Romanian Neurosurgery | Volume XXXI | Number 3 | 2017 | July-September

Article

Twist drill craniostomy vs Burr hole craniostomy in chronic subdural hematoma: a randomized study

Somil Jaiswal, A.K. Chaudhuri, S.N. Ghosh, S. Ghosh, S.K. Saha, Pooja Jaiswal
INDIA

DE GRUYTER OPEN

DOI: 10.1515/romneu-2017-0057

DOI: 10.1515/romneu-2017-0057

Twist drill craniostomy vs Burr hole craniostomy in chronic subdural hematoma: a randomized study

Somil Jaiswal[1], A.K. Chaudhuri[2], S.N. Ghosh[2], S. Ghosh[2], S.K. Saha[2], Pooja Jaiswal[3]

[1]Department of Neurosurgery, King George's Medical University Lucknow, Uttar Pradesh, INDIA
[2]Department of Neurosurgery, IPGMER Kolkata, West Bengal, INDIA
[3]Department of Pathology, IIMS&R, Lucknow, Uttar Pradesh, INDIA

Abstract: *Aim*: To compare two most common operative procedures used in patients with chronic subdural hematomas - Twist drill craniostomy and Burr Hole Craniostomy. *Material and Methods*: The study was a prospective randomized controlled trial on patients with chronic subdural hematomas. *Results*: Both procedures are comparable with respect to outcome but surgical duration is statistically higher in Burr Hole craniostomy than Twist Drill Craniostomy. *Conclusion*: Twist Drill Craniostomy is procedure of choice in emergency surgical situation.

Key words: Twist Drill Craniostomy, Burr Hole Craniostomy, Chronic subdural, Burr-hole drainage, Recurrence

Introduction

Chronic subdural haematoma (CSDH) is one of the most common clinical entities encountered in daily neurosurgical practice with an approximate incidence of 13.1 cases per 100,000 population and mortality rates reported upto 13% (1). It generally occurs in the elderly population in whom age related reductions in brain volume with a corresponding increase in the size of the subdural space increase the vulnerability to this disease. It is common in elderly with the peak incidence in the eighth decade (2, 3) and a male: female ratio of 3:2 (3, 4-7). Trauma is probably the most important risk factor which is associated in about two third of patients (3, 8, 9).

Contemporary surgical treatment options range from twist drill craniostomy (± irrigation ± drainage), burr hole craniostomy (± irrigation ± drainage) and large craniotomies with marsupialisation of haematoma membranes.

Burr hole craniostomy (BHC) seems to have been the most commonly performed procedure for decompressing chronic subdural haematomas in the past 20 years (20). This procedure shares the advantages of twist drill craniostomy, with its high cure rate and low risk of morbidity and mortality, and the

advantage of has low risk recurrence similar to craniotomy to with its low risk of recurrence. However, statements in favour of the less invasive twist drill craniostomy is the positive correlation between the degree of invasiveness and the number of non-surgical complications in elderly people and has an added advantage that it can be performed at bedside and allows early mobilization of elderly moribund patients and reduced inpatient hospital stay (25).

Various aspects of treatment including techniques: twist drill and burr-hole craniostomy versus craniotomy with or without additional irrigation, with or without drainage, position of drain, postoperative nursing of patient, single versus double burr-hole technique have been studied so far.

Evidence based meta-analysis of contemporary surgical treatment of subdural hematoma identified twist drill craniostomy and burr hole craniostomy as the safest methods. Burr hole craniostomy has the best cure to complication ratio and is superior to twist drill craniostomy in the treatment of recurrences (19).

This study aimed at evaluation of advantages and disadvantages of the two most commonly used methods of treatment by a prospective blinded randomized trial so as to provide Class I evidence as to which of these commonly performed surgical treatment of chronic SDH [Burr hole craniostomy (BHC) and Twist drill craniostomy (TDC)] is better in term of complications, recurrence, cure and hospital stay.

Material and Methods

This prospective randomized study, was carried out from February 2012 to September 2013 in the S.S.K.M Hospital, I.P.G.M.E.R, Kolkata, India. All patients above the age of 18 yrs with unilateral chronic subdural hematoma were a part of study. Exclusion criteria were bilateral chronic SDH, Unilobar SDH, Post craniotomy SDH, hygroma or empyema.

Consent- Before enrolling patient in the study, written informed consent was obtained in Bengali / English/ Hindi/ from the patient, or from the blood relative preferably the first degree relative in patients who were comatose or were unable to give consent, explaining both the treatment options i.e. BHC and TDC and need of further studies to prove the superiority of one procedure over the other.

Ethical approval was taken from the Institutional Ethics Committee.

Detailed history including history of trauma within last 3 months, use of anticoagulant or antiplatelet drugs in last 1 week, alcoholism, history of hypertension and diabetes was obtained.

Complete clinical examination was performed and neurological performance of the patients was evaluated using the Glasgow coma scale (GCS) and Markwalder's Neurological Grading System (MGS). The neurological and the general status of each patient on admission and before surgery were assessed by these 2 parameters.

Routine blood investigations and coagulation profile were obtained. Any coagulopathy correction and need of blood or blood product transfusion were noted.

CT details of the following parameters: maximum thickness of hematoma, density, midline shift was noted.

Randomization

The subjects were randomly allocated into two intervention groups, group A (twist drill arm) & group B (burr hole arm) by using the Startrek random number generator. Total of 79 subjects were recruited, out of which 37 subjects were in BHC group and 42 subjects were in TDC group.

Surgical technique

•Patients in group A underwent double (frontal and parietal) twist drill craniostomy (using a twist drill) under local anesthesia. Two 5 mm scalp incision with no.11 surgical blade was given over frontal and parietal region and skull openings of 5 mm were made. Later, dura was punctured and gradual drainage of hematoma fluid with irrigation of subdural space with isotonic normal saline was done using soft silicon catheter. A closed system silicone drain was placed in frontal subdural space through the frontal opening and tunneled away from the primary scalp incision. Single suture was applied at both frontal and parietal sites.

•Patients in group B underwent surgery under local anesthesia/ monitored analgesia. Standard double burr hole craniostomy (>15 mm diameter) at frontal and parietal region was performed. The dura mater was opened with a cruciate incision, and coagulated with bipolar diathermy. Similar irrigation of subdural space and insertion of soft silicon drain in frontal subdural space was done.

Apart from the craniostomy process all other surgical steps were similar. Duration of surgery was time of incision to final suturing was noted. Drain was connected to a collection bag that was kept in a dependent position for 48-72 hours and then removed.

Post operative Assessment

Postoperative CT scan was obtained on 7th postoperative day and noted for: residual collection, thickness of subdural collection, density of collection, mid-line shift and associated findings of parenchymal hematoma, acute subdural hematoma, pneumocephalus if present.

At the time of discharge neurological status was assessed by GCS and MGS scores. Patients of both the groups were assessed by Glasgow Outcome Scale and Markwalder grade at 4 weeks & CT scan was obtained.

Residual hematoma was defined as any residual collection with midline shift on CT scan obtained on 7th post operative day.Recurrence was defined as occurrence of symptoms and signs attributable to an ipsilateral subdural residual hematoma seen on a CT scan within 1 month of the original drainage procedure. Reoperation was done in all cases of recurrence.

Morbidity was defined as any procedure related complication (such as parenchymal injury, wound infection, seizures) during or after surgery other than recurrence and mortality. Mortality included any death within 30 days of post operative period. Cure Rate was defined as percentage of patients with complete cure (GOS of 5 or MGS O) at one month follow up.

Primary outcome measure was recurrence rate requiring reoperation, defined as the rate of reoperation to treat recurrent chronic subdural hematoma in patients previously treated with any of the two procedures

Secondary outcome measures were morbidity, mortality and length of hospital stay.

Statistical Analysis

Statistical Analysis was performed with help of Epi Info (TM) 3.5.3. Chi-square (χ^2) test was used to test the association of different study variables with the study groups. Z-test (Standard Normal Deviate) was used to test the significant difference between two proportions. t-test was used to compare the means. $p < 0.05$ was considered statistically significant.

Results

79 patients admitted in SSKM Hospital Neurosurgery emergency were randomly assigned in two groups during the period February 2012 to September 2013 as per the study protocol. Out of 79 patients, 37 patients underwent Burr Hole Craniostomy and 42 patients underwent Twist Drill Craniostomy.

There was no significant difference between the two groups related to age, gender, predisposing factors, presenting complaints, GCS and MGS at admission, CT scan parameters- density, thickness and midline shift as shown in Table 1.

CT scan parameters thickness of hematoma in BHC group were 19.89±4.89mm, 14.41±3.79mm and 0.42±0.32mm vs TDC group were 20.76±4.76 mm, 14.58±3.51 mm and 0.92±0.32 mm at admission, 7th post operative day and at 1 month follow up showed no significant difference between two groups as depicted in Table 2. Similarly mid line shift and density of hematoma also demonstrated no significant difference between groups at admission, 7th post op day and at 1 month follow up.

Outcome

Table 3 depicts that Patients with Glasgow outcome scale 5 at one month denoted as cured was higher in BHC (94.59%) as compared with TDC (88.10%) showed no significant difference among the group($Z=1.63;p>0.05$). GOS score and MGS score at 1 and 3 months showed no significant difference in two groups. Patients with recurrence was higher in TDC group (4.88%) as compared with BHC group (2.78%) demonstrated no significant difference ($p>0.05$), all three patients were re operated with the previous technique.

Mean duration of surgery in BHC group 52.13± 7.22 min was significantly higher than that of TDC group 36.66±11.77 min and was statistically significant ($p=0.0001$).Thus TDC was better than BHC with respect to operative time. Both groups were no different with respect to mean duration of hospital stay. 34.5% patients in TDC group showed residual collection in post op CT head while it was 30.56% in BHC group and there was no significant difference between the groups($p>0.05$).

Complications

There was no significant difference between the two groups related to complications during hospital stay. One patient died in both the group which presented at the time of admission in low GCS (Table 3).

Predictors of outcome

GOS 5 was found in patients of higher GCS who were of young age group (57.66± 3.44; $p<0.01$) as significant. Similarly male gender and higher GCS at admission showed significant correlation with better outcome.

TABLE 1

	BHC (n=37)	TDC (n=42)	P
Mean Age	56.91	54.59	p>0.05
Male/Female	33/4	36/6	p>0.05
Predisposing factors			p>0.05
Trauma	28	32	
Hypertension	10	11	
Diabetes mellitus	7	7	
Alcoholism	3	2	
Antiplatelet drugs	1	0	
Anticoagulants	4	4	
Presenting complaints			p.0.05
Headache	26	28	
Hemiparesis	24	24	
Vomiting	11	16	
Altered sensorium	8	8	
Gait disturbance	7	7	
Memory loss	7	6	
Urinary incontinence	3	4	
Speech disturbance	2	1	
GCS at admission			p>0.05
14-15	25	24	
9-13	10	15	
3-8	2	3	
MGS at admission			p>0.05
0	2	0	
1	10	14	
2	24	26	
3	1	2	
4	0	0	
CT scan parameters			
Thickness of hematoma			
Mean ± s.d.	19.89±4.34	20.76±4.51	t_{77}=0.87;p>0.05
Mid line shift			
Mean ± s.d.	10.70±2.84	10.83±3.91	t_{77}=0.16;p>0.05
Density			
Hypodense	18	10	χ^2=5.96
Isodense	10	13	p>0.05
Hyperdense	9	19	

TABLE 2

CT scan parameters- Hematoma thickness

Radiological features	**BHC group (n=37)**	**TDC group (n=42)**	**Significance of difference**
Thickness at admission			
Mean ± s.d.	19.89±4.34	20.76±4.51	t_{77}=0.87;p>0.05
Thickness at 7th post op day			
Mean ± s.d.	14.41±3.79	14.58±3.81	t_{77}=0.19 ; p>0.05
Thickness at 1 month			
Mean ± s.d.	0.44±0.32	0.92±0.32	t_{75}=1.58; p>0.05

TABLE 3

Outcome

Variable	**BHC group (n=36)**	**TDC group (n=41)**	Significance of difference(p)
GOS at 1 month			
Mean ± s.d.	4.97± 0.16	4.82±0.588	t_{77}=1.40;p>0.05
Range	4-5	2-5	
MGS at 1 month			
Mean ± s.d.	0.03 ± 0.01	0.17 ± 0.05	t_{77}=0.53;p>0.05
Range	0-1	0-3	
Cure rate			
Cure (GOS 5 at 1 month)	35/37 (94.59%)	37/42 (88.10%)	
Recurrence	1(2.78%)	2(4.88%)	Z=0.47;p>0.05
Residual Collection	11 (30.56%)	14 (34.15%)	Z=0.33;p>0.05
Mean duration of surgery (in minutes)			
Mean ± s.d.	52.13± 7.22	36.66±11.77	t_{77}=6.97;p=0.0001
Range	30-60	20-75	
Mean duration of hospital stay (in days)			
Mean ± s.d.	7.41±1.46	7.48±1.79	t_{77}=0.18; p>0.05
Range	7 – 15	7 - 17	

TABLE 4

Comparison of morbidity among two groups

Complications	BHC group (n=36)		TDC group (n=41)		Significance of difference	
	No.	%	No.	%		p
Wound infection	2	5.56	1	2.44	0.71	>0.05
Seizures	1	2.78	0	0.00	1.07	>0.05
Meningitis/Abscess	1	2.78	0	0.00	1.07	>0.05
Parenchymal hematoma	0	0.00	1	2.44	1.07	>0.05
Morbidity	4	11.11	2	4.88	1.02	>0.05

Discussion

Hamilton et al. (18) compared burr hole evacuation and craniotomy and found no difference between the procedures. Svein and Gelety (39), Robinson (22) and Markwalder et al. (15) advocated the use of only burr hole craniostomy for evacuation of hematomas. Camel and Grubb (26) had achieved an excellent outcome (86%) by using twist drill craniostomy with continuous catheter drainage.

In this study highest incidence in men was noted between 40-60 yrs of age and an average age of occurrence of CSDH was 53.05 yrs which is similarly seen in studies by Markwalder (15), Cameron (2), Robinson (22) and Kaste (23). Age is a strong predictor of clinical outcome by GOS scale ($p<0.01$) in our study this is similar to the study by R. Ramachandran and T. Hegde (23). Male to female ratio reported in literature is 3:2 (3, 4, 5, 6, 7) whereas in this study it came out to be 6.9:1. The higher incidence in men can be attributed to higher rates of head injury in males.

The major presenting complaints were non-specific headache (63.29%) focal neurological deficit in the form of hemiparesis (55.70%), and symptoms of raised intracranial pressure such as vomiting (34.8%) and altered sensorium (20.25%). Similarly headache was the most common complaint in the study by Smely et al (17). Cameron (2) in his series had limb weakness in 40%, cognitive disturbances in 30% and headache in 20%.

History of trauma was obtained in 75.94% of patients in this study with no difference in the two groups. Smely et al. (17) has reported 50% cases related to trauma. The two groups in other studies of Horn et al (19) and Muzii et al. (20) are similar. Other Predisposing factors in both the groups in my study were similar without any significant difference.

Pre operative GCS was identified as strong predictor of clinical outcome in GOS scale. Villagrasa (25) showed that a low GCS at admission had a higher mortality rate. Gokmen et al (21) found that pre operative GCS is an important criterion for operative mortality than surgical method. Neurological status of patients in MGS score was similar in

both the groups. This finding is similar to the series of Smely et al. (17), Gokmen et al (21) and Muzii et al. (20) their data in both the groups were similar.

Pre operative CT scan finding of hematoma density in the two groups of the study showed no significant difference. Similarly the other comparative studies had comparable data in their two groups without any significant difference. Pre operative CT scan in this study showed no statistically significant difference in hematoma thickness between the two groups. Even studies by Smely et al. (17) Horn et al. (19), Muzii et al. (20), Gokmen et al. (21) did not show difference in preoperative hematoma thickness in their study groups and their data were comparable.

Recurrence has been a major problem in the treatment of CSDH with significantly increased morbidity and poor outcome. Recurrence rates in our study are 4.88% in TDC group and 2.78% in BHC group respectively without any significant difference ($p>0.05$) in the two groups although favouring BHC group. Weigel et el. (12) in their meta analysis have reported 33% (3-76) recurrence in TDC group and 12.1 %(0-28) recurrence in BHC group with a significant difference in the two groups. Gokmen et al. (21) have reported 3% and 7% recurrence respectively in TDC and BHC group. Smely et al (17) have reported 18% and 33% reoperation rates respectively. All these study groups have noted no significant difference similar to our study except the meta analysis by weigel et al (12).

In our study we had 25 cases of residual collection, out of which 14 cases (34%) of residual collections were in TDC group and 11 cases (30%) in BHC group. Other than 3 cases of recurrence in 1 month follow up, rest showed complete resolution. CT scan at 3rd month follow up showed complete resolution in them. Difference in the two groups is not statistically significant. This study supports Markwalder's finding in complete resolution of hematoma by 2-3 month following discharge from hospital. Cases in which hematoma increases and causes neurological deterioration or persistent or progressive headache, repeated treatment should be considered.

Average mortality reported in evidence based outcome meta-analysis by Weigel et al. (12) 2.9% (0-7.9%) in TDC group and 2.7% (0-32%) in BHC group. Horn et al. (19) has reported 7% and 13%, Gokmen et al. (21) 2.6% and 3% whereas Muzii et al. (20) has reported no significant difference in two groups. In our study mortality in TDC group was 2.44 % (1 case) and in BHC group was 2.78% (1 case). Both the patient died before 7th post operative day assessment. Both the patients had low GCS score at the time of admission. This suggests that preoperative GCS is an important predictor of operative mortality than the surgical method.

Weigel et al. (12) had demonstrated 3% (0-7.6%) morbidity in TDC group and 3.8% (0-9%) in BHC group. Muzii et al. (20) have reported no difference between the 2 groups. Morbidity in this study in TDC group was 2 cases (4.88%) and in BHC group 4 (11.11%).

Mean duration of hospital stay in TDC group was 7.48 days and 7.41 days in BHC group and difference in not statistically significant although this difference favours

BHC group. Muzii et al. (20) reported no difference between the two groups. However Gokmen et al. (21) has reported larger hospitalization in TDC group and larger hospitalization was associated with higher overall mortality in his study. Minimum duration of hospitalization in our study was kept as 7 days to obtain 1st post operative CT scan of patient. Only patients with some complications were not discharged after 7th post-operative day. Therefore our duration of hospital stay is biased.

The cure rates were 94.59% in BHC group and 88.10 % in TDC group at 1 month follow up. This difference is not significant. Similarly the difference in the two groups was not significant in study by Horn et al. (19) and Gokmen et al. (21). However study by William et al. (15) and decision analysis by Lega et al. (14) have proven superiority of BHC over TDC in respect to clinical outcome and complications.

All the patients who had shown complete resolution of CSDH by 1 month and showed normal CT scan at 3 month follow up in this study. Gokmen et al. (21) with a follow up study for up to 6 months suggested three months follow-up was sufficient.

Conclusion

Cure rate was higher in BHC group than TDC group, though it was not statistically significant. Duration of surgery was significantly higher in BHC group than TDC group. Thus TDC is less time consuming procedure and is procedure of choice in emergency situations. Burr hole craniostomy and Twist drill craniostomy, both the procedures are comparable with respect to residual collection, recurrence, operative complications, morbidity and mortality. Re-operation should be considered in cases of residual collection only if there are persistent progressive symptoms with significant post operative subdural collection. Age, gender and clinical status at admission are important determinants of clinical outcome after surgery.

Correspondence
Dr. Somil Jaiswal
Mailing Address
15/49 Sector 15 Indira Nagar,
Lucknow, Uttar Pradesh, India.
Email: dr.somil26@gmail.com
Phone: +91 7755075630

References

1. Kudo H, Kuwamura K, Izawa I, et al: Chronic subdural hematoma in elderly people: present status on Awaji Island and epidemiological prospect. Neurol Med Chir (Tokyo) 1992; 32:207
2.Cameron MM: Chronic subdural haematoma: a review of 114 cases. J Neurol Neurosurg Psychiatry 1978; 41:834
3.Ernestus RI, Beldzinski P, Lanfermann H, et al: Chronic subdural hematoma: surgical treatment and outcome in 104 patients. Surg Neurol 1997; 48:220
4.Hennig R, Kloster R: Burr hole evacuation of chronic subdural haematomas followed by continuous inflow and outflow irrigation. Acta Neurochir (Wien) 1999; 141:171.
5. Krupp WF, Jans PJ: Treatment of chronic subdural haematoma with burr-hole craniostomy and closed drainage. Br J Neurosurg 1995; 9:619.
6. Reinges MH, Hasselberg I, Rohde V, et al: Prospective analysis of bedside percutaneous subdural tapping for the treatment of chronic subdural haematoma in adults. J Neurol Neurosurg Psychiatry 2000; 69:40.
7. van Havenbergh T, van Calenbergh F, Goffin J, et al: Outcome of chronic subdural haematoma: analysis of prognostic factors. Br J Neurosurg 1996; 10:35.
8.Chen JC, Levy ML: Causes, epidemiology, and risk factors of chronic subdural hematoma. Neurosurg Clin N

Am 2000; 11:399
9.Sambasivan M: An overview of chronic subdural hematoma: experience with 2300 cases. Surg Neurol 1997; 47:418.
10.Markwalder TM. Chronic subdural haematomas a review. J Neurosurg 1981;54:637.
11.Weigel R, Hohenstein A, Schlickum L, et al: Angiotensin converting enzyme inhibition for arterial hypertension reduces the risk of recurrence in patients with chronic subdural hematoma probably by an angiogenic mechanism. Neurosurgery 2007; 61:788.
12.Weigel R, Schmiedek P, Krauss JK. Outcome of contemporary surgery for chronic subdural haematoma: evidence based review.J Neurol Neurosurg Psychiatr 2003; 74:937-43
13.Rohde V, Graf G, Hassler W: Complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. Neurosurg Rev 2001; 69:40
14.Lega BC, Danish SF, Malhotra NR, Sonnad SS, Stein SC. Choosing the best operation for chronic subdural hematoma : a decision analysis. J Neurosurg. 2010;113:615–621
15.GR, Baskaya MK, Menendez J, Polin R, Willis B, Nanda A. Burr-hole versus twist-drill drainage for the evacuation of chronic subdural haematoma : a comparison of clinical results. J Clin Neurosci. 2001;8:551–554
16. Svien HJ, Gelety JE: On the surgical management of encapsulated subdural hematoma. A comparison of the results of membranectomy and simple evacuation. J Neurosurg 1964; 21:172
17.Smely C, Madlinger A, Scheremet R: Chronic subdural haematoma—a comparison of two different treatment modalities. Acta Neurochir (Wien) 1997; 139:818
18.Hamilton MG, Frizzell JB, Traumer BI. Chronic subdural haematomas. The role of craniotomy re-evaluated. Neurosurgery 1993;33:67
19.Horn EM, Feiz-Erfan I, Bristol RE, Spetzler RF, Harrington TR: Bedside twist drill craniostomy for chronic subdural hematoma: a comparative study. Surg Neurol 65:150–153, 2006
20.Muzii VF, Bistazzoni S, Zalaffi A, Carangelo B, Mariottini A, Palma L: Chronic subdural hematoma: comparison of two surgical techniques. Preliminary results of a prospective randomized study. J Neurosurg Sci 49:41–46, 2005
21.Gokmen M, Sucu HK, Ergin A, Gokmen A, Bezircio Lu H . Randomized Comparative Study of burr-hole craniostomy versus twist drill craniostomy ; Surgical management of unilateral hemispheric chronic subdural hematoma. Zentrabl Neurochir 2008 Aug : 69(3):129-33
22. Robinson RG. Chronic subdural haematoma, surgical management in 133 patients. J Neurosurg 1984;61:263
23. Kaste M, Waltimo O, Haiskanen O. Chronic bilateral subdural haematoma in adults. Acta Neurochir 1979;48:231
24. Ramachandran R, Hegde T-. Chronic subdural hematomas—causes of morbidity and mortality. Surg Neurol 2007; 67:36772.
25. Villagrasa J, Prat R, Diaz JF. Analysis of prognostic factors in adults with chronic subdural haematomas. Neurologia 1998;13:120 [Spanish].
26.Camel M, Grubb RL. Treatment of chronic subdural haematomas by twist drill craniostomy with continuous drainage. J Neurosurg 1986; 65:183