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Original Research Article

AN EPIDEMIOLOGICAL STUDY ON HICCUPS IN TRAUMATIC BRAIN INJURY PATIENTS ADMITTED IN TRAUMA ICU

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Abstract

Background: While exceptional, hiccups can be a serious issue for patients who recently suffered from a traumatic brain injury (TBI) in the intensive care unit (ICU). These hiccups may deteriorate their overall health and well-being. This study aims to conduct an epidemiological investigation of hiccups in TBI patients admitted to the trauma ICU. **Materials and Methods:** A method was developed to investigate hiccups in traumatic brain injury (TBI) patients admitted to the trauma ICU of the Trauma Centre, Institute of Medical Sciences, Banaras Hindu University, Varanasi from July 2020 to January2024. The study involved monitoring and recording hiccups during patients' ICU stays. The study population included adult TBI patients aged 18 to 65 who were hospitalized at the trauma centre. Patients with certain medical conditions were excluded. Data on demographics, mode of injury, severity scores, interventions, and treatment response were collected. Biochemical and radiological investigations were conducted to assess intracranial injury and predict outcomes. Statistical analysis was performed using SPSS version 23.0. Descriptive statistics, chi-square test, t-test, and correlation test were used. A p-value of less than 0.05 was considered statistically significant. **Results:** This study analyzed 250 patients of traumatic brain injury (TBI) with hiccups. Majority of patients were male and had a mean age of 39.82 years. Road traffic accidents were major cause of TBI. Most patients had severe TBI and received non-operative management. The mean length of ICU stay was 19.49 days. Ventilator-associated pneumonia was present in 35.2% of patients. The majority of patients survived. Persistent hiccups were the most prevalent type, followed by recurrent hiccups and intractable hiccups. Drug treatment for hiccups was effective in 67.2% of patients. The study found associations between the type of hiccups and age group, mode of injury, and type of TBI. The time of hiccups onset was higher in expired patients compared to survived patients. Severe TBI was associated with a higher prevalence of persistent hiccups. **Conclusion:** This study found a correlation between hiccups and traumatic brain injury (TBI). Overall, it can be concluded that hiccups can be beneficial in evaluating the severity of TBI and a patient's outcome. Consequently, the presented study findings suggest that there is a need for further investigation of the causes of hiccups in TBI patients; additionally, more strategies for developing the interventions aimed at each subtype are needed. The difference in the status of hiccup between expired and survived patients explicate that hiccup type and timing may be useful in determining patient outcomes.

INTRODUCTION

Hiccups is a biological reflex involuntarily involving contraction of the diaphragm and or inspiratory intercostal muscles, abrupt glottic closure causing the 'hic' sound. Chronic hiccups can have a substantial negative influence on a patient's quality of life and clinical management, even though they are usually benign and self-limiting. Intubated and mechanically ventilated patients who experience chronic hiccups may experience pneumonia, pulmonary alkalosis, and hyperventilation. Most hiccups last 48 hours or less on average. "Persistent hiccups" are defined as hiccups that endure for more than 48 hours to a month. A hiccup that lasts more than a month is referred to as "intractable hiccups."

Diseases of the central nervous system and gastrointestinal tract are primarily linked to hiccups, and the frequency of cases is gender-neutral. About 3% of healthy people experience recurrent hiccups, but 10% of people with gastroesophageal reflux diseases (GERD) and 20% of people with Parkinson's disease experience them,[1] 3.9%–4.8% of people with advanced cancer develop hiccups.[2] Central nervous system (CNS0 illnesses are known to cause hiccups, with lateral medullary infarcts (LMIs) responsible for 12%-36% of central instances. The exact brain area responsible for this reaction and the mechanism underlying hiccups are still unknown.

Hiccups has various triggering factors, including large meals, carbonated drinks, hot and spicy foods, alcohol, smoking, and over-excitement.[3] Persistent hiccups can be caused by central or peripheral factors, such as brain stem lesions or phrenic nerve-related diseases. They can lead to exhaustion, sleep deprivation, malnutrition, dehydration, depression, wound dehiscence, and even death.[4] In patients receiving mechanical ventilation, hiccups can cause desynchronization and respiratory alkalosis, potentially causing lung damage and hemodynamic alterations.[5] Prompt correction and monitoring of respiratory parameters can prevent these effects. Continuous positive airway pressure and pressure support ventilation can help stop hiccups.

Hiccups may be a manifestation of brain injuries and neurological conditions. While the specific incidence rate of hiccups in traumatic brain injury patients is not explicitly provided in the sources, the association between hiccups, traumatic brain injury, and mental health conditions underscores the complexity of neurological disorders and their impact on overall well-being. Further the present study focusing on the pattern, risk factors and outcome of hiccups in TBI patients is essential to enhance our understanding of this phenomenon and improve patient outcomes.

MATERIALS AND METHODS

This observational study aimed to investigate hiccups in traumatic brain injury (TBI) patients admitted to the trauma ICU of the Trauma Center, Institute of Medical Sciences, Banaras Hindu University, Varanasi from July 2020 to January 2024. The study involved monitoring and recording hiccups during patients' ICU stays. The study was approved by the Ethical Committee of the Institute of Medical Sciences, Banaras Hindu University. The study included moderate and severe TBI patients with hiccups aged 18-65 years admitted to the ICU of Trauma Center. Patients with GERD, advanced cancer, spinal cord injury, deranged liver and renal profiles, drugs causing hiccups, or sedative and neuromuscular blocking drugs were excluded.

The study used a non-probability authoritative sampling technique to select patients using SPSS version 23. After resuscitative measures, detailed history and demographic factors were recorded. All relevant data were collected including socio-demographic, hospitalization-related, trauma-related, and clinical data. The study aimed to provide a comprehensive understanding of the patient's condition and treatment options.

The study collected data on various aspects of hiccups, including demographics, mode of injury, severity scores, interventions, and the Marshall computed tomography (CT) score. It also documented the time from ICU admission to the onset of hiccups, types of hiccups, length of ventilation, ventilator-associated pneumonia (VAP), and ICU stay. The study also examined the response to drug treatment for hiccups, focusing on whether it works or not. The Glasgow coma scale (GCS) score was used to classify injuries based on severity, sequential organ failure assessment (SOFA) score, Acute physiology and chronic health evaluation II (APACHE II) score, and lactate level. The study also recorded the duration of hiccups, the length of ventilation, and the presence of ventilator-associated pneumonia (VAP) during the ICU stay. The study aimed to understand the effectiveness of hiccup treatment in managing the condition.

After a patient's general condition stabilizes, biochemical and radiological investigations are conducted to assess intracranial injury, predict outcomes, and avoid unnecessary hospitalization. Routine biochemical tests include blood hemoglobin%, blood urea, blood sugar, liver profile, serum creatinine, serum electrolytes, bleeding time, and clotting time. Other biochemical investigations are tailored to individual patient needs. CT scans are useful for assessing intracranial injury, predicting outcomes, and avoiding unnecessary hospitalization. All patients were monitored for hiccups and drug-related side-effects.

The study used SPSS to perform statistical analysis, checking for normal/skewed distribution using Shapiro-Wilk and the KS test. Simple descriptive statistics were used for quantitative variables and frequency with percentage distribution for categorized variables. Categorical parameters were analyzed using chi square test and Fischer's Exact Test. Pearson correlation test was used to determine

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correlations between variables. A p-value of less than 0.05 was considered statistically significant at 95% confidence interval.

RESULTS

The study analyzed 250 patients with hiccups due to TBI, with the majority being male n=190 (76%) and the mean age of patients was 39.82±16.38 years ranging from 18-65 years. Majority of patients (n=170) were from age group 18-40 years age group. Road traffic accidents were the main cause of TBI (n=143), followed by falls from height in (n=51) 20.4% of patients. The majority n=183 (73.2%) had severe TBI, followed by moderate TBI in n=67 (26.8%) patients. In 250 patients with traumatic brain injury, 164 patients received non-operative management and 86 patients received operative management. The mean length of ICU stay was 19.49±5.04 days, with most patients staying between 15-28 days. Ventilator-associated pneumonia was present in 88 (35.2%) patients and absent in 162 (64.8%). Mechanical ventilation was needed in 90.4% of patients, while 24 (9.6%) patients did not need it. Out of 250 patients, 149 (59.6%) survived, and 101 (40.4%) did not survived. Seizure prophylaxis was given to 188 (75.2%) patients, and phenytoin to 62 (24.8%) patients. [Table 1]

The majority 153 (61.2%) had a time of onset of hiccups greater than 48 hours, followed by a time of onset of hiccups ranging from 24 to 48 hours 81 (32.4%) and less than 24 hours 16 (6.4%). The most prevalent type of hiccups among 250 patients was persistent 189 (75.6%), which was followed by recurrent hiccups 53 (21.2%) and intractable hiccups 8 (3.2%). In 250 patients, 168 (67.2%) patients responded to drug treatment for hiccups, while 82 (32.8%) did not respond. [Table 2]

The study found that the mean age of persistent hiccups was 41.88±14.23 years, with a higher mean age in recurrent hiccups. However, no significant difference was found between persistent hiccups and intractable hiccups. The type of hiccups was significantly associated with the age group (61-65 years) and the fall from height. The type of hiccups was also associated with the mode of injury, with a significant association observed between the type of hiccups and the Marshal CT classification. Recurrent hiccups were significantly associated with Marshall CT categories II and V. The association between the type of hiccup and the type of TBI was statistically significant, with severe type (GCS 3-8) being significantly associated with persistent hiccups. No significant association was observed between persistent and intractable hiccups, but severe type (GCS 3-8) was significantly associated with persistent hiccups. [Table 3]

The study found that the time of hiccups onset in expired patients was significantly higher 49 (48.5%) patients than in survived patients n=32 (21.5%), with a significant association between the time of onset and the type of hiccups. In expired patients, persistent hiccups were present in 86 (85.1%) patients, while in survived patients, persistent hiccups were present in 103 (69.1%), intractable in 5 (3.4%), and recurrent in 41 (27.5%) patients. A significant association was observed between the type of hiccups and the outcome of TBI patients. [Table 4]

The study found that in severe TBI, 13 (7.1%)patients had a time of onset of hiccups <24 hours, 62 (33.9%) had a time of onset 24-48 hours, and 108 (59.0%) had a time of onset >48 hours. In moderate TBI, 3 (4.5%) patients had a time of onset <24 hours, 19 patients (28.4%) had a time of onset 24-48 hours, and 45 (67.2%) patients had a time of onset >48 hours. No significant association was found between the time of onset and the type of TBI. In severe TBI, 146 (79.8%) patients had persistent hiccups, 6 (3.3%) had intractable hiccups, and 31 (16.9%) had recurrent hiccups, while in moderate TBI, 43 (64.2%) had persistent hiccups, 2 (3%) had intractable hiccups, 22 (32.8%) had recurrent hiccups. Persistent hiccups were significantly associated with severe TBI compared to moderate TBI. [Table 5]

Table 1: Patients characteristics

Variables	Frequency	Percent
Age group (years)		
18-30	81	32.4
31-40	89	35.6
41-50	20	8.0
51-60	18	7.2
61-65	42	16.8
Gender		
Male	190	76.0
Female	60	24.0
BMI (kg/m^2)		
<18.5	6	2.4
18.5-24.9	173	69.2
25.0-29.0	71	28.4
Mode of Injury		
Road traffic injury	143	57.2
Fall from height	51	20.4
Assault	26	10.4

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Others	30	12.0
Type of TBI (As per GCS)		
Moderate (GCS 9-12)	67	26.8
Severe (GCS) 3-8	183	73.2
Marshal CT Classification		
Category II	49	19.6
Category III	30	12.0
Category IV	44	17.6
Category V	86	34.4
Category VI	41	16.4
Type of treatment		
Non-operative	164	65.6
Operative	86	34.4
Length of ICU Stay (days)		
<7	7	2.8
7-14	23	9.2
15-28	212	84.8
>28	8	3.2
Ventilator associated Pneumonia		
Yes	88	35.2
No	162	64.8
Mechanical Ventilation		
Yes	226	90.4
No	24	9.6
Outcome		
Non-survivor	101	40.4
Survivor	149	59.6
Seizure prophylaxis		
Levetiracetam	188	12.4
Phenytoin	62	37.2

Table 2: Hiccups characteristics

	Frequency	**Percent**
Time of onset of Hiccups		
<24 hr	16	6.4
24-48 hr	81	32.4
>48 hr	153	61.2
Type of Hiccups		
Persistent	189	75.6
Intractable	8	3.2
Recurrent	53	21.2
Responsive to drugs for hiccups		
Yes	168	67.2
No	82	32.8

Table 3: Association between type of hiccups and risk variables

Variable	**Persistent (n=189)**		**Intractable (n=8)**		**Recurrent (n=53)**		**p-value**
	No.	**%**	**No.**	**%**	**No.**	**%**	
Age group (years)							
18-30	53	28	3	37.5	25	47.2	0.009
31-40	66	34.9	3	37.5	20	37.7	
41-50	16	8.5	2	25	2	3.8	
51-60	14	7.4	0	0	4	7.5	
61-65	40	21.2	0	0	2	3.8	
Gender							
Male	143	75.7	6	75	41	77.4	0.966
Female	46	24.3	2	25	12	22.6	
BMI (kg/m^2)							
<18.5	4	2.1	0	0	2	3.8	0.517
18.5- 24.9	128	67.7	5	62.5	40	75.5	
25.0-29.0	57	30.2	3	37.5	11	20.8	
Mode of Injury							
Road traffic injury	114	60.3	4	50	25	47.2	0.006
Fall from height	33	17.5	0	0	18	34	
Assault	17	9	1	12.5	8	15.1	
Others	25	13.2	3	37.5	2	3.8	
Type of TBI							
Moderate (GCS 9-12)	146	77.2	6	75	56	58.5	0.024
Severe (GCS)	43	22.8	2	25	22	41.5	

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3-8							
Marshall CT Classification							
Category II	34	18	1	12.5	14	26.4	
Category III	22	11.6	2	25	6	11.3	0.033
Category IV	37	19.6	1	12.5	6	11.3	
Category V	60	31.7	1	12.5	25	47.2	
Category VI	36	19	3	37.5	2	3.8	
Type of treatment							
Non-operative	124	65.6	7	87.5	33	62.3	0.375
Operative	65	34.4	1	12.5	20	37.7	
Length of ICU Stay (days)							
<7	5	2.6	1	12.5	1	1.9	
14-Jul	18	9.5	0	0	5	9.4	0.532
15-28	161	85.2	7	87.5	44	83	
>28	5	2.6	0	0	3	5.7	
Ventilator associated Pneumonia							
Yes	71	37.6	2	25	15	28.3	0.38
No	118	62.4	6	75	38	71.7	
Mechanical Ventilation							
Yes	175	92.6	7	87.5	44	83	0.108
No	14	7.4	1	12.5	9	17	
Seizure prophylaxis							
Levetiracetam	136	72	7	87.5	41	77.4	0.486
Phenytoin	53	28	1	12.5	12	22.6	
Response for drug for hiccups							
Yes	123	65.1	6	75	39	73.6	0.452
No	66	34.9	2	25	14	26.4	

Table 4: Association between time of onset of hiccups and type of hiccups with outcome of patients

	Non-survived (n=101)		Survived (n=149)		p-value
	No.	%	No.	%	
Time of onset of Hiccups					<0.001
<24 hr	7	6.9	9	6.0	
24-48 hr	49	48.5	32	21.5	
>48 hr	45	44.6	108	72.5	
Type of Hiccups					0.011
Persistent	86	85.1	103	69.1	
Intractable	3	3.0	5	3.4	
Recurrent	12	11.9	41	27.5	

Table 5: Association between time of onset of hiccups and type of hiccups with type of TBI

	Severe (GCS 3-8)		Moderate (GCS 9-12)		p-value
	No.	%	No.	%	
Time of onset of Hiccups					0.467
<24 hr	13	7.1	3	4.5	
24-48 hr	62	33.9	19	28.4	
>48 hr	108	59.0	45	67.2	
Type of Hiccups					0.024
Persistent	146	79.8	43	64.2	
Intractable	6	3.3	2	3.0	
Recurrent	31	16.9	22	32.8	

DISCUSSION

Hiccups are common in patients with traumatic brain injury (TBI), strokes, cerebellar aneurysms, and neuromyelitis optica. Intractable hiccups (IH) may lead to respiratory alkalosis, lung damage, and hemodynamic alterations, especially in intubated or mechanically ventilated patients hence also a risk factor for ventilator-associated pneumonia.[6] Therefore, careful evaluation and management of persistent or intractable hiccups in neurocritical care patients with TBI is crucial, involving physical maneuvers, pharmacological treatments, and close monitoring of respiratory parameters.[7] This study aims to analyze hiccup patterns in TBI patients, identify risk factors, and explore their correlation with outcomes.

The study found that the majority of patients (n = 170) were aged 18-40, with a mean age of 39.82±16.38 years. This is consistent with a 2019 study by which found that 47.4% of TBIs were aged 21-40, followed by 35.6% aged 41-60.[7] This is likely due to risk factors like risky behaviors and high motor vehicle crashes. The study found that persistent hiccups were significantly older than recurrent hiccups, with a higher mean age. However, no significant difference was found between persistent vs. intractable or recurrent hiccups. The age group (61-65 years) was

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significantly associated with persistent hiccups. Older age has been identified as a risk factor for hiccups, with older patients having a higher incidence of hiccups.[8,9] The increase in medications containing drugs that induce hiccups may be a risk factor for older patients.[10] Some studies have reported that hiccups are associated with GABA receptors, which can change their action with age, making older age a risk factor for hiccups.[11,12]

The study found that the majority of patients were male, with a male: female ratio of 3.17:1. This is consistent with previous research, which found that the odds of sustaining a Traumatic Brain Injury (TBI) are 2.22 times higher in men.[13] These findings highlight that males are more prone to traumatic brain injuries compared to females due to factors such as higher participation in high-risk activities, occupational hazards, and differences in biological susceptibility. The study found that the majority of patients with hiccups were male 190 (76%), with no significant association between the type of hiccups and gender. Studies have shown a greater prevalence of hiccups in men and taller individuals.[14,15] However, no gender differences were reported in hiccups resulting from central nervous system disorders in a meta-analysis.[16]

The study found that the majority of patients with TBI have a BMI between 17.5±24.9 kg/m2, which is consistent with previous findings. The study also found no significant relationship between the type of hiccups and BMI, which is not included in the FDA adverse-event reporting system (FAERS) database.[9] Previous studies have reported a relationship between low BMI and tall stature and hiccups. The study suggests that BMI is a suitable physical index for evaluating hiccup risk in adults, and the relationship between low BMI and hiccup risk may provide insights into underlying mechanisms. [10,16]

The study found that hiccups were most common among 250 TBI patients 153 (61.2%), with a time of onset of over 48 hours. The most common type was persistent hiccups 189 (75.6%), followed by recurrent hiccups 53 (21.2%) and intractable hiccups 8 (3.2%). These hiccups can be caused by organic, psychogenic, idiopathic, or medication-induced factors. Persistent and intractable hiccups may indicate a more serious underlying cause, and prolonged episodes can lead to significant morbidity.[17] Common CNS causes of hiccups include cerebrovascular disease, brain tumors, and intracranial injury. However, hiccups are rarely the sole symptom of serious neurological disease.[18]

The study found no significant association between the type of hiccups and the time of onset of hiccups (p=0.114). The study found that the timing of hiccups development, whether early or late in the course of traumatic brain injury (TBI), did not significantly influence the specific subtype of hiccups experienced by TBI patients. This finding contributes to the growing understanding of hiccups in TBI patients.

The study found a significant association between the type of hiccups and the type of TBI (moderate or severe), 183 (73.2%) patients 'hiccups with severe traumatic brain injury (TBI) and 67 (26.8%) had moderate TBI. The findings strengthen the validity of the study, as it indicates that severe TBI is the most common presentation among hospitalized TBI patients. No significant association was found between persistent and intractable hiccups, but a significant association was found between the severe type (GCS 3-8) and persistent hiccups (p = 0.006). The severity of TBI is a significant factor in the development of persistent hiccups in TBI patients, compared to the recurrent hiccup subtype. The lack of a significant association between persistent and intractable hiccups may be due to the rarity of intractable hiccups in the TBI population. These findings offer insights into how the clinical presentation of hiccups may be related to the underlying severity of TBI, but further research is needed.

The study found that road traffic accidents are the primary cause of traumatic brain injury (TBI) in India, accounting for 143 (57.2%) of cases. This is consistent with previous studies, which found road traffic injuries as the leading cause (60%) of TBIs in India.[19] The most prevalent type of hiccups was persistent 189 (75.6%), followed by recurrent 53 (21.2%) and intractable 8 (3.2%). In RTA patients, 114 (60.3%) had persistent hiccups, while 25 (47.2%) had recurrent hiccups. In TBI due to falling from height, 33 (17.5%) had persistent hiccups, 18 (34.0%) had recurrent hiccups, and none had intractable hiccups. The association between type of hiccups and mode of injury was statistically significant (p = 0.006). The study provides new insights into the epidemiology of hiccups in TBI patients, suggesting that the type of hiccups may be influenced by the mode of injury, with falls being associated with a higher proportion of recurrent hiccups compared to RTAs. More research is needed to confirm and further elucidate this potential association.

The study found that the majority of patients 86 (34.4%) had Marshall CT classification category V, followed by category II 49 (19.6%), category IV 44 (17.6%), category VI 41 (16.4%), and category III 30 (12.0%). A study suggested that percentage of patients with diffuse injury patterns (categories II and III) at 31.6% is consistent with reports of diffuse axonal injury and other forms of diffuse brain injury in TBI.[20] The study found a significant association between the type of hiccups and the Marshall CT classification (p = 0.033). Recurrent hiccups were significantly associated with Marshal CT categories II and V (p = 0.017), excluding intractable hiccups due to the small sample size. The Marshall CT classification, which categorizes intracranial abnormalities, may influence the development of recurrent hiccups in patients with TBI compared to persistent hiccups. The classification is based on the presence and extent of

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intracranial pathology, with higher categories indicating more severe injury. This suggests that disruption of neural pathways involved in the hiccup reflex arc, which can occur with brain injuries affecting the brainstem, cerebellum, or other central nervous system structures, may predispose patients to certain hiccup subtypes.

Non-operative management is suitable for mild TBI patients with no significant mass effect or CT scan shift. Operative intervention is recommended for patients with significant mass lesions, hematomas causing mass effect, or refractory intracranial hypertension. Operative treatment in isolated TBI patients over 80 years old is associated with lower mortality but higher rates of poor neurological outcomes.[21] In this study, 164 patients underwent non-operative management, compared to 86 with operative management. The study found no significant association between the type of hiccups and the type of treatment received for TBI, suggesting that the specific management approach, whether pharmacological, non-pharmacological, or a combination, was not strongly influenced by the patient's persistent, recurrent, or intractable hiccups, suggesting that the choice of treatment was not strongly dependent on the subtype of hiccups.

The study found that the average ICU stay for severe TBI patients with hiccups was 19.49±5.04 days, with the majority 212 patients (84.8%) staying between 15-28 days. This was consistent with previous research, which found a median ICU stay of 11 days in traumatic brain injury patients. Longer stays were associated with poorer outcomes.[22] The long ICU stays likely reflect the severity of their injuries, which often require prolonged care for intracranial pressure monitoring, mechanical ventilation, hemodynamic support, management of secondary and complications like nosocomial infections or refractory intracranial hypertension. When we compared the relationship between the type of hiccups and ranges of ICU stay, we observed that no significant association was observed between type of hiccups and ICU stay (p=0.532). The study found that the duration of patients' ICU stay was not significantly influenced by the type of hiccups they experienced, suggesting that the clinical course and resource utilization were not strongly tied to the specific manifestation of hiccups in this TBI patient population.[23]

The study found that 88 (35.2%) of traumatic brain injury (TBI) patients with hiccups developed ventilator-associated pneumonia (VAP), which is consistent with previous studies. Previous studies have reported a range of VAP incidences, from 23% to 60%, and a multicentre study found a VAP incidence of 34.1%.[24] The study found no significant association between the type of hiccups and the incidence of ventilator-associated pneumonia (p=0.380). The study found that the type of hiccups experienced by a patient did not significantly influence the development of ventilator-associated pneumonia (VAP), despite previous associations between persistent hiccups and increased VAP risk in neurocritical care settings. The study suggests that hiccups in TBI patients may not significantly predict ventilator-associated pneumonia, emphasizing the need to consider a wider range of risk factors when evaluating and managing VAP.

The study found that 226 (90.4%) of TBI patients required mechanical ventilation, consistent with previous studies indicating high rates of ventilation requirement. Previous studies have reported that 84.7% of TBI patients required invasive ventilation during their ICU stay.[25] Mechanical ventilation is crucial in TBI management, providing airway protection, optimizing gas exchange, and preventing secondary brain injury from hypoxia or hypercarbia. The study found no significant association between the type of hiccups and the need for a mechanical ventilator (p=0.108). This suggests that the severity of the hiccups does not strongly predict the need for mechanical ventilation.

The study found that levetiracetam was used as seizure prophylaxis in 188 (75.2%) patients out of 250, while phenytoin was given to 62 (24.8%) patients. The Brain Trauma Foundation guidelines recommend either levetiracetam or phenytoin for early seizure prophylaxis in high-risk TBI patients,[26] but there is insufficient evidence to recommend one over the other, and the choice may depend on individual patient factors and clinician preference. The study found no significant association between the type of hiccups and the type of seizure prophylaxis (p=0.486). The management of seizure prophylaxis was not strongly tied to the specific manifestation of hiccups.

The study found that pharmacological interventions effectively manage hiccups in most TBI patients, but nearly one-third did not experience symptom relief. The high response rate 168 (67.2%) patients suggested drug therapy can be a useful first-line approach, however, an 82 (32.8%) non-response rate suggested the need for alternative treatment options. Factors like hiccup type and severity, brain injury patterns, and individual patient characteristics may influence the likelihood of response. Non-responders may require more intensive interventions, such as combination therapy, non-pharmacological approaches, or invasive procedures.

Our findings indicate a strong correlation between the onset of hiccup, specifically between 24-48 hours after traumatic brain injury (TBI), was significantly higher in expired patients 49 (48.5%) patients than in survived patients 32 (21.5%). This suggests that a later onset of hiccups, specifically between 24-48 hours after TBI, is associated with a higher risk of mortality in TBI patients. Notably, this correlation between early hiccup onset and mortality has not been previously reported in the literature. However, previous research has acknowledged the challenges associated with hiccup management and that early onset of hiccups are

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often self-limiting, while persistent hiccups can be refractory to treatment.[17]

The study found a survival rate of (149) 59.6% and a mortality rate of (101) 40.4% in TBI patients, consistent with previous literature. The survival and mortality rates likely reflect differences in injury severity, patient demographics, and care quality.[27] Severe TBI is associated with higher mortality rates. According to the study's GCS score, patients with mild TBI have recurrent hiccups, but those with severe TBI are associated with persistent hiccups. Severe TBI patients experience higher hiccup incidence due to neurological damage and disruption of the hiccup reflex arc, resulting in prolonged and uncontrolled contractions of the diaphragm and other respiratory muscle.[6,27] The pathophysiological mechanism of hiccups is related to lesions in the reflex arc involving the phrenic, vagus, and sympathetic nerves, and central processing in the midbrain.

Limitations

This study had various limitation i.e. Findings from single-centre study. Study with limited follow-up periods may not capture long-term outcomes and complications. Research on hiccups in TBI patients is relatively sparse, and the study may have been limited by the availability of relevant data. The study may not have adequately controlled for factors that could influence the development of hiccups, such as the use of sedatives, neuromuscular blockers, or other medications. The study's findings may not be generalizable to all TBI patients, as the study population may have specific characteristics that are not representative of the broader TBI population.

CONCLUSION

The study revealed a significant correlation between the occurrence of hiccups and traumatic brain injury. This correlation suggests that hiccups may serve as a valuable clinical indicator in assessing the severity of TBI and predicting patient outcomes. The findings emphasize the importance of recognizing hiccups as a potential symptom that could reflect underlying neurological damage. The study found a significant association between the type and timing of hiccups and patient outcomes. Persistent hiccups were the most common type and were significantly associated with severe TBI. Notably, the onset of hiccups was later in patients who did not survive, indicating that the timing of hiccups may be an important prognostic indicator. This points to the possibility of developing targeted interventions based on the nature of hiccups, thereby improving the management and outcomes of TBI patients. This could lead to earlier interventions or more tailored treatment strategies.

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