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Original Article

A Clinical Study of Acute Subdural Hematoma: A Prospective Study

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Abstract

Background: Acute subdural hematoma (ASDH) is seen in approximately one-third of patients with severe traumatic brain injury and in half to more than two-thirds of those undergoing hematoma evacuation. ASDH is associated with high rates of mortality, ranging from 40% to 90%. The aim of this study is to analyze the clinical spectrum and to evaluate the outcome.

Methods: It is a prospective study conducted at the Department of Neurosurgery, Rangaraya Medical College, Kakinada, over a period of 2 years from December 2015 to December 2017. 100 cases are taken for study with head injury, diagnosed to have traumatic ASDH. A detailed clinical history, clinical examination, and computed tomography (CT) scan performed in all cases. Patients segregated as mild, moderate, and severe types of head injuries and studied various factors such as age, sex, mode of injury, Glasgow coma score at admission, pupillary reactivity, surgical/conservative management, and Glasgow outcome score.

Results: About 49% of patients are in 3rd–5th decade, percentage of mortality is increasing with age. Male predominance is seen. Rural population is more affected than urban. Road traffic accidents are the most common mode of head injuries. Glasgow coma scale (GCS) between 9 and 12 was found in 46% of patients. Moderate type of TBI is the most common type of neurological presentation at the time of admission. CT images of 53 patients showed <5 mm thickness, 23 patients showed 5–10 mm, in 24 patients, it is >10 mm. Of 100 patients, surgical approach is considered in 50 patients while the remaining 50 patients were managed conservatively.

Conclusions: GCS between 9 and 12 was found most common mode of presentation at the time of admission GCS <8 showed highest mortality of 80%, GCS 13–15 showed no mortality. Prognosis is worse in patients with pupillary abnormalities than those without. Early surgery leads to better prognosis.

Key words: Acute subdural hematoma, Glasgow coma outcome score, Glasgow coma scale

INTRODUCTION

Acute subdural hematoma (ASDH) is seen in approximately one-third of patients with severe traumatic brain injury (TBI) and in half to more than two-thirds of those undergoing hematoma evascuation.[1,2] ASDH is associated with high rates of mortality, ranging from 40% to 90%, although recent studies have reported improved rates of mortality as low as 14%.[3-5]

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After traumatic ASDH, coma is present at the onset of injury in 25–50% of cases, whereas another 12–38% of experience progressive neurologic decline to coma over the next several hours.[6,7] Coma is primarily the result of brain shifting and distortion, followed by elevated intracranial pressure and low cerebral perfusion pressure.[8] Large ASDH leads to compression and ischemia of the underlying brain within 4–6 h in the absence of emergency evacuation.[9] Posterior fossa SDH is especially treacherous because it can precipitate upward or downward herniation extremely rapidly.[10]

Epidemiology

There is a wide variation in the incidence of ASDH (5–29%) as the primary lesion in patients admitted with head injury. ASDH often occurs in the fifth and sixth decades (mean age 31–47 years) and, therefore, the mean age of patients with ASDH is older than with other types of head injury. Men are 2–4 times more likely to be affected

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than women.[11,12] ASDH is seen in approximately one-third of patients with severe TBI and in half to more than two-thirds of those undergoing hematoma evacuation.[2]

Pathophysiology

Acute subdural haematomas occurs in of 3 mechanisms:

1. Damage to surface cortical vessels.
2. Bleeding from underlying parenchymal injury.
3. Tearing of bridging veins from cortex to dural venous sinuses.

Other Brain Injuries

In addition to SDH, other injuries such as contusions, subarachnoid hemorrhages (SAH), and epidural hematoma may also coexist. Brain edema, brain stem distortion often complicates the picture.

Hematoma Sites in Brain

Common regions are inferior frontal, anterior temporal, parietal, frontopolar and subfrontal, middle cranial fossa, over occipital pole, posterior fossa, and in interhemispheric regions.

Physical Examination

A primary survey focusing on airway, breathing, and hemorrhage control should be performed expeditiously. After immediate life threats are adequately addressed, a secondary survey should evaluate for underlying head injury, brain injury, and neurologic compromise. The percentage of concurrent cervical spine injury in patients with severe head trauma ranges up to nearly 20%.[13]

Acute Neurologic Examination

General

An efficient neurologic examination in the emergency setting includes evaluation of mental status, Glasgow coma scale (GCS) score, pupillary size and responsiveness, and motor strength and symmetry.

The strongest predictors of outcome following ASDH are age, pupillary reactivity, and GCS motor score. Additional predictors include computed tomography (CT) characteristics, hypotension, hypoxia, laboratory parameters (e.g., glucose and hemoglobin levels), and extracranial injuries.[14]

Altered sensorium and gradual worsening of consciousness are the classical presentation. Some evidence of localization is present in about 70% of cases.

With the introduction and wide availability of cranial CT [Figure 1], early diagnosis and timely surgical intervention for SDH are an attainable gold standard.[15]

Many factors influence prognosis. When symptoms appear slowly, the prognosis will be better.[15] There is a direct correlation between the level of consciousness and post-operative mortality.[15] With the onset of decerebrate rigidity, the mortality increases rapidly [Figure 2].

PATIENTS AND METHODS

It is a prospective study conducted at the Department of Neurosurgery, Rangaraya Medical College, Kakinada, over

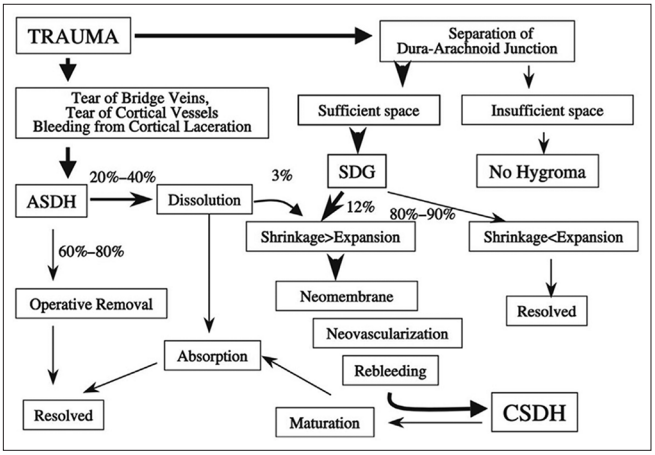

Figure 1: Schematic representation of the origin and pathogenesis of subdural hematomas (SDHs) and the relationship among the three traumatic subdural lesions. Subdural hygroma (SDG). (From Lee KS. Natural history of chronic SDG [Review]. Brain Injury 2004;18:356; Three stages (1) ASDH 1–3days from injury, (2) Subacute SDH 4–21days of injury, (3) Chronic SDH after 3weeks of injury

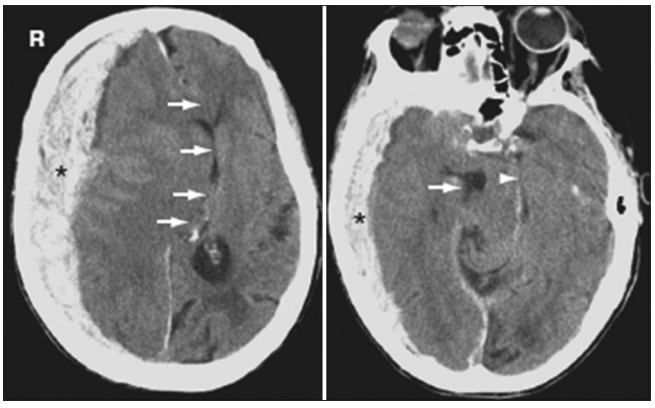

Figure 2: Acute subdural hemorrhage (SDH). Axial computed tomographic images show a large right holohemispheric high-attenuation extra-axial collection (asterisk). The SDH causes (a) severe right-to-left midline and subfalcine herniation (arrows), (b) medial displacement of the right temporal horn (arrow), and right uncal herniation (arrowhead)

a period of 2 years from December 2015 to December 2017.

Inclusion Criteria

1. The patients who presented to the casualty with head injury and on CT scan showing ASDH were taken into the study.
2. About 100 (n = 100) cases were taken into the study taking into consideration their sex, age, area of injury, mode of injury, GCS at admission, and pupillary abnormalities which were recorded at the time of admission.

Exclusion Criteria

1. Patients with chronic and sub-ASDH were excluded from the study.
2. Patients who absconded and those with incomplete data were excluded from the study.

They were divided into three groups based on GCS into mild, moderate, and severe head injury: Mild head injury with GCS 13–15, moderate with GCS 9–12, and severe with GCS 3–8.

Mild head injury patients with GCS 13–15 were studied about sex incidence, age distribution, pupillary abnormalities, management, mortality, Glasgow Outcome Score, duration of hospital stay, and follow-up.

Moderate head injury patients with GCS 9–12 were studied about sex incidence, age distribution, pupillary abnormalities, management, mortality, Glasgow Outcome Score, duration of hospital stay, and follow-up.

Severe head injury patients with GCS 3–8 were studied about sex incidence, age distribution, pupillary abnormalities, management, mortality, Glasgow Outcome Score, duration of hospital stay, and follow-up.

All the patients were followed up for 2 months.

Objectives of Study Are

1. To study clinical characteristics.
2. Factors affecting the outcome.
3. Surgical outcome.
4. Comparative analysis of other series.

OBSERVATIONS AND RESULTS [TABLES 1-12]

This study consists of 100 cases of traumatic ASDH. Age ranges from 9 to 80 years.

Table 1: Age distribution

Age	Number of patients (%)
1–10	1 (1)
11–20	8 (8)
21–30	13 (13)
31–40	18 (18)
41–50	18 (18)
51–60	23 (23)
61–70	17 (17)
71–80	2 (2)
Total	100

Table 2: Age and mortality

Age	Number of patients	Mortality	Percentage
1–10	1	0	0
11–20	8	2	25
21–30	13	6	21.6
31–40	18	8	22.5
41–50	18	5	27.77
51–60	23	8	34.78
61–70	17	6	35.29
71–80	2	1	50
Total	100		

Table 3: Sex

Gender	Number of patients (%)
Male	70 (70)
Female	30 (30)

Table 4: Area of head injuries

Rural	75
Urban	25

Table 5: Mode of injury

Mode of injury	Number of patients (%)
RTA	70 (70)
Fall	24 (24)
Others	6 (6)

RTA: Road traffic accident

Table 6: GCS at the time of admission

GCS	Number of patients	Mortality	Percentage
<8	40	32	80
9–12	46	4	8.69
13–15	14	0	0

GCS: Glasgow coma scale

Table 7: Pupillary abnormalities

Pupil	Number of patients	Mortality	Percentage
Normal pupil	63	5	7.93
Unilaterally dilated pupil	25	20	80
Bilateral dilated pupil	12	11	91.66

Table 8: Thickness of hematoma on CT scan

Thickness of hematoma	Number of patients	Mortality	Percentage
<5 mm	53	8	15.09
5–10 mm	23	8	34.78
>10mm	24	20	83.33

CT: Computed tomography

Table 9: Midline shift

Midline shift	Number of patients	Mortality	Percentage
<5 mm	54	8	14.81
>5 mm	46	28	60.86

Table 10: Associated intracranial injuries

Associated injuries	Number of patients	Mortality	Percentage
Simple SDH	18	6	33.33
SDH+EDH	3	3	100
SDH with contusion	45	21	46.66
SDH+SAH	34	6	17.64

SDH: Subdural hematoma, EDH: Epidural hemorrhage, SAH: Subarachnoid hemorrhage

Table 11: GCS at 1 week

Grade	Number of patients (%)
1	15 (15)
2	17 (17)
3	2 (2)
4	0 (0)
5	2 (2)
6	11 (11)
7	28 (28)
8	25 (25)

GCS: Glasgow coma scale

Table 12: GCS at 2 months

Grade	Number of patients (%)
1	36 (36)
2	0 (0)
3	0 (0)
4	0 (0)
5	0 (0)
6	10 (10)
7	6 (6)
8	48 (48)

GCS: Glasgow coma scale

Youngest patient age was 9 years with a history of accidental fall of blunt object overhead. Oldest patient was 80 years old and sustained injury due to sudden fall at his residence. 49% of patients are in 3rd–5th decade.

In this study, group of 100 patients, percentage of mortality is increasing with age.

Male predominance is seen, but there is no significant difference between males and females in outcome.

This study rural population is more effected than urban.

Injuries and road traffic accidents (RTAs) are the most common mode of head consists of 70%.

GCS between 9 and 12 was found in 46% of patients and is the most common mode of presentation at the time of admission.

Of 100 patients, 63 had normal size and actively reacting pupil. 25 patients showed unilateral dilated pupil. 12 patients have bilateral dilated pupil.

CT images of 53 patients showed <5mm thickness, 23 patients showed 5–10 mm, and in 24 patients it is >10mm.

54 patients showed midline shift of <5 mm, and 46 patients showed >5mm.

SDH with contusions is more common than simple SDH. Mortality is highest with SDH + epidural hemorrhage (EDH).

Of 100 patients of this study, 28 patients are at Grade 7 at the end of the week.

At 2-month period, 48 patients reached Grade 8 of GCS. 36 patients are at Grade 1.

DISCUSSION

ASDH is one of the most common findings in patients who have sustained a TBI. It accounts for 30% of the head injured patients admitted to our department. Despite reports suggesting an improvement in the outcome with rapid transportation to a neurosurgical center, even then the mortality rate is still high. In this study, mortality is 36%.

In this study, of 100 cases admitted in our department for ASDH to analyze the different variables (age, sex, area of injury, mode of injury, GCS at admission, CT findings, and pupil examination) that have been reported to significantly correlate with outcome.

In this study, the mortality rate is increasing with each decade as age advances Richards and Hoff described 100 patients with ASDH, with an average age of 47 years. These authors contrasted the average age of 36 years in survivors with that of 51 years in nonsurvivors.[16]

Gutterman and Shenkin described 14 patients with decerebration with ASDH, with an average age of 48.6 years. The average of survivors was 44 years and that of nonsurvivors was 51 years.[17]

Sex

Few studies of ASDH have mentioned the influence of gender on outcome. Most large series consists of 75–80% men Braakman *et al*. demonstrated that women had predictably better outcomes after severe head injury.[18]

Mode of Injury

In this study, RTA are the most common mode of injury contrary to developed countries where falls are more common.

In this study, it is found that 70% of cases are due to RTA, 24% are due to falls, and 6% due to others.

Majority of them are due to two-wheeler accidents, most of them are not wearing helmets.

Massaro *et al*. reported that a fall was the most common cause of injury among the patients older than 65 years.[15]

Wilberger *et al*. observed the worst outcome in patients involved in the motorcycle accidents: 71% mortality could be due to concomitant cerebral damage associated with high-velocity injury.[19]

GCS at Admission

In the analysis of neurological picture on admission, GCS was found strongly related to outcome. In this study, patients with GCS on admission of <8 had a mortality rate of 80%. All the 14 patients with GCS ≥13 had a complete recovery.

Massaro *et al*. stated that GCS of <8 had a mortality rate of 68% and all the patients with GCS >13 had a complete recovery.[15]

Hasselberger observed the same correlate.[20]

Pupillary Abnormalities

Prognosis is worse in patients with pupillary abnormalities than those without. In this study, 7.93% of mortality is seen in patients with normal size reacting light pupils, whereas the mortality is 80% in unilaterally dilated pupil and 91.66 in bilaterally dilated pupil.

Kristianson and Tandon found 100% mortality when pupils are dilated and fixed, 19% when they are unequal and 14% when pupils are normalon.[21]

Thickness of Hematoma on CT Scan

Thickness of hematoma is correlated with mortality rate. When thickness is <5 mm, the mortality is 15.09%; when thickness is 5–10 mm, the mortality is 34.78%; and when the thickness is >10 mm, the mortality is 83.33%.

Midline Shift

Patients with midline shift <5 mm, the mortality is 14.81% and with midline shift >5 mm, the mortality is 60.86%.

The correlation between CT scan findings and outcome was analyzed by many authors.

Kotwica and Brzezinski found that outcome worsens with a bigger midline shift.[22]

The mortality with simple SDH is 33.33%, mortality with SDH+contusions is 46.66% and the mortality with SDH+EDH is 100% and the mortality with SDH+SAH is 17.64%. Differences in outcome are statistically significant. Ramamurthi reported that 50% of patients have associated lesions.[23]

Time of Surgery

Seelig *et al*. reported a dramatic reduction in mortality to 30% with early surgery (within 4 h of injury) as compared to 65% with delayed surgery. It is confirmed in this study also.

CONCLUSIONS AND SUMMARY

ASDH is one of the most common findings in patients who have sustained a TBI. A clear association between increasing age and worsened outcome, a significant differences in mortality between patients below and above 40 years of age. Males are more affected than females. RTA is the common cause of ASDH. Bike accidents are common. Cases from rural area are more than urban. Most of the male patients are under alcohol influence. GCS between 9 and 12 was found most common mode of presentation at the time of admission. GCS <8 showed highest mortality of 80% and GCS 13–15 showed no mortality. Prognosis is worse in patients with pupillary abnormalities than those without. Hematoma thickness of >10 mm, with midline shift >5 mm is having increased mortality than those without. Early surgery leads to better prognosis. GCS and CT scan findings are the most important prognostic variables in our series. Rapid evacuation improves the outcome in patients with pure SDH without additional traumatic brain lesions. In the cases with additional traumatic brain lesions, the outcome depended more on the initial brain damage than on the timing of hematoma evacuation.

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