Craniotomy Does Have its Share in the Management of Chronic Subdural Hematoma

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Abstract

Background Burr hole drainage (BHD) is the most popular technique for surgical management of chronic subdural hematoma (CSDH) and is able to successfully address the problem in majority of patients. However, in a select few cases, the formation of subdural membrane necessitates a wider surgical approach to relieve the compressed cerebral parenchyma. We evaluated the need for craniotomy and associated issues in management of CSDH in a consecutive series of 114 patients.

Material and Method Data of 114 patients, who underwent surgical management of CSDH in our neurosurgical unit were analyzed. We specifically looked for the cases requiring craniotomy, it's indication and surgical outcome.

Results Craniotomy was required in 12 patients (8.6%)—as primary procedure in 8 patients and as add-on secondary procedure in 4 patients. Clinical outcome was good. Mild subdural bleed, not requiring any surgical intervention, was observed in two patients as postoperative complication. There was no mortality.

Conclusion In the presence of thick subdural membranes, BHD alone may not help relieve the cerebral compression. Wider surgical approach in form of craniotomy and membranectomy is the answer in such situations and can be safely performed with low complications. Good quality computed tomography and magnetic resonance imaging are essential in preoperative identification of membrane and appropriate surgical planning.

Keywords
- chronic subdural hematoma
- craniotomy
- subdural membrane
- burr hole drainage

Introduction

Chronic subdural hematoma (CSDH) is one of the most benign intracranial hematomas as far as disease morbidity and mortality are concerned. This often-encountered hematoma in neurosurgical practice is mostly a disease of the elderly and has a high incidence after the sixth decade of life. Multiple etiologies contribute to its formation including trauma, cerebral atrophy, large subarachnoid space, venous fragility, anticoagulant medications, chronic alcoholism, etc.

Simple observation or medical management have 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.[1] Surgical outcomes are usually gratifying and can be safely performed with minimum morbidity and mortality. In the event of recurrent SDH or when radiographic evidence of subdural membrane (SDM) exists craniotomy is a useful surgical adjunct.[2] It is important to observe whether hematoma is recurrent or evacuation is incomplete as the differentiation between the two may be difficult.[3] Burr hole alone may be a suboptimal technique in presence of thick SDM and smudgy subdural collection and can lead to residual collection and persistent mass effect. Studies have shown that layering in CSDH as observed in radiology is an independent risk factor for hematoma recurrence rather than its volume.[4] Hence, an appropriate surgical planning

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is essential in prevention of an outcome that is less than optimal.

In the present study, we analyzed the need of craniotomy in 114 surgically managed cases of CSDH, the indications for it, and the surgical outcome.

Methodology

Patients admitted to Department of Neurosurgery between 2010 Jan to December 2017 with diagnosis of CSDH and requiring surgery were included in this study. Data were retrieved from hospital record section and evaluated or analyzed regarding patient profile, symptomatology, diagnostic method adopted, procedure performed with special reference to the need of craniotomy and outcome. This is essentially a retrospective study and outcome endpoint used was time of hospital discharge.

Results

Surgery was performed on 114 patients for CSDH. Evaluation was done regardinging the need of craniotomy in the management of CSDH and the outcome thereafter.

Age range was 29 to 88 years and highest incidence was seen in the fifth and sixth decades. Males were affected more in comparison to females (78 versus 22%). Headache was the most common presentation (67%), followed by confused mental state/forgetfulness (58%), hemiparesis (24%), and gait instability, urinary incontinence, unconsciousness etc. being other symptoms. Though the symptomatology and their duration did not show any specific difference in craniotomy group as compared with BHD group, patients requiring craniotomy were usually in the elderly age group (> 58 years). Acute presentation as unconsciousness with cerebral herniation was seen in two patients. Computed tomographic (CT) scan was the main diagnostic tool and was supplemented with magnetic resonance imaging (MRI) when required.

A total of 12 (8.6%) patients required craniotomy in management of CSDH—8 as primary procedure and 4 as secondary procedure to BHD (►**Table 1**). In patients undergoing elective craniotomy, preoperative MRI suggested presence of thick SDM in three cases. Craniotomy confirmed radiological findings and was therefore followed by wide membranectomy and hematoma evacuation. In another four patients who were subjected to BHD, it was per-operative decision to convert burr hole to small craniotomy as thick SDM was encountered on opening the dura. Here the hematoma volume evacuated was disproportionately low to the imaging finding which thereby suggested presence of SDM; hence, burr holes were joined to make small craniotomy for wider surgical approach to the pathology. Craniotomy, ~ 6 to 7 cm in diameter, made under local anesthesia, revealed thick bilayered membrane entrapping hematoma admixed with thick inflammatory exudates (►**Fig. 1a**). Membranectomy exposed cerebral cortex and relieved the compression (►**Fig. 1b**). Few radial cuts were added to the membrane under the part of

Table 1 Surgical procedure, indications, and complications

Total cases		114	
Treatment	Primary craniotomy	8	Indications Preoperative diagnosis of SDM—3 Acute CSDH—1 Perioperative conversion of BHD to craniotomy due to thick SDM—4
	Secondary craniotomy (after primary BHD)	4	Indications Postoperative persistence of SDH with mass effect Radiologic suggestion of SDM Clinically symptomatic patient
	BHD	102	
Complication	BHD		Enlargement of contralateral SDH—2 Residual hematoma requiring resurgery—9 Mortality—2
	Craniotomy		Minor rebleed (not requiring surgery)—2 Mortality—0

Abbreviations: BHD, burr hole drainage; CSDH, chronic subdural hematoma; SDM, subdural membrane.

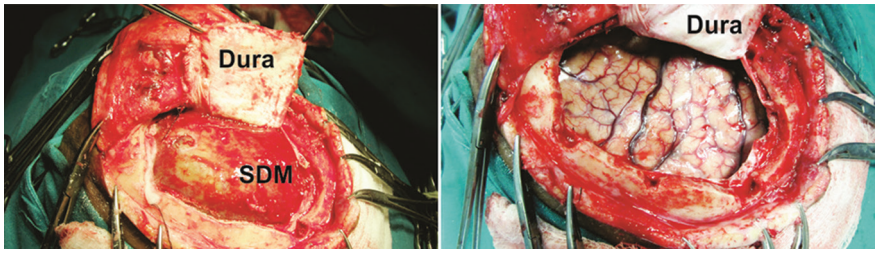

Fig. 1 **(a)** Subdural membrane (SDM) as seen after craniotomy. **(b)** Cortical surface seen after membranectomy.

dura that was beyond the confines of craniotomy, essentially to offset the purse string effect of residual membrane. Adequate cerebral expansion was visible per-operatively and all patients had good postoperative results. One patient, a known case of CSDH and on conservative treatment for being asymptomatic, developed acute subdural bleed after an accident. Here we electively opted to make a craniotomy.

Post-BHD, craniotomy as second procedure was required in four patients. These patients were persistently symptomatic after initial surgery and postoperative scanning suggested large residual hematoma (►**Fig. 2**). Findings suggestive of SDM were also observed which we missed on initial scan. Three of these patients were re-operated within 72 hours with planned large craniotomy and wide membranectomy—all improved clinically. The fourth patient, in spite of large residual hematoma had significant clinical improvement and was therefore kept on observation. One year later, he again worsened slowly with MRI showing thick SDM and cerebral compression. He underwent wide craniotomy and membranectomy with good clinical recovery. It is to be noted that even though it is only the parietal layer of the membrane that is contributor to the problem of hematoma expansion and mass effect, the inner layer of SDM, in direct apposition to brain, is also substantially thick. We excised both inner and outer membrane in all the cases. A subdural drain without negative suction was placed in all cases.

Burr hole drainage was a definitive procedure in 102 patients. Bilateral CSDH was present in 22 patients (19.3%) requiring drainage on both sides in 14 cases. In the remaining eight, the hematoma size on one side was considered not large enough to be worthy of drainage. However, following unilateral drainage, there was a moderate enlargement in size of contralateral hematoma in two patients as seen in postoperative scan. One of these required drainage of contralateral hematoma as the second procedure. Even though bilateral hematoma was seen in 22 patients in series, none required B/L craniotomy.

Regarding complications in the craniotomy group, minor subdural bleed was seen in two patients but none was large enough to warrant resurgery. There was no mortality in the postoperative period.

In BHD group, residual hematoma was a common finding as seen in 24- to 48-hour postoperative scan. We did not measure the volume but observed if midline shift persisted or patient was symptomatic. Resurgery was required in nine patients (8.5%)—craniotomy in four patients (as mentioned above) and redrainage with subdural wash through burr hole in five patients. Two mortalities were observed—one patient was de-cerebrating at time of admission and had large, bilateral subdural collection. Postoperatively he did not improve and scanning revealed multiple micro-bleeds. He subsequently developed sepsis and died of septic shock. The second patient, also decerebrating at time of admission, was a known case of dementia. Though surgery went well, neurological recovery was poor—later he developed pneumonia and died of septic complications.

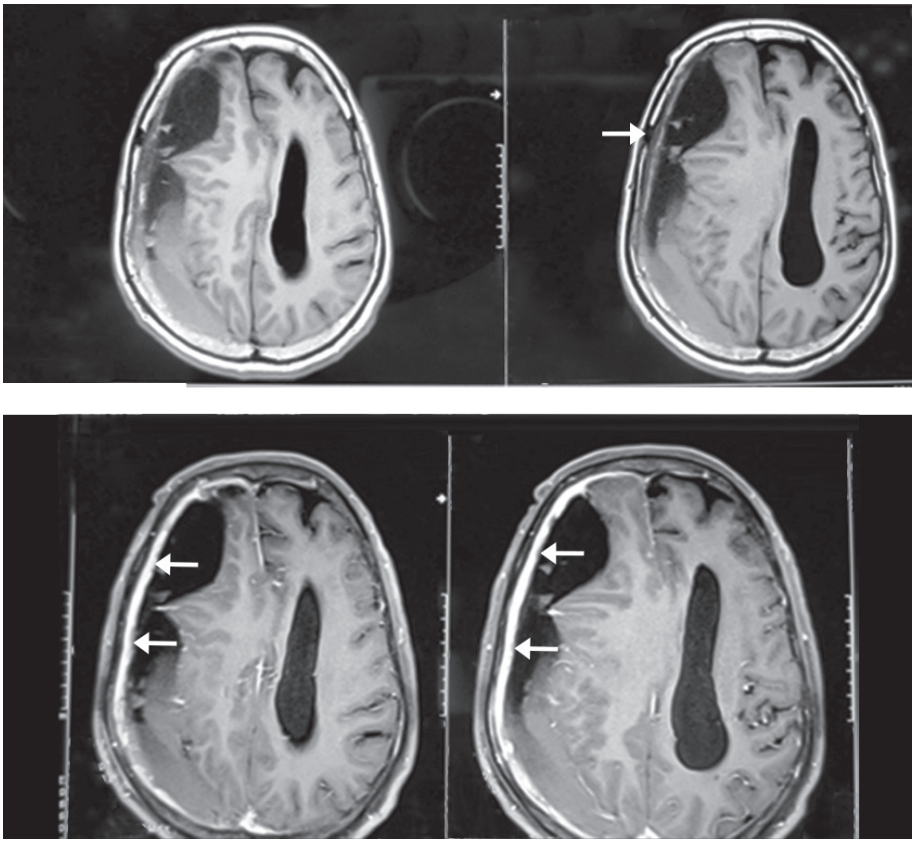

Fig. 2 Post-BHD MRI (plain + contrast) showing burr hole, residual hematoma and contrast-enhancing SDM (arrowhead).

Discussion

Chronic subdural hematoma is usually a benign neurosurgical problem, seen more often in elderly. It is postulated to be a sequel to inflammatory pathology that follows the trivial bleeding in subdural space.[5] Symptomatic patients require surgical intervention. In majority, BHD is adequate enough to resolve the symptoms and is therefore the procedure of choice world over. In a subset of cases however, because of thick SDMs or intrahematomal septations, cerebral decompression by burr hole alone is inadequate, thereby leading to residual collection and persistently symptomatic patient, necessitating resurgery. The reported incidence of resurgery ranges from 3 to 37% in various case series. In the present series, the overall reoperation rate was 7.9% (9/114)—either in the form of craniotomies for excision of SDM or a redo of BHD and subdural washout.

Craniotomy in CSDH is usually required to deal with the problem of SDM, which is a bilayered structure with rich vascularity in its parietal layer. This vascularity has been hypothesized to contribute to hematoma expansion by causing multiple foci of micro hemorrhages. The SDM that we sent for histopathological evaluation clearly demonstrated presence of a network of anastomosing thin-walled blood channels and multiple foci of hemorrhage, which supports the aforementioned hypothesis on hematoma expansion. Though SDM is a usual finding in CSDH, it is only when they grow thick or become multilayered that they start compressing the cerebral cortex. This membrane usually is widespread over the cerebral hemisphere (►**Fig. 2**) and is adherent to dural undersurface. Septations, partially liquefied clots, and smudgy collection of inflammatory exudates are other findings that are often observed along with thick SDM. Burr hole alone becomes inadequate to handle these contributors of mass effect and hence is responsible for persistent postoperative collection and mass effect. Craniotomy is the only way by which wide excision of membrane can be achieved.

The decision for a primary elective craniotomy in CSDH is challenging. Preoperative attention to imaging characteristics can help as the vascularity of membrane gives it a contrast enhancing mixed density appearance, both on CT and MRI. It is to be noted that though the membrane is a bilayered structure, it is only the peripheral layer that enhances due to its vascularity. The membrane which is wide spread over hematoma surface, is often 2 to 4 mm thick and can be seen to be conspicuously absent on the contralateral normal hemisphere. Here a direct craniotomy can be planned as we did in 3 of 114 patients. However, either CT or MRI are likely to miss the membrane if imaging quality is suboptimal as was the case in eight (7.2%) of our patients. Even otherwise, CT scan is less sensitive in identifying membranes as was shown in a study where CT-based membrane detection was missed in more than 70% of MRI-reported membrane-positive cases[7]

The need for craniotomy in CSDH exhibits great variance in different case series, ranging from 18.9[6,8] to 53%,even though the authors have used nearly the same criteria in patient selection for craniotomy. This might be a genuine variation or may possibly reflect personal high sensitivity toward the need of craniotomy while evaluating the radiological findings of membrane or septated collection. In our series of 114 patients, craniotomy was required in 12 patients (8.6%).

Irrespective of the surgical technique used, resurgery is a possibility and has been mentioned in many series. Kim et al, in their series of craniotomy, required resurgery in 12 out of 66 (18.18%) patients—50% resurgery rate in small craniotomy and 10% in large craniotomy. Lee et al, in their case series of 172 patients, comparing outcome of different primary surgical techniques, found reoperation rate of 16% in BHD group and 18 and 23% in partial membranectomy with enlarged and extended craniotomy group respectively. Mondorf et al[9] in his series reported need of resurgery in 27.8% patients who underwent craniotomy as compared with 14% in BHD group. In our series, though we do not have a follow up beyond hospital stay, none of the 12 craniotomies (4 small and 8 large) required resurgery during hospital stay. However, 9 out of 106 patients in BHD group did require resurgery—redo of burr hole in 5 and craniotomy in 4.

The area of SDM accessible for safe excision in small craniotomy is nearly limited to craniotomy margins. To make the decompression effect wider, radial cuts can be added to the inner layer of membrane, which can further release the constricting effect of membrane.

Surgery of this apparently benign entity is not without complications. Postoperative CT findings like pneumocephalus, re-bleed, residual hematoma, etc. are frequent but need to be seen in clinical background as mere radiologic presence of these findings in an asymptomatic patient needs to be evaluated with caution. In the meta-analysis of outcome following craniotomy and membranectomy involving more than 5,000 patients across multiple centers, the authors reported collective mean mortality and morbidity rates of 3.7 and 6.9%, respectively.[11]

We had two unusual complications in BHD group: (1) Enlargement of contralateral small CSDH in two patients requiring drainage by single burr hole in one and simple observation in the other case and (2) post-BHD neurologic deterioration in a patient of bilateral CSDH. Postoperative MRI revealed multiple areas of microbleed in bilateral cerebral cortex, which we assume to be a complication of rapid fall of chronically raised intracranial pressure leading to some kind of reperfusion injury.

Residual hematoma not having mass effect should not be considered a complication as it may take some time before cerebral expansion comes into effect. Also, some amount of fresh bleed in subdural space might be observed post craniotomy and are usually not a cause of concern.

Conclusion

Craniotomy does have its share in surgical management of CSDH and can be safely performed with low risk of complication. Need of different surgical techniques in management of this single entity is a matter of selecting the best modality for the individual patient.

Conflict of Interest

None.

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