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Original article

Surgery for Chronic Subdural Hematoma in Patient on Anticoagulant and/or Antiplatelet Drugs

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Abstract:

Background: CSDH is a serious fluid collection containing blood that is located between the dura and arachnoid mater. This study aimed to evaluate the suitable timing resulting in the best outcome of surgical evacuation of CSDH in patients on anticoagulant and/or antiplatelet therapy and when to restart these drugs post operatively. **Methods:** This retrospective cohort study included 300 patients with CSDH on anticoagulant and/or antiplatelet drugs. Detailed history, general and neurological examination, radiological and laboratory investigations were performed. **Results:** Acute blood accumulation in patients who had urgent intervention more than patients who waited until elimination of effect of anticoagulant or antiplatelets before intervention, but urgent intervention is lifesaving in patient with bad neurological conditions (GCS < 12). Clinical modified Rankin score was significant higher in patients who had urgent intervention compared patients who waited until stabilization before intervention due to risk of bleeding. Delayed recurrence. **Conclusion:** There is high mortality and morbidity with high risk of acute blood accumulation in early evacuation of CSDH in patients on treated with these drugs. So, if patient neurologically stable (GCS ≥ 12), we can wait until elimination the effect of these drugs. On the other hand, patient with bad neurological conditions (GCS < 12), evacuation of hematoma is a mandatory whatever the general conditions. As regard restoring this medical treatment post-operative, the priority usually for the vital conditions. If it's life-threatening conditions, we can restore those drugs as early as possible. Otherwise, we can wait as possible result in better outcome.

Keywords: Surgery; Chronic Subdural Hematoma; Anticoagulant; Antiplatelet; GCS.

Introduction

CSDH enlarges slowly, it is often well tolerated at first, with mild symptoms or non-symptoms at all Patients often present with nonspecific symptoms such as headache, unsteady gait, or cognitive impairment. There may also be focal neurological deficits such as hemiparesis [(1)].

The risk factors of chronic subdural hematomas (CSDHs) include old age (ACs), coagulopathy, anticoagulant (ACTh), antiplatelet (APTh) therapy, alcoholism and diabetes mellitus (DM) Patients over 80 years of age who experienced CSDH without a history of head trauma were more frequently seen than younger patients, associated with cognitive change (memory disturbance, urinary incontinence, and decreased activity) and disturbance of consciousness at admission were more frequent compared to younger patients who commonly presented without a disturbance of consciousness [(2)].

The decision to surgically intervention in cSDH largely depends on its clinical presentation and radiological evaluation, such as hematoma size, midline shift more than 1cm, effacement ventricles, the presence of membranes and the presence of bilateral hematomas. it is generally accepted that patients with neurologic symptoms and relevant radiological findings should undergo surgical evacuation. On the other hand, asymptomatic patients with no compression signs in imaging are usually managed conservatively [(1)].

The aim of the present study is to evaluate the suitable timing resulting in the best outcome of surgical evacuation of chronic subdural hematoma in patients already on anticoagulant and/or antiplatelet therapy and when to restart anticoagulant and/or antiplatelet drugs post operatively.

Patients and methods

This retrospective cohort study included 300 patients at neurosurgery department Benha University hospitals Benha University, throughout the period from January 2023 till January 2024. The study was presented to the research Ethics Committee of faculty of medicine- Benha University and approved with approval code Ms 22-1-2023). Informed consent was obtained from the patients before participating in this study.

Inclusion criteria were patients with CSDH on anticoagulant and/or antiplatelet drugs. **Exclusion criteria were** patients with CSDH with GCS ≤ 9, other intracranial hematoma associated with CSDH, patient with acute medical emergency, cardiac myocardial infarction, renal failure and hepatic failure. All studied cases were subjected to the following: Detailed history taking, including history of trauma, associated medical comorbidity, relevant surgical past history and which anticoagulant and/or antiplatelet drugs patient take, its dose and duration. **Full clinical examination:** General examination of vital signs and neurological examination of Glasgow coma scale, motor deficit and sensory deficit**. Radiological investigations:** CT brain routine on admission and MRI especially in cases of sub-acute subdural hematoma due to isodensity in CT brain and possibility of multiple septations. **Laboratory investigations**: CBC including deferential count and platelet count, coagulation profile especially PT, PTT and INR, kidney function tests and liver function tests. **Operative data:** the operative steps was as following; General anesthesia or local infiltration with sedation according to anesthetic decision, supine position, sterilization and toweling, Skin incision, hemostasis, two Barr holes craniotomy technique, evacuation of hematoma with avoiding sudden decompression. Irrigation with saline in all directions and then Closure of wound over blunted tipped subgalial drain. All patient data will be registered regarding GCS (preoperative, postoperative and late postoperative), vital signs, neurological

deficits, timing neurosurgical intervention (immediate or delayed after correction of bleeding profile) and timing of restarting the previous anticoagulant and/or antiplatelet (after 2days or more than 4 days).

Statistical analysis:

Statistical analysis was done by SPSS v28 (IBM©, Armonk, NY, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by ANOVA (F) test with post hoc test (Tukey. Qualitative variables were presented as frequency and percentage (%) and were analyzed utilizing the Chi-square test. A two tailed P value < 0.05 was considered statistically significant. Spearman correlation was done to estimate the degree of correlation between two quantitative variables. The overall diagnostic performance of each test was assessed by ROC curve analysis. The area under the curve (AUC) evaluates the overall test performance.

Case 1:

70 years old male patient known to be HTN & cardiac on Aspocid 75 mg once daily, presented with disturbed conscious level, headache and heaviness in RT side. The condition started 2 days ago with headache of gradual onset progressive course, not respond to medical treatment then patient developed RT side weakness associated with disturbed conscious level, with history of trauma 3weaks ago. Examination revealed GCS = 14/15, RT side weakness. Laboratory investigations show (Hgb = 13 g/dl, Platelets = 230 X 103 /µl, Pt = 14 – Ptt 32 & INR = 1). Brain CT shows left subacute subdural hematoma, after Waiting for 5 days until stabilizing general condition and control blood pressure and subside effect of antiplatelet, pt is operated with two burr holes for evacuation of hematoma and followed up by clinical examination & CT brain immediately post op. Pt was FC, improved weakness & Ct brain FUP shows well evacuated hematoma. Another Clinical & radiological FUP was done 1 month later showing recurrent ChSDH (Thickness less than 1 cm) with no clinical manifestations and the decision was made for conservative management. **Figure 1**

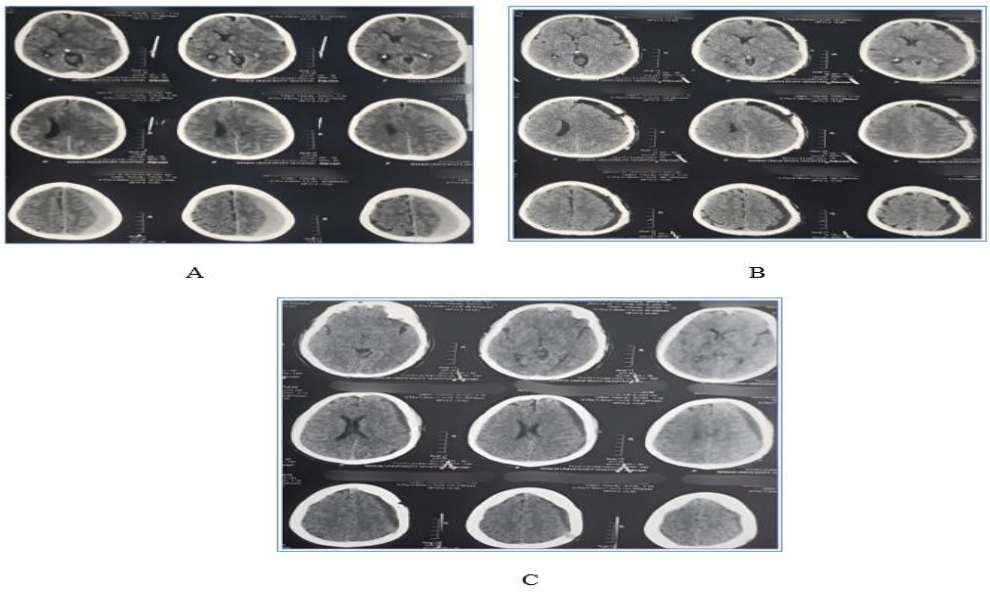

Figure 1: (A) Preoperative CT brain axial view showing LT parietal sub-acute SDH; (B) Immediately Post-operative CT Brain Axial view showing evacuated hematoma, (C) CT Brain axial view FU after 1 month of surgery showing LT recurrent parietal SDH.

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Case 2

65 years old male patient known to be hypertension & cardiac on NOAC, presented with Disturbed conscious level, Headache and heaviness in RT side. Condition started one day ago with headache of gradual onset, progressive course and not responsive to medical treatment then patient developed RT side weakness associated with disturbed conscious level, by history taking from relatives we detected history of trauma 2weaks ago. Examination revealed GCS = 13/15 and RT side weakness. Laboratory investigations shows (Platelets = 230 X 103 /µl, PT = 14, PTT = 32 & INR = 1) Brain CT shows bilateral sub-acute temp-parietal subdural hematoma, surgical decision was taken to Wait for 5 days until stabilizing general conditions and control blood pressure and eliminate effect of anticoagulant, patient is operated with two burr holes bilaterally for evacuation of hematoma and followed up by clinical examination & CT brain immediately post op. Postoperative evaluation showed was FC, improved weakness & Ct brain FUP shows good evacuated hematoma with accepted decompression. Another Clinical & radiological FUP was done 1 month later showing accepted evacuation of hematoma without any clinical deterioration. **Figure 2**

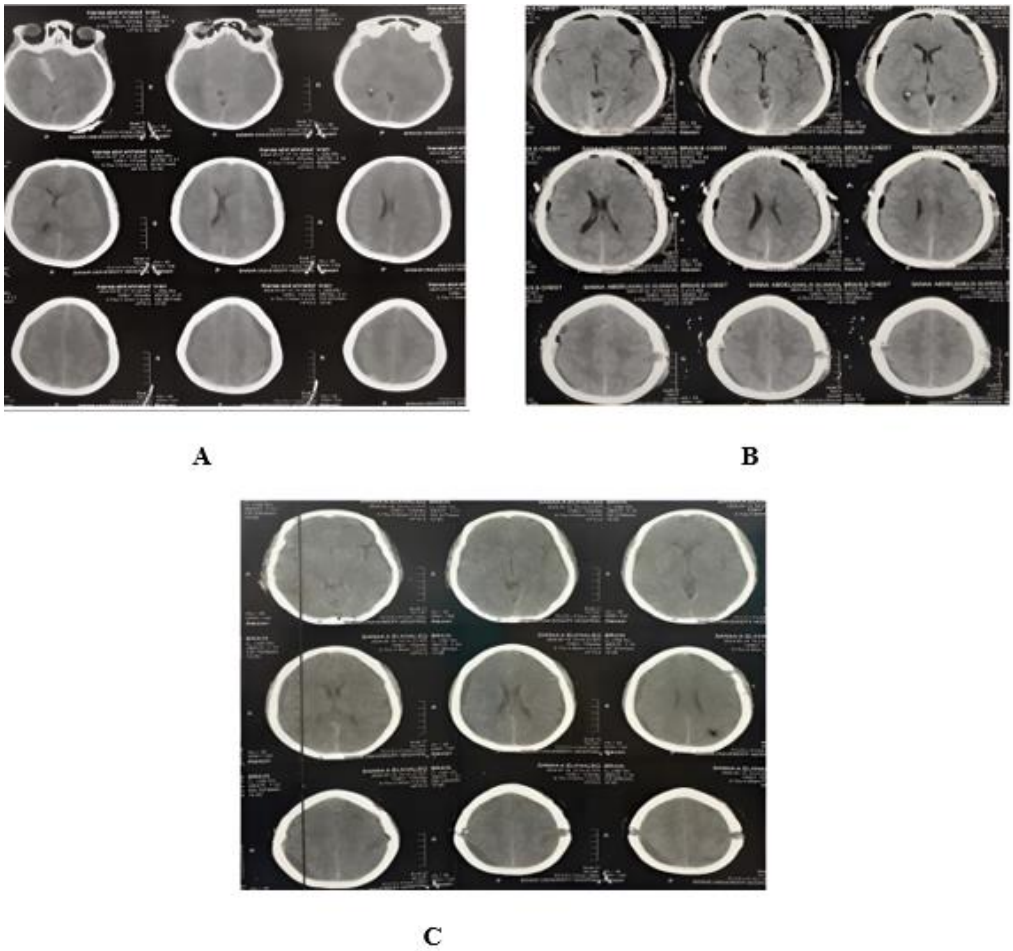

Figure 2: (A) CT brain axial view showing bilateral tempo-parietal sub-acute SDH, (B) Immediate Post-operative CT Brain axial view showing good evacuated hematoma with accepted decompression, (C) CT Brain axial view FU after 1 month of surgery accepted evacuated hematoma.

Results

The age of the studied patients ranged from 25 to 88 years old with a mean value of 61.9 ± 11.9 years old. 210 (70%) patients were ≥55 years old and 90 (30%) patients were <55 years old. 210 (70%) patients were males, and 90 (30%) patients were females. Clinical presentation, radiological and laboratory investigation, time of surgery and restarting anti-coagulation therapy, time of surgery and restarting anti-coagulation therapy are shown in **Table 1**

There was no significant difference in accepted radiological outcome between patients who used different types of antiplatelets or anticoagulants. Clinical modified Rankin score was significantly lower in patients in NOAC compared to patients on different types of anticoagulants or antiplatelet. The number of studied patients who had reoperation was significantly lower in study patients who were on NOAC compared to study patients who were on antiplatelet drugs, warfarin, and enoxaparin. **Table 2**

The number of patients who had accepted decompression was significantly lower in patients with platelets $<50 \times 10^3$ compared to those with platelets $>50 \times 10^3$, but the number of patients with acute blood accumulation was significantly higher. Clinical modified Rankin score was significantly higher in patients with platelets $<50 \times 10^3$ compared to those with platelets $>50 \times 10^3$. The number of patients who had reoperation was significantly higher in patients with platelets $<50 \times 10^3$ compared to those with platelets $>50 \times 10^3$. The number of patients with accepted decompression was significantly higher in patients with normal INR while the number of patients with acute blood accumulation was significantly higher in patients with elevated INR. The clinical modified Rankin score was significantly higher in patients with elevated INR compared to patients with normal INR. There was no significant difference in the number of patients who had reoperation between patients with normal and elevated INR. **Table 2**

In studied patients with GCS ≥12 (210 patients), the number of patients with accepted decompression (168 patients) was significantly higher in patients who waited until stabilization before intervention (180 patients), but in patients who had urgent intervention (30 patients), acute blood accumulation (12 patients) and delayed recurrence (6 patients) were significantly higher. Clinical modified Rankin score was significantly higher in patients who had urgent intervention (3 ± 2.3) compared patients who waited until stabilization before intervention (0.47 ± 1.2). The number of patients who needed reoperation was significantly higher in patients who had urgent intervention (12, 40%) compared patients who waited until stabilization before intervention (6, 3.3%). In study patients with GCS <12 (90 patients), the number of patients with accepted decompression was significantly higher patients who waited until stabilization before intervention (26, 96.3%). **Table 3**

Acute blood accumulation (13, 20.6%), delayed recurrence (14, 22.2%) and reoperation (27, 42.8%) in patients who had urgent intervention more than patients who waited until stabilization before intervention, but urgent intervention is lifesaving in bad neurological conditions (GCS<12). The number of patients with accepted decompression (198, 91.7%) was significantly higher in patients who restarted anticoagulants after 4 days (216 patients), but in patients who restarted anticoagulants after 48 hours (84 patients), acute blood accumulation (18, 21.4%) and delayed recurrence (42, 50.0%) were significantly higher. Clinical modified Rankin score and the number of patients who needed reoperation were significantly higher in patients who restarted anticoagulants after 48 hours compared to patients who restarted anticoagulants after 4 days. **Table 3**

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Table 1: Clinical presentation, radiological and laboratory investigation, time of surgery and restarting anti-coagulation therapy and time of surgery and restarting anti-coagulation therapy in of the studied groups

		Studied patients (n =300)
Type of medication	**Antiplatelet drugs**	198 (66%)
	Warfarin	42 (14%)
	New oral anticoagulant	36 (12%)
	Enoxaparin	24 (8%)
Warfarin dose (n =42)	**Less than 3mg**	24 (57.1%)
	More than 3mg	18 (42.9%)
Duration of treatment	**0 to 6 months**	126 (42%)
	6 months to 3 years	132 (44%)
	More than 3 years	42 (14%)
Clinical presentation		
GCS	**≥12**	210 (70%)
	<12	90 (30%)
Radiological and laboratory investigation		
Side	**Left**	144 (48%)
	Right	90 (30%)
	Bilateral	66 (22%)
Midline shift	**More than 2cm**	228 (76%)
	Less than2 cm	72 (24%)
Chronological age	**Sub-acute**	204 (68%)
	Chronic	96 (32%)
Platelets	**Less than 80,000**	12 (4%)
	80,000 to 150,000	24 (8%)
	More than 150,000	264 (88%)
PT	**Mean ± SD**	13.5 ± 2
	Range	10 - 19
PTT	**Mean ± SD**	30.6 ± 3.4
	Range	21 - 37
INR	**Less than 2**	258 (86%)
	2 to3	18 (6%)
	More than 3	24 (8%)
Time of surgery and restarting anti-coagulation therapy		
Time of intervention	**Urgent**	114 (38%)
	Waiting until stabilization according to labs and cardiac consultation	186 (62%)
Waiting duration (n =186)	**Less than or equal 3days**	18 (9.7%)
	>3 to 5 days	24 (12.9%)
	>5 days	24 (12.9%)
	More than week	120 (64.5%)
Time of restarting anticoagulant related to cardiac conditions	**After 48 hrs**	84 (28%)
	After 4 days	216 (72%)
Time of surgery and restarting anti-coagulation therapy		
Radiological	**Accepted decompression**	222 (74%)
	Acute blood accumulation	36 (12%)
	Delayed Recurrent	42 (14%)
Clinical modified Rankin score	**Mean ± SD**	1.3 ± 2
	Range	0 - 6
Reoperation		54 (18%)

Table 2: Relation between type of antiplatelet or anticoagulant, platelets and INR levels and prognosis of the studied groups

		Antiplatelet drugs (n =198)	Warfarin (n =42)	NOAC (n =36)	Enoxaparin (n=24)	P value
Radiological	**Accepted decompression**	139 (70.2%)	33 (78.6%)	29 (80.5%)	21 (83.3%)	0.404
	Acute blood accumulation	25 (12.6%)	5 (11.9%)	4 (11.1%)	2 (8.3%)	
	Delayed Recurrence	34 (17.2%)	4 (9.5%)	3 (8.3%)	1 (4.2%)	
modified Rankin score	**Mean ± SD**	2 ± 2.2	1.3 ± 2	0.3 ± 0.5	1.5 ± 2.6	**0.022***
	Range	0 – 6	0 – 6	0 – 1	0 – 6	
Reoperation		44 (22.2%)	7 (16.7%)	0 (0.0%)	3 (12.5%)	**0.013***
		Platelets levels				P value
		<50 ×10^3 (n =12)	**50 – 80 ×10^3 (n =24)**	**>150 ×10^3 (n =264)**		
Radiological	**Accepted decompression**	4 (33.3%)	19 (79.2%)	196 (74.2%)		**0.006***
	Acute blood accumulation	6 (50%)	2 (8.3%)	30 (11.4%)		**<0.001***
	Delayed Recurrence	2 (16.7%)	3 (12.5%)	38 (14.4%)		0.942
modified Rankin score	**Mean ± SD**	2.3 ± 2.7	0.4 ± 0.8	1.3 ± 2.1		**0.027***
	Range	0 – 6	0 – 3	0 – 6		
Reoperation		5 (41.7%)	2 (8.3%)	43 (16.3%)		**0.036***
		INR level				
		Normal (n =258)		**Elevated (n =42)**		
Radiological	**Accepted decompression**	198 (76.7%)		24 (57.1%)		**0.013***
	Acute blood accumulation	24 (9.3%)		12 (28.6%)		**0.001***
	Delayed Recurrence	36 (14.0%)		6 (14.3%)		1.000
modified Rankin score	**Mean ± SD**	1.2 ± 1.9		2 ± 2.2		**0.015***
	Range	0 – 6		0 – 6		
Reoperation		42 (16.3%)		12 (28.6%)		0.08

*: statistically significant as P value <0.05

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Table 3: Relation between time of intervention time of intervention, time of restarting anti-coagulant and prognosis in patients with GCS ≥12 and GCS <12

GCS ≥12		Urgent (n =30)	Waiting until stabilization (n =180)	P value
Radiological	**Accepted decompression**	12 (40.0%)	168 (93.3%)	**<0.001***
	Acute blood accumulation	12 (40.0%)	0 (0.0%)	**<0.001***
	Delayed Recurrence	6 (20.0%)	12 (6.7%)	**0.027***
Clinical modified Rankin score	**Mean ± SD**	3 ± 2.3	0.47 ± 1.2	**<0.001***
	Range	0 – 6	0 – 5	
Reoperation		12 (40.0%)	6 (3.3%)	**<0.001***
GCS <12		**Urgent (n =63)**	**Waiting until stabilization (n =27)**	**P value**
Radiological	**Accepted decompression**	36 (57.1%)	26 (96.3%)	**0.008***
	Acute blood accumulation	13 (20.6%)	1 (3.7%)	**0.01***
	Delayed Recurrence	14 (22.2%)	0 (0.0%)	**0.007***
Clinical modified Rankin score	**Mean ± SD**	2.1 ± 2.3	5 ± 1	**-**
	Range	0 – 6	4 - 6	
Reoperation		27 (42.8%)	10 (37%)	**0.007***
		Time of restarting anti-coagulant		**P value**
		After 48 hrs (n =84)	**After 4 days (n =216)**	
Radiological	**Accepted decompression**	24 (28.6%)	198 (91.7%)	**<0.001***
	Acute blood accumulation	18 (21.4%)	18 (8.3%)	**0.003***
	Delayed Recurrence	42 (50.0%)	0 (0.0%)	**<0.001***
Clinical modified Rankin score	**Mean ± SD**	3.14 ± 2.2	0.58 ± 1.4	**<0.001***
	Range	0 – 6	0 – 6	
Reoperation		36 (42.9%)	18 (8.3%)	**<0.001***

*: statistically significant as P value <0.05

Discussion

We found that the radiological and clinical outcome is better in young patients rather than old patients. The final outcome regarding accepted decompression was significantly higher in <70 years old patients, but in ≥70 years old patients, acute blood accumulation, delayed recurrence and need reoperation were significantly higher. Clinical modified Rankin score was significantly higher in patients whose ≥70 years old patients compared to <70 years old patients.

Previous study reported by González-Vargas PM found that the prognosis was significantly worse in patients over 80

years of age. Although advanced age is one of the reasons for poor prognosis, this should be ignored when deciding on surgical intervention. Despite their advanced age, there are many elderly patients who recover after surgical intervention [3]. However, Ou Y found that no significant difference in recurrence rate between different ages groups [4].

We found that there was a significant difference in outcomes between patients who used different types of antiplatelet or anticoagulants. Clinical modified Rankin score was significantly lower in patients in NOAC compared to patients on different types of anticoagulants or antiplatelet.

This is agreed with study done by Amano T detected that the risk of subdural hematoma was significantly higher for those assigned vitamin k antagonist drugs versus direct thrombin inhibitor. The risk of subdural hematoma was significantly lower among participants assigned to NOAC versus warfarin [5]. However, Motoie R stated that severe complications such as acute epidural hematoma and acute subdural hematoma (SDH) are related to the use of oral antithrombotic agents at the time of admission, but they do not increase recurrence rates in these patients [6].

Our study shows that radiological and clinical outcome significantly a better in patients on warfarin dose < 3mg than patients on warfarin dose > 3mg and better in patients who were on warfarin for 0 to 6 months compared to those who were on warfarin for long period.

It is agreed with a previous analyses done by Connolly BJ which demonstrated that the increased risk with VKAs is a significant dosage-dependent effect seen with warfarin. The achieved mean INRs in the included VKA trials fell into a relatively narrow range (2.1–3.2) that approximates the target therapeutic range for most long-term clinical indications. The antithrombotic effects of aspirin seem to be independent of dosage within the ranges tested (50–1300 mg/d) [7].

Our study shows that in patients with GCS ≥12 with less urgently cases and can wait until subside the effect of an anticoagulant or antiplatelet drugs before intervention, the overall outcome was significantly higher in patients who waited until stabilization and subside the effect of anticoagulant and antiplatelet drugs before intervention, than in patients who had urgent intervention. As accepted decompression was significantly higher participants who waited, but in participants who had urgent intervention, acute blood accumulation, delayed recurrence, reoperation and Clinical modified Rankin score were significantly higher.

This agrees with Keeling D study, who showed that continuation of antiplatelet drugs during the perisurgical period is associated with an increased risk of bleeding [8]. On the other hand Amirjamshidi A study showed that an association between higher GCS scores and better functional outcome, a decreased consciousness has been linked to poor outcome [9].

As our study detect that in patients with GCS <12, however the number of patients with accepted decompression was significantly higher in patients who waited until stabilization before intervention, The mortality and morbidity is significantly higher in patient waiting and no significant difference in acute blood accumulation and delayed recurrence in both condition in comparison to this high mortality and morbidity from waiting. So urgent intervention with risk of acute blood accumulation with better prognosis than waiting.

Previous study was done by Shapey J showed that Fresh frozen plasma (FFP), prothrombin complex concentrate (PCC), or recombinant activated factor VII (rfVIIa) could be used for critical situations with low GCS. Besides, FFP could be an issue in patients with cardiac dysfunction and PCC becomes a valuable option [10] . On the other hand, Gerlach R study showed that in high-risk patient we

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can use bridging therapy of LWMH has been recommended for at least 12 h before and after surgery whenever needed [11].

We detected that early restarted anticoagulants after 48 hours have high recurrence compared to patients who restarted anticoagulants after 4 days. And needed reoperation was significantly higher than patients who restarted anticoagulants after 4 days.

It agreed with Zanaty M who identified that the optimal period to restart an oral anticoagulation range between 2 and 21 days after surgery [12]. They concluded that this interval is characterized by a lower risk of both hematoma recurrence and stroke. However, a previous study by Phan K advised restarting antithrombotic agents after 1month, As CSDH recurrences occur in this period after surgery [13].

We found that the radiological and clinical outcome was significantly lower in patients with platelets $<50 \times 10^3$ compared to those with platelets $>50 \times 10^3$. And the number of patients who had reoperation was significantly higher in patients with platelets $<50 \times 10^3$ compared to those with platelets $>50 \times 10^3$.

In a study done by Abdelfatah and a group of researchers 2018, it was reported that if the platelet count is below $>50 \times 10^3$, the risk of acute bleeding increases in the postoperative period. In emergent operations, it is recommended that the platelet count should be at least 80,000 [14].

Conclusion

There are high mortality and morbidity with high risk of recurrence and acute blood accumulation in early evacuation of CSDH in cases of patients on treatment by anticoagulant and or antiplatelet drugs. So, If patient neurologically stable (GCS ≥ 12), we can wait until stabilization of the general conditions, control vital conditions and elimination the effect of these drugs. On the other hand, patient with bad neurological conditions (GCS < 12), evacuation of hematoma is a mandatory whatever the general conditions.

As regard restoring this medical treatment post-operative for those patients, the priority usually for the vital conditions. If it is risky and life-threatening conditions, we can restore those drugs as early as possible. Otherwise, we can wait as possible result in better radiological and clinical outcome.

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Author contribution

Authors contributed equally to the study**.**

Conflicts of interest

No conflicts of interest

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