Clinical characteristics, brain computerized tomography scan and surgical outcome in elderly patients with chronic subdural hematoma

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Summary

Objective: To determine clinical characteristics, computer tomography brain imaging, and surgical outcome for elderly patients with chronic subdural hematoma (CSDH). *Subject and method:* A cross-sectional, descriptive, and retrospective study was conducted on 74 elderly patients diagnosed with CSDH and operated at 108 Military Central Hospital from June 2020 to June 2021. *Result:* Mean age was 75.2 years; male/female ratio was 3.93/1, the most common cause was traumatic brain injury (49%). The common presenting symptoms of CSDH were altered mental state (70.9%) and headache (68.9%), followed by cognitive impairment (54.1%), hemiparesis (21.6%), hematoma maximal thickness and midline shift were associated with a higher rate of hemiparesis in CSDH patients ($p<0.05$); The percentage of patients with GCS score ≥ 13 was 90.5%. The portion of unilateral on the brain CT was 78.4%. The most common densities of CSDH obtained from CT imaging was isodense (accounting for 54.0%); followed by hypodense (20.3%), high-density (17.6%), and mixed-density (8.1%); The most common complication of burr hole technique was pneumocephalus (accounting for 8.1%); recurrence of CSDH (5.4%). The Glasgow outcome scale (GOS) 4-5 was 89.7% within 3 months. *Conclusion:* Chronic subdural hematoma was one of the most common diseases in neurosurgery. The burr hole drainage technique was safe and effective.

Keywords: Chronic subdural hematoma, clinical characteristics, burr hole drainage technique.

1. Background

Chronic subdural hematoma (CSDH) is an encapsulated collection of blood and blood degradation products layered between the dura mater and the arachnoid membrane. CSDH is a common disease, especially in elderly patients in a neurosurgical department. The reported incidence of CSDH varies from 8.8 to 79.4 per 100000 persons per year, with an increasing trend in elderly patients [12].

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Symptoms and signs of these lesions are changeable-from mild to severe-and depend on the type and location of the hematoma within the brain.

Even though the diagnosis has been more straightforward since the introduction of computerized tomography, there are either many cases in the elderly aged above 65 years that are missed or the diagnosis is delayed due to the absence of no focal neurological deficits and/or concomitant chronic diseases. Indeed, the common symptom of CSDH in the elderly is more likely to be presented as mental changes instead of signs of increased intracranial pressure.

Burr-hole craniotomy has been the most advocated and effective surgical strategy for CSDH over the past 20 years [3]. The authors conducted a study to understand better the current clinical, computer tomography brain imaging and results of chronic subdural hematoma.

2. Subject and method

2.1. Subject and design

A cross-sectional, descriptive, and retrospective study was conducted on 74 patients (≥ 60 years) diagnosed with CSDH and surgically treated at 108 Military Central Hospital from June 2020 to June 2021.

Selection criteria: All patients diagnosed with CSDH were surgically treated based on clinical and brain CT.

Exclusion criteria: The patients diagnosed with CSDH didn't surgically treat. Patient or representative disagreeing with participating in the study.

2.2. Variable and data processing

When clinical suspicion for CSDH exists based on history and physical exam, non-contrast computed tomography (CT) is the diagnostic tool. Information and exploitation filled in the research records include:

General characteristics; causes of CSDH (head trauma or none head trauma); medical history (Hypertension, old stroke, serious CSDH, diabetes mellitus, alcohol consumption, coagulation disorder); Common presentations.

Brain CT: Lesion location (left, right, bilateral); Density of hematoma (isodense, hypodense, high-density, mixed-density; hematoma thickness (< 10mm, 10-20mm, > 20mm); Midline shift (< 10mm, ≥ 10mm).

Treatment: All the patients were surgically treated with burr-hole surgery. The subdural blood was evacuated by abundant saline washout followed by a closed system drain placement. The subdural drain was left for 2-5 days and removed based on decreasing drain output and brain re-expansion verified by a CT scan.

Duration of drainage (less than 3 days; 3 days or more); amount of drainage (< 100ml; 100-200ml; > 200ml);

Complications related operation: Pneumocephalus; recurrence of CSDH, infection, hemorrhage; Glasgow outcome score at that time three months after discharge (1: Death; 2 persistent vegetative state; 3 severe disability; 4 moderate disability; 5 low disability).

2.3. Process of data analysis

Descriptive statistics were reported as means and standard deviations, minimum, maximum, or percentage. Data analysis was done by SPSS 22.0 software (IBM Inc, USA).

3. Result

Table 1. Patient demographics and CSDH etiology

Characteristics		Combine (n = 74)	CSDH Unilateral (n = 58)	CSDH Bilateral (n = 16)	p
Patient age in years	$\bar{X} \pm$ SD; (min-max)	75.2 ± 7.8 (60 - 95)	74.4 ± 7.34 (60-89)	77.88 ± 9.06 (60-95)	>0.05
Male, n (%)		59 (79.7%)	45 (77.6%)	14 (87.5%)	>0.05
CSDH etiology n (%)	Head trauma	36 (49.0%)	29 (50.0%)	7 (43.8%)	>0.05
	None head injury	38 (51.0%)	29 (50.0%)	9 (56.2%)	

The mean age of the patients was 75.2 years; the male/female ratio was 3.93/1. The common cause was trauma brain trauma (49.0%); Patient age, gender, and etiology had no significant differences between the patients with unilateral and bilateral CSDH.

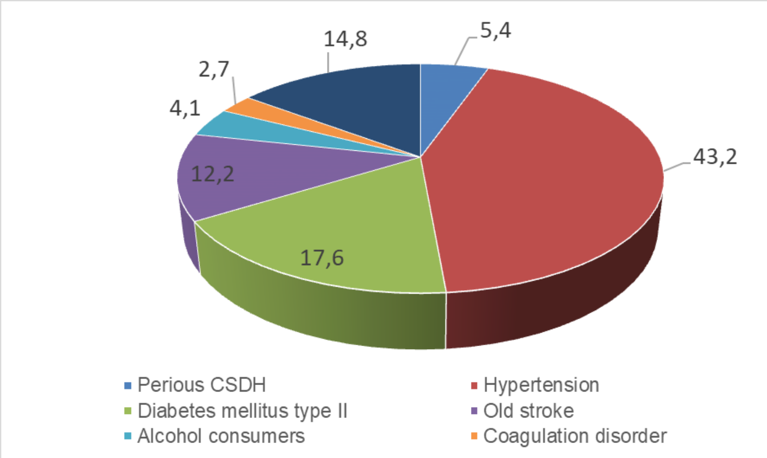

Figure 1. Medical history features

The most common medical history was hypertension (43.2%), diabetes mellitus type II (17.6%); alcohol consumers (14.8%); old stroke (12,2); perious CSDH (5.4%).

Table 2. The GCS scale of patients

Characteristics		Combine (n = 74)	CSDH		p
			Unilateral (n = 58)	Bilateral (n = 16)	
GCS score	($\overline{X}$ ± SD) (min-max)	13.9 ± 1.93 (9-15)	14.2 ± 2.02 (9-15)	12.8 ± 1.8 (9-15)	<0.05
	Moderate (score 9-12) n, %	7 (9.5%)	2 (3.4%)	5 (31.2%	<0.05
	Mile (score 13-15) n, %	67 (90.5%)	56 (96.6%)	11 (68.8%)	

The mean GCS score of the patients was 13.8; The percentage of patients with Glasgow ≥ 13 was 90.5%; There was no patient with GCS score ≤ 8. The GCS score was significantly lower in patients with bilateral than unilateral CSDH (p<0.05).

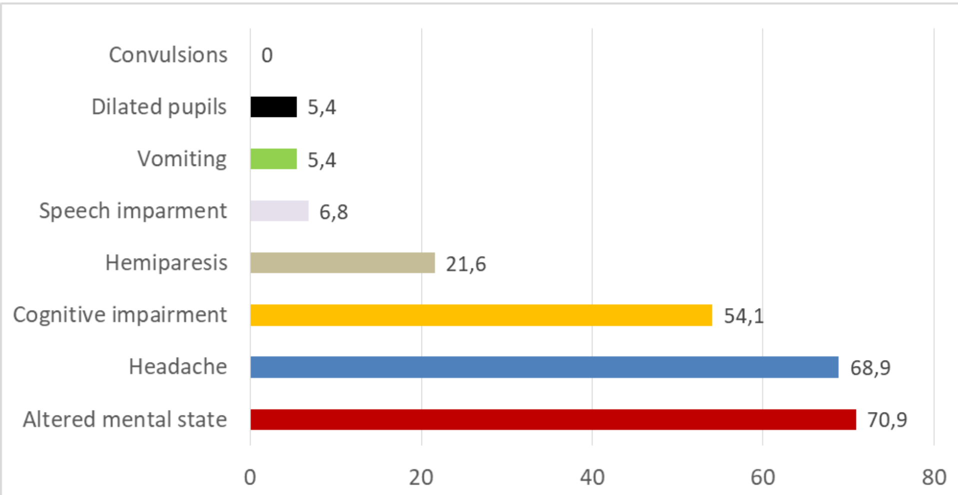

Figure 2. Clinical presentations of CSDH

The common symptoms of CSDH were altered mental state (70.9%), headache (68.9%), cognitive impairment (54.1%), hemiparesis (21.6%); speech impairment (6.8%); vomiting and dilated pupils counted the same percentage (5.4%).

Table 3. The head CT imaging of CSDH

Brain CT Features		Number (%) (n = 74)
Laterality	Right	30 (40.6%)
	Left	28 (37.8%)
	Bilateral	16 (21.6%)
Density	Isodense	40 (54.0%)
	Hypodense	15 (20.3%)
	High-density	13 (17.6%)
	Mixed-density	6 (8.1%)
Maximal hematoma thickness (mm)	$\overline{X}$ ± SD (min-max)	19.5 ± 6.5 (8-38)
	< 10	4 (5.4%)
	10-20	47 (63.5%)
	> 20	23 (31.1%)
Midline shift (mm)	$\overline{X}$ ± SD (min-max)	9.5 ± 3.78 (6-18)
	< 10mm	44 (59.5%)
	≥ 10mm	30 (40.5%)

The percentage of unilateral on the brain CT was 78.4% (left 37.8%, right 40.6%). The most common densities of CSDH obtained from CT imaging were isodense (accounting for 54.0%), then hypodense (20.3%), high-density (17.6%), and mixed-density (8.1%); the maximal hematoma thickness and midline shift was respectively 19.5mm and 9.5mm; the thickness above 10mm accounted for 94.6%, the midline shift above 10mm was 40.5%.

Table 4. Relationship between thickness, midline shift on brain CT and hemiparesis

Brain CT Features	Hemiparesis ($\overline{X}$ ± SD)		p
	Yes (n = 16)	No (n = 58)	
Thickness (mm)	23.1 ± 6.3	18.5 ± 6.6	<0.05
Midline shift (mm)	11.6 ± 3.4	8.9 ± 4.0	<0.05

The thickness and midline shift on CT scans was significantly more significant in patients with hemiparesis than nonhemiparesis ($p<0.05$).

Table 5. Surgical characteristics and outcome of CSDH

Characteristics		Number (%) (n = 74)
Duration of drainage (day)	$\overline{X}$ ± SD (min-max)	2.2 ± 1.1 (1-5)
	< 3	50 (67.6%)
	3-5	24 (32.4%)

Characteristics		Number (%) (n = 74)
Amount of drainage (ml)	$\overline{X}$ ± SD	155.8 ± 74.2
	< 100	16 (21.6%)
	100-200	38 (51.4%)
	> 200	20 (27.0%)
Complication	Pneumocephalus	6 (8.1%)
	Residual of CSDH	4 (5.4%)
	Infection	2 (2.7%)
	Hemorrhage	1 (1.4%)
GOS within 3 months*	5	54 (79.4%)
	4	7 (10.3%)
	3	7 (10.3%)
	≤ 2	0 (0.0%)
	Total	68 (100%)

The mean duration of drainage was 2.2 days; the amount of drainage was 155.8ml; The most common complication of the burr hole technique was pneumocephalus (accounting for 8.1%); the residual of CSDH (5.4%). The GOS 4-5 was 89.7% within three months.

4. Discussion

The study was conducted on 74 patients (≥ 60 years) with CSDH at 108 Military Central Hospital from June 2020 to June 2021.

The patients included 59 males (79.7%) and 15 females (20.3%), and the average age of patients with CSDH was 75.2 years old (between 60 to 95 years old). Studies from the UK and US have documented mean patient ages from 70 to 90 years [7]. Research in Taiwan by Sheng-Yu Cheng et al. conducted on 342 patients with CSDH in the elderly showed that the mean age was 77.2 ± 11.4 years [4].

We found an overall preponderance of males, with a ratio of 3.93/1. The result is higher than the research of Sheng-Yu Cheng et al. (with a ratio of 2.2/1) [4].

The common cause was trauma brain trauma (49%); According to medical literature, trauma is an essential factor of CSDH. However, there are about 30%–50% of the cases absent a history of head injury (direct trauma). On the other hand, indirect trauma seems to be more important. About half of the patients have a fall history but without hitting their head on the ground. The trauma is so trivial in many situations that it is forgotten [1]. Other factors of CSDH include anticoagulation, alcoholism, epilepsy, bleeding diathesis, low intracranial pressure secondary to dehydration or after the removal of cerebrospinal fluid… [1].

The most common medical history was hypertension (43.2%), diabetes mellitus type II (17.6%); alcohol consumption (14.8%); old stroke (12.2%); previous CSDH (5.4%). The percentage of coagulation disorder was 2.7%. Nowadays, there has been a dramatic increase in the use of anticoagulants and dual antiplatelets in modern-day clinical practice. In the research Adhiyaman V et al (2017), about 30% of our patients were on warfarin, and 25% were on antiplatelets. This is likely to increase with the advent of directly acting anticoagulants [2].

The mean GCS score of the patients was 13.8; The percentage of patients with GCS score ≥ 13 was 90.5%; GCS score was significantly lower in patients with bilateral than unilateral CSDH (p<0.05). Many patients have a mild reduction in their level of consciousness (GCS score of 13-15), but elderly patients with CSDH do not typically present in a coma [13]. Patients with CSDH may present in various ways, and the onset and progression of symptoms may range from days to weeks. Elderly patients often present with many symptoms that may resemble a stroke or rapidly progressive dementia.

The common presenting symptoms of CSDH were altered mental state (70.9%) and headache (68.9%), followed by cognitive impairment (54.1%), hemiparesis (21.6%), speech impairment (6.8%); vomiting and dilated pupils counted the same percentage (5.4%). In a study by Gelabert-González M et al, conducted on 1000 patients with CSDH, their presenting symptoms included behavioral disturbance (28.5%), headaches (25.1%), and limb weakness (24.8%); Behavioural disturbance was the predominant clinical feature in elderly patients [5].

The percentage of common symptoms of CSDH is different from the result from the research of Gelabert-González M et al. Their presenting symptoms included varying degrees of confusion, drowsiness, or coma. It may be challenging to differentiate between acute delirium and behavioral or psychotic symptoms. The percentage of headaches varies in different studies ranging from 14% to 80%. But these results agree with the medical literature, 50%-70% of the elderly with CSDH is an altered mental state. It is less common in the elderly than in younger patients. It is partly due to the large available intracranial space for the hematoma to accommodate before creating pressure on the adjacent brain. Another reason is the earlier onset of confusion, which attracts medical attention before the development of headaches in the elderly [1].

Computed tomography (CT) scan is the standard method of diagnosis of CSDH. However, both clinical and CT findings in CSDH have been described previously. The percentage of unilateral on the brain CT was 78.4% (left 37.8%; right 40.6%). Bilateral on the brain CT was 21.6%, which is similar to the research of Adhiyaman V et al showed that a quarter of patients had bilateral CSDH [2].

The most common densities of CSDH obtained from CT imaging was isodense (accounting for 54.0%); following by hypodense (20.3%), high-density (17.6%) and mixed-density (8.1%); This result is similar to the study of Zolfaghari S et al conducted on 998 patients showing that the isodense (accounting for 45.9%); hypodense (28.4%), high-density (17.6%) and mixe-density (1.9%) [15].

Isodense CSDH was often reported as more common than hypodense lesions. It may depend on the patient population, the CT scanner's resolution, and density classification methods. Mixed density was relatively common, roughly one-third of cases in this study. It shared from 16% to 63% of CSDH [11].

Hematoma thickness is one of the important indicators for the diagnosis and treatment of CSDH. According to our study, the maximal hematoma thickness was 19.5 ± 6.5mm; the thickness above 10mm counted for 94.6%, the midline shift equal and above 10 mm was 40.5%. This result is similar to the study of Zolfaghari et al. with a hematoma thickness of 22.5 ± 6.4mm.

The thickness and midline shift on CT scans was significantly greater in patients with hemiparesis than non-hemiparesis ($p<0.05$). The midline shift was 9.5 ± 3.78 (6-18); The midline shift above 10 mm was 40.5%. The midline shift on CT scans was significantly greater in patients with hemiparesis than non hemiparesis (11.6 ± 3.4 and 8.9 ± 4.0; $p<0.05$). According to some studies, patients with maximal thickness of hematoma and midline shift were associated with a higher rate of hemiparesis. In addition, 19.8mm of hematoma thickness and 6.4mm of midline shift were associated with a 50% probability of hemiparesis in patients with unilateral hematomas [9], [10].

All the patients were surgically treated with burr-hole surgery. The subdural blood was evacuated by abundant saline washout followed by placement of a closed system drain. Kita D et al. conducted on 205 patients with CSDH; 202 patients applied the technique of Burr-hole surgery to drain the hematoma. Burr-hole surgery with closed drainage was a safe procedure in the treatment of CSDH [6], [8].

The mean duration of drainage was 2.2 days; the amount of drainage was 155.8ml; The most common complication of the burr hole technique was pneumocephalus (accounting for 8.1%). The most important technique is positioning patient's head on a horseshoe headrest with burr hole at the highest point if possible. Several other methods have been proposed to reduce postoperative pneumocephalus, such as: Using carbon dioxide to fill the hematoma cavity after blood evacuation. The direction of drain placement to reduce pneumocephalus has been examined in only a few studies. In this research, if severe pneumocephalus made the patients not recover (GCS score didn't increase 2 marks after operation) we would drain placement to reduce pneumocephalus. If the patient's condition was stable, we would keep the position patient's head at 30^0.

Despite efforts, the recurrence rate in surgery for CSDH remains high. The rate of recurrence of CSDH is 5.4%. The recurrence rate of chronic subdural hematoma after surgery ranges from roughly 5% to 30% [14]. When defined as symptomatic reaccumulation of hematoma fluid that needs reoperation, the recurrence rate ranges (widely) from 0.4% to 33.3% [7]. Factors of recurrence that can be influenced are mainly certain operative nuances and postoperative measures such as the type of trepanation, intraoperative irrigation, drain insertion and position, air that enters the subdural space, and postoperative patient position.

Patients with infection at the surgical site accounted for 2% but no cases of meningitis; or epidural bleeding (1%). David Kitya M et al. conducted on 250 patients with CSDH, in which 202 patients underwent surgical intervention with burr holes and drainage, and 22.8% (46 patients) were admitted to the ICU. Two patients suffered a recurrence, 5 developed a postoperative wound infection, and 18 died [8].

Postoperative outcome was evaluated with GOS at discharge. The result showed that the GOS 4-5 was 89.7% within 3 months. This result is similar to the research of Sheng Yu Cheng et al. showed that most of the patients (83.3%) had a very good recovery as measured by the GOS [4]. Gelabert-Gonzáles et al. analyzed 1000 patients with CSDH, 559 of whom were aged > 70 years. In their study, the favorable outcome was achieved in 86.1% overall without further differentiation concerning age [5].

The above research results demonstrated that Burr-hole surgery with closed drainage was a safe and effective procedure for treating CSDH.

5. Conclusion

The present study indicated that trauma was a common cause of chronic subdural hematoma. The common presenting symptoms of chronic subdural hematoma were altered mental state and headache, followed by cognitive impairment and hemiparesis. The most common density of chronic subdural hematoma obtained from CT imaging was isodense. Burr-hole surgery with closed drainage was a safe and effective procedure for treating chronic subdural hematoma.

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