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Analysis of risk factors predicting recurrence of chronic subdural hematoma

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Recurrences after evacuation of chronic subdural hematoma are seen in 2-33% of cases with various surgical approaches. Various demographical, clinical, radiological, surgical and postoperative management strategies have been explored as the possible predictors of recurrence.

We performed a retrospective analysis in 160 patients with chronic subdural hematoma with an aim to analyze the post-operative recurrences and factors associated with it. Various socio-demographic and clinico-radiological parameters were studied against the rate of recurrence after surgery using Chi square/Fischer Exact Test. Factors showing significant association on univarate analysis were then analysed using binary logistic regression.

The rate of recurrence of CSDH in our study was 5% and the mean duration of recurrence was 33 days. Chronic alcohol use (p=0.007) and intraoperative brain expansion ((p=0.001) were the two factors associated with recurrence of CSDH. On binary logistic regression chronic alcohol use (wald-6.467, p=0.011) and intraoperative brain expansion (wald= 6.674, p=0.010) were both associated significantly with recurrence of CSDGH with an odds of 7.804 and 0.058 respectively.

Keywords: Subdural hematoma, trauma, recurrence

Chronic subdural hematoma (CSDH) is one of the commonest neurosurgical diseases with an annual incidence of 5 per 100,000 in general population and 58 per 100,000 in those above 70 years of age.[6]Although surgery and evacuation is the most preferred treatment, controversy lies in defining the ideal surgical methods and various ways to decrease recurrence. Recurrences have been reported from as low as 2.3% to as high as 33% with various surgical approaches.[2,5]Surgical approaches to CSDH vary from minimally invasive twist drill craniostomy and single or multiple simple burr hole drainage to more aggressive craniotomies with or without membranectomies. Various demographical, clinical, radiological, operative methods and postoperative management strategies as possible predictors in recurrence in CSDH have been explored; however, the results have been very inconsistent. In this retrospective analytical study we aimed to study the various predictors for recurrence of CSDH in our settings using single burr-hole drainage under local anaesthesiawith dural eversion technique as the sole surgical approach.

Methods

This retrospective study included 160 patients who underwent surgery for CSDH in National Institute of Neurological and Allied Sciences in Nepal, one of the tertiary care centre of the country dedicated solely to neurosurgical care. After approval of the Institutional Ethical Committee, we performed a retrospective chart review of all the patients who underwent surgery for CSDH within April 2009 to April 2014. Various Socio-demographic factors (age, gender, use of alcohol etc.), clinical factors (presenting symptoms, past history of trauma, use of anticoagulants or antiplatelets, coagulation profile, presentation GCS etc.), radiological factors (hematoma density on CT scan, Midline shift), operative findings (Brain expansion at the end of surgery, presence of neomembrane) and outcome was analysed against the rate of recurrence. The hematoma density on CT scan was defined as isodense, hypodense, hyperdense or mixed density and the midline shift was categorized as less than 10mm and more than or equal to 10mm as per the findings. Glasgow outcome scale was dichotomized as favourable GOS (4 and 5) and Unfavourable GOS (1-3) for the convenience of analysis.

A single burr hole craniotomy was made at the most dependent site for all patients under local anesthesia. Dura wasopened in a cruciate fashion and the dural edges were everted and tucked up with the pericranium. Presence or absence of membrane was noted and the CSDH was evacuated with gentle irrigation with normal saline till the egressing fluid was clear and the underlying brain was clearly visible. Presence of absence of re-expansion of brain to the surface after evacuation of subdural hematoma was noted by the operating surgeon. A watertight closure of galea and skin was performed after the procedure. Postoperatively the patient was kept supine with head flat for 48 hours. Intravenous dextrose and corticosteroids were used postoperatively only in those patients who had membrane and non-expansion of brain. Those patient who had been on anticoagulants or antiplatelets were screened for coagulation abnormality which included prothrombin time(PT), activated partial thromboplastin time (aPTT), bleeding time (B.T), clotting time (C.T) and platelet counts. Any abnormalities seen in the basic coagulation profiles were reversed before taking up the patient for surgery.

Recurrence was defined as any documented recollection of hematoma at the site of operationwhich required re-evacuation. Patients were followed up in the outpatient department at 2 weeks and at 3 months. CT scan was performed routinely at 3 months for all patients except in those where early scans were warranted by deteriorating neurological status on follow up.

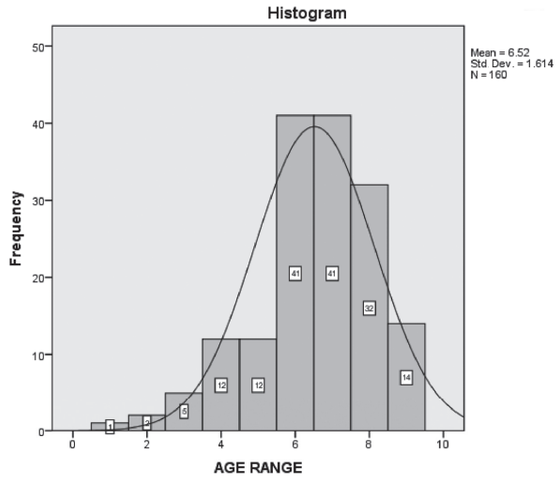

Figure 1: Age distribution of patients with chronic subdural hematoma

All the continuous and categorical variables were tested for association with recurrence using t test and chi square test (Fischer Exact where Chi square was not feasible) respectively. A multivariate analysis using binary logistic regression model as performed with those variables found to have significant association ($p<0.05$) with recurrence on univarate analysis. The result is presented in terms of an odds ratio (OR) and a 95% confidence interval.

Results

The mean age of the patient included in this series was 60.93 years and most of them comprised of males (80.6%). The incidence of CSDH was noted highest in 6th and 7th decades of life (25.6% each) **(Figure 1)**.

Headache and focal deficits (65% each) were the most common presentations (Table 1).

Presentation Features	Frequency	Percentage
Headache	104	65
Focal Deficits	104	65
Vomiting	56	35
Altered Sensorium/ LOC	42	26.3
Urinary Incontinence	49	30.6
Seizure	9	5.6

Table 1. Clinical Presentation of patients with CSDH

Clinical Parameters	Total	NRG	RG	P value
Age (Mean, SD)	60.93 (16.22)	60.48 (16.34)	69.38 (11.48)	0.131
Gender Male Female	 129 (80.6%) 31 (19.4%)	 123 (95.3%) 29 (93.5%)	 6 (4.7%) 2 (6.5%)	0.653
Admission GCS <8 9-12 13-15	 2 (1.2%) 9 (5.6%) 149 (93.1%)	 2 (100%) 8 (88.9%) 142 (95.3%)	 0 (0%) 1 (11.1%) 7 (4.7%)	0.442
Previous Head Trauma Yes No	 86 (53.8%) 74 (46.2%)	 81 (94.2%) 71 (95.9%)	 5 (5.8%) 3 (4.1%)	0.726
Duration from trauma (Mean/ SD)	25.91 (38.03)	25.86 (38.39)	26.75 (32.67)	0.949
Alcohol Use Yes No	 31 (19.4%) 129 (80.6%)	 26 (83.9%) 126 (97.7%)	 5 (16.1%) 3 (2.3%)	0.007*
Anticoagulants/Antiplatelets Yes No	 20 (12.5%) 140 (87.5%)	 19 (95%) 133 (95%)	 1 (5%) 7 (5%)	1.000
Abnormal Coagulation Profile Yes No	 11 (6.9%) 149 (93.1%)	 11 (100%) 141(94.6%)	 0 (0%) 8 (5.4%)	1.000
Hypertension Yes No	 57 (35.6%) 103 (64.4%)	 55 (96.5%) 97 (94.2%)	 2 (3.5%) 6 (5.8%)	0.713
Diabetes Mellitus Yes No	 26 (16.2%) 134 (83.8%)	 25 (96.2%) 127 (94.8%)	 1 (3.8%) 7 (5.2%)	1.000
Glasgow Outcome Scale (GOS) Unfavorable Favorable	 3 (1.9%) 157 (98.1%)	 3 (100%) 149 (94.9%)	 0 (0%) 8 (5.1%)	1.00

Table 2.Result of univarate analysis among clinical parameters

History of recent head trauma was found in 86 (53.8%) of cases and the mean duration of trauma to surgery was 25. 91 days. Fall was the most common mode of trauma (48, 30%) followed by road traffic accident and trivial traumas (15,9.4% each). Assault was noted in 5.6 % of cases. Hypertension and Diabetes were seen in 35.6% and 16.2% of cases respectively. There was history of use of anticoagulants or antiplatelets in 12.5% of cases while only 6.9% had abnormal coagulation profile noted. Chronic use of alcohol was seenin 30 (18.8%) patients with chronic subdural hematoma.Unfavourable outcome was noted in 3 (1.9%) cases and among them 1 patient died within 14 days of surgery, 1 was discharged after 2 months on persistent vegetative stage and 1 had severe disability. All these patients on review had low admission GCS (3, 6 and 8 respectively) with abnormal papillary reaction. The patient who died in our series had chronic renal disease and died due to multiorgan failure.

Variables	Total	NRG	RG	P value
SDH Density				
Iso	11 (6.9%)	9 (81.8%)	2 (18.2%)	0.143
Hypo	124 (77.5%)	119 (96%)	5 (4%)	
Mixed	25 (15.6%)	24 (96%)	1 (4%)	
Side				
Unilateral	136 (85%)	128 (94.1%)	8 (5.9%)	0.607
Bilateral	24 (15%)	24 (100%)	0 (0%)	
Midline shift				
<10mm	79 (49.4%)	75 (94.9%)	4 (5.1%)	1.000
≥10mm	81 (50.6%)	77 (95.1%)	4 (4.9%)	
Brain Expansion				
Yes	110 (68.8%)	109 (99.1%)	1(0.9%)	0.001*
No	50 (31.2%)	43 (86%)	7 (14%)	
Membrane				
Yes	90 (56.2%)	84 (93.3%)	6 (6.7%)	0.467
No	70 (43.8%)	68 (97.1%)	2 (2.9%)	

Table 3 shows various preoperative CT findings and intra operative factors affecting the recurrence.

Variables	B	Wald	Sig	Odds Ratio	95% CI
Alcohol use	2.055	6.467	0.011	7.804	1.602 – 38.025
Brain expansion	-2.850	6.674	0.010	0.058	0.007-0.503

Table 4: Results of logistic regression

Out of 160 patients evaluated in this study, 8 (5%) had at least one recurrence. There were no cases in series having more than one recurrence. The mean duration of recurrence was 33 (26.16 SD) days and ranged from 9days to 3 months.Various clinical parameters with respect to recurrence and non recurrence groups are tabulated in Table 2.

Alcohol use (p=0.007) and absence of intra-operative brain expansion (0.001) were the only two variables which showed statistically significant association with recurrence of chronic subdural hematoma.These variables were further subjected to binary logistic regression which indicated that both chronic alcohol use (Wald=6.467 p=0.011) and intraoperative brain expansion (Wald=6.674, p=0.010) showed significant association with recurrence of chronic subdural hematoma. The odds ratio (OR) for chronic alcohol use was 7.804 (95%CI: 1.602-38.025) suggesting that there was almost seven times increase in incidence of recurrence with increase in incidence of chronic alcoholism. Similarly the odds ratio (OR) for intraoperative brain expansion was 0.058 (95%CI: 1.258-4.562) suggesting a negative odds of recurrence with brain expansion(Table 4).

Discussion

Chronic subdural hematomais one the commonest neurosurgical conditions which is generally considered benign in terms of its clinical course and prognosis. While there is no doubt about the role of surgery as its treatment of choice, the procedure of choice remains controversial till date. Recurrence associated with this condition remains the centre point around which all the existing controversy revolvestill date. Recurrences have been reported from as low as 2.3% to as high as 33% with various surgical approaches.[2,5,19]Surgical approaches to CSDH vary from minimally invasive twist drill craniostomy and burr hole drainage to more aggressive craniotomies and

membranectomies. However, burr hole drainage has been found to be superior amongst the other approaches in terms of lower recurrence rate and complications.[24] In our series, we noted 5% recurrence with single burr hole craniotomy and dural eversion technique. In fact the senior author (Devkota UP) has endorsed this technique ever since 1989 and reported the recurrence to be consistently below 6%.[3,4] Postoperative drainage was the only auxiliary procedure that had some significant role in reducing the recurrence after CSDH evacuation, however we do not use postoperative drainage as this has not affected much in our recurrence so far.[18]

Our goal in this study was to study the factors predicting recurrence of chronic SDH in our setting using univarate and multivariate regression analysis. The role of advancing age in prediction of recurrence has been supported by some authors[15,16] in the literature while others[10,12,14,25] have different opinion. Our study also found no significant association between age and recurrence of CSDH. The incidence of chronic SDH is reported to be higher in male in comparison to females. In our study the male: female ratio is 4.16:1 and is consistent with the literature.[22] The higher incidence in male can be explained by the literature evidence of males being more inclined to trauma. However no significant association between gender and recurrence was seen in our study which is also in agreement with the literature.[10,14]

Trauma was seen in almost half of the patients in our series. Past trauma is one of the most common etiologies of CSDH mentioned in the literature.[17,22,25]Few authors believe that shorter trauma to surgery duration is associated with higher recurrence rate.[21]Nakaguchi and his colleagues explained this situation through the existence of a limited hematoma organization at an early stage with immature fibrosis in new membranes and hyperfibrinolytic activity.[12] However others along with our series have found no significant association between trauma and recurrence or between duration of trauma to surgery and recurrence.[1,10,25]

There are an inadequate number of studies in the literature on whether hypertension affects recurrence in patients with CSDH. Few studies have observed that hypertension does not have any effect on recurrence as in our study.[22] Capillary vasculopathy is a common pathology in diabetes and should be predisposing to hematoma formation through damaged microvessels in the neomembrane. However the was no significant association of diabetes with recurrence in our study. Torihashiet al[22] and Yammamoto et al[25] have mentioned that viscosity increases in diabetic patients, trigerringplatelet aggregation, coagulation and decrease the risk of hematoma.The use of antiplatelets or anticoagulants is of concern in chronic SDH as most of the patients with CSDH are of older age group and under these medications for various problems. Our study shows no definite association with use of this medications or coagulopathy with rate of recurrence of chronic SDH as in other studies.[8,21,22] This may be due to the fact that almost half of the patients under these medications are found to have normal coagulation profile. Those with inadequate coagulation profile are almost always tackled with after proper correction of the coagulation deficit. Torihashietal[22] determined that PT/INR value was adequate in 1/3 of the patients using anticoagulants in non-recurrent cases.

Admission GCS and GOS at discharge did not have any association with recurrence in our study. Similarly, there was no significant difference in admission GCS in between the recurrence and non recurrence group. AAmirjamshidi et al[1] however have found significant association between admission GCS and GOS at discharge with recurrence of CSDH. Their series had higher number of patients with lower GCS in contrast to our study.

In our series none of the radiological parameters like midline shift more than or equal to 10mm, bilaterality or hematoma density had any significant association with recurrence. Density of hematoma had no association with recurrence in some study[25] while few others[1,14] mentioned high density hematoma to have significant association with recurrence. Our series did not have any case of high density hematoma in CT scan and this may well explain the no association of hematoma density with recurrence. Midline shift has not been found to have any association with recurrence in most of the previous studies as well as our study.[13,14,25] Bilateral CSDH has been described as important predictor of recurrent CSDH by many studies.[7,13] This is due to the fact that bilateral CSDH are associated with higher incidences of brain atrophy. Others have discussed that bilateral CSDH also occurs commonly in patients with abnormal coagulation profile and thus leading to higher incidences of recurrences.[11] In our series the incidence of bilateral hematoma was very low than other series (15%) and there was no recurrences at all in bilateral CSDH.

The only factors found to have significant association with recurrence of CSDH were intraoperative impression of brain expansion and chronic alcohol use. While alcohol had positive predictive effect on recurrence of CSDH (OR 7.804), intraoperative brain expansion showed a negative predictive effect on recurrence (OR 0.058). Alcoholism is well known to be associated with CSDH. Higher trauma rate, brain atrophy, and coagulopathy due to hepatic

derangement are the most likely cause of higher incidence of alcohol associated with CSDH and CSDH recurrence after surgery.[4,20]

Non expansion of brain is the center point in etiology of recurrence of CSDH after surgery. This is because the persistence of enlarged subdural space creates a potential site for re-accumulation of hematoma.[16] Non expansion and thus recollection of hematoma is the most important cause in recurrence of hematoma in cases of brain atrophy, bilateral CSDH, large hematoma cavity etc. Fukuhara T et al[3] has observed that brain with higher surface elastance re-expands poorly. Factors of elastance were considered to be the compressibility of cerebrovascular volume, the meningeal membranes and the subpial brain tissue.[23] Presence of organized neomembranes, longer duration of compression by CSDH, age of the patient, and decrease of cerebral blood flow in CSDH patients were some of the important factors determining brain expansion in CSDH.[9]

Conclusion:

Absence of intra-operative brain expansion post CSDH evacuation and chronic alcohol use were found to be the important predictors of recurrence of CSDH in our setting.

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