

Prevalence of traumatic brain hemorrhages in brain death patients

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Research

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Abstract

Background: Considering the significant burden of brain death and its leading cause in emergency clinical settings, head traumatic intracranial hemorrhage, the most prevalent type of hemorrhagic event in these scenarios, will help us predict the possibility of consequent development of a vegetative state.

Methods: This study aimed to assess the prevalence of other intracranial hemorrhages in patients with brain death. 70 head traumatic brain dead patients referred to Masih Daneshvari hospital underwent CT scan assessment to determine the prevalence of major intracranial hemorrhage types and their complications.

Results: Subarachnoid (SAH) and subdural (SDH) hemorrhages consisted of the most prevalent intracranial hemorrhage types among patients with brain dead; 45.7 % and 40%, respectively. Overall, hemorrhagic events led to a midline shift in 14.3% and Edema in 12.9% of cases. We noticed midline shift more in SAH subjects while Edema was of higher prevalence among subarachnoid hemorrhages SDH patients.

Conclusion: This study found Subarachnoid (SAH) and subdural (SDH) hemorrhages as the most prevalent types of intracranial hemorrhage among head traumatic brain-dead patients.

Introduction

Traumatic brain injuries are present in emergency settings persistently. They are of concern regarding intracranial hemorrhage events and their subsequent complications, among which brain death is the end of the clinical scenario. However, 70-80 percent of head traumas are benign with no damage to the brain or function, relief spontaneously by conservative interventions [4] [3].

Head trauma is more prevalent among patients aged 21-30 years old and is of concern due to its higher incidence in past years [15]. Intracranial hemorrhages consist of many types, including epidural hemorrhage (EDH), subdural hemorrhage (SDH), subarachnoid hemorrhage (SAH), and intraventricular hemorrhage (IVH). Head traumatic hemorrhagic lesions can also be accompanied by contusion or midline shift, worsening the clinical prognosis. Assessments of the patient include Glasgow Coma Scale (GCS) assessment and the brain CT scan to diagnose the type of hemorrhage [6,13,8,2,10,14].

According to the Uniform Determination of Death Act (UDDA) guideline; it states that brain death diagnosis is an irreversible absence of brain function caused by lesions involving the entire brain. Bedside examinations for confirmation of brain dead include loss of responsiveness, movement, and brain stem reflexes that confirm the patient's comatose state. It should be kept in mind that the consumption of sedative drugs, hypothermia, hypotension, or metabolic disturbances must be excluded or corrected initially before making the brain-dead diagnosis. Apnea test assesses the brain stem function in detecting the absence of respiratory drive [11]. Insufficient blood supply to the brain is considered critical paraclinical evidence approving the brain death event [7]. Brain CT angiography (with a sensitivity

of 85.7 %) is superior to CT scan (with a sensitivity of 76%) in the diagnosis of brain death; however, CT scan is a useful tool in making the diagnosis [12,5].

According to health data reports of the global burden of diseases, subarachnoid hemorrhage (a prevalent type of intracerebral hemorrhage (ICH)) consists of 0.47 percent of the leading causes of death in Iran and 0.8 percent of death's leading causes globally. DALYs of subarachnoid hemorrhage reported with the rate of 61,014.08 years in Iran and 12,403,459.25 globally in 2017; indicated the enormous emotional and economic burden of intracranial hemorrhages affecting the involved families [1].

Considering unusual complications arising from traumatic brain injuries on patients, the early detection and the required interventions according to the type of cranial hemorrhage predict the clinical outcome and final prognosis. It would be sufficient to decrease the occurrence rate of brain death as the end-stage brain injury. Unfortunately, few reports are available regarding different types of cranial hemorrhages, leading to brain death events in head trauma patients. Here we have assessed the prevalence of different types of intracranial hemorrhages, which have led to brain death in head trauma patients.

Materials And Methods

This cross-sectional study has involved 70 head traumatic brain dead patients referred to Masih Daneshvari Hospital during 2019 according to inclusion and exclusion criteria. Inclusion criteria consisted of patients with age between 18-80 years old and the presence of both recent head trauma and brain death confirmed by two neurologists. Exclusion criteria were hidden history of head trauma and any other known etiologies for the patient's brain death than traumatic intracranial hemorrhage. Patients were assessed by CT scan to determine the prevalence of significant types of intracranial hemorrhages (ICH) - Epidural hemorrhage (EDH), Subdural hemorrhage (SDH), Subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH)-. We have also measured the prevalence of two major intracranial hemorrhage complications, including brain edema and midline shift.

Analysis:

We employed SPSS version 22 for analysis. Quantitative variables were described by means and variances, while their frequencies defined qualitative data. Chi-square tests were used to compare the proportion of presence of complications between types of intracranial hemorrhages. P-value equal to 0.05 assumed statistically significant within CIs of 95%. Ethics: In this research, ethical issues were conserved according to Helsinki's declaration and authorized by the Islamic Azad University of Medical Sciences (IAUTMU) Ethics committee.

Results

Seventy patients of this study were 32 ± 13.26 years on average of their age, and 84.3 % males and 15.7 % females in the sex category. Measuring the prevalence of other hemorrhages using CT scan revealed the presence of SAH in 45.7 %, SDH in 40%, ICH in 21.4%, and EDH in 5.7% of cases. We should bear in

mind that some cases did not have only one type of intracranial hemorrhage. Overall, hemorrhagic events were followed by a midline shift in 14.3% and Edema in 12.9% of cases [Table 1]; [figure 1]. Brain edema was more prevalent among patients with SAH compared to subjects with SDH (P-value < 0.001; Chi-square), while Midline shift was more prevalent among SDH patients compared to SAH subjects (P-value < 0.001; Chi-square) [Table 2].

Discussion

This study found SAH and SDH as the most prevalent types of intracranial hemorrhagic events, respectively, in brain death subjects with different incidence rates of complications. Our results are consistent with reports from Yattoo et al. on the prevalence of SAH, SDH, EDH, ICH, and brain edema equal to 0.74%, 10.39%, 7.92%, 0.74%, and 3.21% in head trauma patients [15]; hence, we have shown equal order of prevalence in hemorrhagic events which have led to brain death. Midline shift is a life-threatening event that could arise from causes of increased intracranial pressure (ICP), such as brain tumors and intracranial hemorrhages [9]. Edema is a considerable complication that may result from intracranial hemorrhagic events. SDH subjects demonstrated a higher incidence of brain edema compared to SAH patients. With the help of epidemiologic studies, physicians got a good grasp of the leading causes of death and disability in their communities.

Conclusion

The significant burden of brain death and its leading cause in emergency clinical settings, head traumatic intracranial hemorrhage is the most prevalent type of hemorrhagic event in these scenarios. According to this study, SAH and SDH are the most prevalent types of intracranial hemorrhagic events in brain death subjects with a different incidence rate of complications. It will help us predict the possibility of consequent development of a vegetative state.

List Of Abbreviations

SAH	Subarachnoid hemorrhages
SDH	subdural hemorrhages
EDH	epidural hemorrhage
IVH	intraventricular hemorrhage
UDDA	Uniform Determination of Death Act
GCS	Glasgow Coma Scale
ICH	Intracerebral hemorrhage.
ICP	intracranial pressure
IAUTMU	Islamic Azad University of Medical Sciences

Declarations

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Conflict of interest / Competing interests: The authors approve that they have no conflict of interest associated with any organization or entity in the subject matter or materials discussed in this manuscript.

Ethics approval: In this research, ethical issues were conserved according to declaration of Helsinki and was approved by Azad University of Medical Sciences (IAUTMU) Ethics committee.

Consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and material: In this paper, we report the Spectral imaging has brought a new light insight to the field of radiology, based on its specific characteristics such as high resolution and, low dose of radiation.

Code availability: Not applicable

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Author Contributions

Parvaneh Hassani (Conceptualization, Project development)(First author and correspond) The main idea and the necessary coordination for legality as well as data capture

Ziya oddin Ahmadi (Data Collection)

Shadi Halimi (Data Collection)

Mehdi Abbasi AND Sajad Besharati³ (Methodology) Both of them reviewed the collected data and analyzed them under the supervision of the staff and the quality supervisor of the project. Ali Sarreshtehdari⁴ (Validation)

Mehran Shafiee (Supervision, Project development) Collaboration as well as the necessary tips as project consulting

Rahele Khademi (Manuscript writing Writing – original draft, Writing – review & editing)

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Tables

Table 1. Descriptive statistics of quantitative data by percentages report

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Variable	Presence (%)	Absence (%)
Gender	Male : 84.3	Female: 15.7%
SAH	45.7%	54.3%
SDH	40%	60%
EDH	5.7%	94.3%
ICH	21.4	78.6%
Midline shift	14.3%	85.7%
Brain edema	12.9%	87.1%

SAH: Subarachnoid hemorrhages

SDH: subdural hemorrhages

EDH: epidural hemorrhage

ICH: Intracerebral hemorrhage

Table 2. Comparison of complications between SAH and SDH

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Complication Hemorrhage	Midline shift (ratio)	Edema (ratio)
SAH	0.16	0.11
SDH	0.07	0.21
P-value (Chi-square)	< 0.001	< 0.001

SAH: Subarachnoid hemorrhages

SDH: subdural hemorrhages

Figures

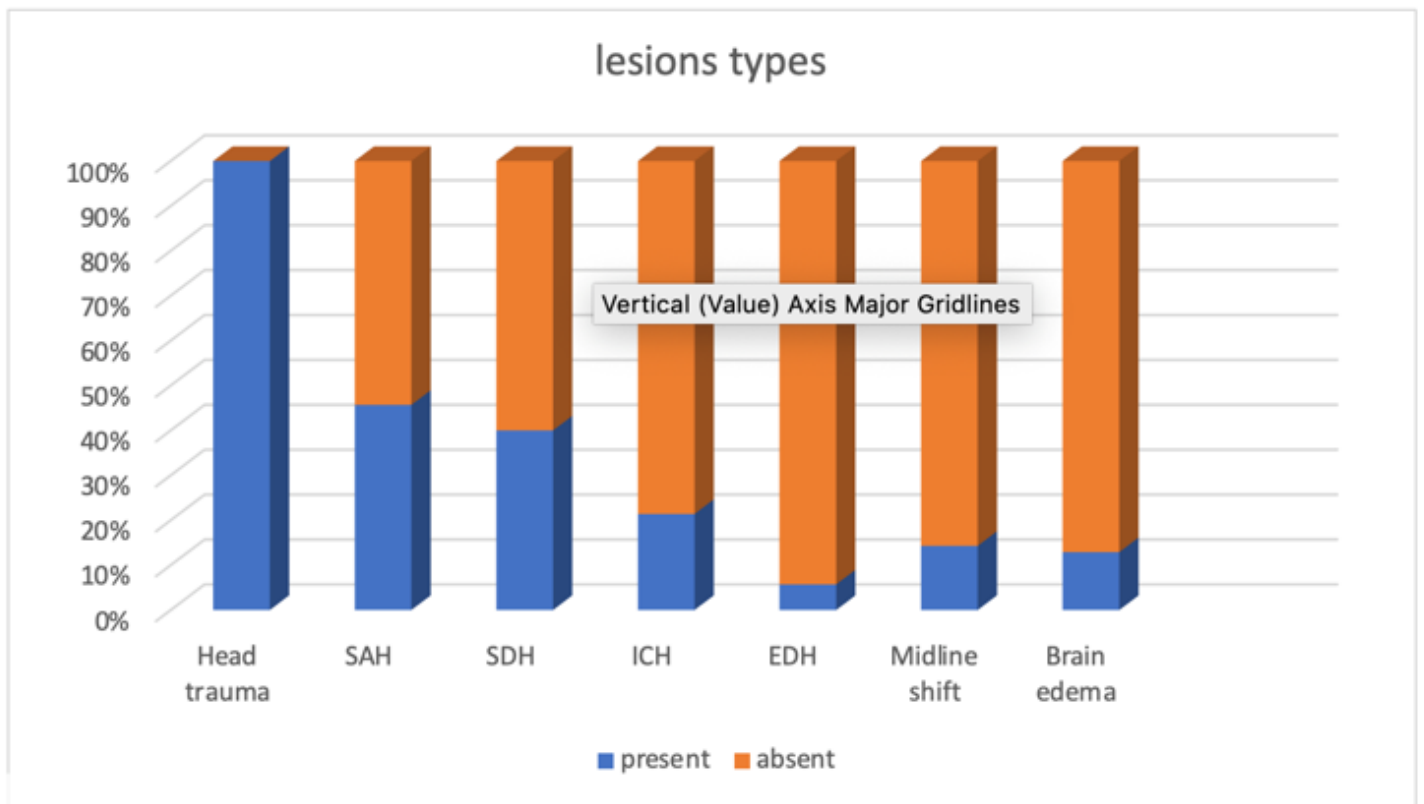


Figure 1

Prevalence of types of lesions. SAH: Subarachnoid hemorrhages SDH: subdural hemorrhages EDH: epidural hemorrhage ICH: Intracerebral hemorrhage