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Single Burr Hole and Drainage in Chronic Subdural Hematoma: Outcome in Consecutive 333 Cases

Original Article

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Chronic subdural hematoma (CSDH) is a common neurosurgical disease with incidence 3 in 100,000 in general population. Recorded or trivial head injury is the most common cause of CSDH with several predisposing factors like alcoholism, coagulopathy, seizure disorder, cerebrospinal fluid shunts, metastases and vascular malformations. Bilateral CSDH are common in infants and interhemispheric subdural hematomas are often associated with child abuse. Coagulopathy and intracranial tumors have been associated with spontaneous CSDH. 86 % were males with 47% of CSDH on left followed by 35% in right and 61 cases (18%) were bilateral. The most common age group was 61 to 80 years (45%) followed by the 41 to 60 year group. During admission headache was the most common symptom followed by neurological deficits that include, loss of speech (65%), mono or hemiparesis (20%), quadreparesis (5%), bowel and bladder dysfunction and loss of memory or altered sensorium. Statistical analysis did not show any significant p value between the Age group, Sex, Side of CSDH or chronic alcoholism as independent variables affecting outcome. GCS at admission was the only factor that had significant p value in terms of outcome prediction. Although there are multiple comorbidities associated with CSDH this study found that except GCS there was no relation to age, side, sex, alcoholism, hypertension or diabetes in the outcome after surgery. Meticulous care to remove all the CSDH followed by use of drain is the most efficient way to manage CSDH.

Key Words: burr hole, craniotomy, GCS, headache, subdural hematoma, trauma

Chronic subdural hematoma (CSDH) is a common neurosurgical disease with incidence 3 in 100,000 in general population.[6] Recorded or trivial head injury is the most common cause of CSDH with several predisposing factors like alcoholism, coagulopathy, seizure disorder, cerebrospinal fluid shunts, metastases and vascular malformations.

Although surgery is the primary modality of treatment there have been various reports of it being successfully managed conservatively.[10,33] The choice of surgical

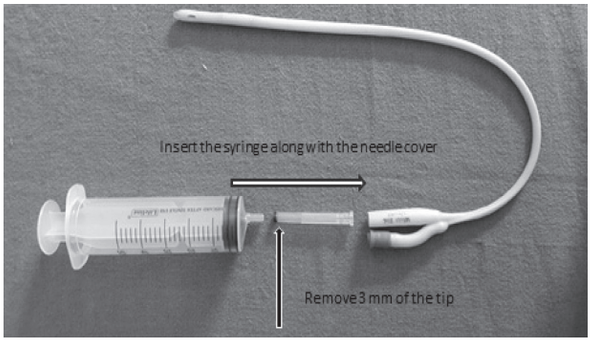

Figure 1: Showing the method innovated by the senior author using a Foleys and modified needle cover for irrigation

procedure is surgeon variable and the common ones being, single or double burr hole drainage with or without a drain or irrigation, twist drill craniostomy, mini-craniotomy, endoscopic removal and subduro-peritoneal shunt.[3,17,20,25-27]

The prognosis of CSDH after surgery is relatively good with recurrence rate between 3 to 34%.[12] The factors associated with increase in recurrence are incomplete removal, pneumocephalus, membrane formation and coagulopathy. Interestingly one study found no relation in post-operative recurrence in surgery performed by either senior or junior surgeons.[24]

Materials and Methods

This is a retrospective single center study of CSDH cases from January 2010 to April 2016. All operated cases of CSDH unilateral or bilateral were included in the study. Epidemiological and demographical data like age, sex, mode of injury if recorded, alcohol intake, co-morbid conditions, side of hematoma, admission Glasgow coma scale (GCS) and GCS at discharge were noted. The outcome of surgery for CSDH is good and therefore the GCS was dichotomized into good (GCS-15) or poor prognosis (GCS-12-14) and this was used to calculate the final outcome and interrelationship between variables.

Surgical procedure

All the procedure was performed by the first author. Under general anesthesia the head was rotated to the opposite side and a single parietal burr hole was performed. Care was taken in the elderly with stiff neck. The dura was coagulated with monopolar and opened in a cruciate manner. With the suction at the dural level the CSDH was sucked till the level was below dura and then the edges coagulated till bone edge. A self innovated (The outer cap of a needle was taken and 3 mm cut off its tip. This is then reversed and inserted into the Foley catheter

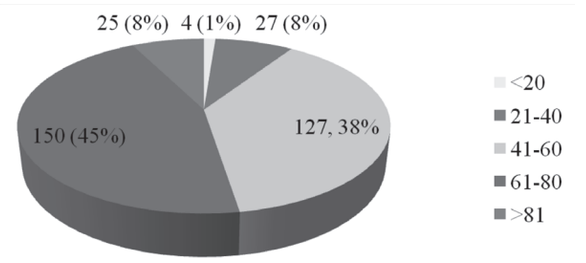

Figure 2: Age group in years

used for drainage. Number 10 Foleys if thin or number 12/14 was used if large CSDH was present) irrigation catheter was introduced and the cavity washed in all direction till the return was clear **(Figure 1)**. The subdural space was continuously irrigated to prevent air trapping followed by a subperiosteal closed suction drain insertion. The head was rotated and the same procedure repeated in opposite side if bilateral. Postoperatively the patient was kept in head low position on a soft pillow for 48 hours following which the drain was removed and the patient ambulated. The drain was clamped during mobilization for meals or visiting restroom. Sutures were removed on 7th postoperative day and discharged. All were followed at 2 weeks, 2 months and one year post surgery. No prophylactic anti-epileptic drugs were used and the latter started if there was postoperative seizure or there was history of seizure.

Statistical analysis

Chi-square test was used for checking the association for the outcome variables. A $P < 0.05$ was considered as statistically significant. Standard deviations, and medians were reported for interval variables, and percentages were reported for categorical variables. Statistical analyses were conducted with SPSS statistical package (version 16.0; SPSS Inc, Chicago, IL, USA).

Results

A total of 333 cases were included in this study. This is 13% of all the neurosurgical cases operated during the same interval. Six cases which were managed conservatively were excluded from the study. 86 % were males with 47% of CSDH on left followed by 35% on right and 61 cases (18%) were bilateral. In the majority of cases the precipitating factor was unknown (64%), followed by fall (25%) and road accidents in 8%. Chronic alcoholism was found in 34% of cases. The most common age group was 61 to 80 years (45%) followed by the 41 to 60 years group (S.D .798). Four cases were below 10 years and 25 cases were above 81 years of age.

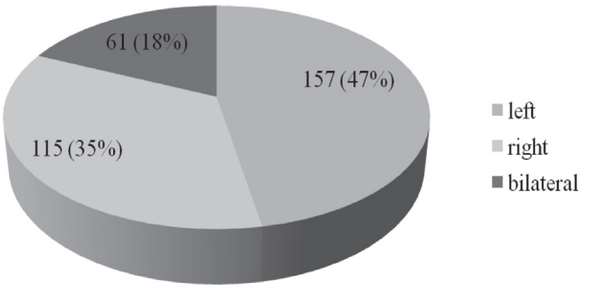

Figure 3: Side of the injury

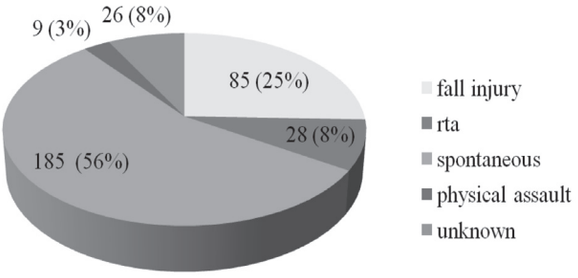

Figure 4: Mode of injury among the patients

During admission headache was the most common symptom followed by neurological deficits that include, loss of speech (65%), mono or hemiparesis (20%), quadreparesis (5%), bowel and bladder dysfunction and loss of memory or altered sensorium. Interestingly 80% of the cases were admitted through the emergency and only 20 % visited the outpatient clinic. The most common morbidity associated with CSDH was hypertension either isolated (8%) or along with diabetes (10 %). The other association was with diabetes, liver disease, seizure, Parkinsonism and operated cases of malignancy/ craniotomy **(Figure 2-6)**.

The cases were divided into two groups on the basis of GCS as either poor outcome (GCS-12-14) or good outcome (GCS>15) and interrelated variables calculated. Statistical analysis did not show any significant p value between the Age group, Sex, Side of CSDH or chronic alcoholism as independent variables affecting outcome. GCS at admission was the only factor that had significant p value in terms of outcome prediction. Each of these variables did not correlate significantly with either the GCS at admission or discharge **(Table 1 and 2)**.

There were only 4 cases of recurrence (2 cases had pneumocephalus, 1 case had trauma and 1 case there was residual collection. Of total, 323 cases had a GCS of 15 at discharge. Craniotomy was done in the case of trauma to remove the acute component of the blood. Follow up is from 2 months to 5 years.

Discussion

CSDH is one of the most common intra-cranial hematoma with an incidence of 3/100,000 in average population and 58/100,000 in those above 70 years of age. [28] CSDH is usually found in the elderly wherein the age related cerebral atrophy leads to shrinking of the brain and thus tension on the bridging veins which rupture with minor trauma. The low pressure venous bleed leads to slow enlargement of the subdural hematoma before clinical signs appear. Small CSDH can spontaneously resorb but the majority of them will need surgical intervention. Although termed subdural, the presence of subdural space is a question in itself. Presence of a layer of cells in direct contact between dura and the arachnoid has been found and a cleavage in this plane leading to CSDH has been postulated.[28]

With time CSDH tends to organize and form capsulated thick membranes which either cover or lead to multiple loculations. [29] The membrane then tends to neovascularize leading to repeated bleeding and further expansion of the hematoma. The other causes of expansion of CSDH could be due to development of an osmotic gradient drawing

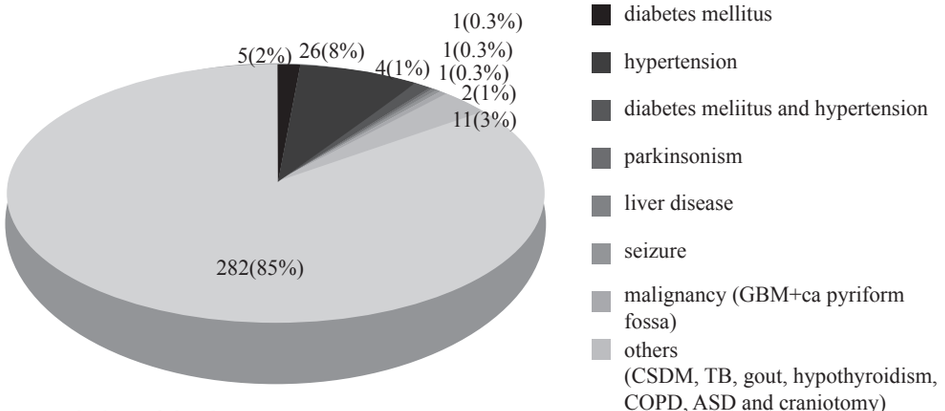

Figure 5 : Comorbidity of the disease

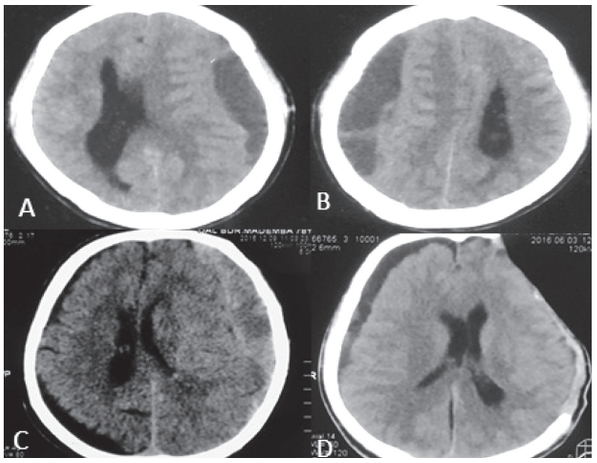

Figure 6: Showing the types of CSDH, A. chronic left sided, B. chronic right sided, C. left side acute on chronic along with subdural hygroma on right side and D. subdural hematoma in a case of decompressive craniotomy

more fluid, active coagulation and fibrinolysis within the hematoma or elevated levels of tissue plasminogen activator. [5, 15, 16] In later stages the membrane may calcify. As the hematoma size increases it reaches appoint where the compensatory mechanism fail and clinical signs start to present. The blood flow to the thalamus and basal ganglia are particularly affected leading to spread of neural depression and thus deficits. A 7% reduction of cerebral blood flow to these areas was associated with headache and 35% with hemiparesis.[31]

The causes of CSDH include, trauma, acute subdural hematoma or idiopathic. The factors that increase the risk of CSDH are chronic alcoholism, epilepsy, coagulopathy, arachnoid cysts (age <40 years), anticoagulant therapy (including aspirin), cardiovascular disease (eg, hypertension, arteriosclerosis), thrombocytopenia, spinal anesthesia, cerebrospinal shunt procedures, severe dehydration and Diabetes mellitus.[19,11,18,34] Bilateral

Characteristics	**Categories**	**GCS at admission**		**p value**	**Remarks**
		Poor prognosis(<14)	Good prognosis(>=14)		
Sex	male	76	210	0.174	NS
	female	17	30		
	Total	93	240		
side	left	52	105	0.071	NS
	right	27	88		
	bilateral	14	47		
	Total	93	240		
h/o alcoholism	yes	35	78	0.375	NS
	no	58	162		
	Total	93	240		
Characteristics	**Categories**	**GCS at discharge**		**p value**	**Remarks**
		Poor prognosis(<14)	Good prognosis(>=14)		
Sex	Male	10	276	0.213	NS
	Female	0	47		
	Total	10	323		
h/o alcoholism	Yes	3	110	0.543	NS
	No	7	213		
	Total	10	323		
	Total	10	323		
Characteristics	**Categories**	**GCS at discharge**		**P value**	**Remarks**
		Poor prognosis(<14)	Good prognosis (>=14)		
GCS at admission	Poor prognosis	10	83	0.000	S
	Good prognosis	0	240		
	Total	10	323		

Table 1: Table showing the relation of different characteristics with the dichotomized GCS (Poor v/s good outcome) at admission and discharge

Characteristics	Categories	GCS at admission		
		Poor prognosis	Good prognosis	
Age group in years	<20	1	3	
	21-40	5	22	
	41-60	33	94	
	61-80	47	103	
	>80	7	18	
	Total	93	240	
Mode of injury	fall injury	17	68	
	RTA	9	19	
	Spontaneous	41	144	
	physical assault	0	9	
	Unknown	26	0	
	Total	93	240	
Comorbidity	diabetes mellitus	1	4	
	Hypertension	0	26	
	DM and HTN	0	4	
	Parkinsonism	0	1	
	liver disease	0	1	
	Seizure	0	1	
	malignancy (GBM+ca pyriform fossa)	0	2	
	others(CSOM, TB, gout, hypothyroidism, COPD,ASD and craniotomy)	0	11	
	None	92	190	
	Total	93	240	
Characteristics	Categories	GCS at discharge		
		Poor prognosis		Good prognosis
Age group in years	<20	0		4
	21-40	0		27
	41-60	5		122
	61-80	3		147
	>80	2		23
	Total	10		223
Side	Left	8		149
	Right	0		115
	Bilateral	2		59
	Total	10		323
Mode of injury	fall injury	0		85

	RTA	0		28
	Spontaneous	0		185
	physical assault	0		9
	Unknown	10		16
	Total	10		323
Comorbidity	diabetes mellitus	0		5
	Hypertension	0		26
	DM and HTN	0		4
	Parkinsonism	0		1
	liver disease	0		1
	Seizure	0		1
	malignancy (GBM+ ca pyriform fossa)	0		2
	others(CSOM, TB, gout, hypothyroidism, COPD,ASD and craniotomy)	0		11
	None	10		272
	Total	10		323

Table 2: Table showing the clinical presentation at admission and outcome at discharge using the dichotomized GCS (Poor v/s good outcome)

CSDH are common in infants and interhemispheric subdural hematomas are often associated with child abuse.[7,8] Coagulopathy and intracranial tumors have been associated with spontaneous CSDH.[4,13,19,21] In this study we also found the association of hypertension, diabetes, previous surgery and Parkinson's disease associated with CSDH but they were all statistically insignificant causes.

The presenting symptoms are depending on the site and size, confusion or coma, altered memory, speaking or swallowing problems, gait abnormalities, decreased mentation, headache, seizures and bowel or bladder incontinence. Computed tomogram (CT) or magnetic resonance imaging remains investigation of choice along with full hematology and biochemistry study to rule out comorbid conditions. CT is sufficient for diagnosis and it can present as hypo, iso or hyper dense lesion depending on the chronicity of the subdural blood. Repeat trauma can lead to mixed findings. CSDH Classically SDH has been defined as acute (<7 days), Sub-acute (7-21 days) or CSDH (>21 days) **(Figure 2)**. The most common feature to be distinguished from is the subdural hygroma which probably form after a tear in the arachnoid allows Cerebrospinal fluid to collect in the subdural space. Measuring the Hounsfield or getting an MRI can distinguish the two as hygromas rarely need any further treatment.

Management includes most often surgery but conservative treatment can also be tried. The morbidity and mortality rates in surgery for CSDH are around 2-11% and 1-5%, respectively. 86% -90% of patients with CSDH are adequately treated after a single surgical procedure. The choice of surgical procedure is surgeon variable and the common ones being, single or double burr hole drainage with or without a drain or irrigation, twist drill craniostomy, mini-craniotomy, endoscopic removal and subduro-peritoneal shunt. In all our cases single burr hole along with irrigation and a subperiosteal drain was used. With this we have had a very low recurrence rate (4/333 cases). Although two burr hole have been advised in large CSDH we have not found it necessary.

There are many studies dealing with outcome of each individual method of treatment but most of them including systemic review and meta-analysis have failed to show any single procedure as the best. [112,23] In the largest meta-analysis of 34,829 cases it was shown that whatever the primary procedure the use of drains resulted in lesser recurrence and craniotomy was better for recurrent cases.[2] They also did not find any difference in performing the procedure at bedside or in the operating room (RR, 0.69; 95% CI, 0.46-1.05; P = 0.09), morbidity (RR, 0.45; 95% CI, 0.2-1.01; P = 0.05), cure (RR, 1.05; 95% CI, 0.98-1.11; P = 0.15), and recurrence rates (RR, 1; 95% CI, 0.66-

1.52; P = 0.99). Steroid did not improve outcome the use of drains resulted in a significant decrease in recurrences (RR, 0.46; 95% CI, 0.27-0.76; P = 0.002). Benefit of drain was shown in another series where 89.4% of patients with CSDH who were treated with a closed drainage system had a good recovery while 2.2% worsened.[22] The benefit of drain is also seen in this study where there were only 4 cases of recurrence (1.2%) (2 cases had pneumocephalus, 1 case had trauma and 1 case there was residual collection. There was no morbidity or mortality associated except for 1 case of superficial wound infection. In comparison with another large series (365 cases from a 15 year study) from Nepal, the majority of the cases were operated in local anesthesia and the center had not used drainage in most of the cases. With their method the authors have shown that the results were beneficial with 6.3 % morbidity and 1.4% mortality.[17] They had also used steroids to an extent of 32%. The common postoperative complications are pneumocephalus, residual CSDH, seizure, infection and ipsilateral or contralateral epidural hematoma.[28]

In comparison with acute subdural hematoma there are no clear prognostic factors associated with CSDH. Preoperative neurological level and early diagnosis may correlate with a more favorable prognosis. Preoperative CT findings have no relation with postoperative outcome. The mortality rate is between 3.2-6.5% at 1 month with more than 80% reaching their pre-CSDH level of function. Sixty-one percent of patients aged 60 years or younger and in 76% of patients older than 60 years have favorable outcomes. Older age group, pre-existing cerebral infarction, presence of subdural air after surgery correlated with poor brain expansion and higher recurrence.[29] The presence of comorbidities (dementia, history of ischemic stroke), psychiatric disorders, patient age, reoperation for recurrence, and preoperative mRS score were also associated with poorer outcome.[1] The size of CSDH, use of anticoagulants, hematoma thickness / radiological findings does not affect the outcome.30 Non-operative management is another option for the high risk cases or those whom are asymptomatic. Female patients, less midline shift, less density (Hounsfield units) and the use of steroids systemically or local application have been shown to benefit in these cases.[32, 35] Middle cerebral artery embolization is one of the latest methods of treating recurrent CSDH successfully.[14] In this study too we did not find any correlation of admission age, sex, side, comorbidity or alcoholism with the final outcome.

Conclusion

CSDH is a common neurosurgical entity which can be managed with minimal morbidity or mortality. Any of the aforementioned methods of surgery can be used with good outcome. In high risk cases or completely asymptomatic cases conservative management can be tried. Although there are multiple comorbidities associated with CSDH this study found that except admission GCS there was no relation to age, side, sex, alcoholism, hypertension or diabetes in the outcome after surgery. Meticulous care to remove all the CSDH followed by use of drain is the most efficient way to manage CSDH.

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