RESEARCH ARTICLE

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Treatment of chronic subdural hematoma: 5-year clinical experience

Kronik subdural hematom tedavisi: 5 yıllık klinik deneyim

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ABSTRACT

Introduction: Chronic subdural hematoma is one of the most common types of intracranial hemorrhage, especially in the elderly. Multiple standart surgical techniques exist for the evacuation of chronic subdural hematoma. We compared the results of treatment with burr-hole craniostomy and craniotomy techniques.

Materials and Methods: A retrospective study was performed on 93 patients who underwent surgical treatment with chronic subdural hematoma. Two surgical procedures were performed; burr-hole craniostomy with membranectomy (Group A) and craniotomy with extensive membranectomy (Group B).

Results: The general outcome of the patients was good. Overall, the rate of reoperation was 11%. Individual reoperation rates of the groups were 14% and 5%, respectively. Coagulopathy was the most common cause of rebleeding in the reoperated patients' group (80%) and the remaining patients had cerebral atrophy which was preventing re-expansion of the brain. In 76 patients, neurologic status improved significantly in the postoperative period and the operative mortality rate was found 4%.

Conclusion: Both surgical techniques seem to be effective for the treatment of chronic subdural hemtaoma. Coagulopathy and brain atrophy are defined as two major risk factors for recurrence.

Keywords: *Chronic subdural hematoma, burr-hole craniostomy, craniotomy*

ÖZ

Giriş: Kronik subdural hematom özellikle yaşlılarda olmak üzere kafa içi kanamaların en yaygın tiplerinden birisidir. Kronik subdural hematomların boşaltılması için birçok standart cerrahi teknik mevcuttur. Bu çalışmamızda burr-hole kranyostomi ve kranyotomi tekniklerinin sonuçlarını karşılaştırdık.

Materyal ve Metod: Kronik subdural hematom nedeniyle cerrahi tedavi uygulanmış olan 93 olguyu inceleyen retrospektif bir çalışma uygulandı. İki çeşit cerrahi tedavi uygulanmıştı; membran eksizyonu ile birlikte burr-hole kranyostomi (Grup A) ve geniş membran eksizyonu ile birlikte kranyotomi (Grup B).

Bulgular: Hastaların genel olarak sonuçları iyiydi. Toplamda tekrar operasyon oranı %11 olarak bulundu. Grupların ayrı ayrı tekrar operasyon oranları sırasıyla %14 ve %5 olarak tespit edildi. Tekrar opere edilen hasta grubunda koagülopati tekrar kanamanın en sık nedeni (%80) olarak tespit edildi ve geri kalan hastalarda beynin tekrar ekspansiyonuna engel olan beyin atrofisi mevcuttu. Toplam 76 hastada postoperatif dönemde nörolojik durumda anlamlı düzelme saptandı ve operatif mortalite oranı %4 olarak tespit edildi.

Sonuç: Her iki cerrahi teknik de kronik subdural hematom tedavisinde etkili olarak görünmektedir. Koagülopati ve beyin atrofisi nüks için iki majör risk faktörü olarak tespit edilmiştir.

Anahtar Kelimeler: *Kronik subdural hematom, burr-hole kranyostomi, kranyotomi*

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INTRODUCTION

Chronic subdural hematoma (CSDH) is one of the most frequent types of intracranial hemorrhage usually associated with trauma. Its incidence is reported to be between 1.7 and 13.1 per 100000 inhabitants per year with the highest incidence observed in individuals over 70 (1-8). There are many operation techniques for CSDH; one or two burr-hole craniostomy with or without saline irrigation and closed system drainage (6,9-21), twist drill craniostomy with or without irrigation and with or without drainage (22-27), craniotomy and excision of the subdural membranes (28-33), reservoir shunting for continuous irrigation and drainage (34), percutaneous needle trephination and open system drainage with repeated saline rinsing (35), replacement of the hematoma with oxygen via percutaneous subdural tapping without irrigation and drainage (36,37), continuous subgaleal suction drainage (38-40). Herewith, we report preliminary results of a retrospective study which compare burr-hole craniostomy with craniotomy.

MATERIALS and METHODS

93 patients who were operated at the Neurosurgery Department of Cukurova University between January 2009 and September 2014 with the diagnosis of chronic subdural hematoma were enrolled to our study. Diagnosis of chronic subdural hematoma was defined with preoperative imaging techniques and confirmed with intraoperative images. Operations were all performed under general anesthesia, and two different surgical techniques were performed. Burr-hole craniostomy with membranectomy and craniotomy with extended membranectomy were classified as Group A and Group B, respectively. In both groups, the parietal and visceral capsule of the hematoma were opened and resected. After the evacuation of the hematoma, the subdural space was flushed with an average amount of 500 cc sterile saline solution. In Group A patients, two individual closed system drains for each burr-hole and in Group B patients one closed system drain were placed. Drains were pulled out subsequent to the clearance of the incoming fluid in 48-72 hours after the surgery and the patients were mobilized after the withdrawal of the drains. Detailed neurological examinations of the patients were evaluated using the "Markwalder's Neurological Grading System" preoperatively and postoperatively which is the most commonly used neurological grading system for CSDH (Figure 1).

RESULTS

93 patients with CSDH who were surgically treated were retrospectively reviewed. There were 66 male, 27 female patients and the male to female ratio was 2.4/1. The mean age was 51 years with a range from 1 to 88 years and there was a peak incidence in the sixth and ninth decades of life. 19 patients were in the pediatric group (Figure 2).

Grade	Patient status
0	Patient neurologically normal
1	Patient alert and oriented; mild symptoms such as headache: absent or mild neurologic deficit such as reflex asymmetry
2	Patient drowsy or disoriented with variable neurologic deficit such as hemiparesis
3	Patient stuporous bult responding appropriately to noxious stimuli; severe focal signs such as hemiplegia
4	Patient comatose with absent motor responses to painful stimuli; decerebrate or decorticate posturing

Figure 1. *Markwalder's neurological grading system.*

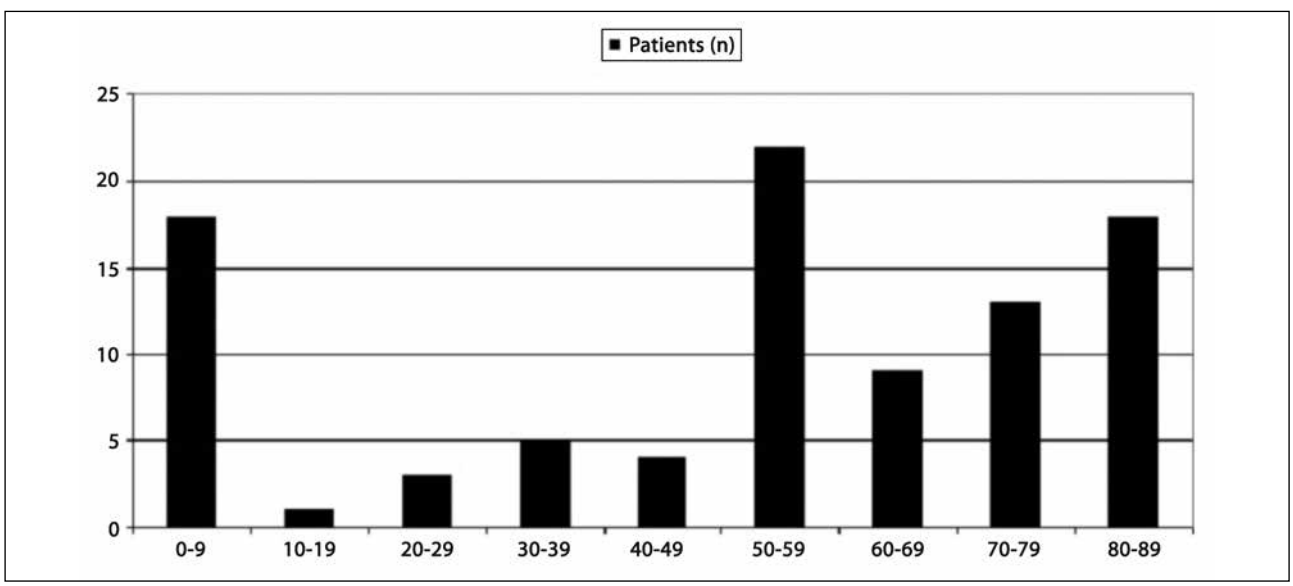

Figure 2. *Age distribution of patients.*

Head trauma was the leading cause of chronic subdural hematoma. In 39 patients (42%), there was a recent history of significant head trauma which was relevant to CSDH. 19 patients of the trauma group had also cerebral atrophy which was a contributing factor for CSDH formation. Coagulopathy due to medication (n=29) and shunt overdrainage (n= 16) were the other major causes. 13 patients of the coagulopathy group had also mild trauma history. 7 patients (8%) had cerebral atrophy in the absence of a trauma history and in 2 patients, there was no significant cause for CSDH formation (Table 1).

Headache was the most common symptom in CS DH patients (n= 55). Disturbance of consciousness (n= 35), hemiparesis syndrome (n= 12), gait disturbance (n= 10) and seizure (n= 6) were the other major symptoms of CSDH, respectively (Table 2).

The hematoma was located on the right convexity in 45 patients and on the left convexity in 34 patients. The hematoma of 14 patients were on both sides. All of the patients with bilaterally hematoma had either cerebral atrophy or shunt overdrainage which was explained by the intracerebral volume depletion.

Two surgical procedures were performed; Burr-hole craniostomy with membranectomy (Group A) and craniotomy with extensive membranectomy (Group B). 56 patients were in Group A and 37 patients were in Group B. In all cases, closed system drains were placed into the hematoma cavity for an average of 48-72 hours after irrigation with physiologic saline solution. Overall, 10 patients underwent reoperations and the rate of reoperation was 11%. 8 of them were from Group A while 2 were from Group B. Individual reoperation rates of the groups were 14% and 5%, respectively (Table 3). Indications for reoperation were rebleeding, increase in the residual subdural fluid within the hematoma cavity and compression of the brain surface observed on computed tomography scans with neurologic deterioration. Reoperation procedures were generally the same as the previous operations. But only two patients from Group A (burr-hole craniostomy) underwent for craniotomy as a reoperation. Coagulopathy due to medication was the most common cause of rebleeding in the reoperated patients' group. 8 of 10 patients (80%) had coagulopathy and the remaining 2 patients had cerebral atrophy which was preventing re-expansion of the brain.

Based on preoperative and postoperative neurologic examinations of the patients, the outcome was good in general. In 76 patients, neurologic status improved significantly in the early postoperative period and in 30 days, all of the patients except those who died demonstrated an amelioration in neurological status. 33 patients were classified as Grade 3 and 4, presenting severe neurologic deficits preoperatively and only 5 of them were still Grade 3 and 4 postoperatively. 73 patients were classified as Grade 0 and 1, presenting only mild or no neurologic deficits postoperatively (Figure 3). Operative mortality rate, defined as death within 30 days after surgery was 4% (n= 4). All of those who were Grade 4 preoperatively, had also accompanying diseases.

Table 1. Etiology of patients with chronic subdural hematoma (n= 93)

Etiology	n (%)
Head trauma	39 (42%)
Coagulopathy	29 (31%)
Shunt overdrainage	16 (17%)
Cerebral atrophy	7 (8%)
Undefined	2 (2%)

Table 2. Major clinical findings of patients with chronic subdural hematoma

Symptom	n (%)
Headache	55 (46%)
Disturbance of consciousness	35 (29%)
Hemiparesis syndrome	12 (10%)
Gait disturbance	10 (8%)
Seizure	6 (5%)

DISCUSSION

Multiple standart surgical techniques exist for the treatment of CSDH, including twist drill craniostomy (TDC), burr-hole craniostomy (BHC) and craniotomy. In general, TDC produce the smallest openings of the skull (< 10 mm), while BHC carried out using a high-speed drill enable larger openings (< 30 mm in diameter). Removal of a substantial piece of bone (> 30 mm) that is replaced and fixed to the skull defect following evacuation constitues a craniotomy (7,14,41).

Table 3. Recurrence rates of the surgical methods

Group (surgical method)	n (%)	Recurrence
Group A (Burr-hole craniostomy with membranectomy)	56	8 (14%)
Group B (Craniotomy with extensive membranectomy)	37	2 (5%)
Total	93	10 (11%)

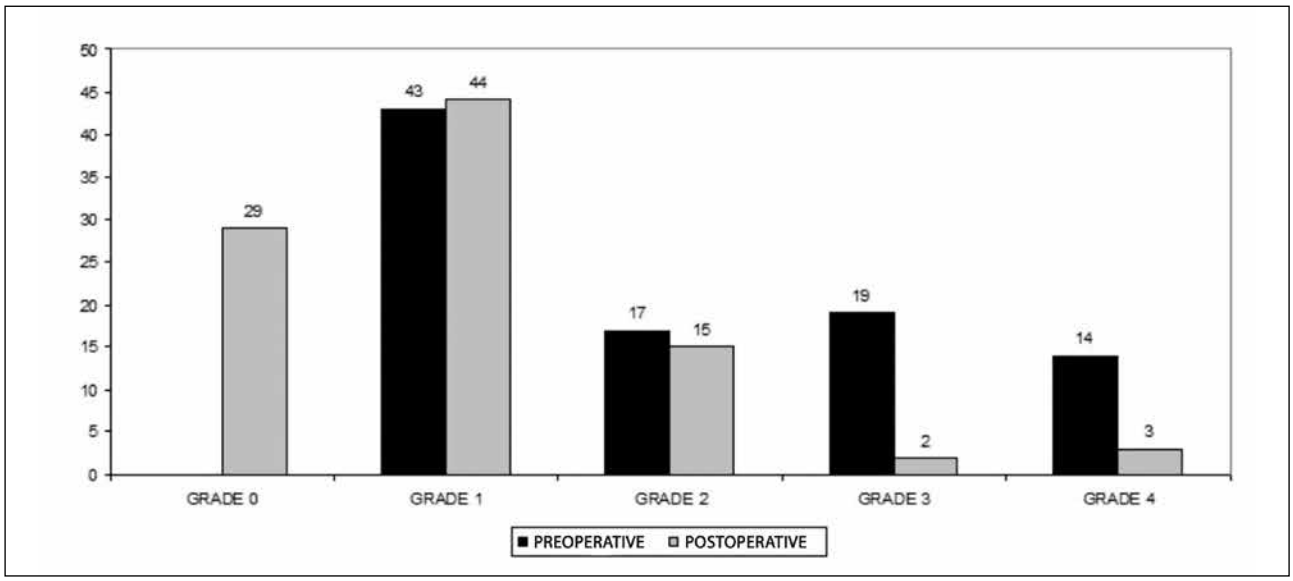

Figure 3. *Neurological outcome of patients according to Markwalder grading system.*

Single or double burr-hole craniostomy is the most common procedure for treatment of a patient with CSDH over the last 20 years. The burr hole technique is relatively safe, effective, technically easy to perform, and cost-efficient with a higher cure rate and a lower risk of recurrence and complications; for this reason the great majority of neurosurgeons currently favour burr-hole craniostomy over other techniques (7,40). In recent studies, Taussky et al. and Han et al. pointed out that double burr-hole craniostomy instead of single burr-hole craniostomy has favorable outcomes and a lower rate of recurrent subdural hematoma (42,43).

There are multiple modalities which has been defined for the burr hole technique. This technique can be performed with or without irrigation. Administration of irrigation indicated no significant difference in some studies (10,44) but Ishibasi et al. reported that burr-hole drainage with irrigation has a significantly stronger association with good outcomes and lower recurrence rates compared to drainage alone (45). Application of drainage systems is also a controversial topic. Despite the adverse studies (46), placement of drainage systems has been usually associated with lower recurrence and mortality rates (6,21,47-50).

There is also a controversion between subdural and subperiostal drainage systems. Despite the common practice, the studies by Zumofen et al., Gazzeri et al. and Bellut et al. indicate the advantages of placement of subperiosteal closed drainage systems regarding rates of hematoma recurrence and serious complications (38-40). This could especially been shown for elderly patients. The method described by Tabaddor and Shulman consisting of burr-hole craniostomy and placement of a subdural drainage system is used widely, and all newly established procedures have to prove their value as an alternative compared with this method (51).

Prior to modern imaging techniques, evacuation of a CSDH was accomplished primarily via craniotomy. Craniotomy is the surgical approach with the least risk of recurrence, but has a greater associated morbidity and mortality. This technique exposes the largest portion of the brain and thus provides the surgeon with the most expansive operative exposure. However, craniotomy is best performed under general anesthesia and is the most invasive option for the treatment of CSDH, encompassing the greatest operative time as well as the greatest volume of the blood loss. Despite the increased risks, craniotomy remains the best option for evacuation of organized, calcified, solid CSDH with numerous thick membranes or the cases with multiple recurrences (5,15,16,28-30,39, 41,47,52,53).

While most patients fully recover, 3.7-30% experience postoperative recurrence due to the hematoma reformation (14,18,54). Recurrence rate of the present study was found 11%. A number of factors may be associated with the recurrence of CSDH. Old age, brain atrophy, poor health status at the time of admission, high bleeding tendency, accompanying kidney and liver diseases, chronic alcoholism, diabetes mellitus, epilepsy, dementia and intracranial hypotension due to cerebrospinal fluid shunt are reported to be relevant factors of CSDH re-currence (8,14,52). Especially anti-platelet agents and poor re-expansion of the brain have been suggested risk factors for recurrence of CSDH (52,55,56). As compatible with the

literature, coagulopathy and brain atrophy are defined as two major risk factors for recurrence in the present study. Coagulopathy due to medication was the most common cause of rebleeding (80%) though any of the prophylaxis. Recurrence rates were lower in the craniotomy group, only 5% of them underwent reoperations. Age, systemic complications such as cardiovascular and renal diseases in elderly patients, coagulopathy and poor preoperative neurological state are contributory causes of postoperative death (28,57,58). Mortality rate was found 4% in the present study. All of those patients were Grade 4 preoperatively and they had also accompanying diseases.

In conclusion, the surgical treatment of CSDH is a controversial topic. Burr-hole craniostomy with irrigation of the hematoma cavity and closed system drainage is recommended initially. This technique is relatively safe, effective, technically easy to perform, and cost-efficient with a higher cure rate and a lower risk of recurrence and complications. Despite this, craniotomy remains the best option for evacuation of organized, calcified or recurrent CSDH. The outcome for patients with coagulopathy was determined poor and inefficient re-expansion of brain is correlated with hematoma recurrence.

CONFLICT of INTEREST

None declared.

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