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Chronic subdural hematoma: Twist drill craniostomy versus burr hole craniostomy a prospective study

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Abstract

Back ground: Chronic subdural hematoma (CSDH) is a common neurological condition that mainly occurs in the elderly. The minimally invasive procedure-twist drill craniostomy (TDC) is theoretically more suitable to treat CSDH than the traditional procedure-burr hole craniostomy (BHC). Compared with burr hole craniostomy (BHC), twist drill craniostomy (TDC) is getting increasingly popular because of its minimal invasiveness in evacuating chronic subdural hematoma (CSDH) under Local Anaesthesia. However, the TDC technique varies and is continually developing; moreover, no consensus yet exists regarding the optimal protocol and the efficacy and safety of TDC is still controversial.

Methods:A randomized study involving 83 patients with CSDH who underwent surgical evacuation at a single center was conducted, involving 41patients undergoing Twist Drill Craniostomy (TDC group) and 42 patients treated by Bur Hole Craniostomy (BHC group). The neurological outcome was studied to evaluate the efficacy of surgery and the radiological outcome was assessed as a supplement to the surgical efficacy. In addition, complications, recurrence, and reoperation, as well as pneumocrania, duration of operation and length of stay, were studied to evaluate the advantages of the modified TDC compared with BHC. Independent sample t tests or rank-sum tests were used to compare the outcomes between the 2 groups.

Results: There was significant improvement in both Markwalder grading scale and Glasgow coma scale in both twist drill and burr hole group within 24 hrs of intervention.The recurrence rate was 17.1% in the twist drill group and 11.9% in the burr hole group. There were 8 deaths in the twist drill group and 1 death in the Burr hole group but none were attributable to the procedures. All deaths that occurred were attributable to pre-existing co-morbidities.

Conclusions: TDC is a minimally invasive surgical technique to treat CSDH; this procedure isas effective as BHC, but safer and simpler than BHC and should be considered for patients with CSDH, especially the elderly.

Keywords: Chronic Subdural Hematoma, Burr Hole Craniostomy, Twist Drill Craniostomy

Introduction

Chronic subdural hematoma (CSDH) is a common neurological condition that mainly occurs in the elderly [1]. Highest incidence is in people older than 70 years[2].CSDH is usually

diagnosed by CT scan and are usually hypodense, but isodense or mixed density lesions are also observed. Although these are usually concavo-convex, rarely they may mimic acute epidural hematomas. These CSDHs could be globular, rarely, due to severe craniocerebral disproportion secondary to associated thin cerebral mantle. Huge hemispheric CSDH, occupying whole cerebral hemisphere and compressing the falx with almost complete obliteration of ipsilateral lateral ventricle, has been reported[2].Chronic SDH is not a static lesion, but an ever-changing lesion. Any forces to shrink the brain can be the precipitating factors, while the opposite forces to expand the brain will be the inhibiting factors.

Chronic SDHs enlarge when rebleeding exceeds absorption and they become symptomatic. Symptoms of the chronic SDH depend on the pressure and the reserving capacity of the cranial cavity[3].A few chronic SDHs may resolve spontaneously when the absorption or brain expansion exceeds rebleeding, then the hematoma will disappear[4].

The incidence of CSDH increases greatly with age and ranges from approximately 3.4-13.1 per 100,000 in patients younger than 65 years of age, to 8 to 58 per 100,000 in those older than 65 years[5-8].The incidence is increasing due to increase in aging population, associated medical diseases such as hemodialysis, anticoagulant, and/or antiplatelet therapy[6, 9].

In most studies BHC was primarily performed under general anaesthesia, whereas TDC was primarily performed under local anaesthesia with 1% lidocaine with epinephrine (1:100,000). The thickest portion of the subdural collection, was chosen for the location of the craniostomy usually anterior to the coronal suture[10].After making a 5mm craniostomy an EVD catheter was inserted into the subdural space and connected to a 3 way cannula. The subdural collection was alternatively irrigated and let out using the three-way cannula till the effluent became clear. A repeat CT brain was done after 24hrs of the procedure. For Burr hole craniostomy group two Burr hole craniostomy was performed in the fronto parietal regions on the affected side, wash given with copious amounts of normal saline till the effluent fluid was clear, the craniostomy was filled with saline and closed without a drain.

Methodology

A randomized study involving 83 patients with CSDH who underwent surgical evacuation at a single center was conducted, involving 41patients undergoing Twist Drill Craniostomy (TDC group) and 42 patients treated by Bur Hole Craniostomy (BHC group). The neurological outcome was studied to evaluate the efficacy of surgery and the radiological outcome was assessed as a supplement to the surgical efficacy. In addition, complications, recurrence, and reoperation, as well as pneumocrania, duration of operation and length of stay, were studied to evaluate the advantages of the modified TDC compared with BHC. Independent sample t tests or rank-sum tests were used to compare the outcomes between the 2 groups.

The Markwalder grading score was used as a prognostic score at the time of admission, after 24hrs of intervention,after 48hrs, at3weeks and after 3 months and the results tabulated.

Grade 0:	Neurologically normal.
Grade 1:	**Alert and Orientated:** absence of mild symptoms such as headache, or mild neurological deficit such as reflex asymmetry.

Grade 2:	Drowsy or disorientated, or variable neurological deficit such as hemiparesis.
Grade 3:	Stuporous, but responding appropriately to noxious stimuli, several focal signs such as hemiplegia.
Grade 4:	Comatose with absent motor responses to painful stimuli, decerebrate or decorticate posturing.

Results

The demographic profile of the subjects was noted at the time of admission.

Table 1: Sex incidence

Sex of the patient	Twist drill	Percentage	Burr Hole	Percentage
F	19	46.3	7	16.67
M	22	53.7	35	83.33
Total	41	100.0	42	100.0

Table 2: Age distribution of patients

Age in years	Twist Drill	Percentage	Burr Hole	Percentage
51-60	6	14.6	12	28.57
61-70	14	34.1	13	30.95
71-80	14	34.1	9	21.42
81-90	5	12.2	8	19.04
91-100	2	4.9	0	0
Total	41	100	42	100

The type of injury leading to the chronic subdural haemorrhage was looked into.

Table 3: Injury mechanism

Laterality	Twist Drill	Percentage	Burr Hole	Percentage
Bilateral	4	9.8	9	21.4
Left side only	21	51.2	20	47.6
Right side only	16	39.0	13	31
Total	41	100.0	42	100

Time lag between the sustained trauma and the date of presentation to the hospital was also found to be variable. Majority of the subjects sought medical help 4-8 weeks after the trauma.

Table 4: Duration after the trauma in weeks

No. of weeks	Twist Drill	Percentage	Burr Hole	Percentage
4	7	17.1	7	16.7
5	4	9.8	3	7.1
6	4	9.8	7	16.7
7	4	9.8	4	9.5
8	6	14.6	4	9.5
9	4	9.8	3	7.1
10	4	9.8	1	2.4
11	2	4.9	2	4.8
12	2	4.9	7	16.7
13	2	4.9	2	4.8
14	2	4.9	1	2.4
Total	41	100.0	42	100

Symptoms at the time of presentation in the outpatient department or casualty were grouped into various categories as depicted in.

Table 5: Presenting symptom

Symptom	Twist Drill	Percentage	Burr Hole	Percentage
Confusion	4	9.8	6	14.2
Decreased orientation	5	12.2	11	26.2
Dizziness	3	7.3	0	0

Hemiparesis	16	39.0	8	19
Imbalance	8	19.5	12	28.6
Lethargy	4	9.8	4	9.5
Seizures	1	2.4	1	2.4
Total	41	100.0	42	100

In the radiological assessment, four subjects had bilateral CSDH. In the unilateral haemorrhage group, the incidence was higher on the left side.
Past medical history was significant in almost all cases. The commonest infirmity was cardiac arrhythmias, followed by dementia.

Table 6: Co Morbidities

Co-morbidities	Twist Drill	Percentage	Burr Hole	Percentage
AF & other arrhythmias	12	29.3	4	9.5
Chronic liver disease	6	14.6	0	0
Chronic renal failure	1	2.4	3	7.1
Cerebrovascular accidents	5	12.2	5	11.9
Dementia	8	19.5	15	35.7
Epilepsy	3	7.3	9	21.4
Myelodysplastic conditions	1	2.4	0	0
Parkinson's disease	4	9.8	2	4.7
Transient ischaemic attack	1	2.4	4	9.5
Total	41	100.0	42	100

All the subjects were on regular medication for different reasonsand these were noted as well. Majority of the patients were already on anticoagulants and/or antiplatelet drugs. The drugs could have contributed to the CSDH following minor injuries.

Table 7: Drug intake by the patient prior to the trauma

Medication	Twist Drill	Percentage	Burr Hole	Percentage
Anticoagulants	20	48.8	7	16.7
Antiepileptic	3	7.3	9	21.4
Antiplatelet drugs	12	29.3	26	61.9
β blockers	6	14.6	0	0
Total	41	100.0	42	100

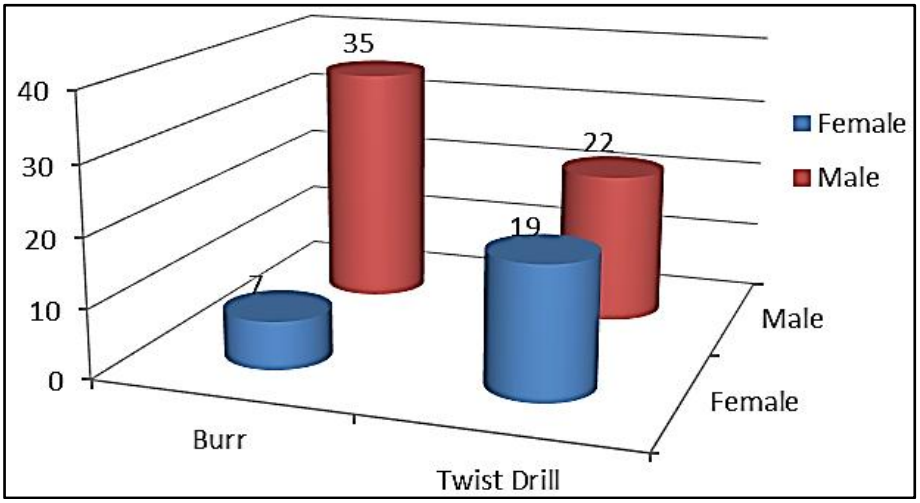

Fig 1: Male: Female ratio undergoing Twist drill & Burr Hole

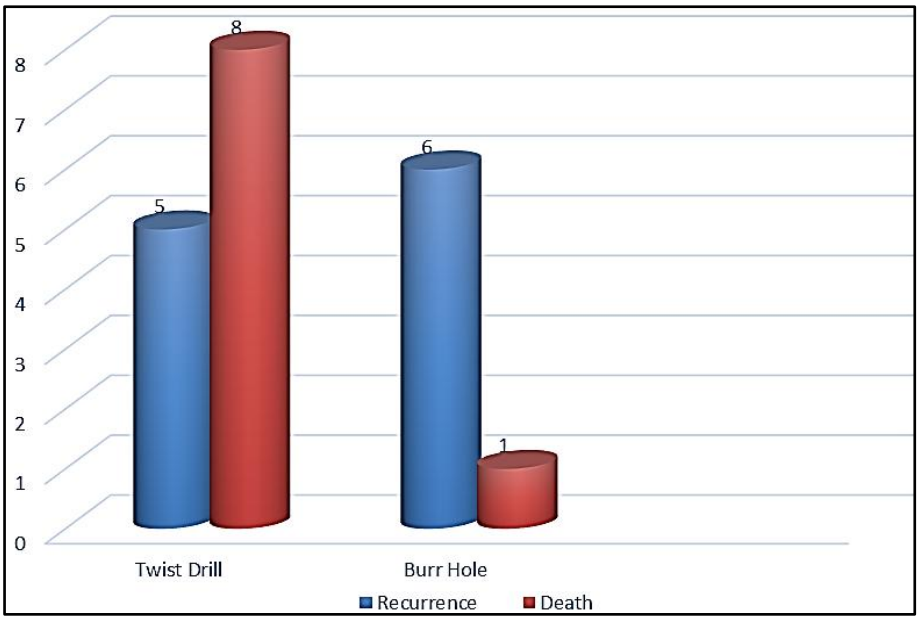

Fig 2: Recurrence Rates and Mortality

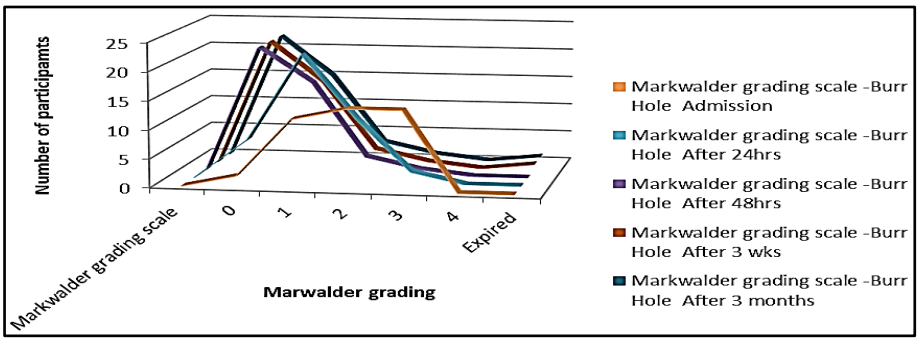

Fig 3: Markwalder Grading in Burr Hole Group

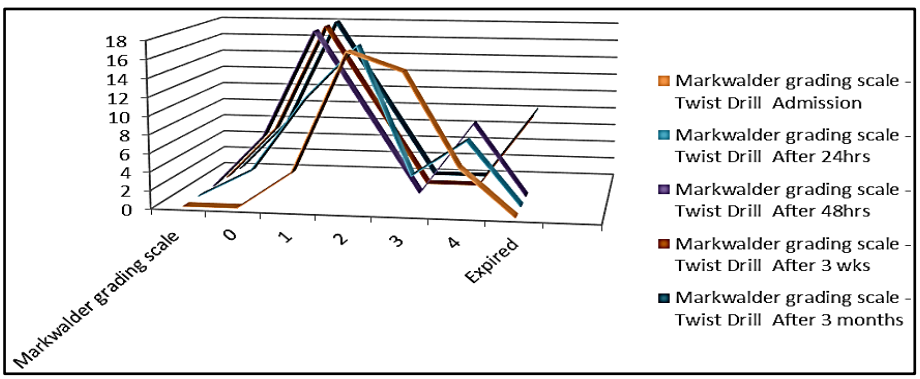

Fig 4: Markwalder Grading in Twist Drill Group

Table 8: Incidence of complications in TDC Vs BHC groups

Complications	Twist Drill Craniostomy group	Burr Hole Craniostomy group
Epidural haematoma:	1	0
Post-operative infections	0	0
Pneumocephalus	41	42
Brain penetration	1	0
C Catheter folding	0	0
Catheter failure/Inadequate drainage	4	0
Intractable Seizures	3	2

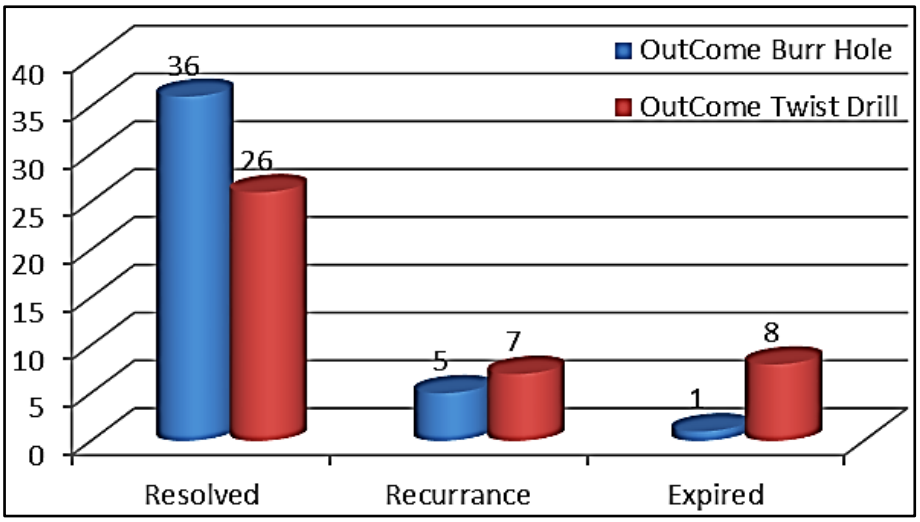

Fig 5: Outcomes in Burr Hole & Twist drill groups

Discussion

Over the past 150 years, a dramatic improvement in outcome was achieved following better understanding of the pathophysiology, the introduction of modern imaging methods, and refinement of operative techniques[11].Craniotomy, mini craniotomy, Trephination, burr-hole craniostomy, twist drill craniostomy and other various surgical techniques have been used over the years[12].The principal techniques used in the present day practise in the treatment of chronic subdural haematoma include twist drill craniostomy(TDC), burr hole craniostomy (BHC) and craniotomy while the other procedures are rarely performed. Additional procedures include intraoperative irrigation of the subdural space and drainage of the haematoma. In a meta-analysis, by Weigel *et al*. it was showed that all the three techniques have about the same mortality (2-4%). Craniotomy was associated with a much higher morbidity than is craniostomy (12.3% vs. 3-4%) and recurrence with twist drill craniostomy is much higher than with burr-hole craniostomy (33% vs. 12.1%) and craniotomy (33% vs. 10.8%)[13].

In our study the outcomescompared in Twist drill craniostomy and the Burr Hole craniostomy groups were

1. Resolved
2. Recurrence
3. Death.

The number of resolved and recurrences were almost similar and statistically not significant. In the TDC group one patient developed a small epidural hematoma and one patient developed a small hematoma due to brain penetration which did not require any further intervention, four patients had catheter failure due blockage by clots which required the catheter to be changed. 3 patients in the TDC group and 2 patients in BHC group developed intractable seizures requiring ventilator support.

From a crude un-adjusted mortality point of view the twist drill appears to be associated with more deaths. (Pearson Chi-Square: 6.298; p = .012) But when the data on co-morbidity is taken as Charlson index Mantel-Haenszel Common Odds Ratio the estimate is not significant[14].

Logistic regression analysis with the variables on treatment type, charlson index and GCS at admission reveals that the deaths are not due to the procedure, rather as a result of either the co-morbidity or severity of the condition at admission[14].

In a study conducted by weigel*et al*. the mortality among the three principal techniques was not significant statistically however morbidity was significantly higher in the craniotomy series (12.3%) when compared with twist drill craniostomy (3%) or burr hole craniostomy

(3.8%) series. The differences in cure rates did not reach statistical significance. Recurrence rates was much lower in both burr hole craniostomy and craniotomy when compared with twist drill craniostomy ($p < 0.001$)[12].An extended surgical approach with partial membranectomy had no advantages regarding the rate of reoperation and the outcome.Extended craniotomy with membranectomy is now reserved for instances of acute rebleeding with solid hematoma[15].

Conclusion

The preferred surgical method continues to attract debate. Due to lack of uniformity about the treatment strategies, various surgical procedures such as burr hole craniostomy, twist drill craniostomy, craniotomy, etc. have been tried in treating CSDH by various surgeons. There is also disagreement about the use of drain, irrigation, and steroid[14]. Management modalities depend mostly on the preference of the Neurosurgical expert, and could vary from medical management to various surgical interventions like burr hole craniostomy. Twist drill craniostomy is a relatively recently evolved minimally invasive procedure, is preferred in certain categories of patients, especially in high risk cases. The minimally invasive procedure-twist drill craniostomy (TDC) is theoretically more suitable to treat CSDH than the traditional procedure-burr hole craniostomy (BHC). However, whether TDC or BHC is the optimal strategy is still controversial. First, the TDC technique varies, and there is no consensus on the optimal technique. Second, it is unclear whether the surgical efficacy of TDC is reliable. Although some studies have demonstrated that TDC is as effective as BHC which was considered to be the most efficient choice for surgical drainage during uncomplicated CSDH, the existing evidence is still unsubstantial to recommend TDC as a first-line strategy[10].

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