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NEUROLOGICAL OUTCOME IN PATIENTS OF TRAUMATIC SUBARACHNOID HAEMORRHAGE, PROGNOSTIC FACTORS AND ROLE OF NCCT HEAD SCAN

Neurosurgery

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ABSTRACT

Introduction: Subarachnoid hemorrhage (SAH) involves bleeding between the brain's arachnoid membrane and pia mater, often causing a sudden headache, vomiting, seizures, and coma. Commonly caused by trauma or aneurysms, SAH is diagnosed with imaging like CT or MRI. The Fisher Grade and Glasgow Outcome Scale predict complications and recovery, respectively. **Methods:** This study, conducted at S.R.N. Hospital, Allahabad, evaluated neurological outcomes in 60 traumatic subarachnoid hemorrhage (SAH) patients from July 2022 to July 2024. Using the Glasgow Coma Scale, Glasgow Outcome Scale(GOS), and NCCT scans, researchers assessed severity and prognostic factors. Standard treatments were applied, with outcomes analyzed via Chi-square tests to determine prognostic significance. **Result:** This study on traumatic subarachnoid hemorrhage (tSAH) found that males (83.33%) and youth (11-20 years) were most affected, primarily due to road traffic accidents (63%). Favorable outcomes (73.33%) correlated with higher initial Glasgow Coma Scores, and Fisher grades 2 and 3 had better prognoses. Mortality was low at 3.33%. **Conclusion:** This study found that the Glasgow Coma Scale (GCS) at admission and Fisher Grade are the strongest predictors of outcomes in traumatic subarachnoid hemorrhage, with lower GCS and higher Fisher Grades indicating worse prognosis. Age, gender, injury type, and SAH location showed minimal or borderline impact on recovery.

KEYWORDS

traumatic subarachnoid hemorrhage (tSAH), Glasgow Coma Scale (GCS), Glasgow Outcome Scale(GOS), Non -contrast computed tomography (NCCT)

INTRODUCTION

Subarachnoid hemorrhage (SAH) involves bleeding into the space between the arachnoid membrane and pia mater surrounding the brain. It is often life-threatening and presents with a sudden, severe headache, vomiting, decreased consciousness, seizures, neck pain, photophobia, and cranial nerve deficits. Coma can occur due to increased intracranial pressure (ICP), brain tissue damage, hydrocephalus, diffuse cerebral ischemia, or seizures.[1,2,3],

Etiology

The most common cause of SAH is trauma, usually from blunt head injuries. Other causes include ruptured intracranial aneurysms (often related to hypertension), vasculitides affecting the central nervous system, cerebral artery dissections (usually post-traumatic), coagulation disorders, cerebral arteriovenous malformations (AVMs), and idiopathic SAH. Risk factors include adolescence, male gender, low socioeconomic status, and substance abuse.[1,2], ,

Diagnosis

Diagnosis relies heavily on imaging:

Non-contrast CT scan– First-line diagnostic tool, detecting over 95% of cases within 48 hours. It reveals blood in the subarachnoid space and assesses complications like hydrocephalus or infarction.[1] ,

MRI– Less useful in the first 24–48 hours but effective for subacute cases (4-7 days).

Lumbar puncture– Used when CT is inconclusive to confirm the presence of blood or xanthochromia in cerebrospinal fluid.

Fisher Grading System

The Fisher Grade classifies hemorrhage appearance on CT to predict complications:

Grade 1: No hemorrhage
Grade 2: Thin layer of blood (<1 mm)
Grade 3: Thick blood layer (>1 mm) or localized clot
Grade 4: Intraventricular hemorrhage or parenchymal extension

Prognosis

The **Glasgow Outcome Scale (GOS)** measures outcomes from good recovery (Grade 5) to death (Grade 1). Timely diagnosis and treatment are crucial in improving survival and recovery in SAH patients. , ,[1]

MATERIAL AND METHODS

Study on Neurological Outcomes in Traumatic Subarachnoid Hemorrhage (SAH)

The study titled "Neurological Outcome in Patients of Traumatic Subarachnoid Hemorrhage: A Study of Prognostic Factors &Role of NCCT Scan"was conducted in the Neurosurgery Department of S.R.N. Hospital, Allahabad, between July 2022 and July 2024. It involved 60 patients with traumatic SAH, covering a wide range of ages and both genders. The study aimed to assess neurological outcomes by examining several prognostic factors and using NCCT scans for diagnosis and classification.

Study Design

The Glasgow Coma Scale (GCS) at admission and the Glasgow Outcome Scale (GOS) at discharge were used to evaluate patients. All participants underwent a brain CT scan upon admission to confirm SAH. The severity of SAH was graded using the Fisher scale, and the anatomical location of the hemorrhage was determined. Standard treatment protocols were followed for all patients based on clinical needs.

Inclusion and Exclusion Criteria
Inclusion Criteria:
Patients with traumatic head injuries confirmed through CT scan to have SAH.

Relatives of the patients needed to understand and comply with the study's requirements and provide informed consent.

Exclusion Criteria:
Patients with brain injuries other than SAH or SAH associated with additional brain injuries.
Individuals with a history of neurological or psychiatric disorders.
Patients suffering from life-threatening medical conditions or serious injuries to the chest, abdomen, or spine.
Participants unable to understand or provide consent.

Role Of NCCT Scan
The CT scan played a critical role in diagnosing traumatic SAH, grading its severity using the Fisher scale, and identifying the location of the hemorrhage, which helped in guiding management and prognosis.

Treatment And Management
Resuscitation followed Advanced Trauma Life Support guidelines, ensuring systolic blood pressure remained above 90 mm Hg. Isotonic saline (0.9% NaCl) was used for fluid resuscitation. Blood transfusions were given in cases of significant blood loss (more than 30%). Mannitol was administered to reduce intracranial pressure, improve cerebral blood flow, and decrease blood viscosity. Other treatments included seizure prophylaxis and antibiotics. Routine lab tests, such as CBC and electrolyte levels, were also conducted. The GCS score was recorded both upon admission and after resuscitation.

Prognosis:
Patient outcomes were measured using the **Glasgow Outcome Scale (GOS)**at discharge:
Grade 5: Good recovery (returned to work or school)
Grade 4: Moderate disability (independent living but unable to return to work or school)
Grade 3: Severe disability (follows commands but unable to live independently)
Grade 2: Vegetative state
Grade 1: Death

Statistical Analysis
Data was analyzed using the Chi-square test, with a p-value of less than 0.05 considered statistically significant. This analysis helped identify the significance of various prognostic factors in determining patient outcomes.

OBSERVATION AND DISCUSSION

OBSERVATION
This study examined sixty cases of traumatic Subarachnoid Hemorrhage (SAH) admitted to the Neurosurgery Department of M.L.N. Medical College, Allahabad. The study focused on eight parameters to assess their impact on patient outcomes.

Age Distribution And Outcomes
The age range of patients was 3 to 60 years, with an average age of 24.17 years. Most cases (33.33%) were between 11 and 20 years old.

Outcome Based On Age
Patients aged 0-10 years and 31-40 years had the most favorable outcomes, with 80% achieving positive results. The worst outcomes were observed in the 21-30 age group, where only 40% had favorable outcomes.

Gender Distribution And Outcomes
Males constituted 83.33% (50 cases) of the study population, while females accounted for 16.66% (10 cases), resulting in a male-to-female ratio of 5:1.

Outcome Based On Gender
Among males, 72% had favorable outcomes, compared to 80% of females. Though males were more affected, both genders showed similar favorable outcomes.

Mode Of Injury
Road traffic accidents (RTAs) were the leading cause of traumatic SAH, accounting for 63% of cases. Falls from height contributed 27%, while assaults made up 10%. In children under 10 years, falls were the most common cause.

Outcome Based On Mode Of Injury
Assault cases had the best outcomes, with 100% favorable results. Patients with falls from height had an 87.5% favorable outcome, while those with RTAs had the lowest favorable outcome rate (63%).

Symptoms At Admission
Disorientation (45%) and vomiting (40%) were the most common symptoms. Other symptoms included convulsions (7.5%), ear bleeding (5%),

Glasgow Outcome Scale (GOS) at Discharge
The Glasgow Outcome Scale (GOS) showed that 43% of patients achieved GOS 5, 30% had GOS 4, 16% had GOS 3, and the rest had lower scores. Overall, 73.3% of cases had favorable outcomes, while 26.7% had unfavorable outcomes.

Glasgow Coma Scale (GCS) at Admission
Patients with a GCS score of 13-15 at admission had a 92% favorable outcome rate, whereas those with a GCS score of 3-8 had the poorest outcomes, with only 22% favorable results. The GCS at admission was strongly linked to outcomes.

Fisher Grade And Anatomical Location
Fisher Grade 2 had the best outcomes (85.7% favorable), while Grade 4 had the worst (40% favorable). Sulcal SAH was the most common type (67%) and had the best prognosis (80% favorable). Intraventricular hemorrhage (IVH) was rare but had poor outcomes (33% favorable).

Parameters		Finding (no of pt.)	OUTCOME in terms of GOS				
			Favourable GOS		Unfavourable GOS		
			GOS 5	GOS 4	GOS 3	GOS 2	GOS 1
Age Distribution (years)	0-10	10	2	6	0	0	2
	11-20	20	10	4	4	2	0
	21-30	12	2	2	4	2	2
	31-40	10	6	2	0	2	0
	41-50	6	0	4	2	0	0
	51-60	2	2	0	0	0	0
	>60	0	0	0	0	0	0
Gender distribution	Male	50	20	16	8	4	2
	Female	10	6	2	2	0	0
Mode of injury	RTA	38	16	8	10	4	
	FFH	16	6	8	0	0	2
	Assault	6	4	2	0	0	0
Severity of injury at time of addmission (GCS)	Mild(GCS 13-15)	32	32		0		
	Moderate(GCS 9-12)	10	8		2		
	Sever (GCS 3-8)	18	4		14		
Anatomical location of SAH	Sulcal SAH	40	32		8		
	Diffuse SAH	14	10		4		
	IVH	6	2		4		
Fisher grade	Grade 2	28	24		4		
	Grade 3	22	16		6		
	Grade 4	10	4		6		

DISCUSSION
This study analyzed traumatic subarachnoid hemorrhage (tSAH), focusing on age, gender, injury mechanisms, severity, and outcomes. The most affected age group was 11-20 years (33.33%), and males dominated (83.33%). This male predominance is consistent with prior

studies like Franco et al[1] . The high number of male patients is attributed to risky behaviors such as rash driving, a common cause of traumatic injuries in young adults. Road traffic accidents (RTA) were the leading cause of tSAH (63%), followed by falls from height (27%) and assaults (10%). Among children under 10 years, falls from height were the predominant cause (80%), which is consistent with the findings from regions where RTA is the primary source of head injuries.

When assessing the severity of head injuries based on the Glasgow Coma Scale (GCS), 53.4% of the patients had mild injuries, 16.6% moderate, and 30% severe. These results are similar to Chieregato et al.'s study[11], where 59% had mild injuries, 14% moderate, and 25.5% severe. The high proportion of mild head injuries in this study may be due to the exclusion of cases with associated severe injuries, which would have otherwise increased the severity of the overall head injury.

The Glasgow Outcome Scale (GOS) showed that most patients had a favorable outcome. About 43% of patients had a GOS score of 5 (good recovery), and 30% had a GOS score of 4 (moderate disability). Paiva WS et al[1] . reported comparable results, with 45% of patients achieving favorable outcomes (GOS score of 4 or 5). Anatomically, the distribution of blood influenced outcomes. In this study, 66.7% of patients with intraventricular hemorrhage (IVH) had poor outcomes, aligning with findings from Gonzalez Pe'rez et al.[1] and Gaetani et al ., who noted poor outcomes in patients with blood in the basal cisterns or on the convexity of the brain. Interestingly, Wong et al[1] . did not find anatomical location to significantly impact outcomes, offering a contrasting perspective.

Mortality in this study was relatively low at 3.33%. In contrast, Franco et al[1] . reported higher mortality rates (43% for basal SAH and 47% for other SAH types). This studys lower mortality could be attributed to the exclusion of patients with more severe injuries, such as those with basal cistern bleeds or other associated brain injuries.

The Fisher grading system revealed that patients with grade 2 and 3 bleeds had favorable outcomes (85.7% and 72%, respectively), while those with grade 4 had a lower rate of favorable outcomes (40%). George et al . noted that the thickness of the blood clot played a critical role in determining outcomes, with thicker clots linked to worse prognoses. Paiva et al.[1] further suggested that patients with cisternal clots thicker than 1 mm had significantly higher mortality rates.

Among the prognostic factors, GCS at admission emerged as the most important. Patients with a GCS score of 13-15 on admission had a 100% favorable outcome, while those with a GCS of 3-8 had only a 22.2% favorable outcome. A GCS of 9-12 had an 80% favorable outcome. This finding is consistent with studies by M Gonzalez Pe'rez[1] , Chieregato et al[11]., and Jung Ho Shin et al.[12].which also identified GCS at admission as a significant predictor of prognosis.

Overall, this study found that 73.33% of patients had favorable outcomes, while 26.67% had unfavorable outcomes, including a 3.33% mortality rate. These findings are comparable to Chieregato et al's[11] study, which reported 70% of patients with good recovery, 9% with moderate disability, and 13% with mortality.

CONCLUSION

1. Age Distribution (p = 0.122) The p-value of 0.122 indicates that there is **no statistically significant difference**in outcomes based on age groups. In other words, age alone does not strongly predict patient outcomes in this study.

2. Gender Distribution (p = 0.896) With a p-value of 0.896, the analysis shows that the difference in outcomes between males and females is **not statistically significant**. This suggests that gender does not play a meaningful role in determining the likelihood of a favorable or unfavorable outcome.

3. Mode of Injury (p = 0.067) The p-value of 0.067 is just above the commonly used threshold of 0.05, meaning the differences in outcomes based on the mode of injury are **not quite statistically significant**. However, it's close to significance, suggesting a potential trend that could become significant with a larger sample size.

4. GCS at Admission (p <0.001)A p-value of 1.59e-08 indicates a **highly statistically significant**difference in outcomes based on the initial Glasgow Coma Scale (GCS) score at admission. This strongly implies that the severity of the patient's condition at admission (as indicated by GCS) is a critical predictor of their recovery.

5. Anatomical Location of SAH (p = 0.054) With a p-value of 0.054, the relationship between the anatomical location of the subarachnoid hemorrhage and outcomes is **borderline**. It is just above the 0.05 significance threshold, suggesting a potential link that might be more evident with a larger sample or more detailed data.

6. Fisher Grade (p = 0.019) The p-value of 0.019 is **statistically significant**, indicating that the Fisher grade, which assesses the extent of bleeding, is an important predictor of outcomes. Higher grades are associated with worse outcomes, reflecting the severity of the hemorrhage.

Overall Interpretation

- **Significant Factors**: The two parameters that are **statistically significant**predictors of outcomes are:
- **GCS at Admission**: A key determinant, with lower scores indicating worse prognosis.
- **Fisher Grade**: Higher grades correlate with poorer outcomes.

Non-Significant or Borderline Factors:

- **Age**and **Gender**do not significantly impact outcomes.
- **Mode of Injury**and **Anatomical Location of SAH**are borderline; they show a potential trend but do not reach the typical threshold of significance.

These findings highlight that the **severity of the injury (GCS)**and the **extent of bleeding (Fisher Grade)**are the most crucial factors in determining recovery, while other factors such as age, gender, or specific injury type play a less central role in predicting outcomes.

The study concluded that NCCT scans are crucial for diagnosing SAH, assessing Fisher grading, and determining the anatomical location of the hemorrhage.

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