Clinical study

Burr-hole craniostomy–irrigation technique vs. burr-hole craniostomy–closed system drainage technique in the treatment of chronic subdural hematomas

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Summary
A few different techniques are used to treat chronic subdural hematomas surgically. In this study, 70 cases with chronic subdural hematomas were surgically treated and analyzed prospectively. Cases were classified according to the clinical conditions and computed tomography images. Results of the cases that underwent burr-hole craniostomy–irrigation (group A; \( n = 35 \)) were compared with those undergoing burr-hole craniostomy–closed system drainage (group B; \( n = 35 \)). The most frequent etiological factor was trauma in both groups. Complete resolution rate in the early period was higher in group B compared to group A (60% vs. 40%). However, no difference was noted between these rates on the first month-follow-up. Recurrence rates were found as 17% in group A and 14% in group B. No significant difference was noted in terms of hospitalization duration and postoperative complications. In conclusion, we believe that burr-hole craniostomy–irrigation technique is a reliable and effective method compared to burr-hole craniostomy–closed system drainage technique in the treatment of chronic subdural hematomas. © 2004 Published by Elsevier Ltd.

Keywords: chronic subdural hematomas, burr-hole craniostomy, closed system drainage

INTRODUCTION

Chronic subdural hematomas are usually encountered in the elderly particularly subsequent to minor head injuries.\(^1,2\) It is a clinical entity with a decreasing mortality and morbidity, especially with the advent of computed tomography (CT) and surgical technique advancements. Chronic subdural hematomas, being encountered more commonly in elderly people, are still a matter of debate due to controversies on the pathophysiology and surgical treatment.\(^3\) Although many surgical techniques have been introduced in the treatment of these hematomas, most neurosurgeons favor burr-hole craniostomy–drainage technique, for it has less morbidity and mortality rates and is readily applicable. In this study, 70 patients with chronic subdural hematomas were operated on and analyzed prospectively by means of radiological, clinical and the surgical findings. Results in burr-hole craniostomy–irrigation group were compared with those in burr-hole craniostomy–closed system drainage group; and the surgical treatment options were discussed in the context of the current literature.

MATERIALS AND METHODS

Seventy patients (16 females and 54 males) who were operated upon between the dates of 1994 and 2002 in Department of Neurosurgery, Firat University School of Medicine, due to chronic subdural hematoma were included in this study. All patients were classified according to the decades they belong to, since etiological factor could have differed according to the age. This classification also facilitated the identification of the frequent symptom and signs (Table 1). They were also subdivided according to their CT and clinical findings. Chronic subdural hematomas were divided into four groups according their attenuation coefficient on CT; i.e., hypodense, isodense, intermediate (mixed) and hyperdense hematomas.\(^4,5\) (Table 2). Cases were also classified into five groups in terms of clinical condition according to Markwalder et al.’s\(^6,7\) classification system (Table 2). Hence, absence of neurological symptom or deficit was graded as 0, minimal deficit together with headache and nausea as grade 1; neurological deficit such as hemiparesis associated with drowsiness or disorientation as grade 2; advanced neurological deficit like stupor and hemiplegia as grade 3; and decerebrate or decorticate posture associated with coma as grade 4. Postoperative clinical status was evaluated as full recovery, minimal neurological deficit, severe neurological deficit, and death.\(^1\)

The surgically treated cases were randomly subdivided; one half underwent burr-hole craniostomy followed by irrigation (group A), the other half underwent burr-hole craniostomy with subsequent closed system drainage (group B). All but five were operated on under general anesthesia, whereas five cases (two from group A and three from group B) were operated on under local anesthesia due to cardiac and hepatic problems. In both groups, saline was used for irrigation process. All cases were prophylactically treated with third-generation cephalosporins. Cases were followed-up by CT images on the postoperative second, fifth, and 30th days. The two differently treated groups were compared with each other in terms of complete resolution time interval of hematoma, postoperative complications, and recurrence rate and postoperative length of hospital stay.

For statistical analysis, we used the chi-square (Fischer exact\(^8\)) to determine significant differences among the groups. Differences were considered statistically significant at the \( P < 0.05 \)-level.

Surgical technique

In group A, a 2-cm scalp incision was made overlying hematoma site and the perioseal membrane was stripped off. In accordance with
RESULTS

Hematoma resolution

In group A, complete subdural hematoma resolution was observed in 14 cases (40%) on postoperative fifth-day CT. On first month follow-up CT, total resolution was observed in all cases, except six with hematoma recurrence.

In group B, complete subdural hematoma resolution was seen in 21 patients (60%) on postoperative fifth-day CT. On first month follow-up CT, total resolution was seen in all but five cases with re-bleeding.

Reurrence

Subdural hematoma recurred in six cases in group A. On CT, hematomas were isodense in three cases, hypodense in two, and of mixed density in one case (Table 3). Hematomas were bilateral in four cases, of which two of them re-bleed later on. Four cases were considered of grade 2 and two cases of grade 1 in terms of the clinical condition. Recurrent hematomas were evacuated with the same technique in three cases at first, in two cases at third, and in one case at fourth postoperative months.

Clinical recovery

Two cases died in group A. Twenty nine cases completely recovered, whereas three cases remained with mild and one case with severe neurological deficits (Table 4).

In group B, three cases died. Twenty seven cases totally recovered, whereas four cases remained with mild and one case with severe neurological deficits (Table 5).

Complications

In group A, pneumocephalus was found in 13 patients (37%) on CT performed on postoperative second day. Pneumonia was seen in two cases, urinary infection in two cases, and mild gastrointestinal bleeding in one case. No seizure was observed pre- or postoperatively in none of the groups.

In group B, pneumocephalus was observed in nine cases (26%) on postoperative second-day CT. In one case, tension pneumocephalus was developed. Postoperative meningitis was developed in one case. CSF cultures proved to be of Escherichia coli origin.
One case with diabetes died due to sepsis subsequent to a urinary system infection. Pneumonia was seen in three cases.

**Length of hospital stay after operation**

The median duration of hospital stay was 5 days (3–19 days) in group A and 6 days (3–20 days) in group B.

**DISCUSSION**

In the treatment of chronic subdural hematomas, different surgical techniques have been used such as burr-hole craniostomy with closed system drainage, or only burr-hole craniostomy with irrigation, or twist-dill craniostomy associated with closed system drainage. In the past these lesions used to be treated most commonly with membranectomy, following either with craniotomy or craniectomy. This technique is less in use today due to relatively high rates of morbidity and mortality, in spite of the novel advances in anesthesia techniques available. Besides, employment of craniotomy or craniectomy techniques were suggested in the case of insufficient expansion of the brain following hematoma evacuation, re-bleeding in the subdural space, and insufficient drainage due to high consistency of the hematoma. When burr-hole craniostomy and twist-drill craniostomy were compared, clinical recovery and recurrence rates were found to be similar and mortality and morbidity rates were relatively low in both groups. In this study, we employed burr-hole craniostomy technique either with irrigation alone or with closed system drainage as the surgical techniques. Craniectomies or craniotomies were performed in none of our cases. Authors have different viewpoints regarding the recurrence rates in either techniques. Wakai et al. reported a recurrence rate of 33% in single burr-hole craniostomy, whereas 5% in the closed system drainage cases. Likewise, Tsutsumi et al. found similar higher rates of recurrence in burr-hole drainage cases in respect to closed system drainage cases (3% vs. 17%). On the other hand, Benzel and his colleagues reported only 12 cases undergoing re-operation due to recurrent bleeding in a total of 111 cases treated with burr-hole craniostomy. Conversely, Iwadate et al. reported a recurrence rate of 1.7% in burr-hole irrigated patients and being consistent with our results, advocated that it could be a reliable and safe technique as well as the closed system drainage method in the treatment of chronic subdural hematomas.

Risk factors in recurrence are also controversial in chronic subdural hematomas. Robinson cited that advanced age and bilateral location of hematoma are risk factors in recurrence. In contrast, Tsutsumi et al. advocated that advanced age was not a risk factor however recurrence had been observed in hematomas of mixed density on CT and/or of bilateral location in his own series. Kwon et al. reported a high recurrence rate in hyperdense chronic subdural hematomas treated with closed system drainage compared to other types of hematomas. Suzuki et al. could not find any correlation between recurrence and age, gender, hematoma density and clinical stage in 186 cases treated with burr-hole craniostomy—closed system drainage. In our study recurrence rate was 17% in group A cases treated with burr-hole craniostomy—irrigation method, whereas it was 14% in group B treated with closed system drainage, and there was not statistically significant difference between the two groups. Age and bilateral location did not influence the difference between the two surgical technique in terms of recurrence risk (P > 0.05). However, being consistent with the literature, in both groups hypodense lesions were found to be associated with less recurrence rates compared to other types of hematomas (Table 3).

Hematoma resolution in the subdural space after burr-hole craniostomy occurs within postoperative 10–20th days depending on the capability of brain re-expansion. On CT performed on the fifth postoperative day, total resolution rate was higher in group B (60%) compared to that of group A (46%) – the craniostomy and irrigation group. More than 50% re-expansion of the compressed brain takes place within the first 2 days of hematoma removal. This high rate is thought to be due to the continuing drainage process of the closed system that allows the brain to re-expand. However, no difference was obtained on postoperative 30th-day CT between the groups in terms of resolution rates of subdural hematomas.

The mortality rates in both groups were also compared, two cases in group A and three cases in group B were dead. There was no statistically significant difference between the two groups in clinical improvement postoperatively (P > 0.05) (Tables 4 and 5). Preoperative grades and existent systemic diseases were crucial in determining the prognosis.

Both techniques have potential risks leading to pneumocephalus development. Postoperative pneumocephalus rate was higher in group A (37% vs. 26%). Development of tension pneumocephalus was remarkable in group B treated with closed system drainage. Meningitis developed in one case in group B. Pneumonia and urinary system infections were the most encountered complications.

No difference was obtained between the groups in terms of length of hospital stay. The main factor prolonging the duration of stay was hypertension, accompanying systemic disease such as diabetes, and postoperative complications.

**CONCLUSION**

In comparison of both surgical techniques, postoperative pneumocephalus rate was found to be higher in the burr-hole irrigation group. Complete subdural hematoma resolution in the early period was much higher in the group of burr-hole craniostomy associated with closed system drainage. No difference was found in terms of recurrence between the two groups. Recurrence rate was low in cases with hypodense hematomas in both groups. When recovery rates and postoperative complications are considered, we believe that burr-hole craniostomy irrigation technique is a reliable and effective method as much as the burr-hole craniostomy—closed system drainage technique.

**UNCITED REFERENCE**

[10].

**REFERENCES**

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