Original Article

Determinants and outcomes in relation to day of ambulation following evacuation of chronic subdural haematoma

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Abstract

Background: Burr hole evacuation remains a widely accepted and effective treatment for chronic subdural haematoma (CSDH). Historically, patients are nursed in the supine position during the immediate postoperative period and mobilised later. The determinants of the timing of ambulation, and its relationship with recurrence and clinical outcomes, remain inadequately characterised in our setting. This study aimed to evaluate the factors influencing the day of ambulation and to examine its association with outcomes following burr-hole evacuation of chronic subdural haematoma.
Methods: We retrospectively assessed all patients who underwent burrhole evacuation of CSDH over 19 years. Data was obtained from a computerised log of patients' records, categorised based on the day of ambulation and outcomes were documented in terms of absence or presence of complications.
Results: Among 150 patients studied, there was no significant difference in demography between the different ambulation groups. The mean age was 60.28 years, and the male-to-female ratio was 4.2:1. Haematoma location, volume, brain expansion, and presence of membranes did not significantly impact the day of ambulation. Recurrence and wound breakdown were observed to be more in patients who were ambulated ≥7 days post op. One patient died.
Conclusion: The determinants of the day of ambulation include preoperative neurological status, age, comorbid conditions, postoperative complications, and institutional protocol. Ambulating patients 48 hours postoperatively appears safe with low recurrence.

Keywords: Chronic subdural haematoma, ambulation, determinants, outcome

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INTRODUCTION

Chronic subdural haematoma (CSDH) was first described by Wepfar in 1657 and has remained a common condition seen in neurosurgical practice.[1] It is a disease pathology frequently seen in the elderly with an annual incidence rate of 8-58.1/100,000 population.[2]. With changing demographics, improving life expectancy, and a rising elderly

population worldwide, it is expected that the incidence of this disease will increase.[3,4]

The treatment of CSDH has evolved over the years, but surgical evacuation remains the first line in the treatment of CSDH.[5] With several surgical methods available, the optimal method for CSDH drainage remains equivocal. These methods include burr hole craniostomy, twist drill craniostomy, craniotomy, and embolization of the middle meningeal artery.[6,7] Burrhole craniostomy and haematoma drainage have been widely used as effective surgical management of CSDH.[8]

One of the common complications following the evacuation of CSDH is recurrence, with a reported rate ranging from 2-37%.[9,10] Numerous factors have been associated with the recurrence of CSDH. These include male sex, advanced age, bilateral haematoma, moderate or severe brain atrophy, coagulopathy, alcohol abuse, haematoma density, diabetes mellitus, arachnoid cyst, inflammatory cytokines, technical aspects of surgery, postoperative subdural air accumulation, and postoperative posture.[11-13]

Historically, patients with CSDH were nursed in the supine position in the immediate post-operative period because this was thought to aid brain expansion, thereby reducing the risk of recurrence. [14,15] Some recent reports, however, suggest that assuming a head-up position early in the post-operative period does not increase the risk of haematoma recurrence.[16-18] This is not without conflict.[19]

There are no clear-cut studies in the literature that have carried out direct, multivariable analysis of patient-level predictors of the actual day of first ambulation after CSDH surgery. Most papers either set a protocol as to the day of ambulation and measure outcomes or study predictors of recurrence or outcome without time to ambulation as the dependent variable.[10-13,17,18-21]At the inception of our unit, the standard protocol recommended ambulation on the 10th postoperative day. This has undergone progressive modification, first to the 7th postoperative day and, more recently, to the 5th postoperative day. However, in selected cases, earlier ambulation was undertaken based on intraoperative findings or instances of patient non-compliance with the prescribed protocol. We therefore sought to evaluate some of the factors that influenced the decision to ambulate earlier and their relationship with clinical outcome following burr hole evacuation of CSDH.

PATIENTS AND METHOD

This was a retrospective observational study of all patients who underwent surgery for CSDH at the Neurosurgical unit of the University of Benin Teaching Hospital over 19 years, from June 2006 to May 2025. The patients were admitted via the Accident and Emergency Department, outpatient clinics, or were referred from the Neurology unit. Clinical diagnosis was made after a detailed neurological examination. Radiological diagnosis was usually made by cranial computerised tomography scan (CT scan) or magnetic resonance imaging (MRI). Only patients managed operatively were included in this study.

Data were obtained from a computerised log of case file records. These included demographic, clinical, and radiological profiles. During the study period, 511 patients underwent surgical procedures. However, complete data were available for only 150 patients.

In all patients, we performed burr hole evacuation of the haematoma without postoperative closed system drainage. Surgery was performed either by a senior registrar or consultant. Single or double burr holes were sited at the discretion of the attending surgeon. Burr holes were made using a Hudson brace and perforator. The subdural space was copiously irrigated with warm antibiotic-impregnated saline until the effluent was clear. They were nursed flat immediately post-operatively on our neurosurgical wards until mobilised, except for a few ill patients who were admitted to the intensive care unit (ICU). Postoperative cranial CT scans were not routinely done.

Following burr hole evacuation, patients were ambulated after a variable period between the

5th and 10th postoperative day as a standard departmental protocol at the time. This could vary depending on intraoperative findings such as rapid brain expansion. Some patients were not compliant with prescribed postural treatment and ambulated earlier. No patient was ambulated immediately or on the same day postoperatively. CSDH was considered to have recurred when neurologic symptoms reappeared. Radiological recurrence was only confirmed after clinical diagnosis was made.

The unit's protocol initially recommended ambulation by the tenth postoperative day; this was subsequently revised to the seventh, then fifth postoperative day, with further delays considered based on intraoperative assessment of brain re-expansion. Recent literature, however, supports earlier mobilisation, as early as postoperative day two.[21] Patients were therefore categorised into four groups according to the timing of ambulation: Group 1 (days 1–2), Group 2 (days 3–4), Group 3 (days 5–6), and Group 4 (≥7 days), to evaluate differences in clinical outcomes.

Data were analysed using STATA software version 12 (StataCorp LLC, College Station, Texas, USA). Continuous variables expressed as means (± SD) were compared using a one-way analysis of variance (ANOVA). Categorical variables were compared using the Chi-squared test or Fisher's exact test as appropriate.

RESULTS

During the study period, a total of 511 patients underwent burr hole evacuation of CSDH. However, complete data were available for only 150 patients who were included in this study with a data retrieval ratio of 29.35%. There were 121(80.7%) males and 29 females (19.3%) with a male-to-female ratio of 4.2:1. The mean age was 60.28 (±16.07) years, with 77 patients (52.74%) being above 60 years. There was no statistically significant difference in the age, gender distribution, GCS at presentation, preoperative GCS, immediate post op GCS, and duration of symptoms before presentation (Table 1a and 1c).

The haematoma was located on the right side in 42 patients (29%), on the left side in 61 patients (42%), and it was bilateral in 42 patients (29%) (*n=145; p=0.653*). Based on radiological description, hemispheric haematoma was the most common (46.1%). Intraoperatively, the mean haematoma volume was 133.78 ml. Larger haematoma volumes were evacuated in patients who were ambulated in groups 3 and 4, though this was not statistically significant. (Table 2a).

Brain pulsatility, dura tension, brain expansion, and the presence of thick subdural membranes were found to be similar in all groups. Most patients in group 3 had moderate haematoma pressure, and this was weakly statistically significant (p=0.04). (Table 2b).

Considering complications, five patients (3.33%) had postoperative seizure disorder. There were no seizures in patients who were ambulated <5days postoperatively. There was a low incidence of wound infection, which was 1.34%. The two cases of wound infection were seen in patients ambulated ≥7 days, and this was not statistically significant. Four cases (2.67%) of wound breakdown were observed, with one patient in group 2 and three in group 4, and this was statistically significant (Table 3).

The overall recurrence rate was 4.7%. Five out of the seven patients (71%) who had recurrence were ambulated >7 days postoperatively. Due to the degree of deterioration in GCS postoperatively, three patients were admitted into the ICU and were ambulated ≥ 5 days post op. Overall outcome was generally good, with 95.9% of patients having a good outcome on the Glasgow Outcome Scale. One death was recorded, and the patient was in group 3. The patient died of sepsis following aspiration pneumonia (Table 3).

Table 1a: Day of ambulation by demographic variables.

Variables	n (%)	1-2 days n=2 (1.33)	3-4 days n=6 (4)	5-6 days n=83 (55.33)	≥7 days n=59 (39.33)	P-values
Age (years), n=146						
0-10	2 (1.37)	0	0	1	1	0.292π
11-20	0 (0)	0	0	0	0	
21-30	3 (2.05)	0	0	2	1	
31-40	13 (8.90)	1	1	9	2	
41-50	18 (12.33)	0	1	12	5	
51-60	33 (22.60)	1	1	15	16	
Above 60	77 (52.74)	0	2	41	34	
Age, Mean (SD), years	60.28(16.07)	50(14.14)	56(15.71)	59.32(16.63)	62.28(15.42)	0.5023F
Gender, n= 150						
Female	29(19.33)	0	3	18	8	0.133π
Male	121(80.67)	2	3	65	51	

π: Fisher's exact test; F: one-way analysis of variance (ANOVA); SD: Standard Deviation; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150

Table 1b: Day of ambulation by aetiology.

Variables	n (%)	1-2 days	3-4 days	5-6 days	≥7 days	P-values
Aetiology, n=136						
Trauma	101(74.26)	1	4	56	39	0.857π
Coagulopathy	34(25.00)	0	2	17	15	
Iatrogenic	1 (0.74)	0	0	1	0	

π: Fisher's exact test; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150

Table 1c: Day of ambulation by clinical variables.

Variables	n (%)	1-2 days	3-4 days	5-6 days	≥7 days	P-values
GCS at presentation, n=136	10(7.35)	0	1	4	5	0.255π
3-8	34(25.00)	0	0	16	18	
9-12	92(67.65)	2	5	54	31	
13-15						
Immediate pre-op GCS, n=135	11(8.15)	0	0	3	8	0.088π
3-8	24(17.78)	0	0	10	14	
9-12	100(74.07)	2	6	59	33	
13-15						
Immediate post-op GCS, n=138	2(1.45)	0	0	1	1	0.182π
3-8	14(10.14)	1	1	5	7	
9-12	122 (88.41)	1	3	70	48	
13-15						
Duration of symptoms before presentation, n= 141						
Mean (SD) days	23.29(34.69)	15(11.31)	31.75(39.32)	26.80(42.08)	18.34(21.49)	0.5129F

π: Fisher's exact test; F: one-way analysis of variance (ANOVA); SD: Standard Deviation; GCS: Glasgow Coma Scale; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150

Table 2a: Day of ambulation by radiologic variables

Variables	n (%)	1-2 days	3-4 days	5-6 days	≥7 days	P-values
Side, n= 145						
Bilateral	42(28.97)	0	2	21	19	0.653π
Left	61(42.07)	1	2	32	26	
Right	42(28.97)	1	2	27	12	
Anatomic description, n=141						
Frontal	4(2.84)	0	0	1	3	0.417π
Frontoparietal	26(18.44)	0	1	13	12	
Frontoparietooccipital	17(12.06)	1	0	8	8	
Frontotemporal	1(0.71)	0	0	1	0	
Frontotemporoparietal	22(15.60)	0	1	18	3	
Hemispheric	65(46.10)	1	3	34	27	
Parietal	1(0.71)	0	0	1	0	
Parietooccipital	1(0.71)	0	0	1	0	
Temporoparietal	4(2.84)	0	0	2	2	
Presence of mass effect, n=147						
No	18(12.24)	1	2	9	6	0.109π
Yes	129(87.76)	1	4	73	51	

π: Fisher's exact test; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150.

Table 2b: Day of ambulation by intraoperative variables

Variables	n (%)	1-2 days	3-4 days	5-6 days	≥7 days	P-values
Haematoma volume, ml (n=129) Mean (SD) ml	133.78(79.16)	100 (0)	112.5(59.65)	138.44(81.51)	129.68(79.01)	0.7952F
Brain pulsatility, n=123	29(23.58)	0	0	18	11	0.653α
No	94(76.42)	2	3	54	35	1.000π
Yes						
Brain pressure, n= 118						
Intense	54(45.76)	0	4	24	26	**0.055α**
Moderate	64(54.24)	2	0	36	26	**0.040π**
Dura, n=98						
Not tense	15(15.31)	1	0	9	5	0.357π
Tense	83(84.69)	1	3	42	37	
Brain expansion, n= 110	37(33.64)	2	3	20	12	0.351π
Full	24(21.82)	0	0	13	11	
Partial	49(44.55)	0	1	30	18	
No						
Membranes, n=124						
No	100(80.65)	2	3	53	42	0.882π
Yes	24(19.35)	0	0	15	9	

α: Chi-square test; π: Fisher's exact test; F: one-way analysis of variance (ANOVA); SD: Standard Deviation; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150.

Table 3: Day of ambulation by outcome variables

Variables	n (%)	1-2 days n=2 (1.33)	3-4 days n=6 (4)	5-6 days n=83 (55.33)	≥7 days n=59 (39.33)	P-values
Post op-seizures, n=150						
No	145(96.67)	2	6	80	57	0.961α
Yes	5(3.33)	0	0	3	2	1.000π
Wound Breakdown, n=150						
No	146(97.33)	2	5	83	56	**0.036π**
Yes	4(2.67)	0	1	0	3	
Wound Infection, n=149						
No	147(98.66)	2	6	82	57	0.260π
Yes	2(1.34)	0	0	0	2	
GOS, n=148						
Death	1(0.68)	0	0	1	0	0.213π
Persistent vegetative state	0(0)	0	0	0	0	
Severe disability	1(0.68)	0	0	1	0	
Moderate disability	4(2.70)	0	0	0	4	
Good outcome	142(95.95)	2	6	80	54	
Duration of hospitalization, n=123 Mean (SD) days	14.28(7.01)	20(14.14)	16.66(12.43)	13.38(6.40)	15(6.75)	0.3089F

α: Chi-square test; π: Fisher's exact test; F: one-way analysis of variance (ANOVA); SD: Standard Deviation; ICU: Intensive Care Unit; GOS Glasgow Outcome Score; n: Some variables had missing data. The available data per variable was used for the analysis, though the total study population was 150.

DISCUSSION

CSDH continues to present as a global public health challenge. It's a disease mainly seen in the elderly population, who usually have medical comorbidities. As such, the goal is to treat and ambulate as early as possible.[22] Early ambulation has been noted to have the advantage of reducing the incidence of complications, which include atelectasis/orthostatic pneumonia, decubitus ulcers, urinary tract infection, deep venous thrombosis, and pulmonary embolism.[21,22] On the other hand, it has also been noted to increase the possible risk of recurrence and reoperation.[19]

In this study, the modal age group of presentation was above 60 years. This is in keeping with established literature that advanced age is a risk factor for CSDH.[23]As individuals age, there is a gradual atrophy of the brain, leading to the expansion of the bridging veins and an increased susceptibility to rupture even with minor trauma. This phenomenon eventually progresses to chronic subdural haemorrhage (CSDH).[24] The expansion of the subdural space is a direct consequence of this brain atrophy. Consequently, surgeons employ flat postoperative positioning for patients to minimise this potential space and thereby reduce the risk of CSDH recurrence.[25] In the past, different measures have been employed to increase brain expansion. These included hyperhydration of the patient, intraventricular injection of physiological saline solution, filling the CSF spaces with fluid from a lumbar tap, postoperative positioning of the patient's head in a 30-degree Trendelenburg position for 3 to 5 days, and clipping cortical veins of the hemisphere adjacent to the CSDH.[26] All these have been long abandoned due to unsatisfactory and even catastrophic results. Nursing patients flat postoperatively necessitates delayed ambulation of the patient. About 55.3% of our patients were ambulated by the 5th or 6th post-operative day.

Burrhole craniostomy was carried out in our centre for all patients with CSDH, though several procedures have been published in the literature as means of evacuating CSDH with different results.[24] The duration of symptoms, preoperative GCS, location of the haematoma, the mean haematoma volume, perceived dura tension, brain pulsatility, on-table brain expansion, the presence of subdural membranes, and immediate post op GCS did not influence the day of ambulation. However, there is paucity of data in the literature relating these factors to the day of ambulation following evacuation of CSDH. It would be expected that patients who had rapid brain expansion intraoperatively would have been ambulated earlier,[14] though our study did not show any statistical significance to support this. It is possible that adherence to the unit's standard of ambulation for most patients by the 5th or 6th day may account for this observation. However, ambulation was unintentional in some patients with altered sensorium who were restless and unrestrained, preventing them from remaining in the flat position until a decision was made to initiate ambulation.

The incidence of seizures in our study was 3.3%. It would seem that patients ambulated after 5 days tended to have more seizures as reflected in our results. However, the occurrence of seizures in these patients and the neurological deterioration that followed was the reason they could not be ambulated earlier rather than prolonged ambulation being the cause of the seizures. In a study carried out by Sousa et al, 9.1% of patients had seizures and this was not associated with the day of ambulation. [21]

There is no consensus as to what determines ambulation postoperatively, but balancing reducing the risks associated with immobilisation and the risk of recurrence appears to be the driving factor now favouring early ambulation today.[21,22] Inferring from preexisting studies, determinants of the day of ambulation include preoperative neurological status, age, and comorbid conditions, surgical factors (which include use of drains, bilaterality, pneumocephalus), postoperative complications (including pneumonia and DVT), and institutional protocol, with many centres having fixed bed rest policies (24 hours – 1 week).[17,21,27-29,]

Historically, one of the main reasons against earlier ambulation was recurrence.[22] In our study, the recurrence rate was 4.7%, which compares favourably with established data.[10] Though no recurrence was recorded in patients ambulated less than 48 hours postoperatively, and 71% of the cases that recurred were at ≥7 days, this was shown not to be statistically significant. This finding was in contrast to the study by Abouzari et al, who found that early mobilisation had a higher risk of recurrence.[19] However, Adeolu et al and Kurabe et al noted that ambulation within 48-72 hours did not increase the risk of recurrence, as seen in our study.[17,22] The GET-UP trial also concluded that early mobilisation did not increase the risk of recurrence.[21]

The main limitation of this study was its retrospective design, which relied on the accuracy and completeness of existing medical records.

CONCLUSION

With the rising incidence of CSDH, burr hole craniostomy and drainage remains a safe and effective method of treatment with a low recurrence rate. The main factors influencing the day to ambulation following surgical treatment of CSDH are the reduction of the risk of prolonged immobilisation and recurrence. From the findings in this study, though limited by its retrospective nature, it is advocated that ambulation of patients within 48-72 hours of burr hole evacuation is safe. Extending to 5 days may be necessary for patients who have delayed neurologic improvement.

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There are no conflicts of interest.

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