Chronic Subdural Hematoma: Is Craniotomy with Membranectomy a Viable Alternative to Burr Hole Drainage?

Thokchom Gojendra Singh[1], Brahmacharimayum Bobby Sarma[2], Laithangbam Pradip Kumar Singh[3], Nongthombam Ratan Singh[4], Mohammad Kamaluddin Vahrott[5], Phindariiaki Wankhar[6]

[1]Associate Professor, Department of Neurosurgery, Regional Institute of Medical Sciences, Imphal, Manipur. [2]Assistant Professor, Department of Surgery, Regional Institute of Medical Sciences, Imphal, Manipur. [3]Professor, Department of Anaesthesiology, Regional Institute of Medical Sciences, Imphal, Manipur. [4]Professor, Department of Anaesthesiology, Regional Institute of Medical Sciences, Imphal, Manipur. [5]Postgraduate Trainee, Department of Anaesthesiology, Regional Institute of Medical Sciences, Imphal, Manipur. [6]Postgraduate Trainee, Department of Anaesthesiology, Regional Institute of Medical Sciences, Imphal, Manipur.

ABSTRACT

BACKGROUND

Chronic Sub-Dural Hematoma (CSDH) is one of the most common intracranial lesions. However, there is still some debate regarding the best strategy for treatment. In the present study, we analyzed the need for craniotomy, their indication and surgical outcome.

METHODS

In this analytical cross-sectional study, 104 patients were subjected to surgery; 81 patients for Burr Hole Drainage (BHD) and 23 patients for Craniotomy with Membranectomy (CWM). Another 120 patients admitted during the study period from January 2012 to December 2016 were excluded from the study on medical grounds. Operative technique was based on the pre-operative radiographic finding and per-operative need.

RESULTS

Recurrence rate was 4.93% (4 out of 81) in the BHD group and none in the CWM group. Mortality rate was 8.69% (2 out of 23) in the craniotomy group and none in the BHD group. Morbidity is unevenly distributed with pneumoencephalus being higher in the BHD group than CWM group (17.28% versus 13.04%) whereas scalp hematoma (4 cases), wound infection (2 cases) and small subdural bleed (2 cases) were found in the craniotomy group.

CONCLUSIONS

Despite higher morbidity and mortality, CWM will continue to be an indispensable alternative to BHD in some cases.

KEYWORDS

Chronic Subdural Hematoma, Burr Hole Drainage, Craniotomy with Membranectomy

Corresponding Author:
Dr. Brahmacharimayum Bobby Sarma,
Department of Surgery,
Regional Institute of Medical Sciences,
Imphal, Manipur.
E-mail: bobbysareng@gmail.com

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BACKGROUND

Chronic Sub-Dural Hematoma (CSDH) is one of the most common intracranial lesions treated in the neurosurgical department. The incidence of CSDH is estimated at 1.7 to 18 per 100,000 people/year and rises to 58 per 100,000 people/year in individuals >65 years of age.[1] The reason why this type of hematoma occurs frequently among the elderly include an increase in antithrombotic medications, venous fragility, augmentation of the subdural space, and an increased exposure to traumatic injury resulting from frequent falls.[2]

Simple observation or medical management has been used in minimally symptomatic patients and in background of coagulopathy. Surgical evacuation by burr hole drainage (BHD) is the mainstay of treatment whereas twist drill drainage and craniotomy are other surgical options.[3] In the event of recurrent subdural hematoma or when radiographic evidence of subdural membrane exists craniotomy is an useful surgical adjunct.[4] Meanwhile, the outcome of the different surgical techniques have remained unchanged over the last few decades.[5] And some investigators believe that the choice of surgical procedure is influenced by factors other than the clinical outcome.[6] Craniotomy as the initial surgical approach have been investigated in organized chronic subdural hematoma (OCSH) with calcified, multiseptated or multilayered internal architecture of the CSDH.[7] However, either CT or MRI is likely to miss the membrane if imaging quality is suboptimal.[8] In this context, we would like to share our experience that initial planned BHD has to be changed to craniotomy per-operatively if we encounter thick membranes difficult to puncture or excise on initial attempts at BHD.

METHODS

It is an analytic cross-sectional study of patients admitted to the Department of Neurosurgery at a tertiary care centre at Imphal (India) between January 2012 to December 2016. During this period 224 patients presented with CSDH. Of these, 114 patients presented with mild headache with or without gait disturbance and thin (<5 mm) hematoma on CT scan brain. They responded to medical treatment with vitamin K, tranexamic acid, mannitol and antiepileptic, and recovered well in about 20 days. Another 6 patients had poor general condition with Glasgow coma scale (GCS) less than 6, and refused to give consent for surgery. Operation was performed on the remaining 104 patients under general anesthesia with orotracheal intubation (to avoid outcome bias of local and general anesthesia). Eighty one patients were amenable to BHD (Figure 1). A closed drainage system was left in the subdural space for 24-72 hours postoperatively and nursed in flat supine position with supplemental oxygen. Remaining 23 patients required craniotomy with membranectomy (CWM): 10 as primary procedure and 13 as secondary procedure to initial attempt at BHD when thick membranes were encountered an opening the dura mater. Initial planned craniotomy was chosen in those 10 patients who had pre-operative CT brain showing thick subdural membrane and /or variegated blood clots (Figure 2). Craniotomy confirmed the radiological diagnosis and was followed by membrane excision and hematoma evacuation. The inner membrane was separated from the underlying arachnoid layer by gentle saline inject. No attempt was made to remove by traction the membrane tenaciously adherent to the arachnoid surface or surrounding bridge veins, but simply left in situation.

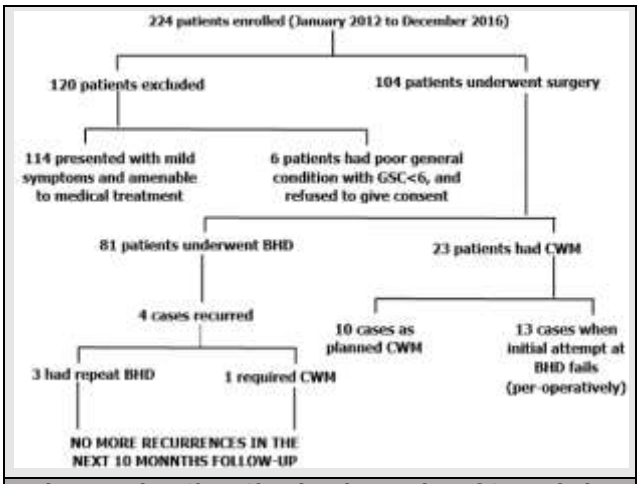

Figure 1. Flow Chart Showing the Number of Cases during Study Period (104 Cases Underwent Surgery)

Figure 2. Showing Pre-Operative CSDH with Calcified and Thickened Membrane

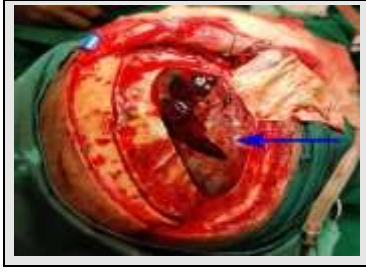

Figure 3. Thick Membrane Difficult to Excise Needing Change from BHD to CWM

Figure 4. Post-Operative CT Brain Showing Pneumocephalus

RESULTS

Surgery was performed in 104 patients: 81 as BHD and 23 as CWM. Four patient in the BHD group recurred in 2-4 months giving a recurrence rate of 4.93% (4 out of 81) for our study. Three of them were amenable to repeat BHD, but one had to undergo CWM because of partially solidified hematoma between thick membranes (Figure 3). There was no more recurrence in the next 10 months follow- up. None of the patients in the craniotomy group had recurrence. Average GCS of the patients who underwent BHD was 10-12. In the CWM group, the average GCS was 8-9 except two patients who had GCS of 7. These two patients died on the second postoperative day giving mortality rate of 8.69% (2 out of 23) in this study. Both the patients were above 70 years of age with co-existing diseases of diabetes mellitus and hypertension. Their hematoma thickness in pre-operative CT scan brain was > 2 cm with midline shift of >8 mm, and volume of clot removed more than 100 ml. Despite optimal support their condition deteriorated in the intensive care unit.

Morbidity was also higher in the craniotomy group except for pneumoencephalus with some patients developing postoperative scalp hematoma (4 cases), wound infection (2 cases) and small subdural bleed (2 cases). Pneumoencephalus (Figure 4) was seen in both the group: 14 cases (14 out of 81; 17.28%) in BHD group and cases (3 out of 23; 13.04%) in CWM group. Among the cases having pneumoencephalus some developed postoperative seizures: 6 cases (6 out of 81; 7.4%) in the BHD group and 1 case (1 out of 23; 4.35%) in CWM. The seizures responded to medical treatment. Age range was 38 to 85 with highest incidence occurring in the fifth and sixth decades. Males were affected more than the females (M:F=76: 28). History of traumatic brain injury was found in about 70% of the cases 2-8 weeks prior to presentation to the neurosurgery department.

History of taking anticoagulant (ACs) and antiplatelet (APs) was encountered in 26 patients (25%) in the surgical group including 6 in the craniotomy group. Their pre-operative INR (international normalization ratio) were stabilized to around 1.3 by pre-operative withholding of the drugs followed by vitamin K injection and fresh frozen plasma infusion. Another 25 patients (20.83%) in the conservative treatment group had also history of taking APs and ACs. Ten patients in the non-operative group, 6 patients in the operative group had history of chronic alcoholism including 3 cases in the craniotomy group. The duration of surgery was 60-90 min in BHD and 2-3 hours in CWM group and average length of stay in the hospital was 10-12 days for BHD and 14-20 days for the CWM groups.

DISCUSSION

There is still some debates regarding the best strategy for surgical treatment for CSDH. Till 1970s, craniotomy with or without removal of the membrane was most frequently used.[9] After 1980, trephination either by burr hole or twist drill became more popular than craniotomy. The burr hole evacuation, irrigation, and subsequent closed drainage technique is a simple treatment which is able to achieve goods results with minimal complication and is at present favoured.[10] In a subset of cases however, because of thick subdural membranes or intrahaematomal septations, cerebral decompression by burr hole alone is inadequate.[8] However, the decision for a primary elective craniotomy in CSDH is challenging. Some retrospective study has shown higher morbidity and cost with craniotomy compared to burr hole drainage.[6] Preferring a procedure based on revenue is a potential conflict of interest, and the choice of surgical procedure might be influenced by factors other than clinical outcomes. In some reviews, craniotomy outnumbers burr hole drainage.[11,12]

Some authors suggest that the applied operative technique is not always of major importance, as long as it is able to suck out subdural fluid slowly, is performed properly without injuring again the subdural space, and is followed by precise and competent nursing.[13] Rather than the operative procedure per se or membranectomy, complete removal of the subdural fluid and adequate rinsing of the hematoma cavity (which contain the fibrinolytic agents) is more important.[14] However, craniotomy seems to be necessary for the organized or calcified CSDH, when the CSDH is manifested by seizures or hemiparesis. Headache alone is hard to be relevant symptom of the longstanding organized CSDH, although it is the third most frequent symptom of CSDH.[15] Although Markwalder had recommended craniotomy for recurrent CSDH, solid hematoma, or failure of brain re-expansion,[16] solid consistency of the hematoma might the only indication of craniotomy. But depending only on the radiological finding is misleading, especially if the image quality is suboptimal.[8] In our series, out of 23 craniotomies, 13 cases were decided per-operatively.

Membranectomy was often recommended when there was solid hematoma with various bleeding foci, multilayer loculations within the hematoma, and excessive formation of solid membranes.[17] However, membranectomy carries a distinctly higher risk of rebleeding, especially membrane surrounding bridge veins and the area of tenacious adherence between the inner membrane and arachnoid surface.[18] In this study, all the 4 cases of recurrence (recurrence rate 4.93%) occurred within 2-4 months following the initial BHD. Chronic subdural hematoma is considered to have recurred when the neurological signs and/or symptom is increased, re-appeared or did not improve within 3-months of original procedure and the hematoma cavity volume increased.[14] Some investigators are of the view that repeated hemorrhage from the outer membrane is the causative factor for hematoma enlargement,[19] whereas the inner membrane is related to liquefaction of the subdural haematoma.[20]

Several predictive factors have been identified for the poor outcome after surgery. These include poor neurological status at admission, increased hematoma density and

presence of brain atrophy,[21] higher age group,[22] uses of anticoagulants and antiplatelets[23] and chronic alcoholism.[24] Markwalder grading is commonly used for assessing neurological status in CSDH patients (grade 0: no neurological deficits, Grade 1: alert and oriented with mild symptoms and no neurological deficit; Grade 2: drowsiness and disorientation with variables neurological deficit; Grade 3: stuporous response to noxious stimuli with severe focal neurological deficits; Grade 4: coma with no motor response or decerebrate or decortical posturing). Poor outcome in associated with grade 3 and 4 patients. In our study Glasgow coma scale (GCS) was used. Two patients (out of 23) who underwent CWM died giving a mortality rate of 8.69%. Both of them had low GCS (7/15).

Whether the type of surgery affects the outcome is controversial. Some studies[7,25] have shown that craniotomy with extended membranectomy is associated with increased morbidity and mortality. However one metanalysis[26] involving 5369 CSDH patients found the mortality, morbidity and recurrence rate lower in CWM compared to BHD (3.7%, 6.9% 7.6% respectively for CWM versus 3.5-5%, 3-12% and 10-21% for BHD). We are of the view that other factors like co-morbid conditions, poor GCS, age of the patient use of anticoagulants and antiplatelets etc. will affect the outcome more. We have not done cost analysis but cost will be more in the craniotomy group because of longer duration of operation and greater length of stay in hospital. One study[6] found the difference in mean cost per patient based solely on operation time to be $2,828

Except for pneumoencephalus, morbidity was more in the craniotomy group. Post-operative seizures developed in 6 patients having pneumoencephalus in BHD groups and 1 patient with pneumoencephalus in CWM groups- all the patients responded to antiepileptic. Pneumoencephalus is commonly encountered after neurological procedures, especially CSDH drainage.[27] Contributing factors for the development of pneumoencephalus include head position, duration of surgery, nitrous oxide anaesthesia,[28] intraoperative osmotherapy, hyperventilation, barotraumas, continuous cerebrospinal fluid drainage through lumbar drain or shunting system.[29] When it leads to neurological deterioration, it is known as tension pneumoencephalus (TP). TP can be a major life threatening post-operative complication especially after evacuation of CSDH.[30] Meticulous attention to details and proper intra-operative and post-operative care should minimize many of these complications.

Limitations

1. Besides pre-operative radiographic finding of solidified hematoma or thick membranes difficult to excise, other predictive factors for craniotomy needs to be identified. Future studies can look into other factors like pre-operative seizures or hemiparesis etc.
2. Because of the need-based nature of the operations, randomized controlled trial could not be planned.

CONCLUSIONS

Despite higher morbidity and mortality, CWM will continue to be an indispensable alternative to BHD in some cases. We found the recurrence rate to be higher in the burr hole drainage group.

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