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Research Article

Factors Associated with the Recurrence of a Surgically Evacuated Intracranial Chronic Subdural Hematoma using Burr-hole Irrigation: A Cross-sectional Retrospective Single-center Study

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Abstract

Background: Chronic subdural hematoma (CSDH) is a common neurosurgical entity characterized by the accumulation of blood in the subdural space. Despite proper surgical management, recurrence of CSDH remains a clinically relevant problem that may necessitate reoperation and prolong morbidity. ***Objective***: To evaluate the factors affecting the recurrence of chronic subdural hematoma after surgical evacuation. ***Methods***: A retrospective cross-sectional study of 50 patients with CSDH evaluated at the emergency room of Neurosurgical Teaching Hospital from October 2024 through September 2025. All the patients were fully examined, managed, and discharged home after 7 days of surgical treatment and followed up for 3 months. ***Results***: The study included 50 patients; 44 (88%) were male, and 6 (12%) were female. Age ranged from 23 to 87 years, with a mean of 69.55±18.4 years for both genders, peaking in the seventh decade. CSDH was on the right side in 30%, the left side in 44%, and bilateral in 26% (13 patients). The mean thickness was 2.4±0.46 cm, ranging from 0.8 to 3.4 cm. Among the 50 patients, 28 had brain atrophy on the CT scan. Recurrence occurred in 10 patients (20% of cases). ***Conclusions***: Factors affecting hematoma recurrence include patient factors (age, bleeding profile, associated diseases, and antiplatelet medications) and radiological factors (hematoma location and thickness, midline shift, and presence of a visible membrane on brain CT).

Keywords: Burr-hole evacuation; Chronic subdural hematoma; Head trauma; Recurrent hematoma.

العوامل المؤثرة على تكرار حدوث النزف الدموي المزمن تحت الأم الجافية داخل الدماغ بعد تفريغه جراحياً باستخدام تقنية تثقيب عظم الجمجمة

الخلاصة

الخلفية: يُعد النزف الدموي المزمن تحت الأم الجافية (CSDH) حالة شائعة في مجال جراحة الأعصاب، وتتميز بتجمع الدم في الحيز الواقع تحت الأم الجافية. ورغم التدخل الجراحي الملائم، تظل مشكلة تكرار الإصابة بهذا النزف ذات أهمية سريرية بالغة، إذ قد تستدعي إجراءات جراحة أخرى وتؤدي إلى إطالة أمد الاعتلال الصحي. **الأهداف**: تقييم العوامل المؤثرة في تكرار حدوث النزف تحت الجافية المزمن بعد التفريغ الجراحي. **الطرائق:** أجريت دراسة بأثر رجعي شملت 50 مريضاً يعانون من CSDH، حيث تم تقييمهم في قسم الطوارئ بمستشفى جراحة الجملة العصبية التعليمي خلال الفترة من تشرين 2024 إلى ايلول 2025. وقد خضع جميع المرضى لفحوصات شاملة وتلقوا الرعاية الطبية اللازمة، ثم سُمح لهم بالعودة إلى منازلهم بعد سبع أيام من العلاج الجراحي، مع متابعة حالاتهم لمدة ثلاث أشهر. **النتائج**: شملت الدراسة خمسون مريضاً؛ 44 منهم ذكور وست إناث. تراوحت الأعمار بين 23 و87 عاماً، بمتوسط 69.55 ± 18.4 عاماً لكلا الجنسين، وسُجّلت ذروة الحالات في العقد السابع من العمر. تموضع CSDH في الجانب الأيمن لدى 30% من المرضى، وفي الجانب الأيسر لدى 44%، بينما كان ثنائي الجانب لدى 26%. بلغ متوسط سماكة النزف 2.4 ± 0.46 سم، أظهر التصوير المقطعي وجود ضمور دماغي لدى 28 مريضاً. فما تكرر حدوث النزف ب 20% من الحالات. **الأستنتاجات**: العوامل المؤثرة على تكرار حدوث النزف المزمن عواملَ تتعلق بالمريض (العمر، والملف النزفي، والأمراض المصاحبة، وأدوية مضادات الصفائح) وعواملَ يكشفها التصوير المقطعي (موقع النزف وسُمكه، وانزياح خط المنتصف، ووجود غشاء مرئي في تصوير الدماغ المقطعي).

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INTRODUCTION

Chronic subdural hematoma (CSDH) is a common neurosurgical entity that occurs due to the accumulation of blood in the subdural space, mainly due to the rupture of bridging veins. It affects elderly people more commonly with a history of head injury [1]. Unlike the other types of traumatic intracranial hematomas, simple trivial trauma may cause it [2]. The patient's symptoms and presentations may not manifest immediately after the insult, leading to a potential delay in diagnosis for weeks. CSDH may expand and increase in size. Many etiological factors may contribute to its expansion, including the osmotic theory and repeated bleeding into the subdural space. The presence of inflammatory mediators also potentiates rebleeding by stimulating vasodilatation, increasing vascular permeability, and prolonging bleeding time. Also, localized coagulopathy may disrupt normal hemostasis, thereby increasing the risk of rebleeding [4,5]. The time of presentation usually occurs after approximately 2–3 weeks of the trauma [6]. Other causes of the collection include antithrombotic drugs, iatrogenic factors, and hematological diseases [7]. The clinical presentation of CSDH ranges from asymptomatic to severe decline in level of consciousness, as assessed by the Glasgow Coma Scale (GCS). Most patients present with mild impairment, and the severity of neurological symptoms is related to the rate of hematoma

accumulation, hematoma size, and pressure on eloquent brain areas [8–11]. Most of the symptomatic patients are diagnosed by performing a computerized tomography scan (CT scan) to evaluate the hematoma size and location and plan the surgical intervention. Most of them are treated with burr-hole craniotomy with irrigation, with or without drainage, and the evacuated hematoma is typically dark and liquefied. Some chronic and recurrent cases with subdural membrane formation are treated with craniotomy and membrane excision [12–14]. Despite appropriate surgical management, recurrence of CSDH remains a clinically relevant problem that may necessitate reoperation and prolong morbidity. Several clinical, radiological, and hematological factors have been proposed to influence recurrence, with variable findings across studies. The current study aims to evaluate the factors affecting the recurrence of chronic subdural hematoma after surgical evacuation.

METHODS

Study design and sampling

A retrospective cohort study was conducted on 50 patients with CSDH admitted at the emergency department of Neurosurgical Teaching Hospital in the period from October 2024- September 2025, all the patients had a history of trauma ranging from trivial to serious injury, and were symptomatic and were fully neurologically examined and assessed according to GCS, they were sent for brain CT scan to diagnose their pathology, the results showed unilateral or bilateral intracranial hypodense crescent-shaped lesion (Figures 1 and 2**)**.

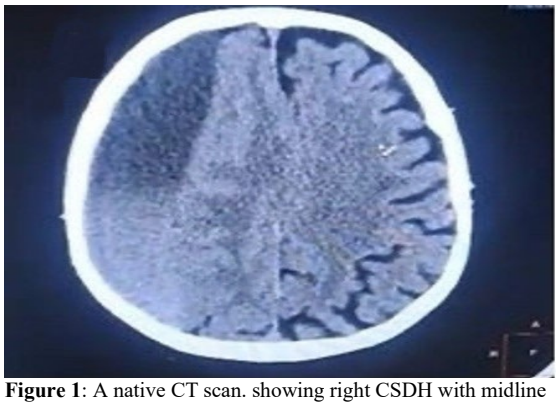

Figure 1: A native CT scan. showing right CSDH with midline shift in a patient with brain atrophy.

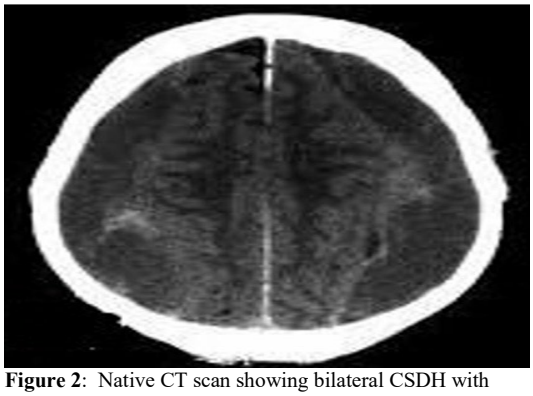

Figure 2: Native CT scan showing bilateral CSDH with membrane formation.

They were also sent for important investigations relevant to their pathology, including platelet count, bleeding profile, prothrombin time (PT), activated partial thromboplastin time (aPTT), and international normalized ratio (INR).

Outcome measurement

Surgery was performed on all patients, including Burr-hole evacuation and irrigation. All patients were observed postoperatively and discharged after 7 days without neurological deficits. A three-month follow-up was done for all the patients to assess their clinical conditions, and a CT scan was performed to evaluate the possibility of hematoma recurrence in the suspected symptomatic patients. Patients with chronic subdural hematoma appearing on CT scan as a hypodense crescent-shaped lesion, for whom symptomatic surgery was performed, and who were fully asymptomatic post-operatively till the time of discharge from the hospital (good post-operative functional outcome) were included in the study. While those with uncorrected inherited or acquired coagulopathy, patients with systemic illnesses or advanced malignancy that could interfere with medical outcomes, or the presence of concomitant intracranial pathology (e.g., brain tumors or intracerebral hematoma) were excluded.

Ethical considerations

Detailed, informed, and written consent was obtained from each participant or a relative for inclusion in this study. The study protocol was approved by the Scientific Committee of Al-Kindy College of Medicine, University of Baghdad (Approval ID 5 on 6th. January 2026).

Statistical analysis

Statistical analysis was done using the SPSS statistical package version 29.The analysis of categorical data was conducted using the Chi-square test. Regression models were employed to verify variables that independently influenced functional recovery A *p*-value< 0.05 was considered statistically significant.

RESULTS

The study included 50 patients; 44 (88%) were male, and 6 (12%) were female. Age ranged from 23 to 87 years, with an average of 69.55 years ± 18.4 for both genders, peaking in the seventh decade (Table 1). The clinical presentations are shown in Table 2.

Table 1: Patients characteristics

Variable		n(%)
Age (year)	< 40	4(8)
	41-64	13(26)
	> 65	33(66)
	Total	50(100)
	Mean±SD	69.55±18.4
Gender	Male	44(88)
	Female	6(12)
	Total	50(100)

Table 2: Clinical presentation on admission

Clinical presentation	n(%)
Headache	28(56)
Hemiparesis	15(30)
Aphasia	9(18)
Gait disturbance	13(26)
Vomiting	7(14)
Amnesia	3(6)
Incontinence	2(4)
Seizure	2(4)

The duration of presentations ranged from 5 days to 3 weeks. The most common presenting symptom was headache, and the most common sign was hemiparesis. The Glasgow Coma Scale (GCS) on admission is shown in Table 3; most of the patients have mild brain injury on presentation.

Table 3: GCS on admission

GCS	n(%)
15	40(80)
9-12	6(12)
8 or less	4(8)

Regarding the history of trauma, 80% of the patients described trivial trauma, such as falling from a chair, slipping in the bathroom, or a minor hit to a solid object. In comparison, 20% of them described more serious injuries (Table 4). Concerning the associated medical history, hypertension was the most common medical illness, followed by type 2 diabetes, as shown in Table 5.

Table 4: Causes of injury

Mechanism of injury	n(%)
Trivial trauma	40(80)
Road traffic accident	4(8)
Fall from height	4(8)
Motor vehicle accident	2(4)
Head hit by a hard object	1(2)

Table 5: Medical history and associated diseases

Medical history	n(%)
Hypertension	10(20)
Diabetes type 2	8(16)
Heart failure	2(4)
Stroke	1(2)
Renal failure	1(2)
Coronary disease	1(2)
Liver failure	1(2)

Regarding antiplatelet and anticoagulant drugs, nine patients have received aspirin, two have received clopidogrel (Plavix), and only one has received warfarin. Regarding the bleeding profile and platelet count, four patients had abnormal bleeding profiles, and one patient had decreased platelet count. In the interpretation of CT scans, the chronic subdural hematoma was on the right side in 30% (15 patients), on the left side in 44% (22 patients), and bilaterally in 26% (13 patients). Figure 2 shows a CT scan of a patient with bilateral subdural hematoma and membrane formation. Its thickness was 2.4 ± 0.46 cm and ranged from 0.8 to 3.4 cm, and the midline shift was 0.8 ± 0.76 with a maximum shift of 1.8 cm; it occurred in 41 patients. Among the 50 patients, 28 had brain atrophy on a CT scan. Patients who had a visible subdural membrane on the CT scan were 9 (Figure 1). Recurrence occurred in 10 patients (20% of cases).

We studied the relation between recurrence and other associated variables. Regarding recurrence by age and gender, the study showed that it increased with age. 90% of the recurrent cases were males (Table 6).

Table 6: The relation between hematoma recurrence and the patients' variables

Variable	Recurrence (%)	*p*-value
Age (year)		
< 40	10	
41-64	30	0.01
> 65	60	
Gender		
Male	90	0.624
Female	10	
GCS		
13-15	10	
9-12	30	0.18
3-8	60	
Antiplatelets and anticoagulant history		
Aspirin	30	
Clopidogrel and aspirin	20	0.01
Warfarin receiving	0.0	
Bleeding profile and platelets count		
Abnormal bleeding profile	30	0.1
Decreased platelets count	0.0	
Pre-existing disease		
Yes	70	0.01
No	30	
Hematoma location		
Right side	40	
Left side	60	0.01
Bilateral	0.0	
Hematoma thickness (cm)		
<1.5	0.0	
1.5-2.5	40	0.01
>2.5	60	
Midline shift		
Yes	100	0.05
No	0.0	
Brain atrophy		
Yes	80	0.01
No	20	
Visible membrane on CT scan		
Yes	70	0.05
No	30	

Among patients with recurrence, 60% occurred in patients with severe injury (GCS 3-8), 30% with moderate injury (GCS 9-12), and 10% with mild injury. Regarding drug history and recurrence comparison, among the seven patients who received aspirin, 3 had recurrent events. While the two patients receiving dual antiplatelet therapy (aspirin and clopidogrel) had recurrences, the one who received warfarin did not suffer a recurrence. The patients who had an abnormal bleeding profile were 4; three of them had recurrence, while the patient with a decreased platelet count was normal. In comparing pre-existing diseases to recurrence rates, patients with a pre-existing disease experienced a significantly higher recurrence rate, with 70% of these cases occurring. Seven patients of 9 with midline shift developed hematoma recurrence. Patients with right CSDH involved 60% of the recurrent cases, while in 40% of the left CSDH, no recurrence occurred in patients with bilateral CSDH. Regarding the comparison of CSDH thicknesses to recurrence, none of the patients with CSDH thicknesses of less than 1.5 cm had recurrence; 40% of recurrent cases occurred with hematoma thicknesses of 1.5-2.5 cm, while 60%

occurred with thicknesses greater than 2.5 cm. Regarding the midline shift and brain atrophy to recurrence comparison, none of the patients without a midline shift had a recurrence, while 80% of recurrences occurred in patients with brain atrophy. Patients with a visible subdural membrane on a CT scan accounted for 70% of recurrent cases.

DISCUSSION

CSDH is a common intracranial insult that occurs most commonly in elderly people [1]. In our study, all patients underwent surgery with satisfactory post-operative functional outcomes; however, the recurrence rate was 20%. Therefore, we thought it was important to assess factors that may increase the recurrence rate in patients with post-operative, symptom-free conditions. Regarding age, it is obvious that increasing age is a risk factor of hematoma recurrence, as in our study 60% of recurrence occurred in age group more than 65 years old, it can be explained as elderly people are more prone to minor falls or hits, also the brain of old human may be atrophied, or having co-morbidities as drugs or associated diseases, age has an impact on recurrence and the relation is significant. Although males constitute the majority of recurrent cases (90%), gender does not affect recurrence. This extreme male predominance could be due to greater male involvement in outdoor work and driving. Regarding the relationship between conscious level and recurrence rate, there is no impact; however, recurrence was higher in patients with a GCS less than 8, although this association was insignificant. There is a significant relationship between taking antiplatelets and the rate of recurrence. In our study, all patients receiving dual antiplatelet therapy and about half of those taking aspirin had recurrence; the finding may be attributed to the effect of these drugs in preventing platelet aggregation in the region of angioneogenesis in the subdural space, even after hematoma evacuation. Patients' pre-existing diseases also affected recurrence. They appeared to significantly affect recurrence. Regarding the important laboratory tests, although the bleeding profile affects recurrence, there is no significant association between platelet count and recurrence. A CT scan remains the most important diagnostic tool in CSDH and has been studied extensively to identify a relationship between hematoma and recurrence. In this study, CSDH most commonly occurred on the left side, comprising 44%, while 30% had CSDH on the right and 26% were bilateral. This phenomenon can be attributed to the left hemisphere (dominant) tending to produce more symptoms, while CSDH in the right hemisphere (non-dominant) may pass unnoticed and be absorbed spontaneously without producing symptoms [15]. Bilateral CSDHs have been reported as a risk factor for recurrence; however, our study didn't confirm this association. Of all patients with bilateral CSDH, none had recurrence, and the difference was highly statistically significant. There is a significant association between hematoma thickness and recurrence; as thickness increases, the recurrence rate increases. Brain atrophy was a common finding among patients with CSDH and is reported in the literature as an etiological factor for developing CSDH and a risk factor for recurrence [16-17]. In this study, 80% of recurrence developed in patients with brain atrophy (P=0.01). Poor brain re-expansion after CSDH evacuation could clarify the high recurrence rate in patients with brain atrophy [18]. A visible membrane has been reported in some literature to affect CSDH recurrence [19-21]. Seventy percent of recurrent cases occurred in patients who had a visible membrane on their CT scans, showing a significant relationship. Additionally, CSDH thickness was identified as a significant prognostic factor. Data evaluation revealed a worse outcome with increasing thickness and a statistically significant impact on recurrence.

Strength and Limitation

A major strength of this study is the use of a single, standardized surgical cohort to evaluate a broad range of clinical, laboratory, and radiological factors associated with chronic subdural hematoma recurrence. In addition, the same surgical technique was used for all patients, thereby minimizing variation in treatment and follow-up. This study has some limitations that should be acknowledged. First, it was a retrospective, single-center study with a relatively small sample size. Second, the follow-up period was limited to three months, which means that any late recurrence occurring after this period could not be captured due to the study's design.

Conclusion

Recurrence of chronic subdural hematoma is an important consideration that faces the neurosurgeon after surgery and can reach up to 20%. Comorbidities, antiplatelet use, and age play major roles in the development of recurrence. Pre-operative brain CT scan is a useful tool to assess the rate of recurrence by measuring hematoma thickness, evaluating the severity of brain atrophy, and assessing the presence of bilateral subdural hematoma; all these factors were statistically significant in relation to the recurrence of hematoma.

Conflict of interests

The authors declared no conflict of interest.

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The authors did not receive any source of funds.

Data sharing statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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