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Original Research Article

Factors Affecting Treatment Outcome in Traumatic Intracerebral Hematomas

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Abstract

Current indications for surgical treatment of patients with traumatic intracerebral hematomas (TICH), generally observed after severe head traumas are unclear. Therefore, mortality and morbidity rates are higher in such cases. In the present study, the aim was to evaluate patients diagnosed with TISH in line with the literature. The archived medical records of patients (n=56) diagnosed with TICH between January 1991- January 1997 in the neurosurgery clinic were scanned. The alpha significance value was accepted as < 0.05 during the evaluation of the obtained data. After initial neurological examinations of patients, 21 patients were diagnosed with mild head trauma (GCS: 13-15), 20 patients were diagnosed with moderate head trauma (GCS: 9-12), and 15 patients were diagnosed with severe head trauma (GCS: 3-8). 71.4% (n = 40) of these patients with TICH had concomitant multiple intracranial pathologies. CT scans revealed that 36 patients had cisternal compression and that 20 patients had not any cisternal compression. As a treatment modality, 53.6% (n = 30) of the patients were treated with conservative treatment, while the remaining patients (n = 26) underwent surgical treatment. Surgical intervention may be required in patients with midline shift greater than 5 mm at the level of the ventricle, and it should be kept in mind that if the volume of hematoma constitutes 4-8% of the total volume of the brain, this may pose a serious life-threat to the life of patients. An open or closed perimesencephalic cistern may be an important indicator for intracranial pressure. It should also be kept in mind that the localization of cerebral oedema and hematoma is important for surgical treatment.

Keywords: Prognosis, Traumatic intracerebral haemorrhage, Therapeutic approach, Traumatic brain injury

INTRODUCTION

Intracerebral haemorrhage is a vascular origin of bleeding within the brain parenchymal tissue. Intracerebral hematomas (ICH) are most commonly caused by hypertension, arteriovenous malformations or can be seen after head trauma. The aim of the treatment is to control the bleeding, eliminate the mass effect caused by hematoma and increase the cerebral perfusion pressure by decreasing the intracranial pressure.Such haemorrhages can exert external pressure to the cerebrospinal fluid circulation pathways or cause secondary obstruction of these pathways, and ultimately lead to hydrocephalus. Accordingly, the intracranial pressure increase syndrome may occur and it may be mortal.

As is well known, head trauma may cause intra-parenchymal lesions such as cerebral contusion, laceration, and ICH, and may cause extra-parenchymal lesions such as epidural and subdural hematoma (Maugeri et al., 2015). Of these lesions, traumatic ICH (TICH) is the least reported and discussed traumatic intracranial hematomas (Bullock et al., 1989).

TICH is usually caused by the movement of neural tissue through multi-vector forces in patients with severe head trauma.

Therefore Glascow Coma Scale (GCS) decreases eight and below this value. Patients with a value of GCS eight and below constitute 30% of patients with TICH. The treatment protocols for patients with poor prognosis due to the concomitant contusion, subdural/epidural hematoma, diffuse axonal injury, and extracranial other pathologies are still controversial and unclear (Moustafa et al., 2018).

The aim of the present study was to determine the factors significantly affecting the outcome of the treatment in patients with TICH and to determine which treatment modality could be used in such cases.

MATERIALS AND METHODS

This study was performed retrospectively using the medical records of patients (n=56) with TICH who were diagnosed and treated in the Republic of Turkey, Ministry of Health, *Haydarpaşa Numune* Training and Research Hospital, Department of Neurosurgery between the dates January 1991 and January 1997.

Eligibility Criteria

Patients admitted to the hospital following a traffic accident, fall, beating, and hard object hit and diagnosed with TICH after imaging examinations were included in the study. Size (single/multiple) of the lesion and the presence of midline shift and cisterns compression were detected through imaging examinations. Patients with gunshot and sharp object injuries and diagnosed with TICH were excluded from the study. Furthermore, patients with TICH lesion smaller than 2cm were also excluded from the study.

The clinical evaluations were performed using the values of GCS at the time of admission and the values of Glasgow Outcome Scale (GOS) (Avanali et al., 2017; Choudhary and Bhargava, 2018) after the treatment. The following values of GCS were used during the evaluations; GCS in mild head trauma:13-15, GCS in moderate head trauma: 9-12, GCS in serious head trauma: 3-8 (Michaud et al., 1993; Whitmore et al., 2012).

Statistical Analysis

Statistical Package for Social Science (SPSS) software was used to analyze and evaluate the data obtained from the archived medical records of patients. Mann-Whitney U test was used to compare the differences between independent groups. The significance of the difference between the averages of three or more groups in the groups that did not show normal distribution was performed by Kruskal-Wallis test. The chi-square test was used to determine whether the difference between observed and expected frequencies was significant. The relationship of the two variables that are ordinal, interval or ratio was tested with the Spearman rank correlation coefficient (rs). The alpha significance value was accepted as < 0.05.

RESULTS

The age range of patients (n=56), of which 47 were males (83.9%), varied from 10 to 90 years and the mean age was 45.5 years. Of the patients, 19 were 30 or less than 30 years, and 37 were older than 30 years.

X-ray imaging was performed for all patients. Computerized Tomography (CT) was performed in 55 patients and CT was not performed in one patient and the diagnosis of this patient was made through exploratory burr hole procedure.

Of patients diagnosed with TICH, the most common cause of trauma with a rate of 48.2% was a traffic accident. This was followed by a fall (37.5%), beating (8.9%), and hard object hit (5.3%).

Thirty-three patients were referred to the hospital at the first 6 h after trauma, seven patients were referred to the hospital between 6-12 h after trauma. The remaining nine patients were referred to the hospital between 12-24h after trauma. The most observed cause of trauma with a rate of 48.2% in patients with TICH was a traffic accident.

Most of the patients were referred to the hospital at the first 6 h after trauma, and this was important to receive a positive response to the treatment. Following neurological examinations, 37.5% of patients were diagnosed with mild head trauma. Direct craniography revealed fractures in 55.3% (n=31) of patients. CT scans revealed cisternal compression in 36 patients, however, this was not observed in 20 patients.

Of the lesions of patients with TICH, 16 were located in the frontal lobe, 10 were located in the temporal lobe, and eight were located in the parietal lobe. The hematomas of 16 patients out of the remaining cases were in the temporoparietal region, those of two patients were in the frontoparietal region. The lesions of the remaining four patients were in the fronto-temporo-parietal, temporo-parieto-occipital and fronto-parietalregions.

As a treatment modality, 53.6% (n = 30) of the patients were treated with conservative treatment, while the remaining patients (n = 26) underwent surgical treatment.

Table 1. The relationship between the multiplicity of the lesion and GOS value as frequency (%).

Presence of multiple lesions	GOS 1	GOS 2	GOS 3	GOS 4	GOS 5	Total
None	3 (18.8%)	-	1 (6.3%)	4 (25%)	8 (50%)	16 (28.6%)
Available	15 (37.5%)	2 (5%)	3 (7.5%)	5 (12.5%)	15 (37.5%)	40 (71.4%)
Total	18 (32.1%)	2 (3.6%)	4 (7.1%)	9 (16.1%)	23(41.1%)	56 (100%)

There was a significant positive correlation between GCS and hematoma size at the time of referral, and this was statistically significant (rs = 0.31; P = 0.021).

After GOS evaluations, 18 patients (GOS: 1) were observed to be dead. GOS of the remaining patients were as follow GOS: 2 in two patients, GOS: 3 in four patients, nine cases GOS: 4 in nine patients and GOS: 5 in 23 patients.

The statistical relationship between age and GOS was not significant (p> 0.05), and 37.5% of patients had a GOS value of five. However, there was a slight negative relationship between lesion size and GOS (rs=-0.49; P=0.00).

The mortality rate in patients with a single lesion was found to be 18.8% when comparing the multiple lesions and GOS (Table 1).

No other concomitant cranial pathologies were observed in patients with GCS value of 13-15 and with mild head trauma, this was statistically significant (P<0.05).

DISCUSSION

Patients with head trauma are frequently encountered in neurosurgery practice. This medical condition can generate severe social and economic losses since it is a leading cause of mortality and morbidity in both adult and paediatric age groups (Vella et al., 2017). Head trauma can be healed without causing any cranial pathology, and however, can cause contusion, ICH, subdural hematoma, epidural hematoma and cranial fractures (Procaccio et al., 2000).

TICH is usually seen after calvarial compression fractures due to trauma, brain lacerations, or gunshot wounds (Turco et al., 2017). With the development of Neuroradiology, the use of CT has increased the diagnosis of TICH (Para et al., 2018).

In patients with TICH, it is of vital importance that patients should be stabilized rapidly then, that appropriate imaging examination should be performed immediately after the neurological examinations at the time of admission to the clinic after trauma. Treatment modalities of intracranial hematomas that occur after trauma are as important as a diagnostic evaluation process. Therefore, the aim of this study was to determine the factors that significantly affected the outcome of treatment in patients with TICH. In this way, it was aimed to elucidate the treatment algorithm in these patients.

The age distribution of patients with head trauma in a study performed by Marshall et al. (1991) was 30 years, and 21.6% of patients with head trauma in a study performed Luerssen et al. (1988) were younger than 14 years.

In the present study, the mean age of the patients was 45.5 years, 33.93% (n = 19) of these patients were 30 years or less.66.07% (n = 37) of these patients were older than 30 years.

Vollmer et al. (1991) reported that the total mortality rate of patients with such head trauma was 38.1% and that the incidence of mortality was significantly increased in patients over 55 years of age.

In this study, the mortality rate was 15.8% in the young people, 39.1% and 42.9% in the middle-aged and older-aged people, respectively.

Alberico et al. (1987) reported that head trauma caused by motor vehicle accidents was at a rate of 66%.However, the authors suggested that the rate of patients with trauma resulting from traffic accidents was 48.2%.

In the literature (Bullock et al., 1989), the clinical monitoring of the symptoms regarding cistern and increased intracranial pressure has been reported as important parameters in determining reliable treatment options. In addition, Taneda et al. (1987) emphasized that CT images of quadrigeminal cistern are very important in cerebellar haemorrhages.The authors reported that successful treatment outcomes cannot be obtained unless the hematoma was evacuated, especially in cases where the cisterns were compressed (Taneda et al., 1987).In that study, cerebellar hematoma (n = 1) was observed, but there was no cisternal compression on CT images.

Eisenberg et al. (1990) reported a high mortality rate in patients with severe midline shift on CT images. Furthermore, the authors suggested that midline shift and compression or obliteration of the mesencephalic cisterns were important determinants of high intracranial pressure (Eisenberg et al., 1990).

In the present study, CT scans of the patients revealed that 55.4% of the patients had 5 mm or above of midline shift and that 64.3%of the patients had cisternal compression. The outcomes of conservative treatment applied to patients without midline shift were more successful than those of surgical treatment applied to patients with midline shift.

In conclusion, 56 patients with TICH were evaluated in the present study. This disorder may have fatal results and is seen in all age groups, but it is more frequently seen in middle-aged people. The success of the treatment modalities of TICH is reduced in the adult-aged and older people. Concomitant extra parenchymal lesions such as epidural and subdural hematoma, subarachnoid haemorrhage, contusion or compression fractures may be observed in more than half of patients with TICH.

The lesions are most commonly located in frontal, temporal, and temporo-parietal regions in patients with TICH. If the GCS values of the patients decrease at the time of the referral to the hospital, the other intracranial pathologies may increasingly be seen in addition to TICH. The earlier the duration of referral to the hospital after the trauma and the higher the value of GCS at the time of referral, the higher the success rates of treatment may be. There is a negative correlation between lesion size and clinical course of the patients.

CT scans performed within 24 h after trauma is important in detecting hematomas that may occur hour's later trauma. CT scans reveal that the half of patients may have 5 mm or above of midline shift and that 65% of patients may have cisternal compression.

Surgical treatment should be considered after evaluating clinical course, localization and the size of hematoma, CT findings of intracranial pressure increases and other intracranial pathologies. However, conservative treatment options should be considered before surgical treatment by taking into consideration CT scans in patients with mild head trauma with GCS of 13-15.

CT is considered as a very sensitive and gold standard imaging method for acute bleeding detection in patients with TICH (Aydin et al., 2018).In addition, a magnetic resonance image (MRI) is a reasonable imaging technique for an initial evaluation (Yu et al., 2017). CT angiography and contrast-enhanced CT are usually referred to as spot sign, detecting patients with an elevated risk of hematoma expansion, based on the presence of contrast (Rosa et al., 2016).

However, since the data evaluated dated back from January 1991 to January 1997, there were no results of CT angiography and/or MRI in the archived medical records of patients. The retrospective design of the study and evaluation of the medical record of patients treated during technologically insufficient years were the limitation of this study.

CONCLUSION

ICH after trauma is a leading cause of mortality and morbidity. The prognosis may be dependent on many factors, such as severity of trauma, patient transport, early diagnosis, the duration between trauma and medical intervention, type of bleeding, and timely intervention. Good prognosis can be achieved with early diagnosis and appropriate treatment modality. Although impairment in general health status is expected in patients with head trauma and concomitant haemorrhage, bleeding may also occur in patients with higher GCS and normal vital signs. Furthermore, it should be kept in mind that traumatic intraventricular haemorrhage may not only accompany other hematomas and brain oedema. It is, therefore, necessary to be careful about the detection of complications after the trauma.

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Conflicts of interest

There are no conflicts of interest.

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