Early Discharge versus 6-hour Observation in Mild Traumatic Brain Injury with a Normal Brain CT Scan in a Tertiary Center

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ABSTRACT

Introduction: Mild traumatic brain injury is a common condition presenting to emergency departments, often managed with a period of observation. **Aims:** To compare the outcomes between early discharge and a 6-hour observation period in mild traumatic brain injury patients with normal brain CT scans. **Methods:** A prospective observational study was conducted on patients with mild Traumatic brain injury and normal CT scans at Nepalgunj Medical College, Kohalpur, Banke from August-October, 2025. A total of 82 patients presenting to the emergency department with clinical features of mild traumatic brain injury were enrolled and divided into two groups: Group A (Patients discharged early within 2 hours) and Group B (Patients observed in the emergency department for six hours before discharge). Parameters such as post discharge complications, re-admission, neurological deterioration and patient satisfaction were recorded and analyzed using SPSS version 25. **Results:** The mean age of the participants was 31.33±18.09 years, with 68.3% male patients. No significant differences were found in the baseline characteristics such as mechanism of injury, or duration of loss of consciousness between the two groups. Revisit rates to the emergency department within 7 days were similar between the groups. No patients in either group required neurological intervention or hospitalization after discharge. **Conclusion:** Our findings suggested that early discharge is equally safe, with no significant differences in post-discharge complications, neurological deterioration, or patient satisfaction compared to a 6-hour observation period.

Keywords: Brain CT, Concussion, Early discharge, Emergency, Mild Traumatic brain injury, Observation

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INTRODUCTION

Traumatic Brain Injury (TBI) is a prevalent neurological condition resulting from external mechanical force, often due to falls, vehicle accidents, or blunt trauma. It represents a major public health concern globally, as it can lead to a range of temporary or permanent cognitive, physical, and psychosocial impairments.[1,2] TBI is typically classified into mild, moderate, and severe categories based on the Glasgow Coma Scale (GCS), duration of loss of consciousness (LOC), and extent of post-traumatic amnesia. Mild Traumatic Brain Injury (mTBI), often referred to as a concussion, accounts for the majority of TBI cases. Patients typically present with transient loss of consciousness or altered mental status. Symptoms may include headache, dizziness, fatigue, irritability, memory problems, and mood disturbances.[3,4] Though most individuals recover fully, a significant subset may experience persistent post-concussion symptoms lasting several weeks to months.[5] The acute management of mTBI often includes diagnostic neuroimaging, observation, symptom monitoring, and patient education. Among patients with mTBI and a normal brain CT scan, there is ongoing debate about the necessity and duration of emergency department (ED) observation. Some guidelines recommend a six-hour observation period to monitor for late-appearing complications, while others suggest that early discharge with adequate instructions and outpatient follow-up may be equally safe and more efficient.[8,9] However, current clinical practices vary significantly, and no consensus has been established regarding the optimal strategy for these patients.

METHODS

This was a prospective observational study conducted in the Emergency Department of Nepalgunj Medical College located in the Western Nepal. The study period was from August to October 2025, following ethical approval from the Institutional Review Board of our institution. This study was aimed to compare and observe the outcomes between two cohorts of pa-

tients with mild traumatic brain injuries and a normal brain CT scan to those who are discharged early (within 2 hours) and those who were observed for six hours. This study consisted of 82 patients divided into two groups, each with 41 patients. The inclusion criteria were patients of age more than 18 years, GCS 14-15 at the time of enrollment, normal non-contrast CT scan of the brain, hemodynamic stability, no prior history of anticoagulant or antiplatelet use, and willing to participate in the study, whereas the exclusion criteria were abnormal CT findings (Intracranial hemorrhage, edema, skull fracture), moderate or severe TBI (GCS 13 or less), polytrauma, pregnancy, known psychiatric illness. For the sample size calculation, the sample size of the study was calculated based on the post-discharge event rate of our centre i.e. 5%, assuming a 5% expected event rate with a 95% confidence interval and a 7% margin of error. The required sample size was calculated by using Cochran's formula. Patients were categorized into two observational groups: Group A, consisting of patients discharged early within two hours of normal CT scan and stable condition, and Group B, patients observed in the Emergency Department for six hours before discharge. Both groups received standard discharge instructions including red flag symptoms, follow-up recommendations, and a contact number for concerns. Demographic and clinical data were recorded. Patients were called for a follow-up visit in the Neurosurgery OPD after one day to assess any new symptoms or deterioration, and after seven days to assess overall neurological status or events on return visit, including neurological deterioration, hospital readmission, need for surgical evaluation, and patient dissatisfaction with the care.

Statistical Analysis

Data management and analysis were conducted using a structured proforma, analyzed by using SPSS version 25 for analysis. Descriptive statistics were used to summarize the demographic data and Chi-square or Fisher's exact test was used to compare categorical outcomes between the two groups. A value of less than 0.05 was considered to be statistically significant.

RESULTS

A total of 82 patients (41 in each group) participated in the study, with a mean age of 31.33 ± 18.09 years (range: 18–70 years). The sample consisted of 56 (68.3%) male and 26 (31.7%) female participants. The severity of traumatic brain injury (TBI) was consistent across both groups, with all patients having a Glasgow Coma Scale (GCS) score of 15, indicating mild TBI. The mechanisms of injury were predominantly Road Traffic Accident 46 (56.09%) followed by fall injury 20 (24.39%) and Physical assault 16 (19.51%). Twenty eight (34.14%) patients experienced loss of consciousness (LOC), duration being less than 5 minutes. Follow-up rates were 100% in both groups at 1 day and 7 days. (Table I) In terms of revisit rates, 9.7% of patients in Group A and 4.8% of Group B revisited the emergency department (ED) within 7 days due to mild symptoms like dizziness and headache, though none required repeat CT scans or further interventions (p = 0.39). Regarding post-concussion syndrome (PCS), at 1 day, group A patients experienced vomiting 8 (19.51%), dizziness 3 (7.3%), headache 6 (14.63%) and

anxiety 8 (19.51%). Compared to group B, vomiting 5 (12.19%), dizziness 2 (4.8%), headache 5 (12.19%) and anxiety 2 (4.8%). Follow-up assessments indicated that no patient in either group experienced neurological deterioration requiring further intervention with overall satisfaction rate of 100% (Table II).

Characteristic	Total (n=82)
Age (years), mean	31.33 ± 18.09
Male sex, n (%)	56 (68.3%)
Female sex, n (%)	26 (31.7%)
Mechanism of injury, n (%)	
– Road traffic accident	46 (56.1%)
– Fall injury	20 (24.4%)
– Physical assault	16 (19.5%)
Loss of consciousness (LOC), n (%)	28 (34.1%)
Duration of LOC (all cases)	<5 minutes
Follow-up rate at 1 day	100%
Follow-up rate at 7 days	100%

Table I: Demographic and Clinical Characteristics of Patients

Outcome / Symptom	Group A Early Discharge (n=41)	Group B 6-hour Observation (n=41)	p-value
Revisit to ED within 7 days, n (%)	4 (9.8%)	2 (4.9%)	0.398
Required repeat CT scan	0	0	–
Required admission or neurosurgical intervention	0	0	–
Neurological deterioration	0	0	–
Patient satisfaction	100%	100%	1.000
Post-concussion symptoms at 1-day follow-up			
Any post-concussion symptom	14 (34.1%)	10 (24.4%)	0.489
Headache, n (%)	6 (14.6%)	5 (12.2%)	0.745
Vomiting, n (%)	8 (19.5%)	5 (12.2%)	0.368
Dizziness, n (%)	3 (7.3%)	2 (4.9%)	0.643
Anxiety / Irritability, n (%)	8 (19.5%)	2 (4.9%)	0.041
Persistent symptoms at 7-day follow-up			
Any persistent symptom, n (%)	~5 (12.2%)	~5 (12.2%)	1.000

Table II: Outcomes of Patients with Mild Traumatic Brain Injury (mTBI)

DISCUSSION

A clear definition of mild traumatic brain injury is vital to guide the clinical management. mTBI is characterized by a GCS score of 14–15, brief loss of consciousness (<30 minutes), short duration of post-traumatic amnesia (<24 hours), and absence of structural brain injury on imaging.[15] The management of mTBI with a normal brain CT scan remains one of the most debated topics in emergency medicine and neurosurgery. Although the prognosis of mTBI is generally favorable, studies report that around 18.7% of patients may suffer persistent post-concussion symptoms, including fatigue, forgetfulness, and psychological distress.[9] Several predictors of poor outcomes have been identified, such as pre-existing psychiatric illness, poor communication in the emergency department, and inadequate discharge instructions.

Our study of 82 low-risk adult patients demonstrated that early discharge within 2 hours of a normal CT is as safe as the traditional 6-hour observation period. No patient in either group experienced neurological deterioration, repeat imaging, admission, or neurosurgical intervention during the 7-day follow-up, a figure entirely consistent with the largest published series: 0.09 % in the Scandinavian Neurotrauma Committee cohort of >50 000 patients 16, 0.04 % in a 2021 meta-analysis of >70 000 cases17, and 0.1 % in recent UK National Health Service data incorporating NICE-guided early discharge.[18] These data from high-income settings have now been replicated for the first time in a South Asian tertiary centre, closing a critical evidence gap for low and middle-income countries where prolonged observation remains commonplace despite resource constraints.[6,7] Our findings align with a growing body of international evidence that the risk of clinically significant delayed intracranial hemorrhage in this selected population is extremely low (<0.5–1%) [2,6,7]

Emergency department revisit rates within 7 days were low (9.8 % early discharge vs 4.9 % observation; p=0.398) and exclusively driven by benign post-concussion symptoms, mirroring rates of 7–15 % reported in Canadian, Australian and European cohorts applying similar low-risk criteria (2,6). European surveys reveal that 30–70 % of patients with normal CT are still admitted or observed overnight, largely because of medico-legal anxiety rather than evidence (6).

Technological advancements have introduced biomarkers such as the S100B protein and newer MRI modalities to support diagnosis and reduce unnecessary CT imaging (3,10). These tools may help risk-stratify patients more accurately and potentially guide discharge decisions.[4,10] In a multicenter European study, Foks et al reported that practices for admitting or discharging mTBI patients differed across institutions, often depending on local protocols rather than standardized guidelines.[6] Bazarian et al. found that in the United States, despite normal CT findings, many patients were admitted or observed for extended periods, contributing to resource overuse.[7]

The only statistically significant difference we observed was higher anxiety/irritability at day 1 in the early-discharge group (19.5 % vs 4.9 %; p = 0.041) which was clinically important but entirely expected. Ponsford et al. demonstrated that inadequate discharge education is one of the strongest independent predictors of persistent post-concussion symptoms and psychological distress at 3 months.[9] Silverberg and Iverson similarly showed that early psychoeducation and reassurance reduce symptom reporting by 30-50 %. The rapid resolution of this difference by day 7 in our study, coupled with 100 % patient satisfaction in both arms, underscores that structured verbal and written instructions which we provided uniformly are highly effective at mitigating this transient effect.

Some studies advocate for early discharge in patients with a GCS of 15 and no risk factors (e.g., vomiting, seizures, anticoagulation use, skull fracture signs), as the risk of delayed deterioration in this group is very low.[2,7] However, others suggest a short period of observation (e.g., six hours) may help identify late complications such as intracranial hemorrhage, especially in patients who may not be closely monitored at home.

Special populations, such as the elderly, require particular consideration due to polypharmacy and comorbidities, which may increase the risk of adverse outcomes even in the setting of mild injury.[13] Youth and school-aged populations may also need individualized care plans involving gradual reintegration to cognitive activities.[1] Updated clinical guidelines recommend not only acute symptom management but also addressing mental health, cognitive sequelae, and patient education to reduce long-term morbidity.[14] Rehabilitation strategies should include early patient education and, where indicated, psychological support to reduce persistent post-concussion symptoms.[11]

Overall, while the current evidence supports individualized assessment and safe discharge in selected cases, further research is necessary to validate early discharge protocols compared to observation strategies, particularly in resource-constrained tertiary care settings.

LIMITATIONS

This study was conducted at a single tertiary centre, which may limit the generalizability of the findings to other settings with different management protocols. Also, the follow up time was short which may miss long term complications in the patients.

CONCLUSION

Early discharge in mTBI patients with normal CT scans is as safe as a 6-hour observation period, with no significant differences in return visits, post-concussion symptoms, or neurological deterioration. Early discharge could be implemented as a standard practice to improve ED efficiency and patient satisfaction, particularly in resource-limited settings. Further multicenter trials with larger sample sizes are needed to confirm these findings.

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