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Original Article

Recurrence Rate of Chronic Subdural Hematoma after Evacuating It by Two Large Burr Holes, Irrigation, and Subgaleal Low-Pressure Suction Drainage

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Abstract

Background: There are no current standard operative steps for chronic subdural hematoma (CSDH). The aim of this study was to detect the recurrence rate after drainage of a unilateral diffuse CSDH by combining certain operative steps. **Materials and Methods:** This is a descriptive, retrospective cohort study that included 47 consecutive adult patients who underwent evacuation of a unilateral diffuse CSDH by two large burr holes (≥2 cm in diameter) and irrigation of the subdural space by warm saline, followed by placement of a subgaleal Redivac drain under low-pressure suction in our university hospital from August 2012 to August 2016. There were 29 men and 18 women with a mean age of 69.1 years. **Results:** All the operations were uneventful. All the patients had adequate drainage of their subdural hematomas, and all patients were discharged alert and oriented. No incidence of recurrence within 12 months after surgery. **Conclusion:** This study demonstrated that surgical management of a unilateral diffuse CSDH in adult patients by two large burr holes, irrigation, and a subgaleal Redivac low-pressure suction drainage was effective and associated with no recurrence.

Keywords: *Burr holes, chronic subdural hematoma, recurrence rate, Redivac drain, subgaleal*

Introduction

Burr-hole craniostomy and closed-system drainage are widely used in evacuating a chronic subdural hematoma (CSDH).[1-15] But still, there is no consensus of the needed number of burr holes, the size of the burr hole, the use of irrigation, and the site of the drain whether subdural or subgaleal (also termed subperiosteal).

There is an ongoing trial by Soleman *et al*. aiming to compare the recurrence rate (RR) between subperiosteal drain and subdural drain in CSDH.[16]

The aim of the present study was to detect the RR after drainage of a CSDH by combining certain operative steps.

Materials and Methods

This is a descriptive cohort study that retrospectively reviewed the patients who underwent CSDH evacuation in our university hospitals from August 2012 to August 2016.

The inclusion criteria were adult patients (≥18 years) who underwent evacuation of a unilateral diffuse CSDH extending from the frontal to the occipital bones through two large burr holes (≥2 cm in diameter) and irrigating the subdural space by warm saline, then placing a subgaleal Redivac drain under low-pressure suction.

Patients with intractable thrombocytopenia were excluded from this study, that is, preoperative platelet count which did not reach 100,000/microliter after platelet transfusions.

Two hundred patients underwent CSDH evacuation in our university hospitals from August 2012 to August 2016. The operating surgeon had the right to choose the operative technique, as there were no standard surgical steps for CSDH evacuation. Forty-seven consecutive patients met the criteria for this study.

The clinical data were collected from the patients' charts and include patients' demographics, cause of the subdural hematoma, preoperative clinical state, laboratory findings, preoperative computed tomography (CT) scan head findings, preoperative preparation, operative details,

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postoperative management, any complications from surgery, recurrence of CSDH, follow-up CT scan head findings, and the progressive notes in the follow-up visits.

The preoperative and postoperative neurologic state of the patients were evaluated using the "Markwalder's neurological grading system," which stated that Grade 0 – the patient is neurologically normal; Grade 1 – the patient is alert and oriented with mild symptoms; Grade 2 – the patient is drowsy or disoriented with variable neurological deficit, such as hemiparesis; Grade 3 – the patient is stuporous but responding appropriately to noxious stimuli with several focal signs, such as hemiparesis; and Grade 4 – the patient is comatose with absent motor response to painful stimuli.[17]

There were 29 men and 18 women in the present study with a mean age of 69.1 years (ranging from 44 to 86 years). The patients' demographic characteristics are mentioned in Table 1.

Eighteen patients (38.2%) were alert and oriented and complained of a headache and dizziness for few days before admission. Twenty-one patients (44.6%) presented in a confusional state and suffered from mild hemiparesis few days before admission. Eight patients (17%) were stuporous on admission with dense hemiplegia.

CSDH was diagnosed by CT scan head and classified as mixed density containing some acute blood or hypodense or isodense to the brain.

Table 1: The patients' demographic characteristics

The patients' demographic characteristics	Number of patients (%)
Sex	
Male	29 (61.7)
Female	18 (38.29)
Mean age	69.1
Medical diseases	
Hypertension	28 (59.5)
Diabetes mellitus	19 (40.4)
Cirrhosis	5 (10.6)
Ischemic heart disease	4 (8.5)
Anemia (hemoglobin <10 g/dl)	3 (6.3)
Coagulopathy	
Antiplatelets	15 (31.9)
Thrombocytopenia (platelet count on admission <100,000)	6 (12.7)
INR >1.4	4 (8.5)
History of head trauma within 8 weeks of admission	23 (48.9)
Markwalder's grades on admission	
Grade 0	0
Grade 1	18 (38.2)
Grade 2	21 (44.6)
Grade 3	8 (17)
Grade 4	0

INR – International Normalized Ratio

The volume of the CSDH was measured on the CT scan head by multiplying the maximum extent in the three orthogonal views then divided by 2.

All the patients received prophylactic antiepileptic in the form of phenytoin (loading and maintenance doses) except, in known hepatic patients who received levetiracetam instead of phenytoin. The antiepileptic was continued for 6 months then gradually withdrawn unless seizures occurred, in which case the antiepileptic drugs were continued for 1 year after the last seizure.

Prophylactic intravenous antibiotic (ceftriaxone) was administered within 1 h of the operation and continued for 5 days after surgery.

The patients whose platelet count on admission was <100,000/microliter, received a preoperative platelet transfusion to increase the platelet count to ≥100,000/microliter.

Antiplatelets were stopped on admission and restarted 4 weeks after surgery. Anemic patients received packed red blood cells transfusion to raise the hemoglobin to ≥10 g/dl.

Patients with preoperative prolonged prothrombin time received fresh frozen plasma to correct the International Normalized Ratio to ≤1.4.

In the operating theater, patients had general anesthesia with a muscle relaxant. A compressive stocking was applied to decrease the occurrence of deep vein thrombosis.

Two linear 3-cm scalp incisions were performed over the subdural hematoma. Adequate subcutaneous hemostasis was achieved using bipolar coagulation before using the self-retaining retractor and then one burr hole was drilled in each incision and enlarged by Kerrison Rongeur to a diameter of at least 2 cm. The bone dust was removed completely before opening the dura.

The dura was coagulated by bipolar diathermy, then was incised in a cruciate fashion along with the membrane of the subdural hematoma; then the dural edges were coagulated, followed by gentle washing of the hematoma cavity by warm saline using 60 mL disposable syringes till the wash became clear.

A 16 Fr Redivac catheter was placed over each burr hole letting the terminal end of the catheter in the subgaleal space. The catheter was pulled through a separate skin incision and sutured to the skin. A loose stay suture was placed over the exit of the Redivac catheter to close the skin opening after the removal of the Redivac.

The subdural space was filled with warm saline to wash out the subdural air. The periosteum is left unsutured. The skin edges were approximated by mattress sutures.

The Redivac catheter was connected to its collecting chamber after compressing it to about 25% of its

height to create a low-negative pressure in the closed system for continuous drainage. No subdural catheter was used.

Postoperatively, patients remained on bed rest and lied flat for 2 days. The Redivac drain was removed 72 h after surgery.

After discharge from the hospital, follow-up visits were once every 2 weeks for 2 months then once monthly afterward.

Follow-up CT head was done on the 5th postoperative day, 2 weeks after discharge, and upon any reappearance of preoperative symptoms.

The RR was defined as the reappearance of symptomatic ipsilateral subdural reaccumulation with mass effect within 12 months after surgery.

Results

Subdural hematomas were on the left side in 31 (65.9%) patients. Twenty-nine patients had mixed density CSDH, ten patients had hypodense CSDH, and eight patients had isodense CSDH.

The preoperative clot volume ranged between 96.2 cm^3 and 175.5 cm^3 with a mean volume of 131.6 cm^3. The maximal thickness of the subdural hematoma ranged between 2.3 cm and 3.5 cm with a mean thickness of 2.8 cm. The midline shift ranged between 12 mm and 21 mm with a mean shift of 16 mm.

All the operations were uneventful. The CT scan head on the 5th postoperative day showed that the maximal thickness of the subdural space decreased in all patients and ranged between 1.2 cm and 2.1 cm with a mean thickness of 1.5 cm. Furthermore, the midline shift decreased in all patients and ranged between 5 mm and 13 mm with a mean shift of 8 mm. The volume of the air in the subdural space ranged between 6 cm^3 and 14 cm^3 with a mean volume of 10.6 cm^3. No new subdural or intracranial bleeding was found in any patient.

No patient developed any wound infection or subdural empyema. No incidence of postoperative deep vein thrombosis.

All the patients improved clinically and were discharged in an alert and oriented state (Markwalder's Grade 0). The hospitalization period ranged between 7 days and 19 days with a mean duration of 12 days.

Three patients (6.38%) developed generalized seizures within 2 months after surgery, so levetiracetam 500 mg tablet twice daily was added and the patients were seizure-free a year later, hence the antiepileptics were gradually withdrawn.

The CT scan head 2 weeks after discharge revealed a decrease in the subdural space compared with that done in the 5th postoperative day in all patients and ranged between 0.6 cm and 1.2 cm with a mean thickness of 0.8 cm. There was neither midline shift nor subdural air in any patient.

The mean follow-up period was 21 months (ranging between 12 and 32 months). No incidence of recurrence within 12 months after surgery in this study. The mortality rate 12 months after surgery was 0%.

Discussion

The present study tried to assess the effectiveness of combined surgical steps in the management of a unilateral diffuse CSDH. Combining the following steps together, the two burr holes instead of one, the large size of each burr hole (≥2 cm), the irrigation of the subdural space by warm saline, the insertion of two drains (one in each burr hole), the subgaleal position of the drains, and the application of a low-pressure suction in the drains led to a 0% RR in this study within 1 year of surgery. All the patients improved to Markwalder's Grade 0 within 3 weeks after surgery.

All the patients in the present study had an adequate evacuation of the CSDH and did not develop a new acute subdural hematoma or intracerebral hematoma.

Although CSDH is a common neurosurgical condition, still there is no consensus on the best surgical steps among different neurosurgical centers and among neurosurgeons of the same center such as the number of burr holes or their size,[18,19] the use of irrigation,[20] the type of the irrigating fluid,[21] and the site of the drain whether subdural or subgaleal.

Most of the studies of the CSDH support the insertion of a subdural drain, and only a few studies had discussed the role of the subgaleal drain and found its effectiveness.[12-15]

The placement of a subgaleal drain across a burr hole keeping the tip of the catheter in the subgaleal space, and not over the burr hole is a safe technique with no potential injury to the brain or the subdural membranes.

Stanišic *et al*. found that the RR in the first 3 months after evacuating CSDH through a single burrhole and drainage was 16% (17/107 patients), but they included unilateral and bilateral cases and did not mention the site of the used drain.[22]

Tailor *et al*. performed a retrospective study of subdural drain usage after burr-hole drainage for CSDH and found that the 6-month reoperation rate was 8.1% (10/123) in the subdural drain group. Two burr holes were used in only 62.6% of patients in their study and 21.1% of cases were bilateral.[10]

Yadav *et al*. found that the RR after evacuating CSDH through one burr hole (16 mm in diameter), and subgaleal closed-system drainage of low-negative pressure was 3.57% (5/140 patients).[12]

Chih *et al*. performed a prospective comparative study between subperiosteal and subdural drains after evacuating CSDH and reported that the reoperation rate was 6.7% in the subperiosteal group and 3.3% in the subdural group. They drilled a single and relatively small burr-hole (≥10 mm in diameter), and no suction force was applied.[13]

The two burr holes permitted adequate evacuation of the subdural hematoma and helped in efficiently irrigating the subdural hematoma.

The large size (≥2 cm) of the burr holes permits wide incision of the dura which offered efficient evacuation of the CSDH and aided in visualizing the bleeders from the deep surface of the dura and the subdural membranes, hence good control of bleeding points. The potential disadvantage is cosmetic, due to the large size of burr holes.

Although the insertion of a subdural catheter is considered safe, it may be associated with potential risk factors such as intracerebral injury from malposition[23] and iatrogenic acute subdural hematoma.[24]

Oral *et al*. concluded that both the subdural and the subgaleal drains have a low risk of recurrence of CSDH and added that subgaleal drainage system is relatively less invasive, safe, and technically easy, so it is applicable for aged and higher risk patients.[14]

Most of the studies found the value of irrigation in reducing the RR of CSDH after burr-hole evacuation.[18,25,26]

To the best of my knowledge, the present study is the first study that found 0% RR after surgical evacuation of CSDH within a relatively long follow-up period of at least 12 months. This study tried to emphasize that we have to perform certain combined operative steps to get better results in the surgical management of CSDH.

A prospective, randomized controlled study is recommended to establish these operative steps in the management of unilateral diffuse CSDH.

The limitations of this study are the retrospective nature, the small number of patients, and the absence of a control group.

Conclusion

This study demonstrated that surgical management of unilateral diffuse CSDH in adult patients by two large burr holes, irrigation, and a subgaleal Redivac low-pressure suction drainage was effective and associated with no recurrence.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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