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ORIGINAL RESEARCH

Evaluating the effectiveness of minicraniotomy vs burrhole evacuation in managing acute on chronic subdural hematoma in tertiary care centre

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ABSTRACT
A prospective study of span of 3 years in 50 patients, with acute on chronic subdural hematoma will be treated with evacuation of clot by mini craniotomy & by burr hole from august 2022 to august 2024.The approach will be done by mini craniotomy approximately 4.5×3.5 cm in the most dependent part over fronto-parietal convexity in 25 patients. In 25 patients, the approach will be done by Burr Hole technique in the most dependent part. Our study shows that minicraniotomy is better and much superior to burr hole procedure in acute on chronic SDH patients because of following points-large and better visualization of surgical field, removal of maximum subdural membranes, complete or near total evacuation of hematoma, better haemostasis, lesser recurrence and provide better functional outcome due to thorough removal of hematoma, which provide faster neurological recovery and better rehabilitation as compared to burr hole.

INTRODUCTION

A subdural hematoma (SDH) is a collection of blood between the dura mater and the arachnoid mater of the brain. It typically arises due to trauma, leading to tearing of bridging veins. An “acute on chronic” subdural hematoma refers to a new bleed super imposed on an existing chronic subdural hematoma. Acute subdural hematomas usually develop rapidly after a head injury. Chronic subdural hematomas, on the other hand, often develop over weeks to months, especially in older adults, individuals on anticoagulants, or those with a history of minor head trauma.[1]

Chronic subdural hematoma is an encapsulated liquefied hematoma in between the dura mater and the arachnoid membrane of brain. Acute on chronic sub dural hematoma may develop acute subdural bleeding over the chronic sub dural hematoma. In patients of acute on chronic subdural hematoma, bleeding occurs over the pre existing chronic sub dural hematoma several days after the trauma and the source being the bridging veins or rupture fragile new vessels in the neo membrane. This bleeding cause acute component in chronic subdural hematoma. The outer membrane contains many fragile sinusoidal vessels that are often the source of repeated multifocal bleeding. Like the repeated hemorrhages from the outer membrane, repeated trauma may cause acute bleeding over the chronic subdural hematoma. Even though the chronic sub dural hematoma continues to enlarge, brain atrophy in the elderly may allow the hematoma to accumulate before symptoms become obvious. Acute-on chronic subdural hematoma has a more quick presentation compared to the chronic sub dural hematoma.[2]

Chronic subdural haematoma prevalence is 58 per 100000 per year. The annual incidence of chronic subdural hematoma is about 1-5.3 cases per 100,000 population.[3, 5] Chronic subdural hematoma predominantly affects males, with an approximately 3:1 male to female ratio across all age groups.[3]

CT scan & MRI are currently the investigation of

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choice in Acute on chronic subdural hematoma. Surgery for chronic subdural hematoma itself is based on several techniques, including evacuation through a small bone flap associated or not with a drainage system or through one or more burr-holes also associated or not with a system of continuous drainage or percutaneous twist drill craniotomy.[4] Surgical treatment usually results in speedy improvement of neurological symptoms and post-operative prognosis is better.[3]

Introduction of Burr Hole Drainage in Acute on Chronic Subdural Hematoma

Acute on chronic subdural hematoma (ACSDH) represents a complex and often challenging clinical entity encountered in neurosurgical practice. This condition typically arises when an acute hemorrhage occurs within an existing chronic subdural hematoma, leading to a compounded increase in intracranial pressure and associated neurological deficits. The management of ACSDH requires timely and effective intervention to prevent significant morbidity and mortality.

Indications and Rationale

Burr hole drainage is indicated in cases of ACSDH where there is significant neurological impairment or rapid progression of symptoms attributable to the expanding hematoma. The rationale for this procedure lies in its ability to provide immediate decompression of intracranial pressure, facilitating the evacuation of the hematoma and allowing for potential re-expansion of the brain. This intervention is particularly advantageous in patients with multiple co-morbidities or those who may not tolerate more invasive surgical procedures.[9]

Procedure Description

The procedure typically involves the following steps:

1. Preoperative Planning
2. Anesthesia
3. Burr Hole Creation
4. Hematoma Evacuation
5. Post operative Care

Outcomes and Efficacy

The success of burr hole drainage in treating ACSDH is well-documented, with numerous studies reporting high rates of hematoma resolution and neurological improvement. Burr hole drainage remains a cornerstone in the management of ACSDH, offering a balance of efficacy and safety. Its continued refinement and integration with advanced imaging and neurosurgical techniques hold promise for further improving outcomes for patients afflicted with this complex condition.[1, 8]

Introduction of Mini Craniotomy in Acute on Chronic Subdural Hematoma

Acute on chronic subdural hematoma (ACSDH) is a common neurosurgical condition characterized by the accumulation of blood between the dura mater and the arachnoid membrane, with both recent and old hemorrhagic components. This condition is frequently observed in elderly patients and those with a history of head trauma, anticoagulation therapy, or coagulopathies. Traditionally, the standard surgical treatment for ACSDH has been burr hole craniostomy, which involves creating small holes in the skull to evacuate the hematoma. However, in certain cases, this approach may not be sufficient to achieve complete hematoma evacuation, particularly when there are organized or thick hematoma components.

Mini craniotomy, also referred to as keyhole craniotomy, has emerged as a valuable alternative to traditional burr hole surgery for ACSDH. This technique involves a small, strategically placed bone flap to provide a larger access window while minimizing tissue disruption. The mini craniotomy allows for better visualization and more effective removal of both acute and chronic blood components, potentially leading to improved patient outcomes.[10]

Benefits of Mini Craniotomy

1. Enhanced Visualization and Access
2. Reduced Recurrence Rates
3. Minimally Invasive Nature
4. Improved Functional Outcomes

Patients undergoing mini craniotomy often experience better functional outcomes due to the thorough removal of the hematoma and reduced surgical trauma. This can result in faster neurological recovery and rehabilitation. Mini craniotomy represents a significant advancement in the surgical management of acute on chronic subdural hematoma. By combining the benefits of enhanced access and visualization with the advantages of a minimally invasive approach, this technique offers a promising alternative to traditional burr hole craniostomy. Continued research and clinical studies are essential to further refine the technique and establish standardized protocols for its use, ultimately improving patient care and outcomes in neurosurgical practice.[15]

REVIEW OF LITERATURE

Santarius T. et al (2009) conducted a randomized controlled trial on 269 adult patients with a chronic subdural haematoma planned for burr hole drainage.108 patients had a drain inserted into the subdural space while the remaining 107 patients had no drain inserted after evacuation. The end point was recurrence needing re-drainage. The authors found that recurrence occurred in 10/108 patients with a drain (9.3%) and in 26/107 patients without a drain (24%,p-value 0.003). 6 months mortality in the drain group was 9/105 and in no drain groupwas19/105(8.6% and 18.1% respectively, p value 0.042).Rate of complications were comparable among the groups. They concluded that use of drain

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after burr hole drainage of chronic subdural haematoma is safe and results in lesser recurrence and mortality6 months later.[1]

Lee.k.S et al, (2011) conducted retrospective study on 107 patients of chronic subdural haematoma, and concluded that repeated trauma may cause acute bleeding over the chronic subdural hematoma and single or two burr holes were usually effective to remove the hematoma.[2]

In series of M N Hossain et al (2021), 105 patients were surgically treated for chronic subdural haematoma and 6 months follow up, only one patient died (0.95%) because of co- morbidities and not directly related to the chronic subdural haematoma, 15 patients (10.3%) improved to mRS 0, 33.33% showed only mild symptoms without any significant disability mRS 1, slight disability was observed in 28.5% patients, moderate disability was observed in 17.10% patients- mRS 3, moderately severe disability was observed in 5.7%-mRS 4.They concluded that mini craniotomy provides excellent outcome in mRS score and GOS score at 6 month follow up with no recurrence of chronic sub dural hematoma.[3]

Yadav.Y.R et al (2016) conducted a study and concluded that surgery is best option in moderate to large hematoma and small craniotomy with irrigation and closed system drainage is indicated in chronic sub dural hematoma patients with multiloculated, organized and calcified or ossified membranes.[4]

Tokpa A et al (2021), conducted a comparative study on 46 patients operated burr hole craniotomy (group A)55 patient operated by minicraniotomy (group B),. They found both group were similar w.r.t co-morbidities, clinical signs on admission and location of the hematoma. There was also no significant difference between recurrence rates (4.3% vs 3.6%p = 0.55), postoperative complications (15.21% vs 7.27% p = 0.172) and neurological findings between the two groups; concluding that patient outcomes are similar in the treatment of chronic subdural hematomas by craniotomy and minicraniotomy.[5]

Sudha Ram et al (2019) carried out 26 mini-craniotomy procedures for chronic subdural hematomas in twenty three patients. The mean age of presentation was 61 years. 82.6% were male and 19 (82.6%) had preceding history of trauma to the head between 2 weeks to 4 months prior to onset of symptoms, average duration of procedure 66 minute, majority of patient undergone surgery under GA. Average hospital stay was 6 days, ranging from 3to 19 days. One patient developed transient aphasia. They concluded that mini craniotomy allowed better visualization of subdural space and had good clinical outcome and lesser rate of recurrence and complication.[6]

Singh T.G et al., (2020), conducted an analytical cross sectional study on 104 patients with chronic sub dural hematoma; 81 patients for Burr Hole Drainage (BHD) and 23 patients for Craniotomy with Membranectomy (CWM) and found that recurrence rate was higher in the BHD. Mortality rate was 8.69% (2 out of 23) in the craniotomy group and none in the BHD group. Morbidity is higher in the BHD group than CWM group (17.28% versus 9.04%) whereas scalp hematoma (4 cases), wound infection (2 cases) and small subdural bleed (2 cases) were found in the craniotomy group; concluding that CWM is an indispensable alternative to BHD.[7]

Gelabert-Gonzalez et al., (2005) conducted a retrospective study using records of 1000 patients (age 8 to 100 years) of subdural haematoma treated using burr hole craniotomy. The average time from trauma to the onset of symptoms was found to be 49.1 ± 7.4 days. The chief complaint in patients above 70 years of age was found to be headache (29.7%), in the patients below 70 years of age it was found to be behavioural disturbances (33.8%). Right sided CSDH occurred in 432 patients, left sided occurred in 471 patients, and bilateral CSDH occurred in the remaining 196 patients out of which 196 patients died during hospital stay. The authors found that poor prognosis was associated with the age of the patient (more than 70 years) and clinical grade during admission (poorer prognosis for grade 3-4as compared to grade 0-2).[8]

A systematic review done by Ivamoto H. S. et al., (2016) including 24 randomized controlled trials having 1900 patients indicated that using a closed system drainage after burr hole evacuation post operatively decreased the incidence of recurrence (riskratio0.48,pvalue <0.00001) with no other significant differences found in complications or benefits. Other findings were that use of twist drills was equivalent to use of burr holes, head end elevation postoperatively might decrease the length of hospital stay, subdural space irrigation using thrombin solution in selected patients with high risk of recurrence might have some benefit in reducing this risk, and, twist drill followed by closed system drainage for 48 hours rather than 96 hours may reduce the rates of general complications, however the authors caution that most of the trials included had a high risk of bias while many had a small sample size, therefore, preventing definitive conclusions.[9]

Hellwig D et al., (1996) had 10 patients with septated subdural haematoma. They were operated with flexible steerable endoscopes through a burr hole. Micro scissors and micro forceps were used for resection of neomembranes. This avoided blunt rupture of membranes and bleeding. A closed drainage system was applied postoperatively. Out of these, 8 patients had a sufficient evacuation of haematoma. One of the patients had to undergo operation again while another patient suffered a subdural infection. Patients were followed up and in the long term, they did not show any recurrence of subdural haematoma. They concluded that membranous septated chronic subdural haematoma can be operated safely using endoscopic technique along with closed drainage system application and

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cam be used as an alternate to the conventional craniostomy-membranectomy technique.[10]

Objective of the study

1. To analyze & compare outcome of burr hole and mini craniotomy in acute on chronic sub dural hematoma patient.

MATERIAL AND METHODS

Study design is Prospective.

Study Population- 50 consecutive patients with acute on chronic sub dural hematoma will be treated with evacuation of clot by mini craniotomy & by burr hole.

Inclusion- All age group patient having acute on chronic subdural hematoma. Exclusion-

*Patient having polytrauma.

*Patient in shock (Non recordable BP and pulse)

*Patient doesn't want operative intervention or to participate into study.

Follow-Up- The patients will be followed as part of routine care and would be given outpatient clinic follow-ups at1 month, 3 months and 6 months after discharge from the hospital.

RESULTS

1.Duration of Surgery(Minutes) among Minicraniotomy and Burr Hole Evacuation in acute chronic Sub Dural Hematoma patients

Duration of Surgery (Minutes)	Mini craniotomy(n=25)	Burr Hole Evacuation(n=25)	P Value
Mean	146.4	45.2	<0.001*
Standard Deviation	37.4	9.9	

As shown in the table number 1,thedurationofsurgeryin mini craniotomy patients group was146±37.4 and in burr hole evacuation patients group was45.2±9.9,the distributions of duration of surgery among mini craniotomy and burr hole evacuation patient was significant and P value less than 0.001

2.Internal Blood Loss (ml) among Mini craniotomy and Burr Hole Evacuation in acute chronic subdural Hematoma patients

Internal Blood Loss (ml)	Minicraniotomy(n=25)	Burr Hole Evacuation(n=25)	P Value
Mean	132.4	58.8	<0.001*
Standard Deviation	37.9	13.9	

As shown in the table number2-the internal blood loss among minicraniotomy group was132.4±37.9 and in Burr hole evacuations group was 58.8±13.9, the Difference in internal blood loss distribution was statistically significant and P value is less than 0.001.

3.Duration of Hospital stay(in days) among Minicraniotomy and Burr Hole Evacuation in acute chronic sub Dural Hematoma patients

Duration of Hospital stay(in days)	Minicraniotomy(n=25)	Burr Hole Evacuation(n=25)	P Value
Mean	13.6	5.3	<0.001*
Standard Deviation	2.3	1.0	

As shown in the table number 3,the duration of hospital stay among minicraniotomy group was13.6±2.3 and Burr hole evacuations Patient group
Was 5.3±1.0 the difference in distribution of both of the group was clinically significant and P value is less than 0.001.

4. Recurrence of the disease among acute chronic subdural Hematoma patients in both the groups

Recurrence of the disease	Minicraniotomy(n=25)		Burr Hole Evacuation(n=25)		P Value
	Number	Percentage	Number	Percentage	
Yes	2	8	9	36	0.017*.00
No	23	92	16	34	

As shown in table number 4 that in minicraniotomy group 8% patients have recurrence of subdural haematoma but in burr hole evacuations group
36% patients have recurrence of subdural haematoma. The difference in the P value of minicraniotomy and burr hole evacuation group is 0.017.

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DISCUSSION

Duration of surgery

In our study, the duration of surgery in minicraniotomy patients group was 146+ -37.4and in Burr hole evacuation, Patient group was 45.2+9.9. The distribution of duration of surgery among both of the group patients was statistically significant and P value is less than 0.001.

Internal blood loss

In our study, the internal blood law among many craniotomy groups was 132.4+37.9 ml and in Baho equation group was 58.8+13.9 the difference in internal blood loss distributions among both of the group was statistically significant and P value is less than 0.001.

Duration of hospital stay

In our study, the duration of hospital stay among mini craniotomy group was 13.6+2.3 and in Burr hole evacuation group was 5.3+1.0. The difference in distribution of both of the group was clinically significant and P value is less than 0.001.

Recurrence of the disease among acute chronic subdural hematoma patients in both the groups.

In mini craniotomy group 8% patients have recurrence of subdural haematoma but in burr hole evacuations group 36% patients have recurrence of subdural haematoma. The difference in the P value of mini craniotomy and burr hole evacuation group is 0.017.

SUMMARY

Duration of surgery in mini craniotomy patients group was 146+ -37.4 and in Burr hole evacuation, Patient group was 45.2+9.9.

The internal blood loss among mini craniotomy group was 132.4+37.9 ml and in burr hole equation group was 58.8+13.9.

The duration of hospital stay among mini craniotomy group was 13.6+2.3 and in Burr hole evacuation group was 5.3+1.0.

In minicraniotomy group, 8% patients had recurrence of subdural hematoma but in burr hole evacuations group 36% patients had recurrence of subdural hematoma.

In our study minicraniotomy allow a large better visualization of surgical field compared to burr hole and making complete evacuation possible,8% patients have recurrence of subdural haematoma in mini craniotomy, so it allow less recurrence but in burr hole evacuations group 36% patients have recurrence of subdural haematoma. And minicraniotomy often provide better functional outcome due to thorough removal of hematoma, which provide faster neurological recovery and better rehabilitation.

CONCLUSION

In present study we concluded that mini craniotomy is much superior to burr hole procedure in acute on chronic SDH patients because of following points-

- Large and better visualization of surgical field.
- Removal of maximum subdural membranes
- Complete or near total evacuation of hematoma
- Better haemostasis.
- Lesser recurrence

Only8% patients had recurrence of subdural hematoma in minicraniotomy in our study. Burr hole evacuations group, 36% patients had recurrence of subdural hematoma because of small operative site, less visualization of operative field with less hematoma evacuation and minimal membrane removal. Minicraniotomy provide better functional outcome due to thorough removal of hematoma, which provide faster neurological recovery and better rehabilitation.

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