A STUDY ON MANAGEMENT OF CHRONIC SUBDURAL HAEMATOMA- BURR HOLE EVACUATION AND MINI CRANIOTOMY

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ABSTRACT

BACKGROUND

Chronic SDH is one of the common neurosurgical conditions requiring surgical treatment. The incidence of chronic SDH is 1.7-18 per 1,00,000 population. The incidence is higher in the elderly patients, i.e. 58 per 1,00,000. Various treatment modalities available for the treatment of chronic SDH indicate that there is no gold standard for the treatment of chronic SDH. Recurrence is the major problem following treatment and can be as high as 30%. Mini craniotomy is one of the surgical options that can offer better view of the subdural space and may allow us to efficiently clear the loculations and haematoma fluid and thereby decreasing the incidence of recurrences and the need for reoperations. Small craniotomies have not been studied well in the literature except for a few publications. In this study, we are comparing mini craniotomy and burr hole evacuation for the treatment of chronic SDH.

MATERIALS AND METHODS

All the patients with chronic subdural haematoma operated between August 2013 and January 2016. Patients with recurrent SDH on the same side and patients who underwent different procedures on either side (in case of bilateral haematomas) were excluded from the study. The patients were operated by two senior surgeons with one surgeon doing burr hole evacuation and another doing mini craniotomy. Preoperative status and postoperative status was analysed.

RESULTS

All the patients were analysed both preoperatively and postoperatively. In both the groups, most of the patients shown improvement following surgery, but recurrences are more in burr hole group when compared to mini craniotomy.

CONCLUSION

Mini craniotomy allows better view of the subdural space and better evacuation of chronic subdural haematoma. Cure rate is higher with mini craniotomy compared to burr hole evacuation.

KEYWORDS

Chronic Subdural Haematoma, Mini Craniotomy, Burr Hole Evacuation.

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BACKGROUND

Chronic SDH is one of the common neurosurgical conditions requiring surgical treatment. The incidence of chronic SDH is 1.7-18 per 1,00,000 population.[1] The incidence is higher in the elderly patients, i.e. 58 per 1,00,000. The incidence is further expected to increase as the life expectancy is increasing owing to improvement in healthcare facilities.

There is no level I evidence for the management of chronic subdural haematoma.[1] Various treatment modalities available for the treatment of chronic SDH indicate that there is no gold standard for the treatment of chronic SDH. Recurrence is the major problem following treatment and can be as high as 30%.

Mini craniotomy is one of the surgical options that can offer better view of the subdural space and may allow us to efficiently clear the loculations and haematoma fluid and thereby decreasing the incidence of recurrences and the need for reoperations. Small craniotomies have not been studied well in the literature except for a few publications. In this study, we compared mini craniotomy and burr hole evacuation for the treatment of chronic SDH.

In the studies on craniotomy and evacuation of chronic subdural haematoma, usually the dura is sutured in a water tight manner. In this study, we have left the dura open following evacuation of haematoma. The inner membrane will now act as dura and the haematoma cavity will be connected to the subgaleal space through the burr holes thus allowing resorption of the residual collections.

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AIMS AND OBJECTIVES

The aim of the study is to compare the efficacy and safety of mini craniotomy and burr hole evacuation for the treatment of chronic subdural haematoma.

OBJECTIVES

1. To compare the recurrence rates associated with mini craniotomy and burr hole evacuation.
2. To compare the time taken for discharge from neurosurgical care (or cure rate) (i.e., till complete radiological resolution also).
3. To compare the time taken for each procedure.
4. To compare the duration of hospital stay for both procedures.
5. To compare the complications associated with each procedure.

MATERIALS AND METHODS

Inclusion Criteria

- All the patients with chronic subdural haematoma operated between August 2013 and January 2016.
- Age >18 years.

Exclusion Criteria

- Patients with recurrent SDH on the same side.
- Patients who underwent different procedures on either side (in case of bilateral haematomas).

MATERIALS AND METHODS

The patients were operated by two senior surgeons with one surgeon doing burr hole evacuation and another doing mini craniotomy. Demographic data were obtained. Preoperative status was documented. All the patients were operated under general anaesthesia.

Burr Hole Evacuation

All the patients underwent standard two burr hole technique (one frontal and one posterior parietal) for evacuation of subdural haematoma. A subdural drain is placed and attached to a closed drainage system. Incisions are closed in layers.

Mini Craniotomy

A linear or Lazy 'S' incision is made over the most prominent part of the haematoma just posterior to the coronal suture extending from 1 cm below superior temporal line to 2 cm lateral to the midline. The superficial temporalis is reflected downwards. A single burr hole is placed and a 4 x 4 cm craniotomy is done. Cruciate incision is given over the dura. The dural leaflets are reflected and tacked to the dura at the corners of craniotomy (Figure 1).

The outer membrane is excised to expose the haematoma cavity as far as possible. The cavity is irrigated with normal saline. The loculations are dissected and internal membranes are excised, if any. Haematoma is evacuated and cavity filled with normal saline. Subdural drain is placed. Bone flap is replaced and incision closed in layers (Figure 2).

The patients were adequately hydrated and postoperative CT scan was obtained on the 1st or 2nd day of surgery. Subdural drains were removed after confirming adequate expansion of the brain on CT scan and patients were mobilised after removal of drain.

Mini Craniotomy

Figure 1. Linear Incision is Given Over the Most Prominent Part of the Haematoma and an Approximate 4x4 cm

Figure 2. The Dura is Exposed and Hitch Stitches are Placed

The following outcomes were analysed

a. Primary outcome.

Recurrence requiring surgical evacuation

b. Secondary outcomes.
    1. Cure rate (defined as complete symptomatic relief and adequate brain expansion).
    2. Mortality (defined as death occurring during the hospital stay).
    3. Residual collections and pneumocephalus.
    4. Complications (both medical and surgical).
    5. Duration of surgery.
    6. Duration of hospital stay.

RESULTS

Most of the patients who presented with chronic SDH were in their 5th-7th decades. The mean age of patients who underwent burr hole evacuation was 54.03 years and those who underwent mini craniotomy was 56.5 years and the distribution of patients between burr hole evacuation and mini craniotomy was similar.

Out of the 60 patients studied, 17 (28%) were female and 43 (72%) were male. Out of 17 female patients, 7 underwent burr hole evacuation and 10 underwent mini craniotomy. Out of 43 male patients, 23 underwent burr hole evacuation and 20 underwent mini craniotomy.

Clinical Features

Headache was the most common presentation (n=29) followed by hemiparesis (n=21); decreased consciousness (n=20). 11 patients had seizures and 11 patients presented in an unconscious state. 10 patients had focal deficits (other than hemiparesis such as slurred speech, urinary incontinence, altered behaviour, etc.). Nine patients had vomiting on presentation.

Risk Factors

A total of 8 patients were on anticoagulants or antiplatelet. 2 out of these 8 patients were in burr hole group and 6 were in mini craniotomy group. Chronic alcoholism was seen in 27 patients; 15 in burr hole group and 12 in mini craniotomy group. Coagulopathy is seen in one patient who underwent mini craniotomy and the cause was not known. This patient died in the postoperative period. History of trauma was seen in 39 out of 60 patients studied and was almost equally divided in both groups (20 in burr hole group vs. 19 in mini craniotomy).

Comorbidities

Valvular heart disease was seen in 3 cases who underwent burr hole evacuation. Hypertension was seen in 16 of all the 60 cases (10 in mini craniotomy group vs. 6 in burr hole group). Diabetes was seen in 3 cases (2 in mini craniotomy vs. 1 in burr hole group). Four cases of COPD were operated with 2 in each group.

Two patients who underwent burr holes were known epileptics while no epileptics were present in mini craniotomy group.

One patient in each group had a history of stroke. Three patients who underwent mini craniotomy and one patient who underwent burr hole evacuation had coronary artery disease.

CT Scan Brain

The preoperative CT scan of brain, the findings were classified into various categories based on the uniformity and density of the collection.

1. Homogenous hypodense collection was seen in 13 patients (burr hole (n=5) and mini craniotomy (n=8)).
2. Homogenous isodense was the most common type, seen in 16 patients (burr hole (n=9) and mini craniotomy (n=7)).
3. A layered type collection (where hyperdense fluid uniformly sinks down to dependent area) was seen in 13 patients (burr hole (n=8) and mini craniotomy (n=5)).
4. Mixed densities (where patches of hyperdense fluid was randomly distributed within iso/hypodense collections) was seen in 13 patients (burr hole (n=6) and mini craniotomy (n=7)).
5. Multilayered chronic on chronic SDH membranes (where the subdural space was divided into more than one compartment) was seen 5 cases (burr hole (n=2) and mini craniotomy (n=3)).

Duration of Surgery

The mean duration of surgery for mini craniotomy was slightly higher (34.5 min.) compared to the burr hole evacuation (31.33 min.).

Characteristics of the Subdural Membrane

The characteristics of the membrane were noted in the patients undergoing mini craniotomy and classified into three categories. The patients who underwent burr hole evacuation were not included as loculated collections and multiple membranes could not be reliably noted during this procedure.

Thick and well-formed membranes (n=18) was seen in 60% of cases and loculated membranes (n=7) was seen in 23% of cases and 2 or more laminar membranes (n=5) were seen in 17% of cases.

Outcome

Thirty five out of 60 patients became neurologically normal at discharge (burr holes (n=17) and mini craniotomy (n=18)). Markwalder[2] grading was used for the assessment of preoperative and postoperative status of the patient.

Markwalder Grading

Grade 0	Neurologically Normal
Grade I	Alert and oriented; Mild focal symptoms like headache, absent or mild neurological deficits like reflex asymmetry.
Grade II	Drowsy or disoriented with variable neurological symptoms like hemiparesis.
Grade III	Stuporous, but responding to noxious stimuli, severe focal signs like hemiplegia.
Grade IV	Comatose or absent motor response to painful stimuli, decerebrate or decorticate posturing.

Thirteen patients had mild symptoms like headache (Markwalder grade 1) of which burr hole evacuation was done in 6 cases and mini craniotomy was done in 7 cases. Seven patients had Markwalder grade 3 at discharge. Five were in burr hole group and 2 were in mini craniotomy group.

Postoperative Status	Burr Hole Evacuation	Mini Craniotomy	Grand Total
Improved	24	27	51
Constant	4	1	5
Death	2	2	4
Grand Total	**30**	**30**	**60**

Table 1. Comparison of Markwalder Grading Before and After Surgery

At the time of presentation, 18 patients had a GCS score of 3 to 8. Of these, 8 were in burr hole group and 10 were in mini craniotomy group.[3] Patients had a GCS score of 9-12; of which 9 were in burr hole group and 4 were in mini craniotomy group. Twenty nine patients had a GCS score of 13 to 15; of which 13 were in burr hole group and 16 were in mini craniotomy group.

At the time of discharge, 54 patients had a GCS of 13 to 15; of which 26 were in burr hole group and 28 were in mini craniotomy group. Two patients who underwent burr hole evacuation had a GCS of 9-12.

Four patients had 2nd surgery for symptomatic reaccumulation of haematoma with 2 patients from each group.

Twenty one patients who underwent burr hole evacuation had residual collection. Ten of these patients had residual collections at the end of 3 months. Seven patients who underwent mini craniotomy had residual collections at discharge, which resolved by 3 weeks.

One patient who underwent burr hole evacuation had surgical site infection, which was treated with antibiotics.

Four patients died during hospital stay with 2 patients in each group. The deaths reported in this series were due to underlying comorbidities of the patients. One of the patients had a history of coronary artery disease and history of cardiac bypass surgery and died of myocardial failure. The second patient had coagulopathy. The third patient had history of valvular heart disease and died of atrial fibrillation and heart failure in the postoperative period. The fourth patient had cardiac arrest before surgery. He was resuscitated and taken for surgery and expired in the postoperative period.

The mean duration of hospital stay was 6.93 days in the burr hole group and 7.37 days in the mini craniotomy group.

DISCUSSION

Chronic subdural haematoma is a common neurosurgical problem. Chronic subdural haematoma is commonly seen in elderly with male dominance with various clinical presentations ranging from headache to unconscious state.[1,4,5] History of trauma was reported in most of the series.[5] Chronic alcoholism is commonly associated with chronic subdural haematoma.[4,6] Chronic subdural haematoma is commonly reported in patients on anti-coagulants.

Despite large amount of literature on the management of chronic subdural haematoma, there has been no level one evidence for the management of chronic subdural haematoma.[7] In the early 20th century, craniotomy was widely used for evacuation of chronic subdural haematoma.[1,8] In the later part of 20th century, burr hole evacuation was introduced. After Svien and Gelety[9] published a comparative study in 1964, craniotomy was largely abandoned and burr hole evacuation had become the most preferred choice. Craniotomies are largely reserved for recurrent chronic subdural haematomas.[1] But, the recurrences following burr hole evacuation have been reported to be as high as 30%.

Large craniotomies have been associated with lowest recurrence rate, but are not preferred due to high morbidity associated with craniotomies. This is evident from the number of studies published in the recent decades. In a recent meta-analysis,[10] which included 250 studies, 203 studies reported outcomes on burr holes while only 25 studies evaluated craniotomies. In some of the studies on craniotomy, the patients were subjected to craniotomy with total membranectomy, which could have added to the morbidity associated with craniotomy.

The other surgical method followed is mini craniotomy with some variations. Some authors did partial excision of the outer membranes.[4] Some authors did durectomy.[11]

Some authors closed the dura after evacuation of haematoma while others left the dura open. Some authors replaced the bone flap while some did not.[12] Most of the studies agree that recurrence is a major problem after surgical evacuation of chronic subdural haematomas. Craniotomy and evacuation of chronic subdural haematoma has the lowest recurrence rate compared to burr hole evacuation and twist drill craniostomy. But, craniotomy is largely reserved for selected cases owing to its high morbidity, longer operating times, need for general anaesthesia, etc.

It is a point worth noting that most of the previous studies have rarely made a distinction between large and mini craniotomies and so the complications associated with large craniotomies are attributed to mini craniotomies also. In this study, there were no complications or increased mortality in the mini craniotomy group.

Mini craniotomy allows better view of the subdural space and better and faster evacuation of the contents of the haematoma cavity. In our study, we have not attempted inner membranectomy. Adequate and near total evacuation of haematoma was achieved thereby clearing off the fibrinolytic products, which are responsible for the recurrence of chronic subdural haematomas. We have excised only the visible portion of the outer membrane leaving behind a larger portion of the outer membrane, which would contain fragile neocapillaries; teasing off which may lead to diffuse bleeding in the immediate postoperative period. We have left the dural edges wide open so that any collections in the immediate postoperative period would be drained out of subdural space. Once the brain expands, the inner membrane will get attached to the dura forming a barrier.

Though, there is no need of reoperation in all the residual collections, they might lead to recurrences in the long term as the residual haematoma fluid is rich in vasoactive substances and fibrinolytic products, which might lead to rebleeds and recurrences. Mini craniotomy allows faster brain expansion by the way of a larger outlet for residual collections out of the subdural space.

Study (Year)	Mortality	Morbidity	Recurrence	Cure Rate
Present study Mini Craniotomy	6.67%	0	6.67%	90%
Burr Holes	6.67%	1.67%	6.67%	80%
Almenawer et al[10] (2014)	4%	11%	11%	82%
Solemen et al[1] (2014)(review)	0-8%	-	0-30%	72-89%
Sousa et al[11] (2013)	-	-	5.4%	88.3%
Gonzalez et al[3] (2005)	0.21%	18.63%	5.8%	-
Van de Veken et al[4] (2014)	13.5%	34%	8.7%	84%
Mohamed et al[12] (2003)	0	7.67%	0	-
Beatty et al[13] (1999)	0	-	0	-
Rovlias et al[6] (2015)	0	22.7%	11.8%	-

Table 2. Comparison of Outcomes Among Various Studies

Mini craniotomy is a balanced approach and midway between the more invasive large craniotomy and less invasive burr hole evacuation. It allows better view than burr holes and allows the surgeon to identify and clear the loculations and also to incise the laminar membranes, which might conceal another haematoma cavity. It also facilitates thorough evacuation of haematoma fluid (and the degradation products) under direct vision. Placement of subdural drain is also safer as it can be manoeuvred under direct vision unlike burr hole evacuation where the subdural drain has a risk of cortical injury and fresh bleeding.

CONCLUSIONS

Mini craniotomy allows better view of the subdural space and better evacuation of chronic subdural haematoma. Mini craniotomy allows early brain expansion and early mobilisation of the patient and is associated with decreased morbidity. Cure rate (symptomatic relief and complete brain expansion) is higher with mini craniotomy compared to burr hole evacuation. Further studies are required to establish the safety and efficacy of mini craniotomy.

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