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# Management of Cranial Subdural Hematoma in Children

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ORIGINAL ARTICLE

# Management of Cranial Subdural Hematoma in Children

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Abstract

*Background:* ***Hemorrhage into the possible area between the dura and the arachnoid membranes results in the formation of a subdural hematoma (SDH).***

*Aim:* ***To study and evaluate a retrospective and prospective identification and treatment of subdural hematoma in children, either traumatic or non-traumatic, at Alazhar Hospitals, Aldoaah Hospital, and Shibin Elkom Teaching Hospital.***

*Patients and methods:* ***This descriptive prospective and retrospective study was conducted on 20 children who attended the emergency ward with subdural hematoma with radiological findings either traumatic or non-traumatic in the neurosurgery department, Al-Azhar University Hospitals, Shebin EL Kom Teaching Hospital, Shebin EL Kom, and Aldoaah hospital, Cairo, Egypt for a period of four years beginning in 2018.***

*Results:* ***The management was surgical in 12 patients (60%) and conservative in 8 patients (40%), while time to surgery "hrs." was ≤4 hrs in 6 patients (50%) and was >4 hrs in 6 patients (50%). A statistically substantial greater frequency of midline shift was found in the surgical group compared to the conservative group (p=0.005). There was a statistically substantial greater median value of the Glasgow coma scale (GCS) in postoperative was 15.0(4.0 – 15.0) compared to preoperative 6.0(6.0 – 9.0), with p-value (p=0.036).***

*Conclusion:* ***SDH in children is an uncommon but dangerous illness. If the right therapy is chosen, the majority of patients may get acceptable care even when their prognosis is poor. For the evacuation of traumatic SDH, craniotomy or decompressive craniectomy may be performed in instances of large acute SDH that are linked to increased intracranial pressure (ICP) and midline displacement.***

*Keywords:* SDH, GCS, Craniotomy

## 1. Introduction

Children's head injuries continue to be the leading cause of mortality and impairment in children older than one year, and they are responsible for a significant number of ER visits and hospital admissions each year. The most frequent injury category is falls, which are followed by incidents involving motor vehicles. Moreover, one of the biggest causes of brain trauma in children less than two years old is still child maltreatment.[1]

In children, particularly in babies and toddlers, acute subdural hematomas (SDH) are very infrequent. In newborns, the prevalence of SDH is 20–25 cases per 100,000 children under one year old and 12 cases per 100,000 children under two years old. [2]

Half to 60% of all subdural hematomas are acute in nature. They are often associated with a traumatic incident. On rare occasions, they could happen on their own, after a mild trauma in patients on anticoagulant or antiplatelet treatment, or following aneurysmatic rupture (most often in the posterior communicant artery).[3]

Acute subdural hematomas that are left untreated or treated conservatively may lead to chronic subdural hematomas, which are often seen in babies.[4]

Blood buildup in the subdural region due to rotating and deceleration forces may cause bridging veins to burst or deform deep draining veins, resulting in acute subdural hematomas (ASH).[5]

Between 37 and 80% of patients with traumatic SDH present with initial GCS scores of 8 or less. A lucid interval has been described in 12 to 38% of patients before admission, but there is no conclusive evidence that this correlates with outcome.[6]

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The use of computed tomography (CT) has made it simpler to identify SDH accurately. While particular threshold values are difficult to identify, there seems to be a link between the result and CT measures, including hematoma volume, clot thickness, midline shift (MLS), and patency of the basal cisterns.[7]

Based on the patient's GCS score, pupillary assessment, comorbidities, CT findings, age, and, in cases when judgments are made later, ICP, the decision to operate on an SDH is made. The choice to operate is also significantly influenced by the progressive decline of neurological function over time.[6]

This work's objective was to investigate and evaluate a retrospective and prospective diagnosis and management of subdural hematoma in children, either traumatic or non-traumatic, at Alazhar Hospitals, Aldoaah Hospital, and Shibin Elkom Teaching Hospital.

## 2. Patients and methods

This descriptive prospective and retrospective study was conducted on 20 children who attended the emergency ward with subdural hematoma with radiological findings either traumatic or non-traumatic at the neurosurgery department, Al-Azhar University Hospitals, Cairo, Egypt, Shebin EL Kom Teaching Hospital, Shebin EL Kom, Egypt and Aldoaah hospital, Cairo, Egypt, and other neurosurgical centers for a period of four years starting from 1st January 2018 until 31st December 2023.

Inclusion criteria: Neonates, infants, children, and post-traumatic with radiological findings.

Exclusion Criteria: Age above 14 years old.

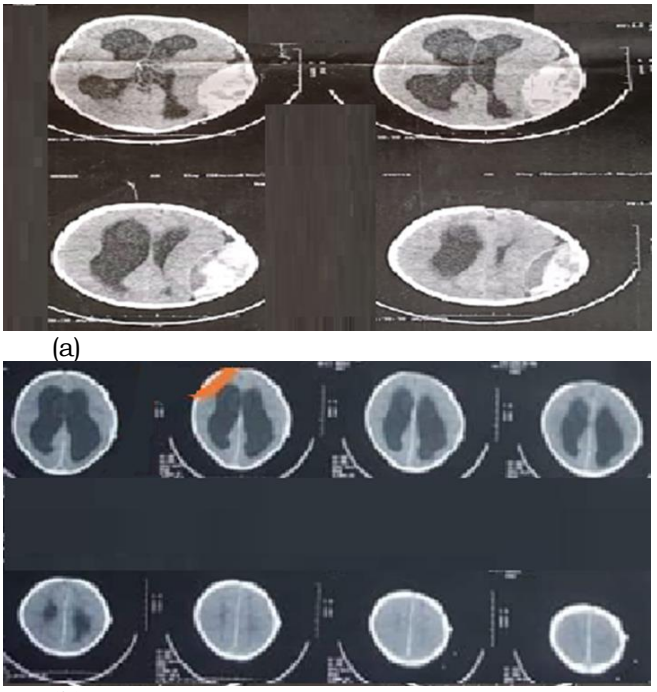
Methods:

All patients underwent the following protocol: Full detailed history, full neurological evaluation of the patient, full laboratory and radiological evaluation as needed, and follow-up of the patients according to the management plain.

CASE PRESENTATION

Case 1: A male child, four years old with a history of hydrocephaly, was admitted to our hospital with a disturbed consciousness level after falling from a height. A general examination was done to exclude other organ injuries. The vital signs were BP 90/60, P 90/min., and RR 19/min. Examination of the head revealed a scalp wound on the left parietal region, 6 cm long. The GCS was 10. Both pupils are regularly rounded and reactive to light. The patient had right-side weakness. Initial CT brain shows left biconcave lesion separated to outer and inner part with effacement of left lateral ventricle without midline shift.

The total size of the hematoma was 96 cc. The patient was prepared for surgery after a full laboratory investigation and transferred to the OR for craniotomy and evacuation of both epidural and subdural hematomas. A follow-up CT scan was done postoperatively, and it revealed a good evacuation of the hematoma. The patient was discharged after eight days of surgery with full GCS 15 and full motor bower.



(a)

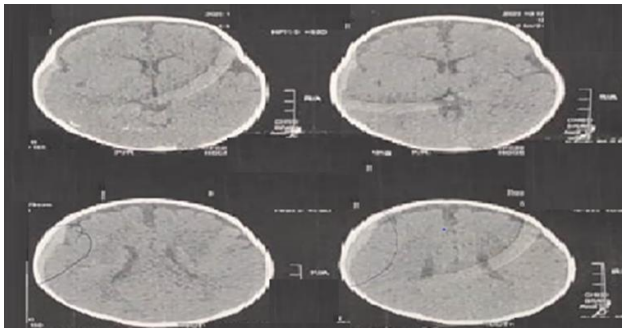
(b)

Figure 1. Case no 1

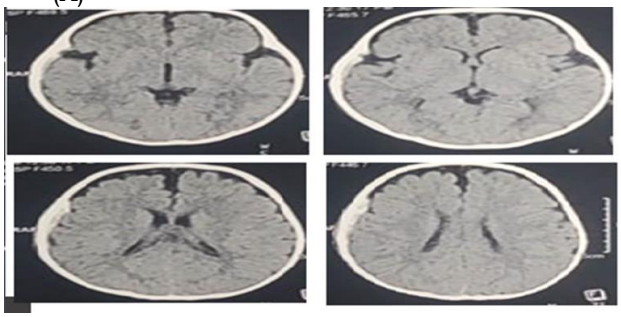
(a): axial cuts of a preoperative CT scan show double lesion epidural and subdural hematoma on the same site, and (b) axial cuts of a postoperative CT scan showing complete evacuation of the hematomas.

Case 2

A female child, two years old, was admitted to emergency triage because of repeated post-traumatic vomiting after falling from a height. A general examination was done to exclude other organ injuries. The vital signs were BP 100/70, P 95/min., and RR 17/min. Examination of the head revealed a scalp abrasion on the right parietal region. The GCS was 15. Both pupils are regularly rounded and reactive to light. The initial CT scan shows a right temporal crescentic shape hyperdense lesion, with size (1×6×4) 24cc and no midline shift. The patient was conservatively managed. A follow-up CT scan was done three days later, showing a mostly resolved hematoma. The patient was discharged with a complete consciousness level.



(A)



(B)

Figure 2. Case no: 2

(A) axial CT at time of admission show acute SDH with size (1× 6×4) 24 cc with no midline shift and (B) follow up axial CT after 2 days of admission and conservative management showing spontaneous resolution of SDH.

## 3. Results

Age ranged from 0.08 to 14 years with mean± SD of 6.44±4.58 and median were 6.0 (2.50–10.50). As regards sex distribution, there was male predominance with 14 males with percentage 70% and 6 females with percentage 30% (Table 1)

*Table 1. Distribution of the cases under study based on demographic information (n = 20)*

| | NO. | % |
|---|---|---|
| SEX | | |
| MALES | 14 | 70.0 |
| FEMALES | 6 | 30.0 |
| AGE (YEAR) | | |
| MIN. – MAX. | 0.08 – 14.0 | |
| MEAN ± SD. | 6.44 ± 4.58 | |
| MEDIAN (IQR) | 6.0 (2.50 – 10.50) | |

IQR: Inter quartile range, SD: Standard deviation

Table 2 showed that the management was surgical in 12 patients (60%) and conservative in 8 patients (40%), while time to surgery "hrs." was ≤4 hrs in 6 patients (50%) and was >4 hrs in 6 patients (50%); as for the ranged 1 to 9 with mean of 4.92 ± 2.64 and median 4.50 (3.0 – 7.50).

*Table 2. Distribution of the cases under study based on management (n=20).*

| | NO. | % |
|---|---|---|
| MANAGEMENT | | |
| CONSERVATIVE | 8 | 40.0 |
| SURGICAL | 12 | 60.0 |
| TIME TO SURGERY (HRS.) | (n = 12) | |
| ≤4H | 6 | 50.0 |
| >4H | 6 | 50.0 |
| MIN. – MAX. | 1.0 – 9.0 | |
| MEAN ± SD. | 4.92 ± 2.64 | |
| MEDIAN (IQR) | 4.50 (3.0 – 7.50) | |

There was a statistically significant higher median value of GCS in post-operative was 15.0(4.0 – 15.0) comparing to Pre-operative 6.0(6.0 – 9.0), with p-value (p=0.036). (Table 3)

*Table 3. Comparison between Pre-operative and Post-operative according to GCS (n= 13).*

| GCS | PRE-OPERATIVE | POST-OPERATIVE | Z | P |
|---|---|---|---|---|
| MIN. – MAX. | 4.0 – 15.0 | 3.0 – 15.0 | 2.097* | 0.036* |
| MEAN ± SD. | 7.77 ± 3.72 | 11.0 ± 5.55 | | |
| MEDIAN (IQR) | 6.0(6.0 – 9.0) | 15.0(4.0 – 15.0) | | |

IQR: Inter quartile range, Z: Wilcoxon signed ranks test, SD: Standard deviation, p: p-value for comparing the groups under study

Table 4 showed highly statistically substantial greater mean value of size in surgical group was 106.08 ± 44.54 comparing to Conservative group was 18.13 ± 7.24, with p-value (p<0.001). (Table 4)

*Table 4. Relation between management and size (n= 20)*

| SIZE | MANAGEMENT | | U | P |
|---|---|---|---|---|
| | Conservative (n = 8) | Surgical (n = 12) | | |
| MIN. – MAX. | 10.0 – 28.0 | 17.0 – 170.0 | 3.50* | <0.001* |
| MEAN ± SD. | 18.13 ± 7.24 | 106.08 ± 44.54 | | |
| MEDIAN | 16.0 | 108.0 | | |

U: Mann Whitney test

*: Statistically significant at p ≤ 0.05

Table 5 showed statistically significant higher frequency of midline shift in surgical group was 10 patients (83.3%) comparing to Conservative group was one patient (12.5%), with p-value (p=0.005).

*Table 5. Relation between management and midline shift (n= 20).*

| MIDLINE SHIFT | MANAGEMENT | | | | TEST OF SIG. | P |
|---|---|---|---|---|---|---|
| | Conservative (n = 8) | | Surgical (n = 12) | | | |
| | No. | % | No. | % | | |
| NO | 7 | 87.5 | 2 | 16.7 | $\chi^2$= | FEp= |
| YES | 1 | 12.5 | 10 | 83.3 | 9.731* | 0.005* |
| MIN. – MAX. | | | 3.0 – 15.0 | | – | – |
| MEAN ± SD. | 1.0# | | 8.30 ± 3.89 | | | |
| MEDIAN | | | 9.0 | | | |

FE: Fisher Exact, χ2: Chi square test, *: Statistically significant at p ≤ 0.05

There was a highly statistically substantial greater median value of GOS in time to surgery ≤4 hours was 5 comparing to time to surgery >4 hours was 1, with p-value (p<0.001). Additionally, there was a statistically substantial greater median value of postoperative GCS in time to surgery ≤4 hours was 15 comparing to time to surgery >4 hours was 3.5, with p-value (p=0.015) (Table 6).

*Table 6. Relation between the times relapsed from trauma to Surgery and outcome.*

| OUTCOME | TIME TO SURGERY | | U | P |
|---|---|---|---|---|
| | ≤4 hours | >4 hours | | |
| GOS | (n= 5) | (n= 3) | | |
| MIN. – MAX. | 5.0 – 5.0 | 1.0 – 4.0 | 0.0* | <0.001* |
| MEAN ± SD. | 5.0 ± 0.0 | 2.0 ± 1.73 | | |
| MEDIAN | 5.0 | 1.0 | | |
| POST-OPERATIVE GCS | (n= 6) | (n= 6) | | |
| MIN. – MAX. | 15.0 – 15.0 | 3.0 – 15.0 | 3.0* | 0.015* |
| MEAN ± SD. | 15.0 ± 0.0 | 6.33 ± 5.05 | | |
| MEDIAN | 15.0 | 3.50 | | |

U: Mann Whitney test, *: Statistically significant at p ≤ 0.05

## 4. Discussion

Age ranged from 0.08 to 14 years with mean± SD of 6.44±4.58 and median were 6.0 (2.50–10.50). As regards sex distribution, there was male predominance with 14 males with percentage 70% and 6 females with percentage 30%.

Deora et al.,[8] has proven the male predominance once again in line with earlier research. The majority of patients showed signs of anorexia, lethargy, enlarged fontanelles, and seizures.

Our results showed that the management was surgical in 12 patients (60%) and conservative in 8 patients (40%), while time to surgery "hrs." was ≤4 hrs in 6 patients (50%) and was >4 hrs in 6 patients (50%); as for the ranged 1 to 9 with mean of 4.92 ± 2.64 and median 4.50 (3.0 – 7.50).

In terms of surgical techniques, there isn't a set procedure for treating individuals with traumatic SDH caused by maltreatment who are less than two years old. Other writers have also reported experiencing this problem: Kurschel et al.,[9] and Vinchon et al.,[10]

The severity of the situation (low GCS score and ICH), the hematoma volume, and the neurosurgeon's preference and expertise all influence the best course of therapy. According to earlier reports by Meyer et al.[11] and Vinchon et al.,[12] children with a GCS score of less than 12 at hospital admission, signs of ICH (bulging fontanels, sunset eyes, Cushing triad, or raised vascular resistance on TCD ultrasonography), or presenting with a large SDH (> 10 mm), were routinely treated with emergency surgery.

Kurschel et al.,[13] revealed that under these youngsters, craniotomy and decompressive craniectomy were justified only under special circumstances.

Both of the children who had craniotomies had massive acute SDHs with a midline shift and ICH signs; the two children who had decompressive craniectomies also had cerebral edema, refractory ICH, and hemisphere ischemia in addition to the massive acute SDH, which have been described by other writers Csókay et al.,[14] and Josan and Sgouros,[15] as indications for this procedure only repaired with conclusive surgery as Paiva et al.,[16]

Our study revealed that there was a statistically substantial greater median value of GCS in postoperative was 15.0(4.0 – 15.0) compared to Preoperative 6.0(6.0 – 9.0), with p-value (p=0.036). Also, our results showed a highly statistically substantial greater mean value of size in the surgical group, which was 106.08 ± 44.54, compared to the Conservative group, which was 18.13 ± 7.24, with a p-value (p<0.001). In addition, our results showed a statistically substantial greater frequency of midline shifts in the surgical group of 10 patients (83.3%) compared to the Conservative group of one patient (12.5%), with a p-value (p=0.005). There was a highly statistically substantial greater median value of GOS in time to surgery ≤4 hours was five compared to the time to surgery >4 hours was 1, with p-value (p<0.001). Additionally, there was a statistically substantial greater median value of postoperative GCS in time to surgery ≤4 hours was 15 compared to the time to surgery >4 hours was 3.5, with a p-value (p=0.015)

Deora et al.,[8] reported that The occurrence of pediatric cSDH is concerning, and the doctor has to be informed in order to rule out child maltreatment and search for an underlying explanation. A thorough skeletal and metabolic workup is necessary. While CSF diversion is not a panacea, it may undoubtedly be the root of all issues; thus, treating core diseases should be the main objective. Thirty of these instances were discovered throughout a ten-year span (2008–2018). There were 20 male patients (66.67%) and 10 female patients (33.33%) with a mean age of 7.3 years (range two months–to 17 years). In 30% of instances, elevated intracranial pressure (n = 9) was the most prevalent presenting symptom, followed by seizures in 26.67% of cases (n = 8). In 43.33% of cases (n = 13), the most prevalent predisposing factor was the prior shunt. 56.67% of patients (n = 17) had unilateral cSDHs, while 43.33% of cases (n = 13) had bilateral ones. In 27 instances (90%), a burr hole craniostomy was performed; in three cases (10%), conservative care was used. Ninety percent of the patients had follow-up accessible, with an average follow-up period of 24 months. The recurrence rate (n = 9) was 30%. 77% of bilateral illness was caused by shunt operation (p = 0.009). In our series, there were no reports of child abuse.

Wang et al.,[17] a 9-year-old kid with a history of dodgeball injuries, was diagnosed with cSDH. According to the aforementioned research, a

patient with or without a history of trauma who presents with any of the following symptoms should be suspected of having cSDH : (1) any modification to the brain's structure, (2) specific neurological impairment, and (3) increasing intensity of headache.

In the most recent ten-year series, Nguyen et al.,[18] and Palmer and Albert,[19] Some examples included individuals with shunted hydrocephalic patients who were scanned during normal follow-up and had very mild headaches.

The study's strong points: This study's strengths include its prospective and retrospective design, as well as the fact that no patients were lost while it was being conducted. This was the first investigation at Al Azhar University Hospitals to evaluate the etiology, treatment, and prognosis of pediatric cerebral subdural hematomas.

Every attempt was taken to ensure that all data were recorded and that the data analysis included only full information. The same team conducted all clinical assessments and evaluated trial results.

The limitations of the study: It is important to note the study's limitations. Because it was conducted in a hospital, there were fewer cases and a smaller sample size compared to the study's outcomes. Because it was not a multicentric study, there was an elevated possibility of publication bias, and the study failed to reflect a particular community.

### *4. Conclusion*

SDH in children is an uncommon but dangerous illness. If the right therapy is chosen, the majority of patients may get acceptable care even when their prognosis is poor. For the evacuation of traumatic SDH, craniotomy or decompressive craniectomy may be performed in instances of significant acute SDH that are linked to midline displacement and increased ICP. The preferred course of therapy for a simple chronic subdural hematoma is burr-hole evacuation (CSDH). Patients who are asymptomatic or have a high surgical risk should only get nonsurgical treatment. Angiotensin-converting enzyme inhibitors and steroids can potentially be important in the treatment. A single management approach is insufficient for all CSDH instances.

## Disclosure

The authors have no financial interest to declare in relation to the content of this article.

## Authorship

All authors have a substantial contribution to the article

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## Conflicts of interest

There are no conflicts of interest.

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