American Journal of Medicine and Medical Sciences 2019, 9(12): 490-492
DOI: 10.5923/j.ajmms.20190912.09

The Use of Minimally Invasive Method of Removing Trumatic Subdural Hematomas

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Abstract The analysis of surgical treatment of 41 patients operated on with acute subdural hematomas was carried out. In group 1 (27 observations), hematomas were removed by traditional craniotomy. In group 2 (14 observations), hematomas were removed using a new minimally invasive method. The results of surgical treatment depended on signs characterizing the severity of the patients' condition: the degree of impaired consciousness, the volume of the hematoma, the degree of the brain median structures displacement. The use of open craniotomy is necessary in all cases when the level of the victims' consciousness was lower than the sopor and the hematoma volume exceeded 60 cm³. In the case of violation of patients' consciousness level not lower than deep torpor, the volume of the hematoma is not higher than 40-60 cm³ and the minimum severity of symptoms of lateral dislocation, when the displacement of the brain middle structures does not exceed 5 mm, a minimally invasive method of removing the subdural hematoma can be used.

Keywords Traumatic subdural hematoma, Minimally invasive method

1. Introduction

Subdural hematoma is a local accumulation of blood between the solid and arachnoid cerebral membranes and makes up about 40% of all intracranial hemorrhages. In most cases, the subdural hematoma is a consequence of a traumatic brain injury (TBI), and the frequency of its occurrence in severe TBI reaches 22% [1-2].

The most common causes of traumatic subdural hematoma (TSH) formation are accumulation of blood around the area of brain injury, as well as rupture of superficial or passing to the dura mater vessels. The choice of treatment method for TSH is surgery. Preference is given to osteoplastic trepanations of the skull with removal of the subdural hematoma. Decompressive resection trepanations are performed at a rapid deterioration of patients' condition [3-5].

In recent years, there are reports in the literature about the possibility of minimally invasive interventions for this pathology [1,3]. Under the certain circumstances, such as a compensated condition, the absence of dislocation signs, the presence of a certain volume of hematoma, it is impractical to carry out wide osteoplastic trepanations. Thanks to the use of MSCT, it became possible to determine the quantitative (size, volume) characteristics of the hematoma, the timing of its formation, localization, as well as the degree of its effect on the brain and, as a result, the possibility of dynamic monitoring of intracranial pathology in general and hematomas in particular [6-7]. In this regard, the interest in the use of less traumatic surgical methods for removing TSH, the definition of indications and contraindications for their use are understandable.

Aim of the research is to optimize the surgical treatment results of traumatic subdural hematomas.

2. Materials and Methods

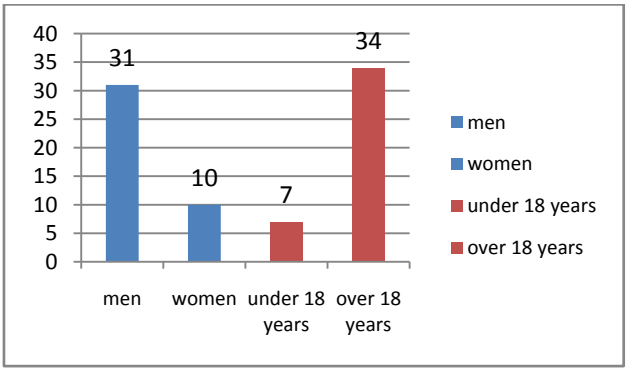

Figure 1. Distribution of patients by gender and age

The surgical treatment analysis of 41 patients with traumatic subdural hematomas was carried out. Patients have been treated in the Samarkand branch of the Republican Research Center of Emergency Medicine from 2017 to 2019. There were 7 patients under the age of 18 years and 34 patients over 18 years. There were 31 men, 10 women

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(Fig. 1).

There were 37 patients who were admitted during the first 24 hours after TBI and 4victims – within 2-3 days. All patients were operated on within 24 hours after admission to the hospital.

The causes of TBI in 21 cases were a car accident, in 9 cases – a fall from a height of growth, in 11 cases – a fall from a great height. The level of consciousness and the severity of patients' condition were evaluated by Glasgow Coma Scale. Upon admission, in 5 patients the state of consciousness was assessed as clear, in 8 - torpor, in 12 - sopor, in 16 - coma (Fig. 2).

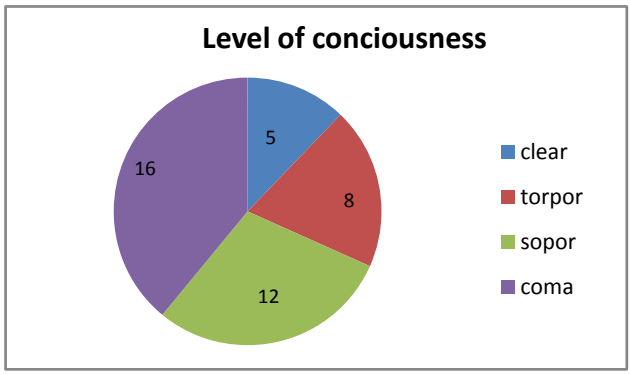

Figure 2. The consciousness level of the investigated patients

All patients were performed brain MSCT upon the admission and in dynamics. Patients were divided into two groups depending on the type of surgical intervention. Patients of the first group (n=27) were undergone open removal of hematomas using osteoplastic and resection trepanations. In 8 cases, the operations were decompressive by nature. 5 patients were children under 18 years old. 2 patients were admitted in a clear consciousness, 2 – in torpor, 11 – in sopor, 16 patients – in a coma. There were 3 patients with a hematoma volume of 41-60 cm³, with a volume of 61-90 cm³ - 9, over 90 cm³ - 15 (Fig. 3).

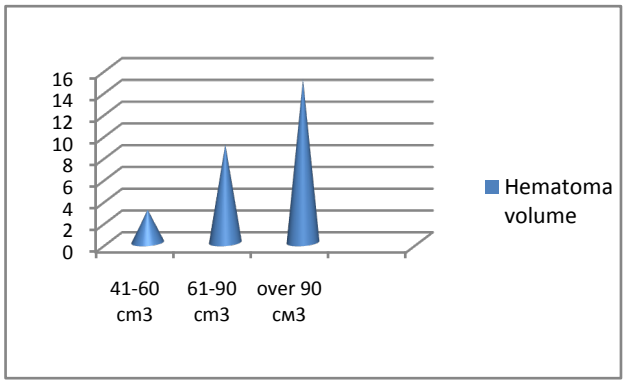

Figure 3. The hematoma volume of the investigated patients

A displacement in of the brain median structures up to 5 mm was noted in 4 patients, 5-10 mm – in 10 patients, more than 10 mm – in 13 patients.

The second group included 14 observations. There were 2 patients under the age of 18. 3 patients were admitted in clear consciousness, in torpor – 6, in sopor – 1 patient. There were 9 patients with a hematoma volume of up to 40 cm³, with a volume of 41-60 cm³ – 5 cases. A displacement in of the brain median structures up to 5 mm was noted in 9 patients, 5-10 mm – in 3. There were 2 patients without signs of lateral dislocation (Fig. 4.)

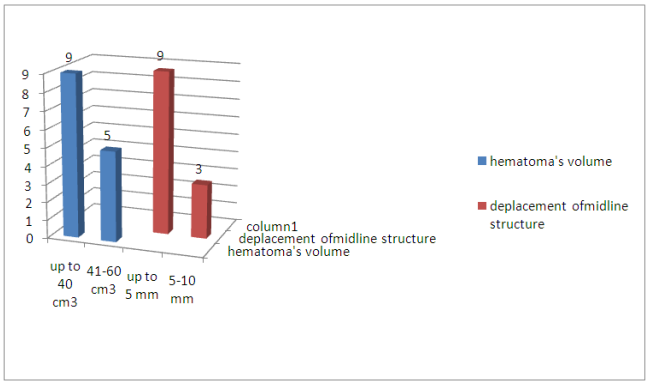

Figure 4. The volume of hematoma and the displacement of the median structures

Patients of the second group were undergone minimally invasive removal of the hematoma according to the following method: 2-3 milling holes are applied in the projection of the hematoma, depending on its size and prevalence. The application of bone holes is pre-determined on CT-slices and, taking into account the real scale factor and then is transferred to the head surface. The dura mater is opened cruciformly long enough to hold the brain spatula. Further, the subdural hematoma is evacuated through the holes in the dura mater with a spatula and electric suction. The spatula moves in different directions, both towards the superimposed holes, and in the opposite direction. The most complete removal of blood clots can be achieved using this tactics. The subdural space is drained. The wound is sutured.

3. Results

The treatment results of patients were evaluated according to the hospital mortality rate and types of functional outcomes, for which the Glasgow outcome scale was used. We analyzed the disease outcomes depending on the severity of the patients' condition, the level of impaired consciousness, the amount of hemorrhage and the brain median structures displacement. The level of consciousness disorder and the severity of the condition were determinative in the estimation of severity and significantly influenced on the disease outcome. So, from 5 patients who arrived in clear consciousness there were no dead. From the 8 patients admitted in torpor one died; from 12 in sopor - 2, from 16 in a coma – 6 died. (Fig. 5.)

Mortality increased with an increase of hemorrhage volume. There were no fatal outcomes among patients with hemorrhage up to 60 cm³, 3 patients with a volume of 61-90 cm³ died, over 91 cm³ - 6 lethal outcomes. (Fig. 6.)

Mortality rates also increased with an increase of dislocation signs. There were no lethal outcomes in patients

without displacement of the brain median structures and with a displacement up to 5 mm. 2 patients died with a displacement of 5-10 mm, over 10 mm – 7 cases of lethality. According to the disease outcomes, the following results were obtained: in the first patients group good recovery was in 6 cases, moderate neurological disorders – in 9patients, gross neurological disorders were registered in 3 and a fatal outcome – in 9 cases. In the second group there was a good recovery in 8 cases, moderate neurological disorders were in 6 patients.

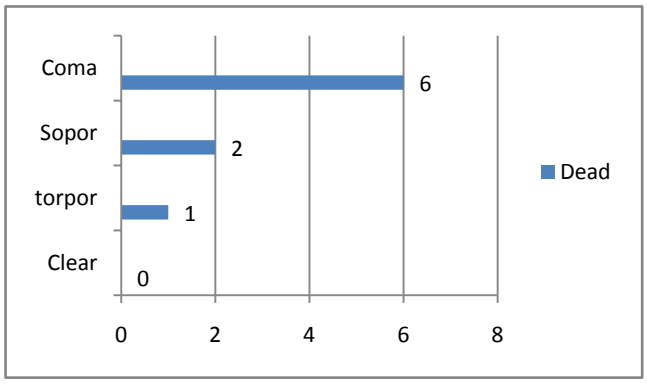

Figure 5. The lethality rate by consciousness level

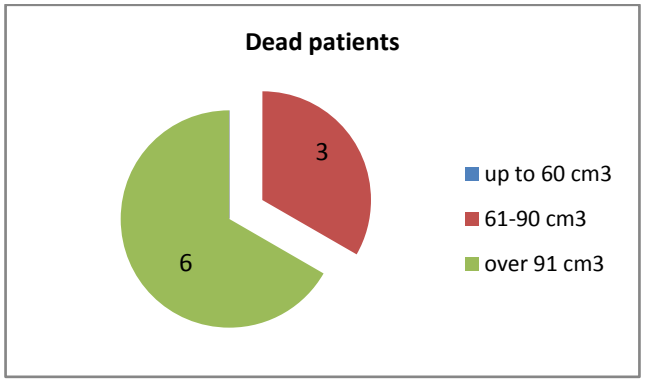

Figure 6. The lethality rate depending on hematoma level

4. Discussion

The results of surgical treatment in groups depended on signs characterizing the severity of the patients' condition — the degree of impaired consciousness, the volume of the hematoma, the degree of the brain median structures displacement. The use of open craniotomy was necessary in cases when the level of consciousness in patients was lower than the sopor and the hematoma volume was above 60 cm^3. Emergency decompression was carried out as an element of resuscitation in cases of an increase in the dislocation syndrome. The data obtained showed that the use of a minimally invasive method for removing hematoma is possible subject to a number of conditions:

- level of patients impaired consciousness not lower than deep torpor;
- the volume of the hematoma is not higher than 40-60 cm^3;
- minimal severity of lateral dislocation symptoms when the displacement of the brain median structures does not exceed 5 mm.

Encouraging clinical results were obtained subject to the above mentioned conditions. The volume of the removed hematoma was insufficient in 2 from 17 patients and therefore they needed repeated surgical interventions – bone-plastic craniotomy. The bone cutting lines were performed through previously superimposed milling holes. The application of this method should be strictly controlled by clinical, neurological and neuroimaging methods in the postoperative period.

5. Conclusions

The use of a minimally invasive method when removing traumatic subdural hematomas is possible subject to certain clinical, neurological and neuroimaging conditions and their control in the postoperative period. The low-invasiveness of the method in combination with the short duration of the operation and the results obtained in this way allow further accumulation of data to study the indications and contraindications for its use.

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