Turkish Neurosurgery 2006, Vol: 16, No: 1, 19-24

Treatment of Chronic Subdural Hematoma by Twist Drill Craniostomy With Irrigation

Twist Drill Kraniostomi ve İrrigasyon ile Kronik Subdural Hematomların Tedavisi

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Received : 18.10.2005
Accepted : 01.11.2005

ABSTRACT

OBJECTIVE: To investigate the competence and the results of the treatment in which 'Twist drill craniostomy and spontaneous hematoma efflux' is used in chronic subdural hematoma.

METHOD: A prospective analysis of bedside percutaneous subdural tapping and spontaneous hematoma efflux after twist drill craniostomy, a less invasive surgical technique, performed under local anesthesia in 20 adult patients.

RESULTS: 19 of the 20 patients had unilateral and one had bilateral subdural hematomas. 11 of the patients were treated by single drainage, seven of them were treated with up to five drainages and two of them were treated by craniotomy after attempting to efflux the hematoma by twist drill craniostomy. No complication occurred.

CONCLUSIONS: This therapeutic approach is suitable for elderly or otherwise medically frail patients who pose a high anesthesia and operative risk and also for other patients suffering from chronic subdural hematoma as a first and minimally invasive attempt.

KEY WORDS: Chronic subdural hematoma, Surgical treatment, Twist drill craniostomy

ÖZ

AMAÇ: Bu çalışmada, kronik subdural hematom tedavisinde uygulanan cerrahi tedavi yöntemlerden biri olan "Lokal Anestezi Altında Twist Drill Kraniostomi "uygulamasının yeterliliği ve sonuçlarının değerlendirilmesi amaçlanmıştır.

YÖNTEM: Yirmi erişkin hastaya, az invazif cerrahi tedavi yaklaşımlarından biri olan, yatak başında lokal anestezi altında twist drill kraniostomi uygulandı. Bu hastalar prospektif olarak izlendi.

BULGULAR: Yirmi hastanın 19'unda tek taraflı, bir tanesinde ise bilateral subdural hematom mevcuttu. On bir hastanın tedavisinde tek drenaj yeterli olurken, yedi hastada birden fazla drenaja ihtiyaç duyuldu. İki hastaya ise, lokal anestezi altında twist drill kraniostomi yöntemi ile hematom boşaltılamadığı için kranitomi uygulandı. Olgularda komplikasyon olmadı.

SONUÇ: Olguların büyük kısmının ileri yaş grubunda olması ve eşlik eden tıbbi sorunlar nedeniyle kronik subdural hematom olgularında, minimal invaziv tedavi şekli olan twist drill kraniostomi ilk tercih edilecek yöntem olmalıdır.

ANAHTAR SÖZCÜKLER: Kronik subdural hematom, Cerrahi tedavi, Twist drill kraniostomi

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INTRODUCTION

The incidence of chronic subdural hematoma (CSDH) is 1–2 per 100000 population per year (34) and the treatment of this disease is therefore of great importance. However, the optimal treatment is not yet defined. Although there are reports on spontaneous resolution (18, 20) and successful non-surgical treatment (3, 13, 18, 27), there is general agreement that surgery is the best therapy (1, 4, 5-7, 9, 10, 12, 14, 15, 17, 19, 21, 22-24, 26, 28-33). The aim of the surgical treatment is decompression and removal of the fibrinolytic substances from the area. For this purpose, either "craniotomy and excision of the subdural membranes" or less invasive surgical treatment techniques (14) like "burr-hole craniostomy + irrigation ± closed system drainage", "neuroendoscopic techniques"(11) and "twist-drill craniostomy (TDC) ± drainage" can be used.

The fact that a large percentage of patients whose diagnoses are CSDH are in their late adulthood places them at high risk for concomitant medical problems that underlines the importance of choosing a less invasive treatment option.

The objective of the current study was to investigate the effectiveness and results of the treatment, which was done by using TDC in CSDH.

PATIENTS and METHODS

Between 1998 and 2000, 20 consecutive patients with chronic and subacute subdural hematoma received surgical treatment as TDC. The median age of the 20 patients was 58 years. Eight of the patients (40%) were female and twelve (60%) were male.

The neurological performance of the patients was evaluated using the "Markwalder's Neurological Grading System" preoperatively which is the most commonly used neurological grading system for CSDH (14) (Table I).

Computed tomography (CT) scans were performed repeatedly (although it should be noted that some of the patients were referred to us with a previous initial evaluation of magnetic resonance imaging performed at their home hospital), evaluating for different parameters such as location and maximal hematoma width, density, septation and compression signs (ventricular, midline, cisternal compression or shifting).

All patients were treated at the bedside (in the neurosurgery clinic or in the emergency service) by TDC under local anesthesia. After partial hair shaving, disinfection and infiltration with local anesthesia, an incision of the skin approximately 0.5 cm in radius was performed at the site of maximum thickness of the CSDH and the optimal localization that enabled us to use gravity for assistance. TDC was performed using a 3 mm hand-driven drill. After penetration of the skull, the dura was perforated with a 16G cannula (Mediflon™ IV cannula with P.T.F.E. Radiopaque & injection valve). The hematoma was then discharged to a scaled tube inside of the cannula, first by spontaneous efflux and thereafter using the Valsalva's maneuver or positioning the patient in the Trendelenburg position while properly orienting the head. The amount of hematoma efflux was then quantified and compared with the preoperative CT scans (Figure 1). If the amount of the efflux was insufficient, physiological saline solution was infused to the hematoma region passively. After cessation of CSDH efflux, the cannula was removed and the skin was closed with a single suture. In the postoperative period, the patients were controlled clinically and a follow-up CT scan was performed approximately within the next 6 hours (Figure 2). If the appearance of the CSDH did not change radiologically or if the patient was still symptomatic, TDC was repeated at

Table I: Markwalder's Neurologic Grading System

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

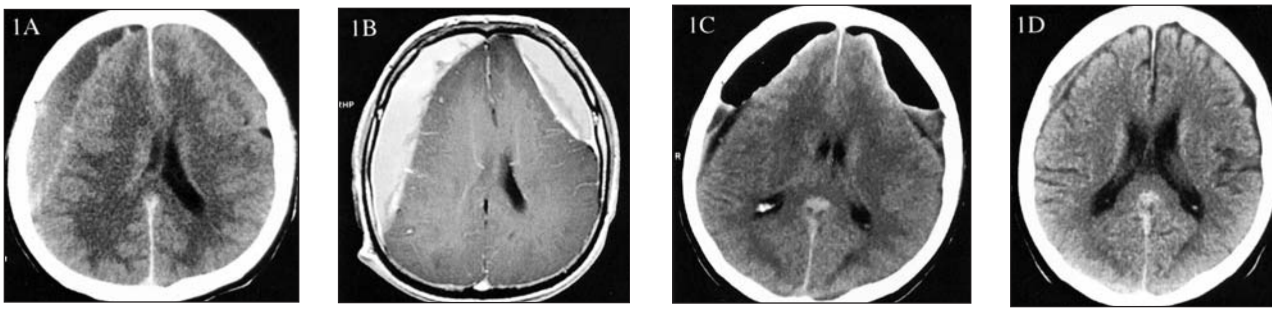

Figure 1: The serial imagings of a patient with bilateral chronic subdural hematoma.
A: Preoperative axial CT image of the patient shows hypodense chronic subdural hematoma in the right side which resulted in an ipsilateral cortical and ventricular compression; and also shows isodense subacute subdural hematoma in the left side.
B: Hyperintense bilateral subdural hematomas (chronic in the right, subacute in the left side) with contrast enhancement on T1 weighted axial MRI scan, preoperatively.
C: Postoperative axial cranial CT scan of the patient shows nearly total evacuation of the hematomas and pneumocephalus on both sides after six hours of the operation.
D: Almost total disappearance of the subdural effusion with intact cortical mantle six months after of the operation, by axial cranial CT image, respectively.

the same area by using the same hole. If the patient's clinical condition did not change after repeated subdural tappings, secondary treatment by membranectomy after craniotomy was used.

After discharge, the patients were re-evaluated clinically and radiologically by CT scans within the next 7 days, 6 weeks and 12 weeks. If there were no positive clinical or radiological signs, the patients were then followed up yearly.

RESULTS

There was a previous history of significant trauma in 12 (60%) of the patients. The median symptomatic period was 9.2 days and median follow-up time was 12.8 months. 80% of the patients had either cardiovascular disease or arterial hypertension. There were 19 (95%) unilateral and 1 bilateral (5%) hematomas as defined with the CT scan evaluations with an average maximal width of 20 mm (16–34 mm); 16 (80%) of these were in the chronic and 4 (20%) in the subacute period. According to Markwalder's neurological grading system, 16 of 20 patients were grade 1 and 4 were grade 2. Single drainage was sufficient in 11 patients (55%) but 7 patients (35%) had to be treated with up to five TDC sessions. Two of the patients (10%) were finally treated by craniotomy. The first was the youngest patient of the subacute subdural hematoma group whose total volume of hematoma decreased with TDC, but the neurological outcome did not change and hence had to be treated by craniotomy. The reason for craniotomy of the other patient was the development of a very thick membrane in the frontal region following TDC treatment of parietal CSDH, which caused a mass effect.

No complications or mortalities occurred in our series. 55% of the patients who were treated with single drainage were discharged during the first five days post-operatively. The duration of the inpatient treatment of the other patients were longer due to repeated tappings and craniotomy.

DISCUSSION

The routine surgical therapy for CSDH in our department is "burr-hole craniostomy + irrigation ± closed system drainage". We used this bedside therapeutic alternative only during night duty and especially for patients who needed emergency decompression and for those who posed a high anesthesia and operative risk, as it requires less surgical experience than other techniques (not to mention the effect of long work hours and busy surgical theatres). Therefore the number of patients is less than that reported in literature (2, 4, 25).

Although there is general agreement that the treatment of CSDH should be surgical, the extent of surgical therapy is still under debate (2, 4, 5, 7, 9, 10, 12, 14, 15, 17, 19, 23, 25, 30, 33). However it has been demonstrated that increased invasiveness does not guarantee better results (9, 23, 29, 30).

Some authors maintain that CSDH should be removed of as completely as possible with surgery (2, 8). However others report that complete drainage of the hematoma seems unnecessary (7, 14, 15, 23). The pathophysiological basis is that incomplete hematoma evacuation may change the ratio between rebleeding and reabsorption towards reabsorption and in doing so initiate a self-healing process (23). We also think that the complete drainage of the collection is not necessary.

There have been reports on surgical attempts to treat CSDH either radically or by minimally invasive techniques. In Markwalder's review on CSDH, he stated that craniotomy (as a radical approach) is reserved for those cases where: 1) the subdural collection re-accumulates; 2) there is solid hematoma; or 3) the brain fails to expand and obliterate the subdural space (14). One of the minimally invasive surgical approaches is burr-hole craniostomy + irrigation ± closed system drainage which is the most widely accepted method for evacuation of hematoma. Complete recovery by burr-hole craniostomy is not possible in all cases and the re-operation rates range from 3.1–33.3 % (7, 10, 12, 14, 25, 32). The other minimal invasive surgical treatment choice is TDC ± drainage. In 1968, Burton reported the management of CSDH by TDC and aspiration of the subdural hematoma (5). In 1975, Negron et al. reported a seven patient series with subdural hematoma, five of which had been successfully treated by bedside needle trephination (19). Hubschmann reported 22 cases of CSDH treated by TDC and closed system drainage in 1980. In his series, the other surgical treatment methods were excluded because of the anesthetic risk associated with co-existing medical illness or age greater than 60 years. The mortality in this series was 23% due to the coexisting diseases. Sixteen of the remaining 17 patients improved and achieved a satisfactory or better neurological outcome (12). Aoki presented a study of 24 patients with CSDH treated by subdural tapping and spontaneous evacuation of the hematoma. However, because of the high recurrence rates, he changed the technique into subdural tapping and irrigation and ended with a recurrence rate of 7% (2). In 1986, Camel and Grubb reported on the neurological and radiologic outcomes of 114 treated patients. In this series, 12 patients (11%) required either craniotomy or trephination because twist drill drainage was unsuccessful (7). Also in 1986, Burchiel and Taylor treated 131 patients by serial twist drill craniostomy and hematoma aspiration. In their study, 73% of the patients achieved significant neurological improvement, 23% required an additional operative procedure (4). In 1991, Rychlicki et al. (24) reported on a series of 65 patients treated by twist drill method. In this group, two patients (3%) required additional surgical procedures. Also in 1991, Smely et al, reported the results of a prospective study of 33 patients treated by twist drill craniostomy with catheter drainage compared with a previously treated consecutive series of 33 patients treated by burr-hole craniostomy with catheter drainage. In this study group, three patients (10%) required readmission for symptomatic recurrence of CSDH and all of them were treated with one additional twist drill drainage procedure (26). Finally, in 2000, Reinges et al. reported the results of a prospective study of 122 patients treated by twist drill craniostomy and hematoma aspiration. In their study, they had to repeat TDC up to five times in the unilateral and up to ten times in the bilateral CSDH group. 11 patients (9%) were treated by other treatment protocols due to complications or insufficient hematoma efflux (23).

The therapy protocol we used is similar to that already described (2, 4, 5, 19, 23). Treating CSDH by bedside percutaneous tapping after twist drill craniostomy under local anesthesia without continuous drainage or irrigation is a less invasive treatment alternative to other presently available surgical treatment protocols. Although we did not come across any complications with this therapy regimen, there are some risks of the conventional treatment of CSDH by placing a subdural drain into the hematoma cavity through one or more burr holes. These are the danger of creating acute subdural bleeding or of damaging the brain by uncontrolled placement of the drain (26, 33) and damaging both superficial cerebral vessels or bridging veins and macrocapillaries of the outer neomembrane of the CSDH.

These can result in acute subdural bleeding and reaccumulation and require placing a drain into the hematoma cavity and irrigation of the subdural space (26, 33). The latter risk can be reduced by using a twist drill that does not penetrate the skull (22, 23). However, acute epidural hematomas occurring following this technique have been reported (35). There is also the risk of damage to fragile vessels and the neomembrane by creating negative subdural pressure due to evacution of the CSDH by suction and even by gravity alone in continuous subdural drains. Thus, in the present series evacuation of the CSDH was achieved only by spontaneous efflux and Valsalva's maneuver with the patient placed in Trandelenburg position. Furthermore, continuous catheter drainage and irrigation carries the risk of infection (15, 21, 26, 33). Wound infection and meningitis occurred in 18% of the patients reported by Smely et al (26). The rate of wound infection and subdural empyemas ranges between 1%-18% in published series (9, 10, 21, 23, 26, 29, 33). To reduce the risk of infection, we removed the subdural cannula after cessation of spontaneous efflux in every subdural tap, as Reinges et al. did (23). Reinges et al. suggests that the risk of infection should be reducible by defining a maximal number of subdural taps before changing to another protocol. The maximal number of subdural taps should not exceed five in unilateral CSDH and ten in bilateral CSDH (23). Finally, in all surgical techniques for treating CSDH, there is the risk of postoperative pneumocephalus, potentially resulting in increased intracranial pressure (21). To reduce the risk of pneumocephalus, Reinges et al. closed the skin immediately after cessation of spontaneous blood efflux with the patient in the 30º Trendelenburg position (23).

Two of the 20 (10%) patients had to be finally treated by craniotomy and membranectomy due to the development of a very thick membrane in the frontal region causing a mass effect and due to insufficient clinical response. This rate is similar to the reported rate of reoperation in other series that range from 2% to 37% for recurrence and reoperation (2, 8, 9, 10, 14, 17, 25, 26, 29, 33).

We think that the patients who have visible extensive septation or demonstrate a significant hyperdense component suggesting the presence of solid or mixed hematoma on preoperative CT scans should be excluded from this therapy regimen, as do other authors (6, 23).

Our patients' neurological condition was the determining factor for follow-up CT evaluations. Markwalder TM et al. (14-16) have reported that radiological changes lag behind the degree of clinical improvement and therefore one must not be hasty about repeating the treatment based solely on CT scans.

In the present series, we did not investigate the duration of mean hospital stay. In the literature, the mean duration of inpatient treatment ranges between 4.9 and 23 days (4, 7, 8, 10, 17, 26, 30).

CONCLUSIONS

The ideal surgical treatment of CSDH has not been clearly defined. The major advantage of this technique is that it can be performed at the patient's bedside with the use of local anesthesia. The complication rate is as low as other modern surgical techniques. We state that this therapeutic approach is suitable both for elderly or otherwise medically frail patients who pose a high anesthesia and operative risk and also as a first and minimally invasive attempt for all patients suffering from CSDH.

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