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LARGE CRANIOTOMY AND EXTENDED MEMBRANECTOMY AS INITIAL TREATMENT OF ORGANIZED CHRONIC SUBDURAL HEMATOMA: OUTCOMES

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ABSTRACT The aim of this study is to evaluate outcomes and incidence of complications of large craniotomy and membranectomy for the initial treatment of organized chronic subdural hematoma (OCSDH). Here we present a non-randomized prospective observational study conducted in the department of Neurosurgery, Osmania General Hospital, including 64 patients presenting with organized CSDH who were treated primarily with large craniotomy and membranectomy. Postoperative recovery was assessed by the Markwalder's Neurological Grading System and complications like recurrence, cardio-pulmonary compromise, post-op seizures, DVT and mortality were evaluated. Patients were discharged on day 7 or in hemodynamically stable condition (whichever was later) and were followed up after 2 months and 6 months. The mean hospital stay was 9.9 days. The complication rate and mortality in our study was comparable to previous studies done in different parts of world. Although a large craniotomy under general anaesthesia requires the patient to be able to tolerate the procedure and carries a higher risk when compared to burr-hole evacuation under local anaesthesia/ sedation, it should be considered the procedure of choice in such patients unless contraindicated.

KEYWORDS : chronic subdural; craniotomy; membrane; membranectomy

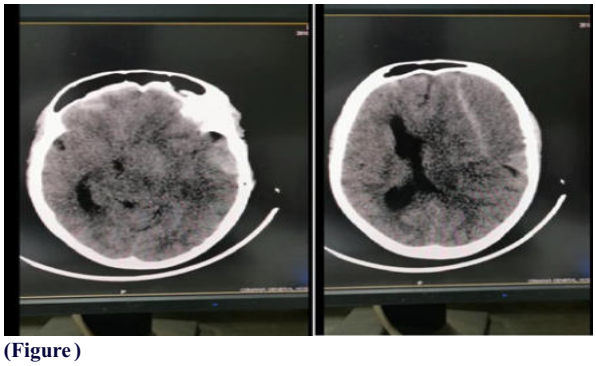
INTRODUCTION:

Chronic subdural hematoma(CSDH) representing one of the most frequent intracranial hemorrhages encountered in neurosurgical department, is seen more commonly in the elderly. Elderly population is at a higher risk of developing CSDH due to many factors like increase in antithrombotic medications, venous fragility, augmentation of the subdural space, and an increased exposure to traumatic injury resulting from frequent falls.

It has been hypothesized that inflammation is a key factor in the development of a CSDH [1] inflammation and trauma may be co-existing factors in CSDH development and that the trauma need only be very trivial. Hematoma fluid is usually liquid that does not clot. Usually hematomas are liquefied, but mixed lesions with solid components are also seen. The higher concentrations of fibrinogen and D-dimer are seen in the layered and mixed types of CSDH. The fibrinolytic factors appear to be associated with evolution in CSDHs with heterogeneous density[2] Older hematomas (40 days after trauma) usually show numerous capillaries and thin-walled sinusoids accompanied by patent, larger diameter blood vessels. Blood vessels are frequently occluded by clots in the fibrotic outer membrane of 60 or more day old hematoma [2]. The outer capsule may calcify or ossify in some cases CSDH are usually managed by twist-drill or burr-hole drainage. However, in a subset of patients with organized CSDH (internal architecture of CSH appear as multiseptated, calcified, multilobulated, or multi-layered, in which thick membranes with multiple septations develop, leading to the formation of encapsulated areas of a solid consistency), burr-hole alone may be a suboptimal technique in presence of thick membrane and smudgy subdural collection and can lead to residual collection and persistent mass effect and this technique is associated with recurrence and poor outcomes. Hence, an appropriate surgical planning is essential in prevention of an outcome that is less than optimal.

Methodology:

We did a non-randomized prospective observational study conducted from January 2018 to January 2020 in the department of Neurosurgery, Osmania General Hospital, associated with Osmania Medical College. The indication to perform a primary enlarged craniotomy as initial treatment for non-liquefied CSDH with multilayer loculations was based on the hematoma plain CT brain appearance – mixed density, usually hypodense to iso dense multiseptated, multilobulated, or multi layered organized chronic subdural hematoma, with or without signs of recent haemorrhage (hyperdense areas), ± midline shift, thickening, or calcification of the inner membrane- hyperdense; often displaying a hypodense web- or net-like structure within the hematoma cavity



(Figure)

The patients were operated under general anaesthesia, in the supine position; the head was turned to the contralateral side at a 45 degree angle. A large craniotomy flap is performed to expose the transition zone between external and internal hematoma membranes. The dura is then opened and separated by the external membrane of the hematoma with a dissector.

Outer hematoma membrane was excised. Once the reflection zone of the hematoma and the adjacent cortical surface are well recognizable, we remove the hematoma by a gentle inject of physiologic saline solution. The inner membrane of the hematoma is progressively separated from an underlying arachnoid layer only by the water inject. This strategy avoids any traction on the cortical surface. No attempt was made to remove by traction the membranes tenaciously adherent to the arachnoid surface or surrounding the bridge veins and they were left in situ. CT scan of brain was done in the immediate post-operative period if the patient was hemodynamically stable to diagnose pneumocephalus and postoperative subdural, epidural, subarachnoid, or intracerebral haemorrhage.

Membranectomy being done

Further CT scans were taken if the patients showed unexpected neurological deterioration. If recurrence was noted on repeat CT brain, patients were taken for reoperation immediately if the general condition permitted. Patients were observed in ICU and nursed in supine position for 24 hours with administration of fluids, and supplemental breathing of 100% O2. Mobilization was encouraged from 2nd post-operative day if possible, otherwise limb and chest physiotherapy was initiated. Patients were discharged on 7th post-operative day, or when clinically stable, whichever was later.

RESULTS:

A total of 64 patients were included in our study. The mean age at presentation was 61.62 years (Range: 30-90 years) The duration of presentation in hospital after history of trauma or onset of symptoms ranged from 1 day to 3 months. The mean age at presentation was 61.62 years (Range: 30-90 years). The duration of presentation in hospital after history of trauma or onset of symptoms ranged from 1 day to 3 months.

Out of 64 patients, 44 patients had medical co-morbidities ranging from hypertension to CAD:

Hypertension	24
Diabetes mellitus	12
Coronary ArteryDisease	5
Old CVA	4
Chronic Renal Failure	2
seizure disorder	3
Hypothyroidism	2
Rheumatic heart disease jaundice Alzheimer's disease DVT Anti-coagulants/ deranged coagulation profile	1 1 1 1 16

Co morbidities

The mean Markwalder's Neurological Grade at the time of admission was 2.5+0.743

0	No neurological deficits
1	Patient alert,oriented with mild symptoms
2	Patient drowsy with deficits
3	Patient stuporous with severe focal deficits
4	Patient comatosed with posturing to paonful stimuli

Table I Markwalder S Neurological Grading System

Markwalder s neurological grading at time of admission	Number of patients	percentage
0	0	0
1	5	7.8
2	26	40.6
3	29	45.3
4	4	6.25
total	64	100

TABLE II Markwalder s neurological grading at time of admission

Two patients expired before 7th post-operative day. The complications seen in post-operative period were as follows: Table III

TABLE III

complications	frequency	percentage
Recurrence	6	9.3
Chest infections	4	6.25
seizures	1	1.56
DVT	2	3.12
Expired	4	6.25

Complications

The mean Markwalder's neurological grade on 7th post-operative day was 1.703+1.064. Hence there was a significant improvement in median Markwalder's neurological grade. Among the 64 patients included in study, 6 patients had recurrent hemorrhage. Out of these 6 patients, 5 were taking some kind of anti-coagulants for coronary artery disease and 1 patient had a positive history of jaundice. Upon follow up, the patients were again evaluated according to the Markwalder's Neurological Grading System at 2 months and 6 months respectively. 3 patients were lost to follow up during the 6 months follow-up assessment. The mean Markwalder's neurological grade at 2 months follow up was 1.53+0.910 and at 6 months follow up was 1.508+0.928.

Table IV Markwalder s neurological grading at 7 th day of admission

Markwalder s neurological grading at 7 th day of admission	Number of patients	percentage
0	6	9.67
1	26	41.93
2	17	27.41
3	10	16.21
4	3	4.83
total	62	100

Table V Markwalder s neurological grading at 2 months of followup

Markwalder s neurological grading at 2 months of followup	Number of patients	percentage
0	6	10
1	27	45
2	16	26.6
3	11	18.3
4	0	0
Total	60	100

Table VI Markwalder s neurological grading at 6 months of follow up

Markwalder s neurological grading at 6 months of followup	Number of patients	percentage
0	7	12.28
1	24	42.10
2	16	28.07
3	10	17.5
4	0	0
total	57	100

DISCUSSION:

Typical CSDH is liquid hematoma. In some cases, the internal structure of the hematoma can be multiseptated or multilayered. Organised Chronic Subdural hematoma (OCSH) is defined as CSDH, has a thick membrane with multiseptations, and forms an encapsulated area with a solid consistency. The incidence of OCSH is low, and its pathogenesis is unclear. This form of CSDH is different from typical CSDH which consists of a fibrous capsule made up of inner and outer membranes filled with bloody fluid .[3] The neomembrane in OCSH is similar to granulation tissue.[3]

Fibrous material slowly increase in volume, forming a solid hematoma in which the inner and outer membranes tend to fuse completely. Callovini et al. [4] reported that a prevalent minor head injury was present in 60% of OCSH patients, while in the remaining patients, history of a traumatic event was unclear. No underlying risk factors were found in 35% of the patients.

Clinical symptoms of OCSH are variable and they include headache, alteration of consciousness, motor weakness, aphasia, and seizure. Mostly, there are only minor symptoms and there may be no neurologic deficits.

In our study, altered sensorium was the most common presentation followed by headache. Among the 64 patients operated, 12 patients showed significant improvement in neurological status in immediate

post-operative period, 44 patients remained status-quo, and 8 patients showed deterioration in the first 7 days after surgery.

Out of these 8 patients, 6 had a recurrence (re-bleed) and 5 were reoperated for evacuation of bleed and one patient expired on post-operative 2nd day. The remaining two patients did not have a re-bleed but developed pneumonitis. One patient among the re-operated group expired on the 4th post-operative day. Among the 6 patients with re-bleed, 4 patients were above 60 years of age, 5 patients had history of anti-coagulant intake and one 30 years old patient had deranged coagulation profile due to jaundice.

Another two patients expired in the 10th post-operative day and on the 18th post-operative day due to cardio-pulmonary complications (pneumonia and sudden cardiac death, respectively). Cardiopulmonary complications like pneumonia, sepsis and hypotension were seen in 4 patients. Other complications included new-onset seizures in the post-operative period in 1 patient, and DVT in 2 patients. Simple pneumocephalus was managed conservatively, none of the patients developed tension pneumocephalus.

There was an improvement in the mean Markwalder's neurological grade from 2.5 to 1.7 in post operative period. We witnessed a collective complication rate of 10.93%. There was a recurrence rate of 9.37% and the mortality rate was found to be 6.25%. The mean Markwalder's grade improved from 1.7 to 1.5 after two months of surgery and 6 months of surgery.

Craniotomy and removal of the membranes still carry high rates of mortality and morbidity.[7] Aggressive membranectomy may induce a postoperative seizure, brain contusion, and haemorrhage. These complications result from traction injury during the attempt to remove the membranes adhering tightly to the cortex.[3] Oda et al. [8] suggested that the inner membrane should be preserved and left intact on the brain surface after removal of only the calcified layer.

The prognosis for OCSH is highly variable, but it often remains poor, depending on the extent of the damage, the timing of surgery, and the presence of comorbidity. OCSH often result in a critical manifestation, including seizure and motor weakness. Prompt removal of a large amount of hematoma is essential to relieve the critical state condition and to improve the prognosis. A failed burr-hole surgery can delay proper craniotomy and worsen the prognosis. The rate of OCSH in patients with CSDH is low because CSDH is detected in the early stages before deterioration of neurologic symptoms. However, if detection of CSDH is delayed, CSDH may develop into OCSH, requiring an enlarged craniotomy.[3] In addition, an organized hematoma can compress the brain parenchyma for a long time and cause convulsions, as observed in the present case. Enlarged craniotomy may be critical in elderly patients because the blood oozing from the margin of the incised membrane can cause an acute subdural hematoma or recurrence of CSDH.[5]

Callovini et al[4]reported that in one case (3%), intraventricular and subarachnoid haemorrhage occurred which led to death. Two cases (6%) presented with a hemorrhagic stroke ipsilateral to the OCSH. Also, many elderly patients take medications like antiplatelet and anticoagulation agents for cerebrovascular and cardiac diseases and they have a coagulopathy in the liver and renal disease. Additional surgery is often required after the primary operation and it leads to a poor prognosis. Large craniotomy with extended membranectomy technique could be required to reduce the recurrence rate in non-liquefied hematoma, multilayer intra-hematomal loculations, and organized or calcified CSDH, as compared to small craniotomy with partial membranectomy technique. [6]

CONCLUSION:

The management of chronic SDH, being a disease of older age group associated with myriad comorbidities, warrants a multi-disciplinary approach. In our study we found that a large craniotomy and extended membranectomy as the initial management of organized chronic SDH carries less chances of recurrence. Stripping the inner membrane is also an important step to allow expansion of brain parenchyma but should be done very meticulously to prevent injury to cortical vessels. The complication rate and mortality in our study was comparable to previous studies done in different parts of world. Early recognition of OCSH and determination of proper treatment may lead to improved survival

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