Bedside Percutaneous Twist Drill Craniostomy of Chronic Subdural Hematoma—A Single-Center Study

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Abstract

Background Chronic subdural hematoma (CSDH) is predominantly a disease of the elderly.

Objectives This article studies the clinical and radiological outcomes in patients with CSDH who had undergone bedside percutaneous twist drill craniostomy (TDC).

Patients and Methods A retrospective study was conducted in 80 patients who had undergone percutaneous TDC for CSDH between January 2017 and December 2018. Patients between 18 and 90 years of age were selected. CSDH showing computed tomography (CT) scan findings of homogeneous hypodensity, homogeneous isodensity, mixed density, and CSDH with hyperdense gravity-dependent fluid level were selected. CT evidence of multiple septations, recurrent CSDH, bilateral CSDH, and acute on CSDH were excluded. The presence of midline shift (MLS) was measured as any deviation of the septum pellucidum from the midline. The mass effect was determined by the effacement of the sulci, Sylvian fissure obscuration, or compression of lateral ventricles. Postoperative decrease in the signs and symptoms were considered as the postoperative clinical improvement. Improvement in the postoperative CT scan was determined by the decrease in the thickness of CSDH and absence of MLS with decrease in the mass effect. The presence of the CSDH with mass effect and MLS was considered as the significant residue in the postoperative CT scan.

Statistical Analysis Statistical analysis is done using Epi Info software.

Results The mean age range was 67.78 years ± 12.03 standard deviation (SD). There were 49 (61.25%) males and 31 (38.75%) females. Thirty-eight (47.5%) CSDHs were on the right side and 42 (52.5%) on the left side. The locations were in the frontotemporoparietal region in 91.25% patients and in the frontoparietal region in 8.75% patients. The mean duration of symptoms was 4.62 days ± 5.20 SD. History of trauma was present in 58.75% patients. The mean duration of trauma was 45.78 days ± 28.32 SD. The most common symptoms were weakness of the limbs (68.75%), altered sensorium or decreased memory (52.5%), and headache (32.5%). The preoperative Glasgow Coma Scale (GCS) score ranged from 4 to 15 (mean 12.86 ± 2.98 SD). Limb motor weakness was noted in 75% patients. The maximum thickness of the CSDH (in millimeter) in axial CT scan was 8 to 32 (mean 23.22 ± 4.87 SD). All of the 80 patients had MLS. Postoperative GCS ranged from 3 to 15 (mean 14.1 ± 2.78 SD). Postoperative power was improved in 95% of affected limbs. Postoperative power was deteriorated (including

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patients of complications and death) in 5% patients. Clinical improvement was noted in 93.75% patients. Postoperative CT scan improvement was noted in 95% patients. Two patients (2.5%) had significant residue which required reoperation. Two patients (2.5%) developed extradural hematoma which was operated. Five (6.25%) patients developed complications, among which 4 (5%) patients died. The mean duration of stay in the hospital was 6.82 days ± 4.16 SD.

Conclusions CSDH is a disease of elderly population. CSDH is more common in male population. The most common symptom is weakness of the limbs. High clinical and radiological improvement can be achieved with TDC. TDC should be considered as a safe and effective alternative to burr hole craniostomy.

Introduction

Chronic subdural hematoma (CSDH) is predominantly a disease of the elderly. It usually follows a minor trauma. A history of direct trauma to the head is absent in up to half of the cases. The common manifestations are altered mental state and focal neurological deficit. Neurological state at the time of diagnosis is the most important prognostic factor. Morbidity and mortality is higher in the elderly but outcome is good in patients who undergo neurosurgical intervention.[1]

Twist drill craniostomy (TDC) performed at the bedside is just as effective in treating CSDH as burr hole craniostomy (BHC) or craniotomy in the operating room. This procedure can most often be the first line of treatment in patients with symptomatic CSDHs.[2]

Asghar et al did a retrospective study on 40 cases of CSDH with more than 65 years of age. The incidence in this population was 8.2/100,000. Falls (57%) and antithrombotic therapy (33%) were the most frequent risk factors. The most common presenting features were altered mental state (52%) and focal neurological deficit (50%). Twenty-four patients (60%) underwent surgical intervention with 4 deaths (17%). In the nonoperated group, mortality was 7/16 (44%). Most of the deaths in this series were due either to CSDH or to the complications of frailty and poor mobility. Surgery itself was generally successful.[3]

Between August 2001 and October 2002, 55 patients with CSDH were treated with TDC and 24 with BHC or craniotomy. There were no differences in the mean age of presentation, thickness of hematoma, length of hospitalization, reoperation rate, mortality rates, or ability to be discharged to home between the two groups. TDC performed at the bedside is just as effective in treating CSDH as BHC or craniotomy in the operating room. This procedure can most often be the first line of treatment in patients with symptomatic CSDHs.[2]

Hwang et al did angiographic evaluation of the course of the middle meningeal artery and radiographic review of the relation of the middle meningeal artery groove to the coronal suture, and proposed that the normal TDC entry point should be 1 cm anterior to the coronal suture at the level of the superior temporal line.[4]

Lee et al retrospectively analyzed data for 134 symptomatic CSDH patients who underwent TDC at the pre-coronal point with closed-system drainage. They showed 85.1% improved clinical performance and imaging findings after surgery. TDC at this site is safe and effective for patients with symptomatic CSDH whose hematomas extend beyond the coronal suture.[5]

The authors share their experience of bedside percutaneous TDC of CSDH.

Objectives of the Study

This article aims to study the clinical and radiological outcomes in patients with CSDH who had undergone bedside percutaneous TDC.

Patients and Methods

We retrospectively analyzed 80 patients who had undergone percutaneous TDC for CSDH between January 2017 and December 2018 at the Department of Neurosurgery, Government Medical College, Thrissur, Kerala, India. The ethical clearance for the study was obtained from the Institutional Review Committee and Institutional Review Board of the institution. Patients between 18 and 90 years of age were selected. Patients with CSDH showing computed tomography (CT) scan findings of homogeneous hypodensity, homogeneous isodensity, mixed density, and CSDH with hyperdense gravity-dependent fluid level were selected. CT evidence of multiple septations, recurrent CSDH, bilateral CSDH, and acute on CSDH were excluded from the study.

Diagnosis of CSDH was done using noncontrast CT scan. The maximum thickness of the CSDH was measured in the axial film of preoperative CT scan. The presence of midline shift (MLS) was measured as any deviation of the septum pellucidum from the midline in axial CT film. The mass effect was determined by the effacement of the sulci, Sylvian fissure obscuration, or compression of lateral ventricles. Fresh-frozen plasma, platelet transfusions, or vitamin K were given before surgery to the patients who were taking anticoagulant/antiplatelet medications or if international normalized

ratio (INR) was deranged. Unless it was an emergency, surgery was delayed until INR was corrected to less than or equal to 1.3. All the patients were treated with antiepileptic and third-generation cephalosporin medications. During the postoperative period in the hospital, the decrease in the signs and symptoms of CSDH were considered as the postoperative clinical improvement. Postoperative CT scan was taken before discharge from the hospital. Improvement in the postoperative CT scan was determined by the decrease in the thickness of CSDH and absence of the MLS with decrease in the mass effect. Complete resolution of the CSDH was not taken as the criteria for the improvement in postoperative CT scan. Thickness of CSDH in postoperative CT scan was not measured. The presence of CSDH with mass effect and MLS was considered as the significant residue in the postoperative CT scan. Patients with significant residue underwent reoperation.

Parameters Analyzed

The data collected includes age, sex, clinical details, prothrombin time (PT) in seconds, INR, activated partial thromboplastin time (APTT) in seconds, platelet counts per microliter of blood, serum sodium level in milliequivalents per liter (mEq/L), use of antiplatelets or anticoagulants, comorbidities, and postoperative neurological status. Pre- and postoperative Glasgow Coma Scale (GCS) scores were noted. Pre- and postoperative motor power of the affected limbs was measured in Medical Research Council grading. The thickness, location, and side of CSDH and presence of MLS in preoperative CT scan were noted. Improvement in postoperative CT scan and any occurrence of complications were noted. The presence of significant residual CSDH requiring reoperation was noted. Reoperation due to complication of surgery was noted. Duration of the hospital stay was also noted.

Operative Technique

Percutaneous TDC is performed as a bedside procedure under local anesthesia in neurosurgery intensive care unit. After scalp preparation with povidone-iodine, local infiltration of scalp was done using 2% lignocaine with adrenalin. For frontoparietal and frontotemporoparietal CSDH, 1 cm scalp incision was put and twist drill trephination was performed using hand drill at a point 1 cm anterior or posterior to the coronal suture along the superior temporal line. Dura mater and outer membrane of CSDH were pierced. Note that 10 FG infant feeding tube was inserted perpendicularly at a depth of 1 to 2 cm from the inner table and fixed to the scalp with suture. The distal end of the infant feeding tube was connected to urinary drainage bag. Patient was positioned supine in neutral position. Continuous gravity-dependent drainage was kept. The drain was removed after 24 hours and scalp stapled. CT scan was taken in the postoperative period.

Results

There were 80 patients who underwent TDC. The age range was 33 to 90 years with mean age of 67.78 ± 12.03 standard deviation (SD). There were 49 (61.25%) males and 31 (38.75%) females. Thirty-eight (47.5%) CSDHs were on the right side and 42 (52.5%) on the left side. The location of CSDH was in the frontotemporoparietal region in 73 (91.25%) patients and in the frontoparietal region in 7 (8.75%) patients. The duration of symptoms ranged from 1 to 30 days (mean 4.62 ± 5.20 SD). History of trauma was present in 47 (58.75%) patients. The duration of trauma ranged from 21 to 120 days (mean 45.78 ± 28.32 SD).

Table 1 Preoperative Glasgow Coma Scale score and motor weakness of limbs in patients with chronic subdural hematoma undergoing twist drill craniostomy

	TDC
GCS score	4–15
Score 3–8	8 patients
Score 9–13	22 patients
Score 14–15	50 patients
Mean ± SD	12.86 ± 2.98
Median	15
Mode	15
Limb weakness (MRC grading) (%)	60 patients (75)

Abbreviations: GCS, Glasgow Coma Scale; MRC, Medical Research Council; SD, standard deviation; TDC, twist drill craniostomy.

The symptoms of the patients include weakness of the limbs in 55 (68.75%) patients, altered sensorium or decreased memory in 42 (52.5%), headache in 26 (32.5%), vomiting in 13 (16.25%), urinary incontinence in 16 (20%), speech abnormalities in 13 (16.25%), seizure in 4 (5%), dizziness in 2 (2.5%), facial palsy in 1 (1.25%), and photophobia in 1 (1.25%) patient. The preoperative GCS score ranged from 4 to 15 (mean 12.86 ± 2.98 SD). Limb motor weakness was noted in 60 (75%) patients (►**Table 1**). Nine (11.25%) patients had preoperative grade 0 power, 5 (6.25%) had grade 1 power, 3 (3.75%) had grade 2 power, 12 (15%) had grade 3 power, 7 (8.75%) had grade 4 power, 21 (26.25%) had grade 4 power, 3 (3.75%) had grade 4+ power, and 20 (25%) had grade 5 power.

The comorbidities include hypertension (27.5% patients), diabetes mellitus (21.25%), coronary artery disease (11.25%), cerebrovascular disease (8.75%), anemia (5%), seizure disorder (2.5%), chronic kidney disease (2.5%), chronic obstructive pulmonary disease (1.25%), pulmonary tuberculosis (1.25%), psychiatric illness (1.25%), rheumatic heart disease (1.25%), pancytopenia (1.25%), carcinoma tongue (1.25%), carcinoma larynx (1.25%), carcinoma thyroid (1.25%), use of antiplatelets or anticoagulants (16.25%), and chronic alcoholism (8.75%).

The maximum thickness of the CSDH (in millimeter) in axial CT scan was 8 to 32 (mean 23.22 ± 4.87 SD). All the 80 patients had MLS. The PT ranged from 11.4 to 60 seconds (mean 15.53 ± 5.77 SD), INR 0.90 to 3 (mean 1.14 ± 0.26 SD), APTT 23 to 47.1 seconds (mean 29.86 ± 4.49 SD), platelet count 1.4 to 4.4 lakhs per microliter (mean 2.52 ± 0.72 SD), and serum sodium ranged from 103 to 147 mEq/L (mean 134.72 ± 6.49 SD).

The postoperative clinical statuses were assessed. Postoperative GCS ranged from 3 to 15 (mean 14.1 ± 2.78 SD). In

patients with preoperative motor weakness of limbs, postoperative power was improved in 95% of cases. Postoperative power was deteriorated (including patients of complications and death) in 4 (5%) patients. Clinical improvement was noted in 75 (93.75%) patients (►**Table 2**). Postoperatively, 2 (2.63%) patients had grade 3 power, 3 (3.94%) had grade 4 power, 21 (27.63%) had grade 4+ power, and 50 (65.78%) had grade 5 power. Postoperative CT scan improvement was noted in 76 (95%) patients.

Two patients (2.5%) had significant CSDH residue which required reoperation. Another five (6.25%) patients developed complications. The risk factors involved in the development of residual CSDH and complications are given in ►**Table 3**. The duration of stay in the hospital was 2 to 30 days (mean 6.82 ± 4.16 SD).

Discussion

Baechli et al reviewed 354 patients undergoing surgery for CSDH over a period of 7 years (1996–2002). CSDH occurred more often in elderly (> or = 65 years) than in younger people (69 vs. 31%), and in men than in women (64 vs. 36%). Falls were reported in 77% of patients. There was a trend toward a higher risk of falls in the elderly. Antithrombotic or anticoagulant therapy was present in 41% of patients, 32% of them having had falls. Overall, postoperative mortality was 0% and overall recurrence rate was 13.6%.[6]

A novel technique involving a hollow screw, which is threaded through a twist-drill hole in the cranium and then connected to a closed drainage system, has been increasing in popularity. Chari et al found 9 eligible studies comprising 796 patients treated with this new technique. Pooled analysis showed a "success rate" of 77.6%, recurrence rate of 22.4%, and in-hospital mortality of 1.4%. Overall, TDC with hollow screws appears to be safe and effective. Class I evidence is necessary to optimize the surgical management of patients with CSDH.[7]

Wang et al introduced a new modified TDC technique using a novel device, the YL-1 puncture needle, and evaluated its efficacy and advantages compared with BHC.

Table 2 Postoperative clinical status of patients with chronic subdural hematoma undergoing twist drill craniostomy

Postoperative clinical status	TDC
GCS score	3–15
Mean ± SD	14.1 ± 2.78
Median	15
Mode	15
Postoperative limb power improvement in MRC grading	57 patients improved out of 60 affected patients: 95%
Postoperative limb power deterioration in MRC grading (%)	4 patients (5)
Clinical improvement (%)	75 (93.75)

Abbreviations: GCS, Glasgow Coma Scale; MRC, Medical Research Council; SD, standard deviation; TDC, twist drill craniostomy.

Table 3 Poor outcome and risk factors for poor outcome in the patients of chronic subdural hematoma undergoing twist drill craniostomy

Poor outcome	Risk factors
Residual CSDH requiring reoperation	Age 80 y Antiplatelets Preoperative CT showing 27 mm CSDH
Residual CSDH requiring reoperation	Age 75 y Preoperative CT showing 32 mm CSDH
EDH which was initially managed conservatively and later aspirated	No risk factor
EDH operated, died	No risk factor
Pneumonia, tracheostomy, sepsis, and death	Poor preoperative GCS (GCS 4) CVA, CAD, antiplatelets PT 60 s, INR 3
Pneumonia, sepsis, and death	Age 75 y Pancytopenia GCS 9
Aspiration pneumonia, metabolic and respiratory acidosis, renal failure, and death	Age 75 y Diabetes mellitus

Abbreviations: CAD, coronary artery disease; CSDH, chronic subdural hematoma; CT, computed tomography; CVA, cerebrovascular disease; EDH, extradural hematoma; GCS, Glasgow Coma Scale; INR, international normalized ratio; PT, prothrombin time.

A retrospective study involving 121 patients with CSDH who underwent surgery was conducted, involving 68 patients undergoing modified TDC and 53 patients treated by BHC. The neurological and radiological outcomes did not differ significantly between the TDC and BHC groups, while the rates of complication and pneumocrania in patients who underwent the modified TDC were significantly lower than that in those who underwent BHC. The recurrence and reoperation rates in patients from the two groups were similar. The operation duration and length of hospital stay of the patients who underwent the modified TDC were significantly shorter than those of the patients who underwent BHC.[8]

In our study, the mean age was 67.78 years ± 12.03 SD. The mean duration of symptom was 4.62 days ± 5.20 SD. History of trauma was present in 58.75% patients. The most common symptom was weakness of the limbs (68.75%). The mean CT scan thickness of the CSDH (in millimeter) was 23.22 ± 4.87 SD. The postoperative clinical improvement was noted in 93.75% patients and postoperative power was improved in 95% of affected limbs. Postoperative CT scan improvement was noted in 95% patients. Five percent patients died and 6.25% developed complications.

Conclusion

CSDH is a disease of elderly population. CSDH is more common in male population. The most common symptom is weakness of the limbs. High clinical and radiological improvement can be achieved with TDC. This bedside life-saving procedure avoids the need for general anesthesia. TDC should be considered as a safe and effective alternative to BHC.

Note

This study was approved by the Institutional Review Board of the Government Medical College, Thrissur, Kerala, India.

Funding

The study is self-funded by the authors.

Conflict of Interest

None declared.

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