

## Original Research Article

## A Prospective Study To Evaluate Role of Closed Drainage To Reduce Recurrence and Improve Outcome of Chronic Subdural Hematoma Cases At A Tertiary Care Centre of Bihar

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**Abstract**

**Introduction:** Chronic subdural hematoma (CSDH) is one of the most common types of intra-cranial hematoma, and often occurs in the elderly. Its incidence is about 5/100,000/year in the general population, but is higher for those aged 70 years and older; 58/100,000. Surgical treatment has been widely accepted as the most effective way to manage CSDH. In this study, we have compared the postoperative recurrence rates after burr-hole drainage (BHD) of CSDH with and without subdural drain. We have also compared the mortality and morbidity between two groups. **Methodology:** During the period of 12 month from March 2021 to February 2022, all the patients of symptomatic CSDH proven by computed tomography (CT) scan admitted to Department of Neurosurgery were allocated randomly in two groups using random allocation software: Group A included patients who were treated by burr-hole craniostomy with closed-system drainage, and Group B included those patients who were treated with burr-hole craniostomy without closed-system drainage. Based on these criteria, a total of 100 cases were enrolled for the study with 50 cases in each group. **Result:** Of the 100 patients, 90 patients had unilateral CSDH and rest 10 patients had bilateral CSDH. Of the unilateral CSDH, 49 were on the right side. Homogeneous collection was more common than heterogeneous one (72 and 28, respectively). The most common homogeneous collection was hypodense CSDH on NCCT head. The common clinical symptoms were headache and hemiparesis. Patients were evaluated for other co-morbid conditions. Brain atrophy, history of head trauma, and hypertension were common. **Conclusion:** In this study, the recurrence rate of CSDH is significantly lower. Hence, we would like to conclude that the use of a subdural drain reduces the recurrence rate in CSDH without any significant increase in complications and should be routinely placed after BHD.

**Key Words:** Closed Drainage, Reduce Recurrence, Outcome Of Chronic Subdural Hematoma.

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**Introduction**

Chronic subdural hematoma (CSDH) is one of the most common types of intra-cranial hematoma, and often occurs in the elderly. Its incidence is about 5/100,000/year in the general population, but is higher for those aged 70 years and older; 58/100,000. Surgical treatment has been widely accepted as the most effective way to manage CSDH. Craniotomy, burr-hole craniostomy, twist drill craniostomy and other various surgical techniques have been used for years. In a meta-analysis, Weigel *et al.* showed that all the three techniques have about the same mortality (2-4%)[2]. Craniotomy is 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%). Burr-hole craniostomy, an evacuation through one or two burr-holes drilled over the site of hematoma, is the most popular surgical technique worldwide. The subdural evacuating port system (SEPS) permits the neurosurgeon to drain sub acute or chronic hematomas by a method which is minimally invasive, simple, and safe[3, 4]. The SEPS can be used quickly with local anesthesia only, making it ideal in elderly or sick patients who might not tolerate the physiological stress of a craniotomy under general anesthesia[5]. In mixed density collections with large proportions of acute hemorrhage and in collections with numerous intrahematoma septations, alternative surgical techniques should be considered as first-line therapies[6].

Recurrences are a major problem and require re-rinsing of the

subdural space, sometimes repeatedly. The reported recurrence rate ranges from 9.2% to 26.5% after surgical evacuation[7]. Among many measures to prevent recurrences, one is placing a subdural drain for a day or two. This has certain potential complications like risk of puncturing the cortex and causing an intra-cerebral or subdural hematoma, or causing a bacterial subdural empyema. In this study, we have compared the postoperative recurrence rates after burr-hole drainage (BHD) of CSDH with and without subdural drain. We have also compared the mortality and morbidity between two groups.

**Methodology**

During the period of 12 month from March 2021 to February 2022, all the patients of symptomatic CSDH proven by computed tomography (CT) scan admitted to Department of Neurosurgery were allocated randomly in two groups using random allocation software: Group A included patients who were treated by burr-hole craniostomy with closed-system drainage, and Group B included those patients who were treated with burr-hole craniostomy without closed-system drainage. Pre- and post-operative CT scans were used for radiological evaluation. Patients were randomized into two groups once subdural hematoma was evacuated and drain placement was not contraindicated pre-operatively.

Exclusion criteria were: (1) Patients with ipsilateral hematomas who had undergone cerebrospinal fluid (CSF) diversion within 6 months of presentation; (2) patients in whom surgery other than burr-hole evacuation was indicated; (3) patients not needing surgical treatment because of size of CSDH or clinical status of patients; and (4) patients in whom brain completely surfaced after BHD of CSDH. Based on these criteria, a total of 100 cases were enrolled for the study with 50 cases in each group.

"Recurrence" was defined as the occurrence of symptoms and signs attributable to an ipsilateral hematoma seen on a computed

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tomographic scan within 6 months of original drainage procedure. All such symptomatic recurrences were re-operated.

#### Surgical technique

After getting consent, the numbers of burr-holes were made as per neurosurgeon's preference and were usually made over the maximum width of hematoma. Surgeries were done under local or general anesthesia. The number of burr-holes to be made was left to the discretion of the operating surgeon because if the SDH was a localized one then placing two burr-holes as a fixed protocol would have been incorrect. SDH cavity was irrigated copiously with normal saline with a soft silicon catheter until clear return came out. Closed-system drain was put in the subdural space in patients of group A and was not placed in group B patients.

The bilateral CSDHs were treated as one case, and both sides received the same treatment. When a patient was assigned to group B, the subdural space was filled with normal saline and the scalp wound was closed in two layers. Those assigned to drain group, a soft silicon plain catheter was inserted into the subdural space through the burr-hole overlying the large part of the subdural cavity, and tunneled for a minimum of 5 cm away from the scalp incision. The subdural space was filled with normal saline and the scalp was closed in two layers. The drain was connected to a soft collection bag that was kept in dependent position for 48 h and then removed after doing noncontrast CT (NCCT) scan. The duration of drain placement was uniformly 48 h in all patients of drain group. The patients were followed-up with

clinical symptoms or signs and if required repeat CT imaging was done.

#### Follow-up

After discharge from hospital, patients were followed-up in the outpatient department, initially at fortnightly for 1 month, and then on a monthly basis for up to a minimum of 6 months.

#### Statistical methods

Student t-test was applied for comparison between two groups and Chi-square test for checking the association for the outcome variables. Value of  $P < 0.05$  was considered as statistically significant. Mean, standard deviations, and medians were reported for interval variables, and percentages were reported for categorical variables. Statistical analyses were conducted with SPSS (version 17.0; SPSS Inc, Chicago, IL, USA).

#### Results

During the study period, 100 diagnosed patients of CSDH were enrolled for the study after assessing them for inclusion and exclusion criteria and obtaining duly signed informed consent forms. Of the 100 patients enrolled for the study, 50 patients each were randomized to group A and B using random allocation software.

The common clinical symptoms were headache and hemiparesis. Patients were evaluated for other co-morbid conditions. Brain atrophy, history of head trauma, and hypertension were common. Other clinical symptoms and co-morbid conditions have been shown in table 1.

**Table 1: Distribution of study population based on clinical features and co-morbidity**

Findings	Number of patients
<b>Clinical presentation</b>	
1. Headache	72
2. Hemiparesis	65
3. Incontinence	14
4. Vomiting	12
5. Dementia	6
6. Seizure	5
7. Diplopia	1
<b>Co-morbid conditions</b>	
1. H/O trauma	65
2. Brain atrophy	62
3. Alcohol abuse	55
4. Hypertension	44
5. Antiplatelet drugs	21
6. CAD	20
7. Diabetes	12

On admission, most of the patients were in Glasgow Coma Scale 9-15 (83%). Of the 100 patients, 90 patients had unilateral CSDH and rest 10 patients had bilateral CSDH. Of the unilateral CSDH, 49 were on the right side. Homogeneous collection was more common than heterogeneous one (72 and 28, respectively). The most common homogeneous collection was hypodense CSDH on NCCT head. The mean midline shift on NCCT scan was  $10.9 \pm 5.1$  mm in group A, and  $11.5 \pm 4.2$  mm in group B ( $P > 0.05$ ). The volume of CSDH was

$101.8 \pm 33.1$  ml in group A, and  $102.3 \pm 31.2$  ml in group B ( $P > 0.05$ ). Hence, both had comparable pre-operative status.

Various parameters such as color of subdural fluid, subdural fluid pressure, brain expansion, volume of CSDH evacuated, and volume of saline used for irrigation were compared in the two groups [Table 2]. None of these characteristics showed statistically significant difference between both the groups.

**Table 2: Operative characteristics of both the groups**

Characteristics	Group A	Group B
<b>Colour of subdural fluid</b>		
Clear	2	1
Straw	6	7
Engine oil	22	25
Fresh bleed	11	12
Mixture	19	15
<b>Subdural fluid pressure</b>		
Low	4	7
Medium	25	20
High	21	23
<b>Brain expansion</b>		

Readily	29	32
Partial	14	12
None	7	6
<b>Volume of CSDH evacuated</b>	80.4 (29.3)	78.6 (30.5)
<b>Saline used for irrigation</b>	643.6 (317.8)	620.5 (311.9)
<b>Amount of subdural drainage over 48 hours</b>	44.9 (28.6)	--
<b>Residual CSDH in post-operative NCCT</b>	32.8 (17.6)	35.7 (16.8)
<b>Pneumocephalous in post-operative NCCT</b>	11.7 (11.7)	12.7 (10.7)

Complications of burr-hole evacuation of CSDH surgery ranged from seizures to death. In patients of group A, 4 patients showed recurrences, and had to undergo repeat surgery and 2 patients expired during the postoperative period in this group. While in group B patients, 13 patients had recurrences during follow-up and 3 patients expired during the postoperative period. The recurrence between the two groups was statistically significant ( $P < 0.05$ ) though, the difference for mortality in the two groups was statistically not significant ( $P > 0.05$ ).

The potential complications of subdural drain such as intra-cerebral hematoma, seizures, subdural empyema, surgical site infection, and pneumocephalus were compared in two groups and were found not to be statistically significant [Table 3]. One patient in drain group developed tension pneumocephalus (detected on repeat CT scan), in the postoperative period leading to deterioration in his sensorium. This was treated with removal of subdural drain and replacing pneumocephalus with saline through burr-hole and the patient made an uneventful recovery.

**Table 3: Complications encountered in both the groups**

Complication	Group A	Group B
<b>Intra cerebral hematoma</b>	1	1
<b>Residual hemiparesis</b>	3	5
<b>Seizures</b>	3	4
<b>Pneumocephalous with mass effect</b>	2	2
<b>Surgical site infection</b>	5	6
<b>Subdural empyema</b>	-	1
<b>Pulmonary embolism</b>	1	1

Of the 4 recurrences in group A, three patients underwent re-operation once, while one patient was re-operated twice. No patient required more than two re-operations in this group. Among 13 cases of recurrence in group B, 8 patients were re-operated once, 4 patients were re-operated twice, and 1 patient were re-operated thrice or more number of times.

### Discussion

CSDH are common in the elderly, and treatment of CSDHs continues to be a challenge. A history of head injury is present in 60-80% of patients. This variation is possible because of the fact that most head injuries leading to CSDH are trivial; these events are easily forgotten or not actually considered important by patients. In our series, head injury was seen in 65% patients and most of our patients had falls. Similar were the observations in the study by Baechli et al[8].

The existence of a "potential" subdural space has been questioned by many. A continuum of cells has been shown between the dura and the underlying arachnoid layer with no subdural space. A cleavage in the weakest layer of this continuum by blood, leukocytes infiltrates, etc., can result in the formation of CSDH. This cleaved cell layer forms the inner membrane subsequently. This layer has loose junctions between the cells, which is a cause of repeated hemorrhages into the subdural space, and expansion of the hematoma. The outer membrane is formed by the outer-zone of the dura-arachnoid interface. This outer membrane contains blood vessels, smooth muscle cells, red blood cells, eosinophils, collagen fiber, etc., which are not usually found in the normal dural border cell layer. The exact role of all these elements in the evolution and subsequent progression of a CSDH is not yet clearly known.

As the CSDH matures over a period of time the fibrous content increases along with a decrease in the cellular and vascular components. It may also result in some long standing CSDH membranes having calcification. The evolution of the CSDH is probably due to a complex interaction between the CSDH fluid and the outer membrane histology. One of the theories of increase in CSDH is due to the local fibrinolysis resulting in liquification of the clot.

After performing a burr-hole evacuation followed by irrigation of subdural cavity with saline, the rate of reoperation varies between 2.7% and 30%[9]. In our series, the recurrence rate is in accord with results from three prospective studies. Wakai et al. have reported recurrence rates of 5% for the drain and 33% for no drain, and Tsutsumi et al. have reported rates of 3.1% and 17%, respectively[10,11]. Santarius et al. have reported recurrence rate of 9.3% in drain group, and 24% in without drain group of CSDH[12]. In their studies, Okada et al. had found treatment of CSDH, postoperative hospitalization was shorter and the recurrence was less frequent with drainage than with irrigation[13]. The use of a drain drastically reduced recurrences and mortality[14]. Our recurrence rates are very similar to those in the retrospective study by Lind et al., who identified recurrence rates of 10% for the drain and 19% for no drain, and that of Mori and Maeda who showed a recurrence rate of 9.8% for use of drain[15,16]. These results are consistent with a positive effect of drains in prevention of postoperative recurrent collections, and their use could avoid repeated operations and additional time in hospital.

The subdural drain placement increases the approximation of the outer and inner membranes resulting in the obliteration of the subdural space. The increased wash out of the subdural hematoma and reduced fibrinolytic activity also reduces the recollection. The reduced pneumocephalus also contributes to the decreased recollection rates[17].

When a reservoir is inserted to aspirate a recurrent subdural hematoma, the infection rate is 2.1%[18]. In our study, subdural empyema occurred in two patients in "with drain" group and in four patients in "without drain" group. The incidences of other complications like intra-cerebral hematoma formation, residual hemiparesis, seizures, pneumocephalus with mass effect, and pulmonary embolism are comparable in "with drain" and "without drain" group in our study.

### Conclusion

In this study, the recurrence rate of CSDH is significantly lower if subdural drain is inserted after BHD of CSDH, in comparison to those without the use of subdural drain. Hence, we would like to conclude

that the use of a subdural drain reduces the recurrence rate in CSDH without any significant increase in complications and should be routinely placed after BHD.

#### Conflict of interest

None declared by any of the authors

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#### Ethical issues

None

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