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MANAGING CHRONIC SUBDURAL HEMATOMA IN JORDAN: INSIGHTS FROM A POPULATION-BASED STUDY

Neurosurgery

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ABSTRACT

Background: Chronic subdural hematoma (CSDH) is a neurological condition characterized by the gradual accumulation of blood and fluid within the subdural space. It predominantly affects the elderly. With the global population aged 65 years and older anticipated to double between 2000 and 2030, the incidence of CSDH is expected to rise substantially, posing a significant healthcare challenge. In Jordan, similar demographic trends necessitate a comprehensive understanding of CSDH to inform clinical practices. **Objective:** This study aims to provide epidemiological data on CSDH in Jordan, assess the applicability of existing surgical management guidelines to the Jordanian population, highlight the importance of brain imaging evaluations in managing this condition, and identify potential risk factors in affected patients. **Methods:** A retrospective analysis was conducted on medical records from January 2021 to December 2023 at King Hussein Medical Center (KHMC). Data from 191 consecutive adult patients treated for CSDH were collected, including demographic parameters, past medical history, presenting symptoms, use of anticoagulant and antiplatelet medications, and imaging findings at admission. The outcome was assessed during outpatient visits approximately six months post-treatment. Recurrence rates, timing of recurrence, complications, and clinical parameters contributing to poor outcomes were also evaluated. **Results:** The study population comprised 146 males and 45 females, with a male-to-female ratio of 3.24:1. The age distribution ranged from 25 to 94 years, with a median age of 69.52 ± 14.34 years. No significant differences were found between male and female groups regarding mean age, sides affected, body mass index (BMI), mean follow-up duration, or smoking history. The mean symptom duration prior to surgery was 4.6 ± 2.82 months, and the average postoperative follow-up period was 9.32 ± 3.12 months. Postoperative complications, such as recurrence observed in 16.75% of cases while tension pneumocephalus was revealed in 5.76% of cases. **Conclusion:** Chronic subdural hematoma predominantly affects the elderly population, with a higher prevalence in males. The findings underscore the importance of timely diagnosis and management to improve patient outcomes. Further research is needed to establish standardized treatment protocols and to explore factors contributing to recurrence and poor functional outcomes.

KEYWORDS

Chronic subdural hematoma; Middle meningeal artery embolization; recurrence; epidemiology; surgical management; elderly population.

INTRODUCTION

Chronic subdural hematoma (CSDH) is a neurological condition commonly encountered in clinical practices and increasingly treated surgically both around the world and in Jordan as a result of the rapidly aging population, characterized by a gradual and abnormal accumulation of blood and fluid within the subdural space [1-3], Chronic subdural hematoma primarily affects elderly individuals, with its incidence increasing significantly with age [3]. Individuals of age over 70 years, showed incidence ranging from 2.0 to 58 for 100,000 individuals-years, while the overall incidence is estimated at 8.2–14.0 per 100,000 persons annually. On the other hand, the global population of age 65 years and older anticipated to double between 2000 and 2030, the burden of CSDH is expected to rise substantially, posing a major healthcare challenge [4-6]. This age-related condition is associated with brain atrophy and cerebral blood flow reductions, among other factors **[Figure 1].** CSDH often follows a trivial head injury, likely due to the low-impact forces transmitted onto a shrunken brain [3].

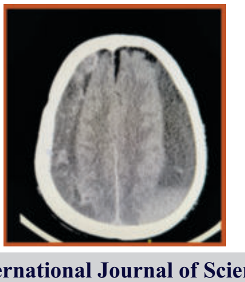

Figure. I: A brain Computed tomography; axial cut of a 66-year-old male patient presented with altered consciousness. Showing bilateral chronic subdural hematoma with elements of fresh blood causing mass effect.

The most widely accepted approach for managing symptomatic CSDH is a surgical evacuation of the hematoma, primarily through burr hole drainage, to alleviate its space-occupying effects **[Figure. 2]** [3]. The progressive aging of the population in Jordan, similar to elsewhere, is expected to perceive an increasing need for this information by clinicians practicing in Jordan. Yet, there is no established consensus on the standard treatment for chronic subdural hematoma.

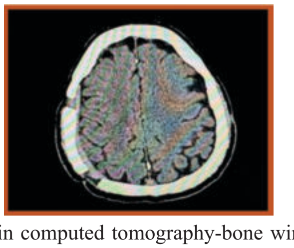

Figure. II: A brain computed tomography-bone window shows the burr evacuation.

While the majority of patients achieve favorable outcomes following surgery, complications, and adverse events remain a concern [3,7]. Recurrence rates after surgical intervention range from 5% to 30% [8], and up to 22% of patients experience poor functional outcomes [9]. Consequently, numerous studies have been undertaken to explore improved treatment options for chronic subdural hematoma.

Our primary goal was to characterize CSDH in the real-world setting of Jordan. The secondary goals of this study were to provide epidemiologic data to aid the clinician's awareness of CSDH, to apply the available surgical management guidelines to CSDH cohorts in the Jordanian population, to raise awareness of the potential value of brain imaging evaluations in managing this condition, and to recognize potential risk factors in affected patients. These applied findings are important for the provision of resources and the development of public health policies regarding elderly and neurological diseases and comorbidities in general.

MATERIALS AND METHODS

Ethics

Patient medical records from January 2021 to December 2023 were retrieved from the King Hussein Medical Center (KHMC) database and analyzed retrospectively. The Royal Medical Services Institutional Ethics Committee has approved this study (Approval No. 52/2/2025). Given the retrospective nature of the study, the requirement for informed patient consent was waived.

Patients

We collected data from 191 consecutive adult patients who were presented and treated for chronic subdural hematoma. Demographic variables, including sex and age, along with patients' medical history, presenting symptoms, and the administration of anticoagulant and antiplatelet therapy were documented. Admission imaging was analyzed based on the anatomical localization of the chronic subdural hematoma and the degree of midline shift (measured in millimeters at the level of the foramen of Monro). The radiological characteristics of CSDH were classified into homogeneous, laminar, separated, or trabecular patterns [10].

Clinical outcomes were evaluated using the modified Rankin Scale during an outpatient follow-up approximately six months post-treatment. Recurrence was defined as the necessity for reoperation, with recurrence timing recorded in 6 weeks following the primary surgical intervention. Postoperative complications were also documented. Additionally, clinical parameters potentially associated with poor outcomes and recurrence were analyzed

Study Design

This study was conducted retrospectively by reviewing the medical records and radiological images of all consecutive patients evaluated at King Hussein Medical Center (KHMC). Patient medical reports were retrieved from the hospital's electronic database for comprehensive analysis.

Statistical Analysis

For the statistical analysis in this study, patient data was systematically recorded and managed using Microsoft Excel 2019. Subsequently, the data was analyzed with SPSS (version 27.0; IBM Corporation, Armonk, NY, USA). Continuous variables are presented as median (range) or mean ± standard deviation. Clinical outcomes over time were evaluated by performing an unpaired sample t-test in Excel 2019, comparing preoperative data with outcomes at 6 months postoperatively. Additionally, an unpaired Student's t-test was utilized to compare outcomes between different patient groups. A p-value of less than 0.05 was considered statistically significant throughout the analysis.

RESULTS

The final study population consisted of 146 males and 45 females, encompassing a total of 45 cases operated bilaterally,92 cases on the left side, and 54 cases on the right side, with a male-to-female ratio of 3.24:1. The age distribution ranged from 25 to 94 years, with a median age of 69.52 ± 14.34 years. Statistical analysis revealed no significant differences between the male and female groups regarding mean age, sides, body mass index (BMI), mean follow-up duration, or smoking history (Table 1).

Table 1: Patient Demographic Data And Characteristics.

Parameter	Males	females	P-value
Number of patients	146	45	0.224
Surgery side			
Bilateral Left Right	38 71 37	7 21 17	0.663
Average Age (years)	69.19± 14.55	68.02± 16.69	0.07
BMI*	28.1±3.2	27.2±3.6	0.98
Mean follow-up duration (months)	9.22±2.68	7.34±3.6	0.225
History of smoking	31	20	0.95
History of minor trauma	68	19	0.44
*BMI = body mass index			

Clinically, the mean symptom duration prior to surgery was 4.6 ± 2.82 months, the average postoperative follow-up period was 9.32 ± 3.12 months, and the cardinal presentation was slurred speech followed by altered consciousness (Table 2). Early postoperative complications, such as seroma, hematoma, or surgical site infections occurring within the first few days after surgery, were excluded from this article. Recurrence was observed in 16.75% of cases while tension pneumocephalus was revealed in 5.76% of cases.

Table II: The Main Manifestation Of Clinical Presentation

Overall %	Male Patients(n)	Female Patients (n)	Presentation
15.70%	16	14	Headache
26.70%	40	11	Altered consciousness
15.70%	20	10	Limb weakness
27.22%	43	9	Speech impairment
14.13%	26	1	Unsteady gait

DISCUSSION

Chronic subdural hematoma is a pathological collection of fluid, blood, and blood degradation products located between the dura mater and the arachnoid layers on the brain's surface [11,12]. This condition exerts a compressive effect on the brain, resulting in neurological deficits that vary depending on the size and location of the hematoma [Figure 3].

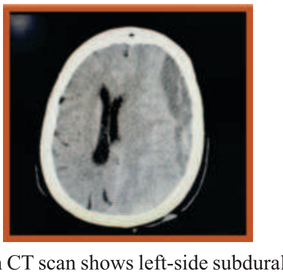

Figure. III: A brain CT scan shows left-side subdural hematoma with midline shift.

The global incidence of CSDH ranges from 8.2 to 14.0 cases per 100,000 people annually and is most prevalent among individuals over the age of 70 [13-16]. With the ongoing aging of the global population, the incidence of CSDH is projected to double by 2037 [17,18].

Historically, all forms of subdural hematoma were thought to originate from venous bleeding of bridging veins, which drain from the cortical surface into the dura mater, leading to blood accumulation in the subdural space [19,20]. This acute bleeding results in clot formation and persistent clots promote the development of fibrous membranes. Over time, these membranes generate their own microvasculature through neo-angiogenesis, with bleeding from these fragile blood vessels contributing to the further expansion, persistence, and recurrence of CSDH [21]. Similar to the initial hemorrhage, recurrent bleeding typically occurs within the capillary layer of the dura mater [20]. These capillaries arise from distal branches of the middle meningeal artery (MMA) [22,23].

Multiple factors have been identified as predisposing elements in the development of chronic subdural hematoma; however, these factors often coexist (Table 3) (Table 4). They can be categorized into broad themes, including traumatic etiology, medical and physiological conditions, craniocerebral disparity, and iatrogenic causes [24]. In the majority of patients with CSDH, a history of head trauma is observed, typically occurring weeks prior to symptom onset. This traumatic event is hypothesized to initiate the disruption of the dural border cell layer. While a definitive history of trauma is not always obtainable, previous studies have identified a preceding traumatic incident in approximately 50–77% of cases [25,26]. A Brazilian cohort study involving 778 patients with CSDH reported that traumatic etiologies included falls (36.2%), traffic accidents (9.5%), physical aggression (4.5%), and other accidents (10.1%), collectively accounting for 60.4% of CSDH cases [27]. Notably, trauma leading to CSDH is frequently associated with alcohol-related incidents. Chronic subdural hematoma development is influenced by various medical and physiological factors including male gender as a significant risk factor, the use of antithrombotic agents, including low-dose aspirin, clopidogrel, direct oral anticoagulants, and vitamin K antagonists. Particularly, vitamin K antagonists present the highest risk, with patients using these medications for 1 to 3 months exhibiting the greatest susceptibility. Long-term dialysis patients experience a subdural hematoma occurrence rate ten times higher than the general population, potentially due to increased anticoagulant use in these individuals [28-32]. Other factors, such as high-altitude exposure, have been proposed as potential contributors, possibly due to increased venous pressure; however, evidence is limited to case reports [30]. Craniocerebral mismatch between brain and skull sizes, is often due to factors like age-related brain atrophy, severe dehydration, or chronic alcohol consumption. This mismatch can increase the risk of chronic subdural hematoma [33]. Iatrogenic cerebrospinal fluid dural leaks, often resulting from surgical procedures or over-drainage during lumbar punctures or drainage systems, can lead to intracranial hypotension. This condition may cause inferior displacement of the brain, stretching cortical bridging veins and arachnoid microvasculature, thus increasing the risk of chronic subdural hematoma. Notably, extended endonasal endoscopic surgeries have been associated with a higher predisposition to CSDH due to postoperative CSF leakage. In cases of CSF drainage, over-drainage has been linked to a 5% incidence of CSDH requiring surgical intervention, particularly in patients with an opening pressure exceeding 160 mmH2O during lumbar puncture. However, the overall occurrence of CSDH attributable to dural leaks remains relatively low [34,35].

Table III: The main co-morbidities patients were suffering from.

Co-morbidity	Female Patients (n)	Male Patients(n)	Overall %
Ischemic heart disease	8	44	27.22%
Hypertension	14	33	24.61%
Diabetes mellitus	12	29	21.47%
Trauma	9	14	12,04%
Alzheimer	1	5	3.14%
Epilepsy	1	4	2.61
Cerebral Vascular Accident	3	8	5.76%
Psychiatric disease	2	3	2.61%
Spinal anesthesia	2	0	1.05%
* Many patients had multiple co-morbidities			

Table IV: The Medication Patients Were Taken Before Diagnosis.

Overall %	Male Patients(n)	Female Patients (n)	Medications
17.80%	19	15	Anti-platelets
24.08%	37	9	Anti-coagulants

Chronic subdural hematoma presents a wide range of clinical manifestations, from asymptomatic cases to severe neurological impairment. The severity of symptoms is influenced by factors such as hematoma volume, rate of expansion, location, and the presence of a mass effect, which may include signs of herniation, loss of gyri visibility on imaging, and reduced ventricular size. Approximately 89% of patients present with a Glasgow Coma Scale (GCS) score between 13 and 15, while about 8% have a GCS between 9 and 12, and 3% present with a GCS between 3 and 8 [25,35-38].

Computed tomography scan is the primary imaging modality for diagnosing and monitoring chronic subdural hematoma. Typically located on the cerebral convexities, CSDHs can be unilateral or bilateral, with bilateral occurrences accounting for approximately 9–22% of cases. In pediatric populations, bilateral presentations are more common. Some studies have noted a slight predominance of left-sided hematomas, possibly due to left hemispheric dominance leading to more noticeable symptoms [25,27,32,39]. Computed tomography imaging of CSDH assesses factors such as hematoma location, laterality, age, thickness, and the presence of membranes. Additional findings may include sulcal effacement, herniation, ventricular compression, midline shift, and cortical thickening [40].

The necessity of routine postoperative imaging for CSDH patients is debated. Recent studies suggest that scheduled follow-up CT scans may not significantly impact patient outcomes, as symptom recurrence often precedes radiological findings. For instance, one study found that in cases requiring reoperation, symptom onset occurred before planned 6-week follow-up CT scans [41]. Another study reported a 5% recurrence rate among 423 operated patients, with the majority being symptomatic at the time of recurrence [42]. These findings indicate that clinical monitoring may be sufficient, reserving imaging for patients exhibiting new or worsening symptoms.

Management of chronic subdural hematomas depends on symptom severity and hematoma characteristics. Surgical intervention is typically recommended for symptomatic patients, hematomas exceeding 10 mm in thickness, or those causing more than 7 mm of midline shift [43]. Burr hole surgery is a common procedure for draining hematomas [24]. Non-surgical treatments may be considered for asymptomatic patients without signs of intracranial hypertension or cortical irritation [44]. The choice between surgical and non-surgical management should be individualized, taking into account patient-specific factors and the potential risks and benefits of each approach [24].

Non-surgical management of chronic subdural hematoma is considered when patients exhibit no signs of intracranial hypertension or cortical irritation, such as seizures. While surgical drainage remains the standard treatment, non-surgical alternatives are gaining attention, especially for patients at high surgical risk [44]. Dexamethasone has been studied for its anti-inflammatory and anti-angiogenic properties. However, evidence regarding its efficacy is mixed. A meta-analysis indicated higher re-intervention rates in patients treated solely with steroids compared to those undergoing surgery or combined treatment [43]. Additionally, a randomized controlled trial found that dexamethasone resulted in fewer favorable outcomes and more adverse events than placebo at six months, despite a reduction in repeat operations. These findings suggest that the benefits of dexamethasone are uncertain and may be accompanied by significant risks [45]. Atorvastatin Primarily studied in Chinese cohorts, has shown potential benefits in reducing hematoma volume and improving clinical outcomes in CSDH patients. However, further research is needed to confirm these findings and establish optimal dosing regimens [46]. Tranexamic Acid, as an antifibrinolytic agent, has been explored as a non-surgical treatment for CSDH. In a small series of 21 patients, 18 experienced favorable outcomes with tranexamic acid alone, and no hematoma recurrences were reported. While these results are promising, larger studies are necessary to validate its efficacy and safety [47,48].

Middle Meningeal Artery (MMA) Embolization is an emerging non-surgical option that aims to reduce blood flow to the outer meninges, thereby addressing the source of bleeding in CSDH [Figure 4]. Advantages of this procedure include being less invasive than surgery, causing less pain, and allowing for the immediate resumption of anticoagulants or antiplatelet medications if needed. However, more research is required to establish its long-term efficacy and safety [49-51].

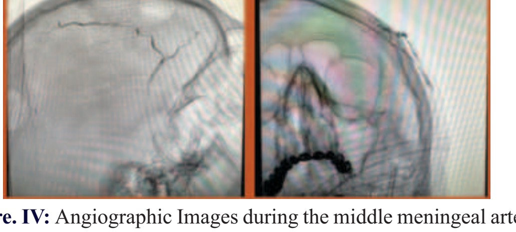

Figure. IV: Angiographic Images during the middle meningeal artery embolization.

Recurrence of CSDH after treatment is a significant concern, with rates varying between 9% and 33%. Factors contributing to recurrence include conditions such as diabetes mellitus and the use of antithrombotic medications that have been associated with higher recurrence rates. Hematoma Characteristics, A hematoma width of 20 mm or more, bilateral occurrence, and specific CT scan features like isodense or hyperdense lesions increase the risk of recurrence.

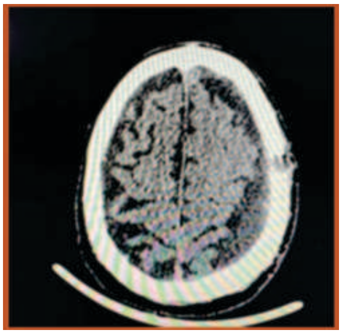

Figure. V: A brain CT-scan shows left side recurrence post burr hole for subdural hematoma evacuation.

A midline shift of 5 mm or more after surgery is linked to a higher chance of recurrence. Other potential complications include infections, seizures, tension pneumocephalus, and medical issues such as deep vein thrombosis or pulmonary embolism.

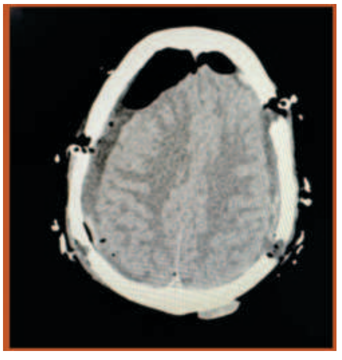

Figure. VI: A brain CT-scan shows right side tension pneumocephalus post bilateral burr holes for bilateral subdural hematoma evacuation.

Table V: The Main Complications Encountered During The Study Period.

Complications	Female group(N)	Male group(N)	Overall (%)
Recurrence	7	25	16.75%
Bilateral	1	7	4.19%
Left	2	13	7.85%
Right	4	5	4.71%
Focal brain contusions	1	1	1.05%
Seizures	3	2	2.62%
Intraparenchymal hematoma	1	2	1,57%
Tension pneumocephalus	5	6	5.76%
Superficial surgical site infection	3	4	3.66%
Subdural empyema	2	4	3.14%

The prognosis for CSDH largely depends on factors like the patient's age, overall health, and the presence of other medical conditions. Early detection and appropriate management are crucial for favorable outcomes.

In summary, while surgical evacuation remains the primary treatment for CSDH, non-surgical options are being explored. Understanding the risk factors for recurrence and potential complications is essential for optimizing patient care.

However, this study has several limitations. Firstly, it lacks a comparative analysis between preoperative and postoperative imaging findings and does not include asymptomatic patients as a control group. Additionally, the relatively small sample size and short follow-up duration may limit the generalizability of the results and restrict insights into long-term outcomes. Socioeconomic factors that could potentially influence the study's findings were also not accounted for in this analysis. Despite these limitations, the study provides valuable insights into postoperative imaging markers and their clinical significance using advanced imaging techniques.

CONCLUSION

Chronic subdural hematoma is a prevalent condition in neurosurgical practice, characterized by encapsulated blood collections that often develop weeks after minor head trauma. Traditionally, surgical intervention has been the primary treatment approach. However, recent studies have explored non-surgical treatments, such as pharmacological therapies, as potential alternatives or adjuncts to surgery. These findings suggest that conservative management may be a viable option for selected patients, particularly those who are mildly symptomatic or asymptomatic.

Emerging minimally invasive procedures, like middle meningeal artery embolization, have also shown promise in managing CSDH. This could potentially reduce recurrence rates and associated morbidities, offering alternative treatment strategies for CSDH patients.

Future Work: We need prospective standardized interval evaluations and a larger population.

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Conflicts Of Interest: The authors certify that he has no affiliation with or any direct or indirect involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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