	TBI + ICH	TBI + SAH	TBI + CPA + ICH	TBI + SAH + ICH	TBI + CPA	
2014	0 (0.0)	0	0	0	0	0	0	0	0
2015	0 (0.0)	0	0	0	0	1 (1.4)	1 (5.3)	0	2 (2.7)
2016	0 (0.0)	0	0	1 (1.4)	0	0	0	0	1 (1.4)
2017	3 (4.1)	0	0	2 (2.7)	5 (6.8)	0	2 (2.7)	0	12 (16.4)
2018	5 (6.8)	1 (1.4)	1 (1.4)	4 (5.5)	4 (5.5)	0	5 (6.8)	1 (1.4)	21 (28.8)
2019	3 (4.1)	0	0	3 (4.1)	3 (4.1)	0	4 (5.5)	0	13 (17.8)
2020	3 (4.1)	0	0	0	1 (1.4)	0	4 (5.5)	1 (1.4)	9 (12.3)
2021	0 (0.0)	0	0	1 (1.4)	1 (1.4)	0	2 (2.7)	0	4 (5.5)
2022	2 (2.7)	0	0	4 (5.5)	4 (5.5)	0	1 (1.4)	0	11 (15.1)
Total	16 (21.9)	1 (1.4)	1 (1.4)	15 (20.5)	18 (24.7)	1 (1.4)	19 (26.0)	2 (2.7)	73 (100.0)

Between 2014 and 2022, analysis of 73 cases revealed that traumatic brain injury (TBI), alone or in combination with other conditions, was the leading contributor to brain stem death. The most common combination was TBI with subarachnoid hemorrhage (SAH) and intracranial hemorrhage (ICH), accounting for 26% of cases. TBI alone and TBI with ICH followed at 21.9% and 20.5%, respectively. Rare combinations involving cardiopulmonary arrest were observed in only 1.4% of cases each. Yearly trends showed no cases in 2014–2015, with a peak in 2018 (28.8%) and a secondary rise in 2022 (15.1%), This variability indicates possible changes in reporting, diagnostic practices, or external factors influencing patient outcomes over time.

DISCUSSION

Intracranial Injury Patients

Frequency distribution of the injured patients across the year of 2014-2022 fluctuates with the highest number of 21 cases found in 2018 and zero cases as the lowest rate in 2014. The global incidence of TBI has increased significantly, primarily due to the rising use of motorized vehicles in low- and middle-income countries[7]. This trend is relevant to Indonesia, which the World Bank classified as an upper-middle-income country. Nationally, data from Dr. Soetomo General Hospital, Surabaya, in 2009 until 2013, showed incidence of TBI reached 1,178 cases every year, with mortality rates ranging from 6.2% to 11.2%, also data from Global Burden of Diseases, Injuries, and Risk Factors 2016 stated that the incidence of TBI from 2009 to 2013 in Indonesia indicated an increase of about 25% compared to 1990[8]. Globally, the most recent study published in 2025 on global burden of TBI, stated that in 2021, there were 20.84 million (95% UI: 18.13, 23.84) incident cases and 37.93 million (95% UI: 36.33, 39.77) prevalent cases of TBI[9].

The incidence of TBI during the study period was predominantly among adult male patients, with notable peaks in 2018 and 2022. Pediatric cases were extremely rare (1.4%), and overall, males were more frequently involved than females. Studies in Indonesia and abroad consistently show that traumatic brain injury (TBI) is more common among males, particularly young adults, due to their higher involvement in high-risk activities and traffic accidents. Research at various Indonesian hospitals, including Haji Adam Malik General Hospital, RSUD Dr. H. Abdul Moeloek, and RSUD NTB, found the highest incidence of TBI in the 18-45 age group, with men being more affected[7-8]. A 2024 study at RSUD Prof. Dr. Margono Soekarjo reported that 70.53% of TBI cases were male, linking this disparity to occupational hazards, frequent motorbike use, and risk-taking behaviors[10]. Similarly, global studies, such as Grigorakos et al. (2016) in Greece and Zhong et al. (2025) in China, highlight that young male, especially those aged 20-24, are more prone to TBI due to reckless driving and risk-seeking tendencies, whereas females tend to be more proactive in seeking healthcare, influenced by social norms and gender roles[9,11].

Also, in acknowledging the presence and significant impact of the COVID-19 pandemic from 2020 to 2022, which profoundly affected all aspects of life worldwide—particularly the healthcare sector and its policies—it would not be a surprise that disease incidence and reporting trends may have changed during those years. In 2021, there were 783,270 deaths in Indonesia, and Yogyakarta ranked sixth among the provinces with the highest number of deaths during the pandemic, with a total of 27,090 deaths[12]. The earliest report on TBI incidence during COVID-19 pandemic published in 2020. A brief article described and increase in TBI admissions to the emergency department of Cipto Mangunkusumo National General Hospital (RSCM) in Jakarta, Indonesia, between March 16th and June 14th 2020, compared to the same period in previous year. The study found a familiar demographic pattern of cases predominantly involving adults, males, and road traffic injuries. That article by Prawiroharjo et al. (2020) mentioned the need for further research, suggested the observed increase in TBI cases might not have been directly cause by COVID-19 itself but rather by changes in government policies that influence social behaviour and daily routines[13]. However, the study did not formulate a specific hypothesis in regarding the results, aside from mentioning “possible changes or impacts.” Given the quieter roads and national distancing measures specifically stated in the article, one might have expected a decrease in TBI incidence instead. This assumption is supported by a study done at the same year in Poland, a high-income country, which analysed TBI incidence over six years prior to the pandemic. Contrary to the findings from RSCM, this study reported a lower TBI incidence (24.68% drop) during the pandemic but a drastically increased mortality rate (26.75% more). The researchers concluded that the significant reduction in human mobility due to lockdowns played a crucial role in these findings[14].

Based on the mechanism of injury, the majority of TBI during the study period were caused by motor vehicle accidents (86.3%), with a smaller portion attributed to falls (12.3%) and only one case from an alternative mechanism (1.4%). The other mechanism recorded specifically referred to injury caused by a falling tree. Traffic accidents are the leading cause of severe traumatic brain injury (TBI) worldwide, accounting for 40-61.99% of cases, followed by falls and other causes such as workplace accidents and physical aggression, with studies from Greece, India, Indonesia, and China confirming this trend[7,11,15-16].

Brain Stem Death Patients

The frequency of brain stem death among 73 TBI patients was low over the 9-year period (6.85%) in a total of two females and three males. While the information on brain stem death prevalence or incidence in Yogyakarta or Indonesia is still lacking, there were some data that can give us an outline on what the trend could possibly be. This could come from the cause or mechanism of injury that causes the possible conditions leading to brain stem death, or any other factors that may end up in the declaration of brain stem death. These data may help us find context on the brain stem death incidence in Indonesia, further specific research needed. Globally, between 2012 and 2016, there were 69,735 cases of brain stem death in the United States, an increase from 12,575 cases in 2012 to

15,405 in 2016, with a mean age of 47.83 years with males comprising 56.47% of cases[17]. A study by Prin et al. (2019) showed among 449 ICU patients admitted to Kamuzu Central Hospital in Malawi from 2016 to 2018, 9.6% (43 patients) were diagnosed with brain stem death[18]. Up to this point, there are no local (i.e. Yogyakarta) nor national (i.e. Indonesia) report on the incidence number of brain stem death.

All five cases of brain stem death diagnosis during the study period were caused by motor vehicle accidents (100%), with no cases attributed to falls or other causes. Though there is still yet research on the direct relation of TBI to brain stem death, it can be concluded that because the most common cause of TBI admission to the hospital were motor vehicle accidents, followed by falls, and other, this research will continue the discussion based on those found facts. One research dated back in 2005, studying brain death after severe traumatic injuries, highlighted the cause of 61.3% of patients admitted to the hospital was caused by motor vehicle accidents[19].

In analysing possible conditions or diagnosis that may lead to brain stem death in intracranial injured patients, the data reflect that TBI, either alone or in combination with other conditions, is the most common cause of brain stem death during the studied years. The data analysed showed the combination of TBI, SAH, and ICH (26%), followed by TBI and SAH combination only (24.7%). The most common processes leading to brain death, in order of frequency, are cardiopulmonary arrest, TBI, subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH)[20]. TBI alone made up a significant number (21.9%) of cases, although not the highest. There are still minimal studies specifically discussing the direct relation or researching the prevalence of brain stem death as the result of TBI. There is one study in 2005 titled "*Brain Death After Severe Traumatic Brain Injury: The Role of Systemic Secondary Brain Insults*", brain death occurred in 14.6% (59 out of 404) of severe TBI patients. A TBI can elevate ICP due to swelling or hemorrhage, potentially surpassing cerebral perfusion pressure, which may cause ischemia, brain function loss, and ultimately lead to brain stem herniation[21]. There was no recorded case of cardiopulmonary arrest contributing to the brain stem dead patients.

The combination of TBI and SAH alone was the second leading cause of progression to death, accounting for 24.7% of cases. Traumatic SAH is common, occurring in 41%-55% of patients after moderate or severe TBI and traumatic SAH is also linked to early cerebral contusion progression in 59%-71% of patients, with a subsequent poor outcome. Though the death mentioned was not specifically refer to brain stem death or death by neurological criteria, it was mentioned in the result of comparing head injury patients with traumatic SAH versus those without, traumatic SAH was strongly associated with death and 6-month unfavorable outcome, where sixty-three patients (29%) had died in 6 months post injury[22]. Subarachnoid hemorrhage (SAH), a complication of traumatic injury, can result in intraventricular and intracerebral hemorrhage, ultimately causing intracranial hypertension exceeding 20 mmHg. Zoerle et al. (2015) reported that over 80% of SAH patients experience at least one episode of elevated intracranial pressure[23]. The release of a large amount of hemoglobin into the subarachnoid space triggers calcium channel activation in vascular smooth muscle cells, leading to contraction and subsequent vasospasm. This vascular constriction reduces cerebral perfusion, which can progress to cerebral ischemia and infarction. Intracerebral hemorrhage can also cause the aforementioned process of subsequent vasospasm, since the presence of a mass hematoma in any part of a rigid skull triggers the same process. However, a large intracerebral hemorrhage is also known to cause more shifting and thus causes brain herniation; a displacement of brain tissue to an opening or space in the skull. Hence, the presence of brain herniation can further progress into brain stem death[24-26].

Out of the total five patients declared as brain stem death, none specifically had been recorded as having any brain stem lesions. The researcher found limited study specifying the direct and indirect brain stem involvement, nor their examples, after traumatic brain in and their progression to brain stem death. Though, what is certain is that indirect lesions could lead to brain death through the same processes as other complications of traumatic mechanisms on the brain. While brainstem lesions might seem to indicate a higher likelihood of brainstem death, this is not always the case. Research from 2009 highlighted diagnostic challenges, emphasizing the need to differentiate true brain death from mimicking conditions like high cervical cord injury or baclofen toxicity[27]. A 2013 UK study noted that brainstem death typically results from severe neurological injuries such as traumatic brain injury (TBI), aneurysmal subarachnoid hemorrhage (SAH), or fulminant meningoencephalitis, while anoxic-ischemic injury or brainstem stroke rarely cause it unless asphyxia is prolonged, particularly in neonates and children[28].

The declaration of all brain stem dead patients were done 100% as the legal regulation instructed. The researcher did not find any oddity regarding the steps of those declarations. Though, the researcher may suggest that in managing brain stem dead patients, the medical records could be more organized. The author also noted that even though a patient "declared as brain stem dead", medical records might not put it as the cause of death.

The average length of stay (LOS) for patients declared as brain stem dead in this study was 5.2 days, ranging from 4 to 7 days. This aligns with findings from previous research, where critically ill TBI patients requiring ventilatory support often experience a short but intensive ICU stay before brain stem death is confirmed. The relatively brief LOS may be attributed to the rapid progression of secondary brain injury mechanisms, such as increased intracranial pressure and cerebral herniation, which accelerate neurological deterioration. Additionally, the standardized brain stem death determination process—requiring repeated assessments before an official declaration—could influence LOS variability.

In summary, the correlation between traumatic brain injury (TBI) and brainstem death is largely determined by the severity and progression of brain damage. TBI, often from motor vehicle accidents, can lead to complications like intracranial hypertension, cerebral edema, and hemorrhages, increasing intracranial pressure and reducing cerebral perfusion. These factors may cause brainstem herniation and irreversible loss of function. While brainstem death is relatively rare among TBI cases, severe hemorrhages, prolonged hypoxia, or secondary brain insults significantly raise its likelihood. This study found a short length of stay before brainstem death, indicating rapid neurological decline despite intensive care. Early intervention and effective management of intracranial pressure are crucial in improving outcomes and extending survival time in intracranial injury patients.

There are several limitations to this study. The amount of data analysed would be more accurate if the ICD used for brain stem death diagnosis is used and recorded well on the medical records. Additionally, the author can collect a larger sample size to provide more detailed or reliable representation of the population.

CONCLUSION AND SUGGESTION

CONCLUSION

Based on the research findings, this study reveals the mortality profile of patients declared brain stem dead at RSUP Dr. Sardjito from 2014 to 2022, highlighting demographic characteristics, trends, and documentation challenges. Brain stem death was rare, with only five officially declared cases, all adults, caused by motor vehicle accidents and was not always directly linked to structural brain stem damage. Notably, TBI and or with other intracranial complications was recorded as the cause, the length of stay was generally short which emphasizes the importance of timely intervention and effective neurocritical care management in potentially delaying or preventing progression to brain stem death in severe intracranial injury patients, and all brainstem death cases followed proper declaration procedures.

SUGGESTION

Future research on brain stem death should prioritize the regular updating of mortality profiles among affected patients, incorporating detailed analyses of Glasgow Coma Scale (GCS) data, the location of cardiopulmonary arrest (CPA) occurrence, additional risk factors for traumatic brain injury (TBI) patients during the COVID-19 pandemic, and key demographic variables such as age and sex. It is essential that researchers employ the most current and region-specific ICD codes relevant to brain stem death, ensuring data accuracy aligned with the study period, particularly during pandemic years when mortality risk factors may shift due to changes in road activity or immune system vulnerabilities. Furthermore, scholars and policymakers are encouraged to explore the relationship between accurate brain stem death declarations and their implications for organ donation, emphasizing the need for comprehensive evaluations of national-level procedures and policies to support ethical, timely, and effective organ transplantation practices.

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