THE ASSOCIATION BETWEEN EARLY DISCHARGE AND LONG-TERM OUTCOME OF PATIENTS WITH TRAUMATIC INTRACRANIAL HEMORRHAGE ADMITTED TO EMERGENCY DEPARTMENTS

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ABSTRACT:

Introduction: Head trauma is associated with high morbidity and mortality. Common complications of head trauma are intracranial hemorrhages (ICH), which may cause numerous physical and cognitive disabilities. This study was performed to evaluate the association between early discharge and long-term outcome of patients with traumatic ICH.

Materials & Methods: In this prospective cohort study, patients with traumatic ICH referred to emergency departments (EDs) of two teaching hospital were investigated. Demographic and clinical characteristics of the patients were recorded in the check list and then radiologic assessment was done. According to time of discharge, the patients were divided into two groups: early discharge (≤ 24 hours) and late discharge (> 24 hours). All subjects were followed by intervals of 24 hours, one month and three months after discharge and their outcome were evaluated based on clinical criteria and the Glasgow Outcome Scale (GOS). The collected data were analyzed using SPSS-24.

Results: A total of 28 patients (84.8%) in the early discharge group and 36 patients (81.8%) in the late discharge group completed the study. The age distribution was similar between two groups. In the first group, 26 patients (92.8%) and in the second group, 25 patients (69.4%) were male. Epidural hemorrhage was the most common type of intracranial hemorrhage (n = 15, 53.7% vs. n = 27, 75.0%; P = 0.005). The most common clinical symptoms after discharge were headache in the first group and headache and vertigo simultaneously in the second group (n = 7, 25.0% vs. n = 4, 11.1%; P = 0.020). At the end of follow-up, in the first group of 28 patients (100%) had GOS = 5 and in the second group, 33 patients (91.7%) had GOS = 5 and 3 patients (8.3%) had GOS = 4 that were statistically not significant (P = 0.118).

Conclusions: The results of this study showed that early discharge
of patients with traumatic ICH had fairly similar outcome with patients with late discharge.

Introduction

Trauma is one of the first causes of death and the leading cause of disability in the active population of developing countries [1-3]. The mortality rate of trauma in the world and Iran are 88 and 39 people per hundred thousand populations, respectively [4].

Among the injuries to certain organs of the body, head trauma associates with the highest mortality rates. People with traumatic head injury than other people are three times more likely to be experiencing death [5-8]. One of the common complications of head trauma is intracranial hemorrhage (ICH) that is divided into two main categories include epidural hematomas and intradural hematomas (subdural and intracerebral hematomas). According to various references, 58% of patients underwent operation for evacuation of hematoma and 21% of patients with severe head injury had suffered from subdural hematoma and the ratio of male to female in these studies were reported from 1:3 to 1:6 [9-12].

The most common mechanism of subdural hematomas is falling down and physical assault but in young people are mainly due to traffic accidents [13,14]. Currently in the United States, 3.5 million people live with disabilities due to head trauma [5,8].

The problems related to data collection for epidemiological statistics of head injuries caused to detailed information in this regard does not exist. Death from traumatic brain injuries can occur at different times since the event until years later. Previous studies have shown that overall 30 percent of deaths from trauma occur in the first 24 hours of patient admission to the hospital that its main leading causes are also head injuries, uncontrolled hemorrhage and shock which can result in cerebral ischemia and increase secondary brain damage [15,16,17].

Unfortunately, there was not accurate information on the outcome of brain injury patients discharged from hospital in Iran. Due to the

high incidence of accidents causing head trauma, followed by brain hemorrhage, and also the importance of timely diagnosis and early treatment in the final outcome of the patients and their quality of life in the future, this study was performed to evaluate the association between early discharge and long-term outcome of patients with traumatic ICH.

Materials & Methods
Design and Subjects
This was a prospective cohort study performed on patients with traumatic ICH referred to two academic EDs (Firoozgar and Shohadaye Haft-e Tir hospitals) in Tehran in 2016.

Inclusion & Exclusion Criteria
Inclusion criteria were all patients with ICH caused by head trauma, Glasgow coma scale (GCS) of 14 or 15 and informed consent to participate in the study.

Exclusion criteria were GCS of 13 or less, need for surgery and death of patient before discharge, patient dissatisfaction or his caregivers to participate in the study and the lack of definitive diagnosis of the disease (Figure 1).

Figure 1.Flow diagram of patient classification
Data Collection
In this prospective cohort study, all eligible with traumatic ICH referred to EDs were investigated. Diagnosis of patients was confirmed based on history, complete clinical examination and imaging such as skull X-ray, CT scan or MRI of the brain. First, using check list, demographic characteristics including age and sex were recorded. Level of consciousness of the patients on admission was determined based on GCS. Of these patients, the cases of minor head trauma including GCS of 14 or 15 were recruited. The patients' blood pressure was measured by standard sphygmomanometer under monitoring. All radiologic information were collected with observation by a neurologist or radiologist and radiology reports and the occurrence of ICH, the type of intracranial lesion and radiographic findings were confirmed based on the obtained data.
The patients were observed continuously during hospitalization and if each patient died, his/her death was recorded. They were followed after discharge at intervals of 24 hours, 1 month and 3 months later by phone calls or return visits to the ED and their final outcomes including death, sustained lesion, relative or complete improvement were determined. Finally, patients with early discharge (within 24 hours) from ED (first group) and patients were routinely hospitalized and later discharged (second group) were compared in terms of the final outcome (on the basis of Glasgow outcome scale).

The Glasgow Outcome Score (GOS) is a scale that patients with brain trauma can be classified into groups that allow standardized descriptions of the objective degree of recovery. The first description was in 1975 by Jennett and Bond [18]. The GOS is used for patients with brain injury allowing the objective assessment of their recovery in five categories. This scale predicted the long-term course of rehabilitation to return to work and everyday life.

Statistical analysis
All statistical analysis was performed using IBM SPSS statistics 24 software (IBM Corporation, Armonk, NY, USA). The frequency of the studied variables was determined using mean ± SD and percentage. Tables and figures were drawn to display the distribution of data. After assessing normality of data distribution, chi-square (χ2) and independent t-test were used for comparing the obtained values in the groups. In all analysis, < 0.05 was considered statistically significant at 95% confidence interval.

Ethics statement
The study protocol was approved by Ethics Committee of Iran University of Medical Sciences and all patients' data will be remained confidentially.

Results
A total of 77 patients with traumatic ICH were investigated. Of these, 33 patients (42.9%) were discharged in less than 24 hours, and 44 patients (57.1%) in more than 24 hours from the time of admission. Accordingly, the patients were divided into two groups; early discharge (n = 33) and late discharge (n = 44). In patients with early discharge, 28 patients (84.8%) completed the study and were fully followed, but 5 patients (15.2%) due to failing to answer the phone calls and impossibility of complete follow-up discontinued the study. In the late discharge group, 36 people (81.8%) finished the study and were passed the complete follow-up, but 8 patients (18.2%) discontinued the study and had not complete follow-up.

None of the patients in two study groups had recent history of using anticoagulation or antiplatelet drugs and all patients on arrival to the ED had GCS of 14 or 15. Also, all of them had undergone brain CT scan. A comparison of demographic and clinical characteristics of patients in two groups has been shown in Table 1.

Table 1. Comparison of demographic and clinical characteristics of patients with traumatic ICH between early and late discharge groups.

There was no significant difference between two groups in terms of age (P = 0.078), but about sex, a significant difference was found between two groups (P = 0.021). In addition, systolic blood pressure was significantly different between the groups (P = 0.023), while this statistically difference was not observed about diastolic blood pressure (P = 0.429). In terms of the mechanism of head trauma in patients with ICH traumatic, in both groups, motor vehicle collision was the most common mechanism (18, 64.3% vs. 11, 30.6%) that the difference was statistically significant (P = 0.043)

In terms of radiologic findings, in early discharge group, 10 patients (35.7%) had brain contusion and 18 patients (64.3%) had obvious cerebral hemorrhage, and in late discharge group, 1 subject (2.8%) had brain contusion and 35 subjects (97.2%) had obvious cerebral hemorrhage that were significantly different (P = 0.001). About the type of traumatic ICH, in both groups, epidural hemorrhage was the most common type of ICH (15, 53.7% vs. 27, 75.0%) which there was a statistically significant difference between two groups (P = 0.005)

The assessment of clinical manifestations of traumatic ICH in the patients during follow-up after discharge showed that in patients with early discharge, 15 patients (53.6%) had the symptoms and 13 patients (46.4%) were without symptoms that the most common clinical symptom in this group was headache (7, 25.0%). In the late discharge group, 10 cases (27.8%) had the symptoms and 26 cases (72.2%) were without symptoms that the most common clinical symptoms in this group were also headache with vertigo (4, 11.1%). The frequency of clinical symptoms in patients with early discharge was significantly higher than those with late discharge (P = 0.020) (Table 2).

Table 2.Comparing the clinical symptoms in patients with traumatic ICH between early and late discharge groups.

Evaluating the follow-up and outcome of the patients within 24 hours after discharge showed that in both groups, none of the patients had complete improvement, but all patients had relative improvement. Also, assessing the final outcome of patients on the basis of GOS at the end of the study showed that all patients with early discharge those were participated in the analysis (n = 28) had GOS of 5, who had a full recovery and returned to old works, but in patients with late discharge among 36 subjects participated in the analysis, 33 cases (91.7%) had a complete improvement and returned to their previous jobs, but 3 patients (8.3%) had GOS of 4 who due to moderate disability were not able to return to their former jobs. The outcome of patients with traumatic ICH one month after discharge among patients with early discharge and those with late discharge was significantly different (P = 0.033), while there was

no significant difference between two groups in 3-month outcome and GOS at the end of study (P = 0.703, P = 0.118, respectively) (Figure 2).

Figure 2.Comparing the 1-month and 3-month outcomes and GOS in patients with traumatic ICH between early and late discharge groups (left to right, respectively).

No deaths were reported in the patients of two study groups during follow-up after discharge.

Discussion

In this study, patients with ICH due to head trauma were followed after early discharge from the ED and their clinical outcomes at specified intervals were compared to the outcome of patients who were later discharged. Unfortunately, some patients during the follow-up period did not returned to assess clinical status and their post-discharge follow-up by phone calls was also failed. For this reason, patients who discontinued from the study and did not participate in the analysis may have died or suffered serious adverse consequences that could affect the study results. However, the analysis of data obtained from patients who have successfully completed the study and were completely followed showed that patients with early discharge (group I) and late discharge (group II) were similar in terms of age and their average age was between 25 and 30 years, although the average age of the first group was 5 years less than second group and it seems that younger patients had better outcomes and are more suitable for early discharge from the ED. But in terms of gender, unlike age, two groups were not homogeneous and a significant difference was found between two groups. In both groups, the number of female patients was significantly lower than males and accordingly cannot be properly judged in terms of the effect of gender on the final outcome of patients. In terms of systemic blood pressure, in patients with early discharge, systolic blood pressure increased significantly compared with late discharge group. However, in both group, the average systolic blood pressure was in the normal range. But both groups were similar for diastolic blood pressure and mean values were within normal limits. Comparing the mechanism of head trauma in two study groups showed that most cases of traumatic ICH admitted to the ED were following the collision of two motor vehicle, which head trauma could be caused by the vehicle rollover or head on vehicle collision that the frequency of this mechanism of trauma in the first group significantly more than the second group (more than 2-fold). Also, falling down in first group and pedestrian struck by vehicle in second group were in the next place in terms of frequency. Comparison of imaging (brain CT scan) in the patients also showed that the frequency of brain contusion in the first group far more than the second group and that can improve the final outcome of patients compared to those in the initial radiological investigation clearly had cerebral hemorrhage. In addition, in terms of the type of ICH, the frequency of epidural hemorrhage in the second group are substantially less than the first group, which it can be argued that this type of traumatic intracranial hemorrhage, because of its specific clinical pattern and fluctuating level of consciousness causes delays in discharge from the ED and needs more intensive care in hospital, and more adverse consequences will follow for patients. A significant percentage of patients with early discharge (over 50%) after discharge showed various clinical symptoms that headache was the most common symptom, while in the late discharge group, the frequency of these symptoms almost half the amount reported in first groups. In the late discharge group, headache was mainly associated with vertigo.

Evaluation of outcomes between two groups showed that within 24 hours after discharge, none of the patients in both groups had complete improvement. Despite the significant improvement of patients' outcome in first group in the first month after discharge compared with the second group, the final outcome of the patients in the three months after discharge, according to clinical criteria and GOS did not show significant differences between two groups. On the other hand, no deaths were reported in patients with early discharge as well as patients discharged later. Accordingly, early discharge of patients with traumatic ICH despite the increase of clinical symptoms during the post-discharge period, were followed relatively similar outcomes to patients with late discharge.

Other researchers have found various results in their studies. Fujii et al (2016) by investigation of the prognostic factors of outcome and early discharge of patients undergoing surgical intervention for ICH showed that younger age, higher GCS on admission, lack of coagulation disorders before surgery, lack of hypernatremia and fever were predicting factors of favorable outcome. In addition, increasing the duration of surgery and hospitalization were defined as predictors of negative outcomes after surgery [19]. In the present study, the direct relationship of age with the final outcome of patients and the odds ratio of unfavorable outcomes were not assessed but it seems that younger people, such as patients with early discharge would be associated with relatively better outcomes, as follow-up one month after discharge showed that the outcome of these patients compared to patients with late discharge and higher average age was significantly different, although this statistical difference was not seen in the final outcome of two groups. Kreitzer et al (2014) also assessed the clinical outcomes and radiographic findings in patients with TBI and acute traumatic ICH and by repeating imaging showed that the subarachnoid hemorrhage is the most common type of traumatic ICH and less than 1% of patients had found requiring neurosurgical intervention. As a result, discharge after a repeat brain CT scan and the short period of observation in ED can be allowed the early discharge of patients with acute TBI and traumatic ICH without late adverse outcomes [20]. In the present study, epidural hemorrhage is the most common type of traumatic ICH that was significantly higher in patients with late discharge and it can be concluded that type of hemorrhage can have an important role in clinical outcome of the patients and cause at least a significant effect on the incidence of clinical symptoms due to head trauma, as in the present study, the frequency of epidural hemorrhage was high in both groups and that's why early discharge of patients increased the frequency of associated symptoms after discharge. Shabiri et al (2014) by investigation of the relationship between the findings of brain CT scan with the level of consciousness, surgical findings and the outcomes of patients with traumatic ICH showed that based on the results of the CT scan, epidural hemorrhage was the most common type of traumatic ICH and there was a significant relationship between the level of consciousness at discharge and the outcome of nonoperated patients. As a result, the outcome of patients with head trauma depends on the level of consciousness and volume of the hematoma and midline shift on CT scan had a reverse correlation with the level of consciousness of patients [21]. In the present study as well as above study, epidural hemorrhage was the most common type of ICH in patients with head trauma, but all patients with GCS 14 or 15 had been recruited and thus, the effect of outcome of consciousness was removed. Nishijima et al (2013) in their cohort study assessed the risk of long-term unfavorable outcomes in older adults with traumatic ICH and use of anticoagulant or antiplatelet before the injury with or without a history of using these drugs showed that the patients with a history of warfarin or clopidogrel before the injury compared with patients without a history of drug use were more likely to develop an adverse outcome [22]. But in the present study, none of the patients in both groups had history of taking these drugs; therefore, the possible effects of these drugs on patients' outcome were removed. Skandaroghli et al (2011) by investigation of the factors affecting the outcome of acute subdural and epidural hematomas in patients with head trauma showed that epidural hematoma (as the present study) was the most common type of traumatic brain hemorrhage and based on Glasgow system, the outcome of treatment in 70% of patients was favorable and the mortality rate was high (13% of patients and 53% of them had epidural hematoma and subdural hematoma, respectively). As a result, type of injury (subdural or epidural hematomas), age, duration of ICU stay and GCS on

admission affected on the outcome [23]. In the present study, in patients with early discharge, all patients fully recovered and had GOS of 5, but in the late discharge group, less than 10% of patients had moderate disability and GOS of 4, and for this reason, they could not return to their previous jobs that results of this study was much better than above study. On the other hand, no cases died in the present study (at least in the analyzed samples) and even by assuming that all patients who discontinued the study during follow-up be dead, the mortality rate is much lower than above study. The direct association of variables in the above study with final outcome of the patients was not assessed in the present study, but evidence suggests that younger patients with non-epidural ICH will have relatively better outcome after discharge and possibly in the long term. Ebrahimifakhar et al (2010) by evaluating the outcome of patients with severe head based on GOS showed that more than 50% of patients since admission until 2 years later died and the average score of GOS since discharge until 2 years later was increased [24]. In the present study, outcome of patients after discharge gradually improved over time, but no deaths were reported and the final outcome of patients with early discharge slightly better than patients with late discharge, although the difference were not statistically significant.

Limitations of the Study

Inadequate cooperation of the patients and their caregivers on admission and difficult follow-up of them were the problems facing the study. In addition, patients who due to failure to answer the phone and also due to loss to follow-up, discontinued the study and were excluded from the analysis, may be due to the possibility of death or serious complications after traumatic ICH, have distorted the accuracy of the results.

Conclusion

The results of this study showed that early discharge of patients with traumatic ICH followed a final outcome similar to patients with late discharge. Thus, early discharge in selected patients reduces the cost of treatment and hospital stay and increases patient satisfaction.
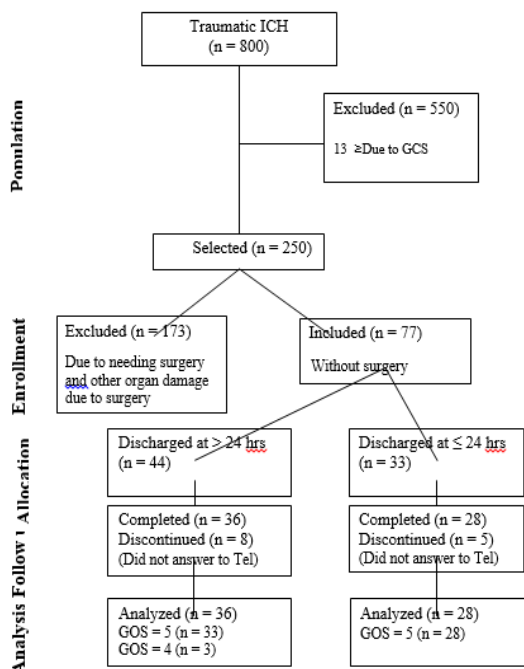
Conflict of Interest

None declared.

Table 1. Comparison of demographic and clinical characteristics of patients with traumatic ICH between early and late discharge groups.

Characteristics	Early Discharge (n = 28)	Late Discharge (n = 36)	P - value
Age, mean ± SD	25.78 ± 11.26	30.94 ± 11.55	0.078
Sex (male), n (%)	26 (92.8)	25 (69.4)	0.021
Systolic blood pressure (mmHg), mean ± SD	117.32 ± 7.51	123.33 ± 11.95	0.023
Diastolic blood pressure (mmHg), mean ± SD	78.03 ± 4.37	78.89 ± 4.16	0.429
Mechanism of trauma (motor vehicle collision), n (%)	18 (64.3)	11 (30.5)	0.043
Radiologic finding (hemorrhage), n (%)	18 (64.3)	35 (97.2)	0.001
Type of ICH (epidural hematoma), n (%)	15 (53.7)	27 (75.0)	0.005
Clinical symptom after discharge (headache), n (%)	15 (53.6)	10 (27.8)	0.020
Outcome 1month after discharge (complete improvement), n (%)	16 (57.1)	11 (30.6)	0.033
Outcome 3month after discharge (complete improvement), n (%)	28 (100.0)	33 (91.7)	0.703
GOS (5), n (%)	28 (100.0)	33 (91.7)	0.118

Table 2. Comparing the clinical symptoms in patients with traumatic ICH between early and late discharge groups.

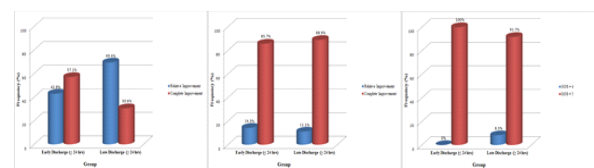| Clinical Symptoms	Early Discharge (n = 28)	Late Discharge (n = 36)
Headache, n (%)	7 (25.0)	3 (8.3)
Vertigo, n (%)	1 (3.6)	1 (2.8)
N/V, n (%)	0 (0)	0 (0)
Agitation, n (%)	2 (7.1)	0 (0)
Headache + N/V, n (%)	3 (10.7)	0 (0)
Headache + Vertigo, n (%)	0 (0)	4 (11.1)
Vertigo + Unilateral hearing loss, n (%)	2 (7.1)	0 (0)
Vertigo + Blurred vision, n (%)	0 (0)	1 (2.8)
Vertigo + Seizure, n (%)	0 (0)	1 (2.8)
No symptoms, n (%)	13 (46.4)	26 (72.2)

*N/V: nausea/vomiting

Figure 2. Comparing the 1-month and 3-month outcomes and GOS in patients with traumatic ICH between early and late discharge groups (left to right, respectively).

Figure 1. Flow diagram of patient classification

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