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Analysis of Mortality Risk Factors in Children with Epidural Hematoma (EDH)

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ABSTRACT
Head injuries hold the third position among all injury categories in Indonesia, with the highest number of cases occurring in children. Approximately 2% of all head injury cases are epidural hematomas (EDH). The majority of these epidural hematoma cases are caused by head trauma such as accidents, falls, collisions, or other physical assaults leading to traumatic mechanisms. Additionally, EDH can also be caused by non-traumatic processes such as infection/abscess, vascular malformations, tumors, and coagulopathy disorders. Epidural hematoma has a relatively favorable prognosis, yet there are several factors that contribute to a worsened prognosis. This study aims to examine of several research articles outlining the factors contributing to mortality in pediatric EDH cases. The method used is a literature review technique utilizing scholarly databases meeting specific inclusion criteria. The study found that the preoperative GCS, preoperative treatment time interval, operative treatment, and pupillary abnormalities are some of the factors that can impact patient outcomes, including mortality rates, in pediatric EDH cases. Subsequent research is expected to delve deeper on the outcomes of patients undergoing surgical and conservative interventions to address mortality incidents in pediatric EDH.
KEYWORDS: Epidural Hematoma, Mortality, Children, Risk Factors.

INTRODUCTION

Head injuries remain prevalent cases. According to the Basic Health Research Data (Riskesdas) 2018, head injuries rank third after lower and upper limb injuries. With the highest number of injury cases observed among children. Approximately 2% of all head injury cases are epidural hematoma (EDH) cases, and 5-15% of severe head injury patients are diagnosed with EDH (Ansar et al., 2021)

Epidural Hematoma (EDH) also known as extradural hemorrhage is a condition where there are bloods between the dura mater layer and the skull bone, typically associated with fractures of the skull bone and causing tears in the middle meningeal artery, middle meningeal vein, or dural venous sinuses, which often occur in the temporal or temporo-occipital area (Amrizal & Saanin, 2018). Based on a study by Al Mukhtar et al (2022), head injuries in children are often caused by falls

from heights, accidents, or collisions with objects. Additionally, EDH can also be caused by non-traumatic processes such as infection/abscess, vascular malformations, tumors, and coagulopathy disorders (Khairat & Waseem, 2024).

Based on earlier research findings, it's evident that EDH cases are the most prevalent, comprising 99 out of 224 patients in total (Hafez, 2021). EDH commonly occurs at young ages because the dura mater layer gradually adheres more to the bones above it as individuals grow, resulting in a lower prevalence of EDH in the 50-60 age group (Kemenkes RI, 2021). The incidence rate of EDH in children reaches 2-3% of total Traumatic Brain Injuries (TBI) and represents more than 16% of all diagnoses in children undergoing inpatient care after TBI (Spazzapan et al., 2019).

Childhood is a developmental phase, with the maturation of organ functions being one of them. This can have adverse effects due to chronic progressive processes that pose a risk of growth disturbances in various aspects (Pediatric department of medical faculty Wijaya Kusuma University Surabaya et al., 2019). Based on research, there are 4 age groups, with the highest number of Epidural Hematoma cases found in the 0-20 age group, with 49 patients out of a total of 266 patients (43.8%) (Ansar et al., 2021).

EDH has a fairly good prognosis. However, several factors worsen the prognosis, such as age, lucid interval, prehospital time, GCS score, pupil abnormalities, lesion size from head CT scan findings, and surgical intervention (Afni, 2018). Therefore, this study aims to review a number of research articles presenting factors contributing to mortality in pediatric EDH cases.

MATERIALS AND METHODS

This study utilizes the technique of literature review using scholarly databases such as ScienceDirect, Medline/PubMed, and Google Scholar. The keywords used to obtain these databases are "Epidural Hematoma," "Mortality," "Children," and "Risk Factors." The inclusion criteria for this literature review encompass articles and journals from both national and international sources, with primary data sourced from global surveys. The journals used have research spanning the last 10 years, with all relevant studies up to 2024 examined. A total of 4 scholarly articles meeting these criteria were obtained, which are subsequently presented in the literature review.

RESULTS

No.	Writer	Result
1.	(Khalid et al., 2023)	The research results indicate that the mortality rate in cases of epidural hematoma reaches 4.3%, with females aged 0-5 years being the most affected. Factors contributing to mortality include a Glasgow Coma Scale (GCS) score upon hospital admission of less than 8, abnormal pupil diameter, lesions found, and patients undergoing surgery more than 6 hours after the incident.
2.	(Spazzapan et al., 2019)	The research results indicate that there were no mortalities in the study. However, there are factors worsening the prognosis in pediatric patients. These factors include surgical intervention. It is evident that patients undergoing surgery (76.4% with mRS 0) have a worse prognosis compared to those undergoing conservative treatment (92.3% with mRS 0).
3.	(Atci et al., 2018)	The research results indicate that patients who died in this study had a Glasgow Coma Scale (GCS) score below 6 upon arrival at the hospital, with surgical intervention approximately 4 hours after the incident.
4.	(Afni, 2018)	The research results indicate that the mortality rate for epidural hematoma (EDH) reaches 32.3%. The highest number of deaths occurs in individuals aged 15-45 years, with systolic blood pressure below 90 mmHg, prehospital time exceeding 4 hours, and pupil diameter less than 2 mm.

Based on the literature study results presented in the table above, it is evident that there are several factors that can worsen the prognosis of pediatric epidural hematoma patients and even lead to mortality. Two out of the four studies mentioned state that mortality rates are dependent on GCS scores and the time taken from the incident to surgical intervention. Khalid et al. (2023) reported that the highest mortality rates were observed among females aged 0-5 years with a GCS score below 8 upon hospital admission. Similarly, Atci et al. (2018) found that patients who passed away had a GCS score below 6 upon hospital admission, with surgical intervention approximately 4 hours after the trauma. Furthermore, studies by Khalid et al. (2023) and Afni (2018) also explain abnormalities in pupil dilation among patients who passed away from epidural hematoma cases.

DISCUSSION

Glasgow Coma Scale

Khalid et al. (2023) used the Chi-square test to investigate how categorical variables affect the

Glasgow Outcome Scale (GOS). Among a total of 116 patients, 5 experienced mortality. The GCS was categorized into 3 groups: "<8", "9-12", and ">12". The research results indicate that 4 out of the 5 deceased patients had a GCS score <8 upon hospital admission, with a total of 20 patients having a GCS score <8. The remaining patient fell into the "9-12" GCS score category. This suggests that almost all deceased patients had a low GCS score, below 8. Similarly, a study by Atci et al. (2018) using Student's T Test found that all deceased EDH patients (14%) had a GCS score below 6 upon hospital admission. However, the effectiveness of using GCS measurements in children under 5 years old remains uncertain. This is because some modifications are needed for verbal and motor responses in children of this age. While there are several methods to assess consciousness in children, there is no universally accepted method yet (Mawuntu, 2019).

Preoperative treatment time interval

Khalid et al. (2023) used the Chi-square test to investigate how categorical variables affect the Glasgow Outcome Scale (GOS). Among a total of 116 patients, 5 experienced mortality. The preoperative treatment time was categorized into 4 groups: "<6hours", "7-12 hours", "12-24 hours", and ">24 hours". The results of this study indicate that 5 out of 5 deceased patients had a preoperative treatment time interval of 7-12 hours out of a total of 32 patients who underwent surgery 7-12 hours post-trauma. Meanwhile, patients with a preoperative treatment time interval of <6 hours showed promising prognosis without any mortality. These findings align positively with previous research by Afni (2018). Based on the data obtained, out of 40 patients with a prehospital time >4 hours, 11 of them exper

ienced mortality. However, this variable still shows varied results, indicating the necessity for further research to reinforce its results.

Surgical Intervention

In their study, Spazzapan et al. (2019) evaluated outcomes using the modified Rankin Scale. They found that patients undergoing surgical intervention (76.4% with mRS 0) had a worse prognosis compared to those undergoing conservative treatment (92.3% with mRS 0). . This is also reinforced by a study conducted by Onodera et al (2020), which stated that 14 out of 58 patients experienced a decrease in GCS score post-surgery. Additionally, another study showed that 31 out of 268 EDH patients passed away after neurosurgical procedures (Rosyidi et al., 2019). However, it is emphasized in this study that the results are not significant, which may also be caused by the neurological condition of the patient before the intervention, such as the patient's GCS and radiological results.

Pupil Abnormalities

Afni (2018) used bivariate analysis using Fisher's exact test and multivariate analysis using multiple logistic regression. With a total of 65 patients categorized into two groups based on pupil diameter: "<2mm" and ">3mm". Furthermore, the results of this study indicate that out of 65 patients, 56 experienced abnormal pupil dilation, specifically with dilation <2 mm, with 12 of them deceased. Additionally, 9 patients showed abnormal pupil dilation (>3 mm), all of whom were deceased. Similarly, Khalid et al. (2023) reported comparable results, where 7 out of 116 total samples showed pupil abnormalities, with 3 of them deceased.

CONCLUSIONS

In conclusion, preoperative GCS, preoperative treatment time interval, operative treatment, and pupillary abnormalities are some factors that can impact patient outcomes and mortality rates in pediatric epidural hematoma. Subsequent research is expected to delve deeper on the outcomes of patients undergoing surgical and conservative interventions to determine their significant correlation with mortality rates in pediatric epidural hematoma cases.

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Conflict of Interest
There is no conflict of interest in this writing.

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