A STUDY ON THE MANAGEMENT OF BORDERLINE SUB DURAL HEMATOMA.

Dissertation submitted in partial fulfillment of the requirements of

M.Ch BRANCH II NEUROSURGERY (3 YEARS) EXAMINATIONS
AUGUST 2014

MADRAS INSTITUTE OF NEUROLOGY
MADRAS MEDICAL COLLEGE
&
RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL
CHENNAI-600003.

THE TAMILNADU Dr.M.G.R MEDICAL UNIVERSITY

CHENNAI-600 032.

CERTIFICATE

This is to certify that this dissertation titled **"A Study on the management of borderline Subdural Hematoma "** submitted by **Dr.Ramkumar R.R.**, appearing for **M.Ch (Neurosurgery)** degree examination in August 2014, is an original bonafide record of work done by him from January 2012 to January 2014 under my guidance and supervision in partial fulfillment of requirement of the Tamil Nadu Dr.M.G.R. Medical University, Chennai. I forward this to the Tamil Nadu Dr.M.G.R. Medical University, Chennai, Tamil Nadu, India.

Prof.Dr.K.MAHESHWAR,MCh
Professor of Neurosurgery and GUIDE
Head of department Institute of Neurology,
Madras Medical College & Rajiv Gandhi
Government General Hospital,
Chennai – 600 003.

THE DEAN
Madras Medical College & Rajiv Gandhi
Government General Hospital,
Chennai - 600 003.

DECLARATION

I, Dr.Ramkumar R.R. , solemnly declare that this dissertation **"A Study on the management of borderline Subdural Hematoma"** was done by me at the Madras Institute of Neurology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai under the guidance and supervision of the Professor of Neurosurgery, Institute of Neurology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai-3, from January 2012 and January 2014.

This dissertation is submitted to the Tamil Nadu Dr.M.G.R. Medical University, Chennai-600032 in partial fulfillment of the University requirements for the award of the degree of M.Ch. Neurosurgery.

Place: Chennai RAMKUMAR R.R.

Date: 22.04.14

ACKNOWLEDGEMENT

I thank the Dean Dr.Vimala.M.D and previous Deans of, Madras Medical College, Chennai from January 2012, for permitting me to utilize the facilities of the hospital for conducting this study. I extend my thanks to the members of Ethical Committee for their role in approval and guidance of the study.

I am extremely grateful to **Prof.K.Maheshwar, M.Ch.** Professor of Neurosurgery and Head of the Department, Madras Institute of Neurology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, who has also been my guide for this study, for his constant encouragement, expert advice, and guidance throughout the study. I thank my teachers, **Prof. Ranganathan Jothi, Prof. G.S.Jegannarayana, Prof. J.V.Mahendran, Prof. S.Syamala, and Prof. D.Balasubramanian** for sparing their valuable time in guiding me during this study. I am indebted to all my Assistant Professors for their support, guidance and help to carry out this study. I thank the Anesthesia team including chiefs, assistant professors, and post graduates. I thank all my fellow Postgraduates for their support. I thank all the nursing staff who took excellent care of the patients. I thank all my patients and their relatives for their immense cooperation and consent to this study.

I express my heartfelt appreciation for my family for their support and patience.

TABLE OF CONTENTS

ABBREVIATIONS USED

SAH-SUB ARACHNOID HEMORRHAGE

EDH-EPIDURAL HEMATOMA

SDH- SUB DURAL HEMATOMA

MLS- MIDLINE SHIFT

IVH-INTRA VENTRICULAR HEMORRHAGE

GCS –GLASGOW COMA SCALE

GOS- GLASGOW OUTCOME SCALE

CT- COMPUTERISED TOMOGRAPHY

B.P-BLOOD PRESSURE

PRE-OP- PRE OPERATIVE

POST –OP –POST OPERATIVE

BTF- BRAIN TRAUMA FOUNDATION

TBI- TRAUMATIC BRAIN INJURY

LOC – LOSS OF CONSCIOUSNESS

INTRODUCTION

Traumatic Brain Injury remains the major cause of death and severe disability among people, particularly the young. For Acute Subdural Hematomas and intra parenchymal lesions, the outcome is worse, with death or severe disability occurring in up to 60% of patients.

Some experts maintain that aggressive surgical intervention, though able to preserve life, will result in a very poor quality of life for the survivors.

The initial event in cranio cerebral trauma involves direct impact injury to the brain producing parenchymal contusion, EDH, SDH and shearing injury of axons in the white matter of cerebral hemisphere and brainstem producing DAI.

Under these loading conditions, the strain within the brain is concentrated along the outer margins where the Para sagittal bridging veins reside. If the vascular tolerance is suppressed, subdural bleeding occurs. SDH may also occur due to bleeding from a cortical vein or from a laceration in the brain surface. Due to its similar etio pathological mechanism, SDH may coexist with underlying DAI. This explains the frequency of cases in which the SDH is small, but the brain damage underlying it is more than what is expected because of the brain compression from the hematoma.

The primary injury due to SDH produces secondary alterations in brain metabolism, hemodynamics, ion homeostasis etc., These evolving

pathophysiological processes can produce changes in the intracranial pressure – volume relationship with resulting intracranial hypertension and brain herniation.

Borderline SDH is a Sub Dural Hematoma with 5-9 mm thickness and/or Midline Shift 2-5 mm.

Current studies do not have adequate information regarding Borderline SDH and its subsequent management.

It is a known fact that most intra parenchymal mass lesions /SDH will enlarge with time requiring serial CT scanning, neurological monitoring and ICP monitoring.

Studies reveal 10% mortality in SDH less than 10mm thick[7] (90 % in thickness greater than 30mm). In some studies, Midline Shift has been found to be a better predictor of failure of non-operative treatment.[8]

Despite available guidelines for surgical or conservative management of acute SDHs, management of the patients has to be individualized. Associated injuries have been reported to occur in 47%-57% of patients, accounting for a higher morbidity and mortality.

There are no clear cut guidelines regarding the management of these borderline SDH and a subset of these patients managed conservatively worsen requiring surgical evacuation

The decision to operate on Borderline SDH depends on the GCS score, pupils, CT findings, age and comorbidities. Neurological deterioration and ICP increase over time are also important indicators of failure of non-operative management and the need for surgical intervention.

AIMS AND OBJECTIVES OF THE STUDY

1. To study the various parameters affecting the outcome in management of borderline Acute Sub Dural Hematoma.

3. To analyse if any significant correlation exists between Midline Shift (MLS), SDH thickness and the outcome and to compare with CT findings, Glasgow Coma Scale (GCS) and outcome.

3. To assess the outcome at 30 days based on Glasgow Outcome Scale (GOS).

REVIEW OF LITERATURE

Authors have concluded that the operated and non-operated patients represent two different patient populations and that studies evaluating the conservative management of traumatic acute SDHs should only include patients conservatively treated.[2,5]

Review of literature indicates that:-

67% of the patients with acute SDH survive with conservative management.

In a study by Feliciano, patients less than 65 years old had a favorable or functionally independent outcome in 85% of the cases. Patients with Glasgow Coma Scale scores greater than 8, had a functionally independent outcome in 78% of the cases. Patients with acute subdural hematomas with thicknesses ≤10 mm and midline shifts ≤ 5 mm showed functionally independent outcomes in 82% of the cases.[3]

Croce, et al. reported a functionally independent outcome in 93% of the patients conservatively managed presenting acute SDHs that measure 10 mm or less at the thickest diameter and a GCS≥11.[5]

Mathew, et al. proposed guidelines for the conservative management of traumatic acute SDHs. Their criteria include a GCS≥13, midline shift <10mm, absence of CSF basal cisternal effacement, and absence of other associated intra parenchymal lesions. [7]

Zumkeller, et al. showed that the amount of midline shift is very important in survival rate with the survival function decreasing as the midline shift increases.[11]

Servadei, et al. recommended conservative treatment in comatose patients (GCS≤8) with SDHs less than 10 mm thick and midline shifts less than 5 mm who have an improved or stable GCS score since the injury, show no pupillary abnormalities, and an intracranial pressure less than 20 mm Hg or between 20 and 30 mm Hg if the cerebral perfusion pressure is greater than 75 mm Hg.[10]

Haematoma thickness, midline shift, status of the basal cisterns and presence of SAH are related to outcome when identified on the initial (early) CT examination. However, early (within 3 h from injury) CT under-estimates the ultimate size of parenchymal contusions. Patients with SAH on early CT are those at highest risk for associated evolving contusions. The use of sequential CT should be included in the routine management of head-injured patients.[12]

Patients with a midline shift of less than 10 mm on the computed tomography (CT) scans and with a GCS score of 15 initially might be treated conservatively under close observation, reserving urgent craniotomy and evacuation of the SDH for those with deteriorating neurological conditions. A smaller degree of midline shift was tolerated by patients with an GCS score of less than 15: a shift of more than 5 mm on the initial CT scans predicted an exhaustion of the

cerebral compensatory mechanism within 3 days of injury Mathew, et al. 4 recommended conservative management with a midline shift <10 mm in conscious patients, but Wong recommended it only on those patients with a GCS score of 15. Wong found that a midline shift >5 mm in patients with a GCS score <15 was significantly related to conservative management failure due to exhaustion of the cerebral compensatory mechanisms within three days of injury. Therefore, he recommended that the minimal hospital stay for patients with small SDHs under conservative management should be three days. He also found that the thickness of the hematoma was non-predictive of the outcome.[1,2,7,8]

It is found that patients with a TICH volume of less than 15 ml, a midline shift of less than 5 mm, an open peri mesencephalic cistern on CT scans, a Glasgow Coma Scale (GCS) score of 12 or more, and an absence of lateralizing signs may be treated conservatively and expected to make a good recovery.[1,2,7,8]

Dent, et al. reviewed all patients with an acute SDH admitted over a 6-year period to a single trauma centre and found that 61% of the patients received conservative management. The patients conservatively managed tended to fare better, but they also had better initial GCS scores, smaller hematomas, less shift of midline cerebral structures, less associated brain injuries and less cerebrospinal fluid (CSF) basal cistern effacement.[4]

Lobato et al recommend ICP monitoring after admission in all patients and serial CT scanning at 2-4, 12, 24, 48 and 72 hours after injury with additional controls as indicated by clinical or ICP changes in all cases. Over 50% of the patients with initial lesions developed new CT changes and nearly 50% showed intracranial hypertension during the acute posttraumatic period.[9]

Small subsets of patients fail with non-operative management, and subsequently require surgical decompression for progression of a pre-existing lesion or delayed presentation of new lesions. Failure of non-operative management has been associated with the timing of initial post injury CT scans, hematoma location and volume, the presence of edema around the hematoma, and physiologic variables such as hypotension, hypoxia, and coagulopathy of the variables investigated, only anatomic location of injury was found to be predictive of early failure of non-operative management. Frontal intra parenchymal hematomas are particularly prone to early failure. Clinical examination and intracranial pressure monitoring are equally important in detecting failure and should be an integral part of non-operative

management. [2,13]

MATERIALS AND METHODS

The study was done at Department of Neurosurgery at the Madras Institute of Neurology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai from January 2012 to January 2014. Patients who were admitted with head injury and acute SDH were included based on the following inclusion and exclusion criteria.

Inclusion Criteria

1. Age-adults (13 years and above)
2. SDH thickness 5-9 mm
3. Midline Shift (MLS) 2-5 mm
4. GCS score greater than 8
5. Time since injury within 6 hours of trauma
6. Volume of contusion less than 20 ml
7. Loss of consciousness less than one hour duration

Exclusion Criteria

1. Age less than 13 years
2. Midline shift greater than 5 mm in CT scan at admission.
3. Subdural Hematoma thickness more than 9 mm in CT scan at admission.
4. GCS score less than 9.
5. Loss of consciousness more than one hour duration.
6. Time between injury and admission more than 6 hours
7. Chronic alcoholics or abnormal LFT
8. Presence of Bradycardia.
9. Pupillary Asymmetry
10. Presence of paucity of movements on one side or hemiplegia
11. Associated Contusion size more than 20 ml.
12. SAH with Fisher grade 4
13. Severe life threatening musculo skeletal/spine/thoraco abdominal injuries
14. Evidence of severe brain stem dysfunction.
15. Systemic illness, metabolic disorder, endocrine abnormality, coagulopathy
16. Patients who are unwilling for inclusion in the study.

Methodology

Head injury patients who were admitted at our hospital with borderline SDH as per the above inclusion and exclusion criteria were included in the study. Patient and attenders were explained in detail regarding the study. Written informed consent was obtained for inclusion in the study. Data regarding the various parameters such as age, sex, mode and time of injury, clinical examination pertaining to GCS, pupils, neurological deficit, pulse, Blood Pressure, respiration were noted. CT was done at regular intervals as per Proforma and earlier if needed. Findings were recorded.

Renal function tests, blood sugar, serum electrolytes, complete blood count, Coagulation profile and blood grouping was done.

Patients were monitored daily till discharge. After discharge patients were followed up at weekly intervals for one month. Patients were contacted regularly throughout the study period over mobile phones.

Patients were evaluated and treatment was done according to brain trauma foundation guidelines and as per the attached Proforma.

Brain Trauma Foundation Guidelines

1. All patients with Acute SDH in coma (GCS score less than 9) should undergo intracranial pressure (ICP) monitoring.

2. A comatose patient (GCS less than 9) with an SDH less than 10mm thick and a midline shift less than 5 mm should undergo surgical evacuation of the lesion if the GCS score decreased between the time of injury and hospital admission by 2 or more points on the GCS and / or the patient presents with asymmetric or fixed and dilated pupils and / or the ICP exceeds 20 mm Hg.

Most patients were treated conservatively with antibiotics, antipyretics, anticonvulsants, anti edema measures and supportive treatment as required.

Serial CT scans of brain were taken at regular intervals as per the hospital protocol. Neurological status of the patient was monitored intensively. Treatment was altered according to changes in neurological status or CT scan.

In patients, improving with this treatment, conservative management was continued.

Patients who had deteriorating GCS and patients who had increase in SDH thickness or MLS radiologically were taken up for emergency decompressive craniectomy.

SURGERY:

Patient is placed in supine position, with head end elevated to 30 degrees. Head is turned so that the side of the SDH faces upwards. By a question mark incision, trauma flap is raised. With six burr holes, free bone flap raised.

Temporal decompression was done up to temporal base. Dura opened sinus based. SDH evacuated. Contusions or burst lobe if present are excised. After achieving haemostasis, dura was left open. Galea was closed with interrupted 1 vicryl sutures. Skin was closed with continuous 1-0 Nylon.

Patients with low GCS were managed with mechanical ventilator support.

Wound care was given appropriately. Suture removal was done on 7-9th POD.

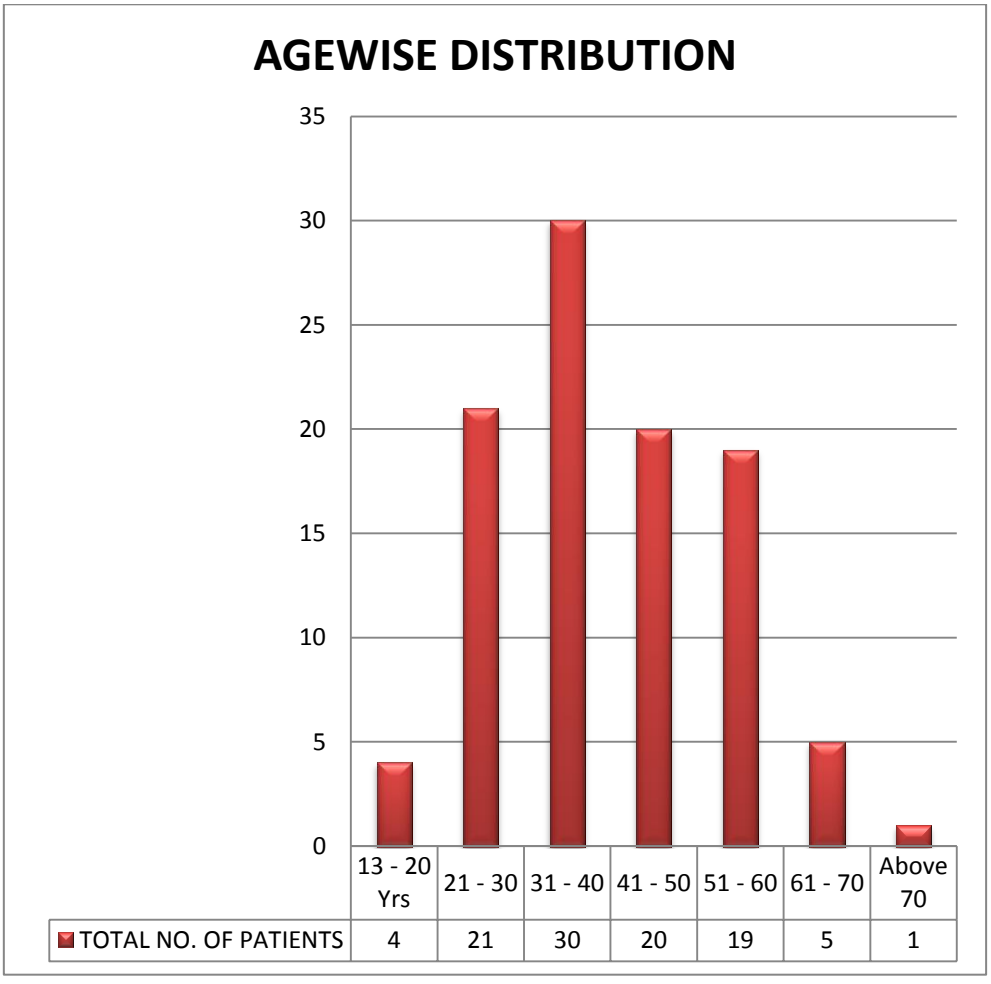
Physiotherapy and respiratory exercises were given regularly. Outcome was assessed by Glasgow Outcome Scale on the 30th day.

Observations were recorded in the master chart and analysis done.

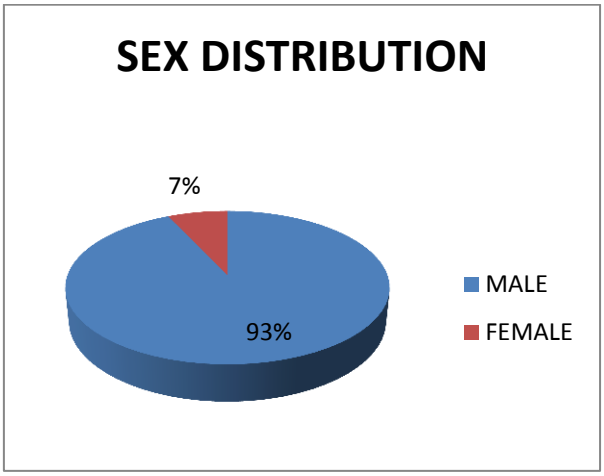
OBSERVATIONS AND RESULTS

Age distribution:

In our study, the agewise distribution was from 13 to 74 years. 90% of patients were between 21 to 60 years with peak incidence in the 31 to 40 years group.

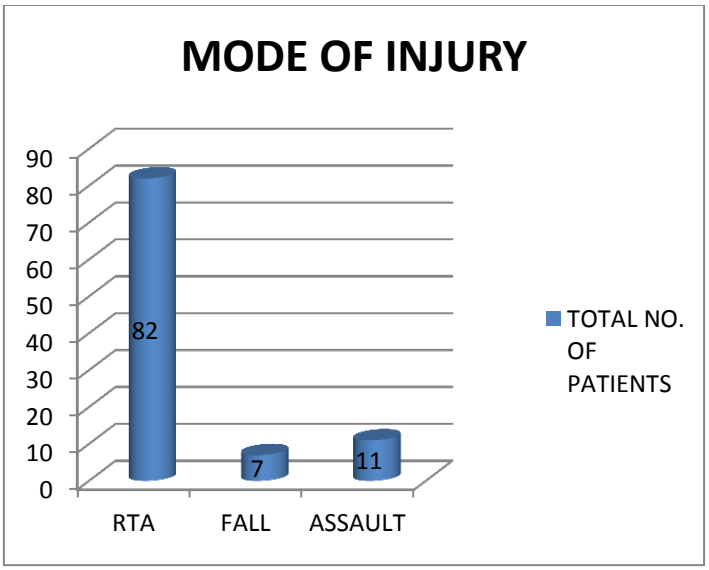


SEX DISTRIBUTION: 93% of the patients with borderline SDH were males and the remaining 7% were females.



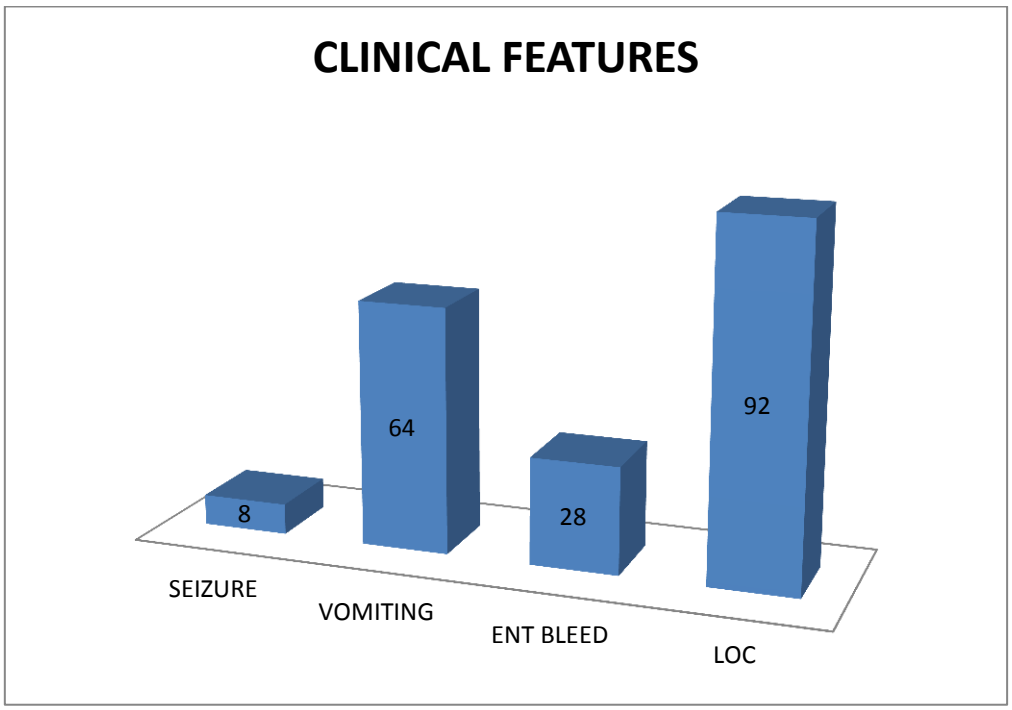
MODE OF INJURY:

Majority of the patients in our study were admitted due to RTA (82%). Falls and assault accounted for 7% and 11% respectively.



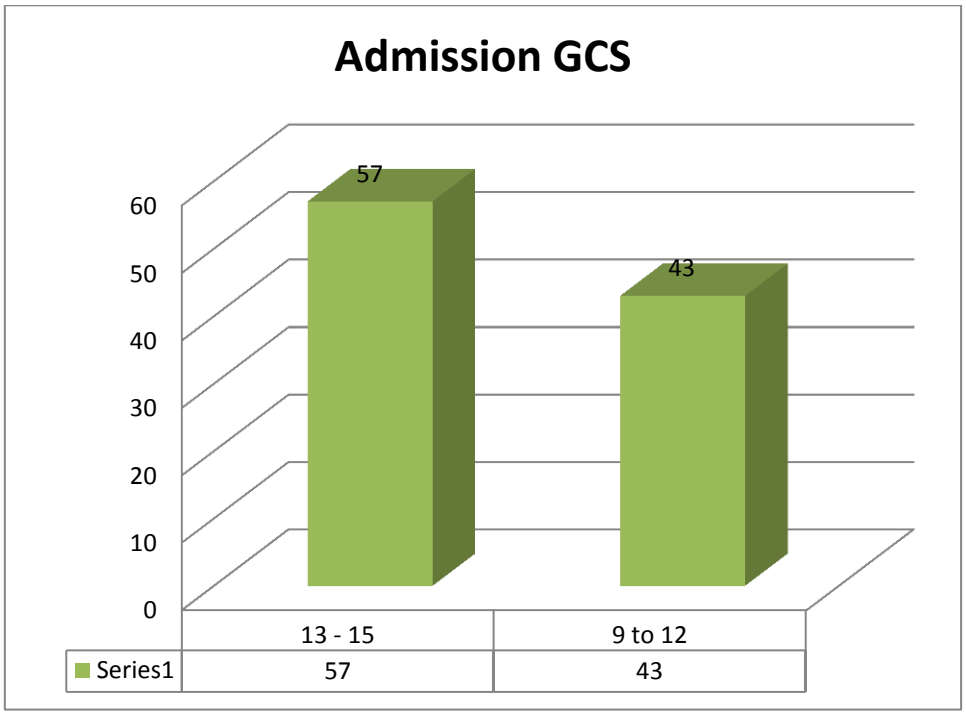
CLINICAL SYMPTOMS:

Among the 100 patients studied in this group, the most common clinical symptom observed was loss of consciousness (92%). The next common symptom was vomiting which occurred in 64% of patients. Ear and nasal bleed occurred in 28% of patients. The least common symptom was seizures (8%).



GCS ON ADMISSION:

In the 100 patients studied, Mild head injury group with GCS 13 to 15 were the majority with 57 cases. Moderate head injury patients constituted second with 43 patients in GCS 9 to 12.

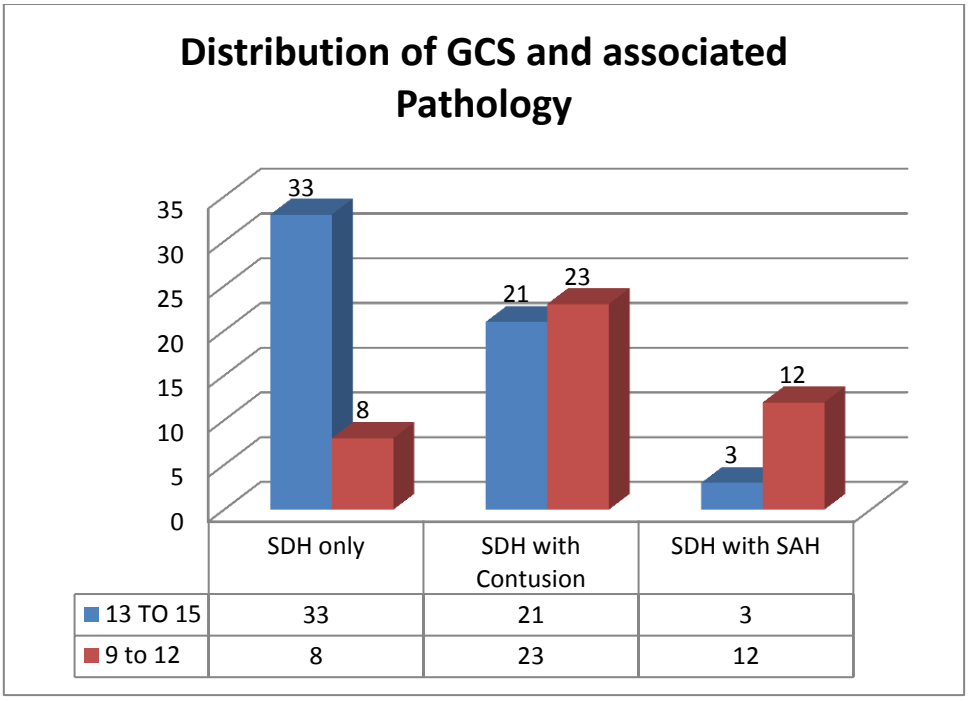


DISTRIBUTION OF GCS AND ASSOCIATED PATHOLOGY: Patients with only SDH were predominantly in the mild head injury group with 80%

having GCS score 13-15 and the remaining 20% in the moderate head injury group.

In the patients having both SDH and contusion 48% had mild head injury, 52% had moderate head injury.

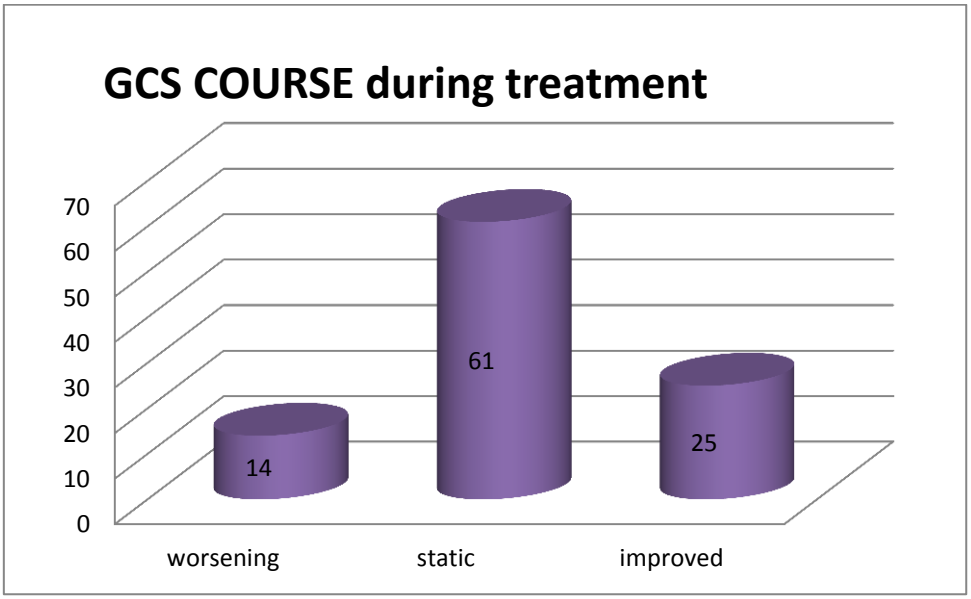
80% of patients with SDH and SAH had moderate head injury while 20% had mild head injury.



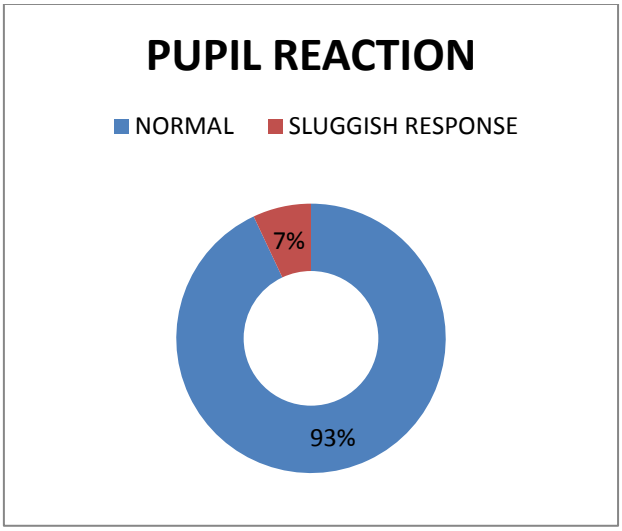
GCS COURSE DURING TREATMENT:

Of the 100 cases studied, majority (61%) had no gross change (more than 2) in the GCS score during the course of treatment. There was improvement more

than 2 in GCS score in 25 patients, while 14 patients had deterioration more than 2 in GCS score.



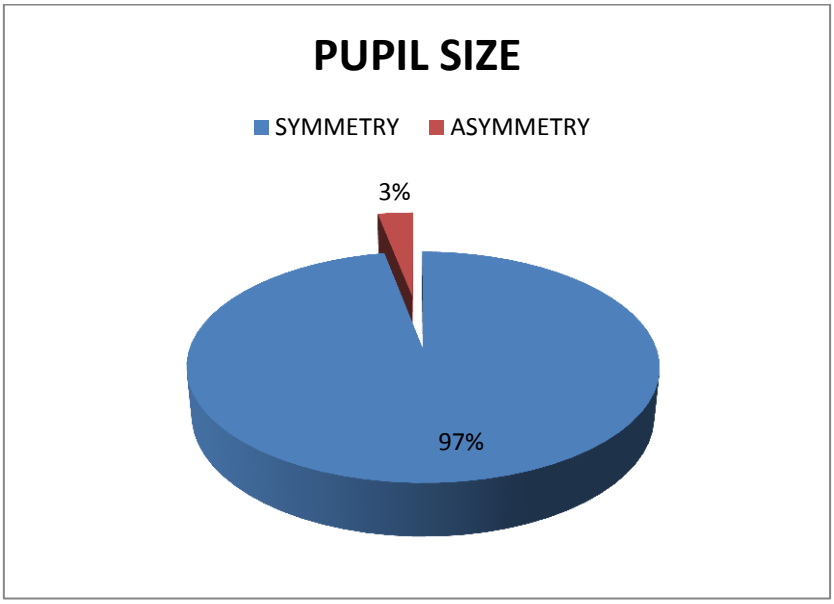
PUPIL REACTION: In our study, 93 patients had normal pupillary response on admission. Sluggish response was seen in 7 patients.



PUPIL SIZE:

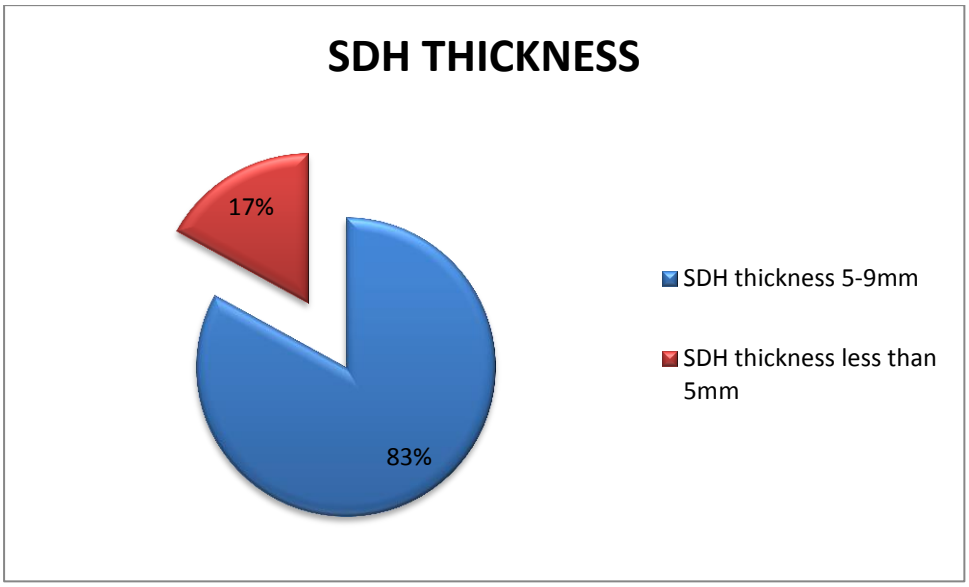
No Patient with borderline SDH had anisocoria at admission. Of the 100 patients only 3 had anisocoria. One patient developed anisocoria after 24 hours and two patients developed anisocoria after 48 hours.

In this study, pupillary asymmetry was not significant in influencing the outcome.

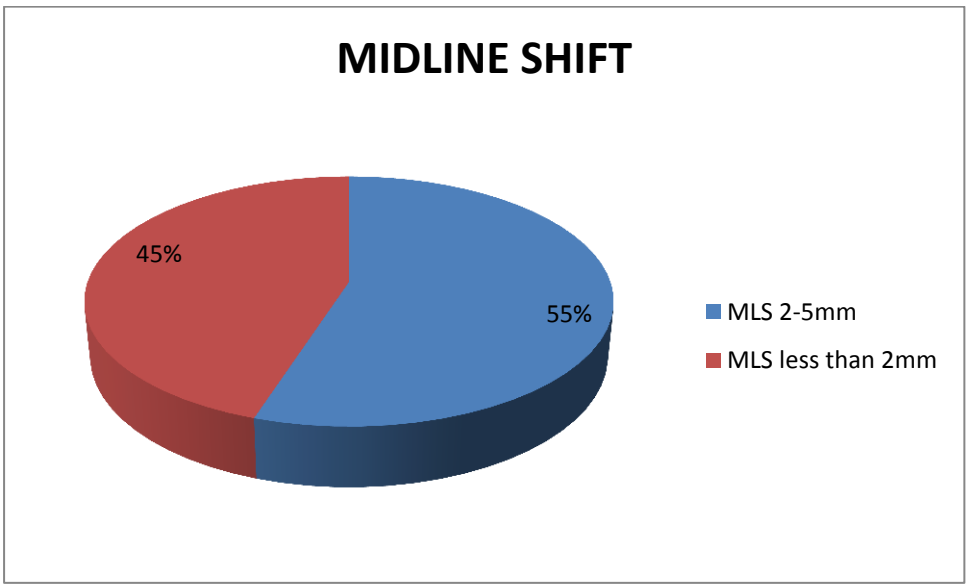


CT FINDINGS:

SDH: Among the 100 cases in this study, 83 had SDH with thickness 5 to 9mm. There was SDH thickness less than 5mm in 17 cases.

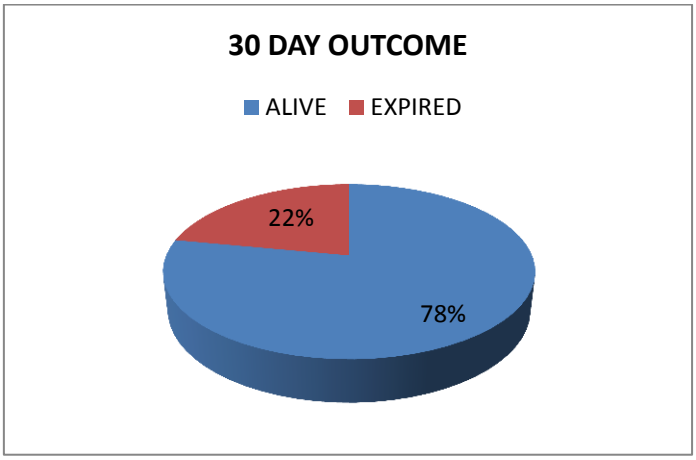


MIDLINE SHIFT: In 55 patients, there was midline shift of 2-5 mm whereas in 45 patients, the midline shift was less than 2mm.



OUTCOME AT 30 DAYS:

Of the 100 patients, majority (78%) were alive at 30 days while 22% expired.

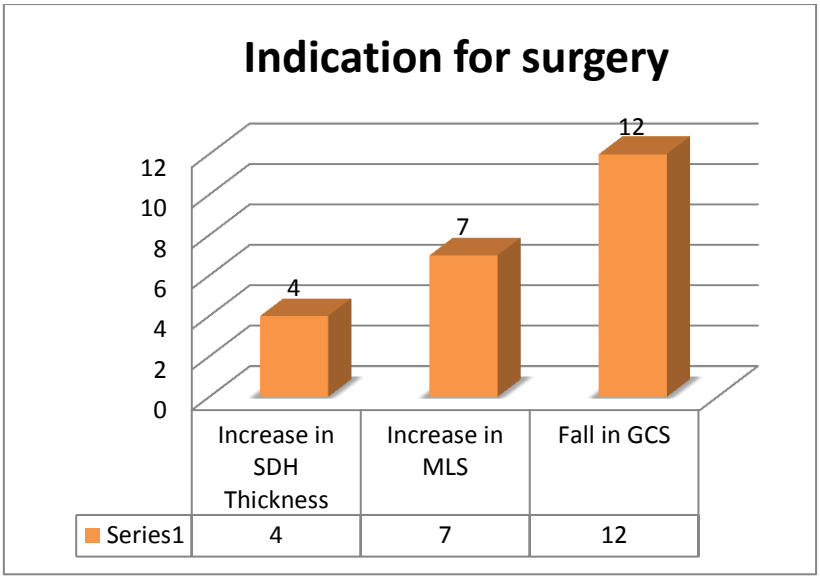


INDICATION FOR SURGERY:

The most common indication for surgical intervention was fall in GCS score after initial conservative therapy in this study among 12 cases.

Increase in MLS was the second most common indication and occurred in 7 cases.

The least common indication was increase in SDH thickness which occurred in only 4 patients.

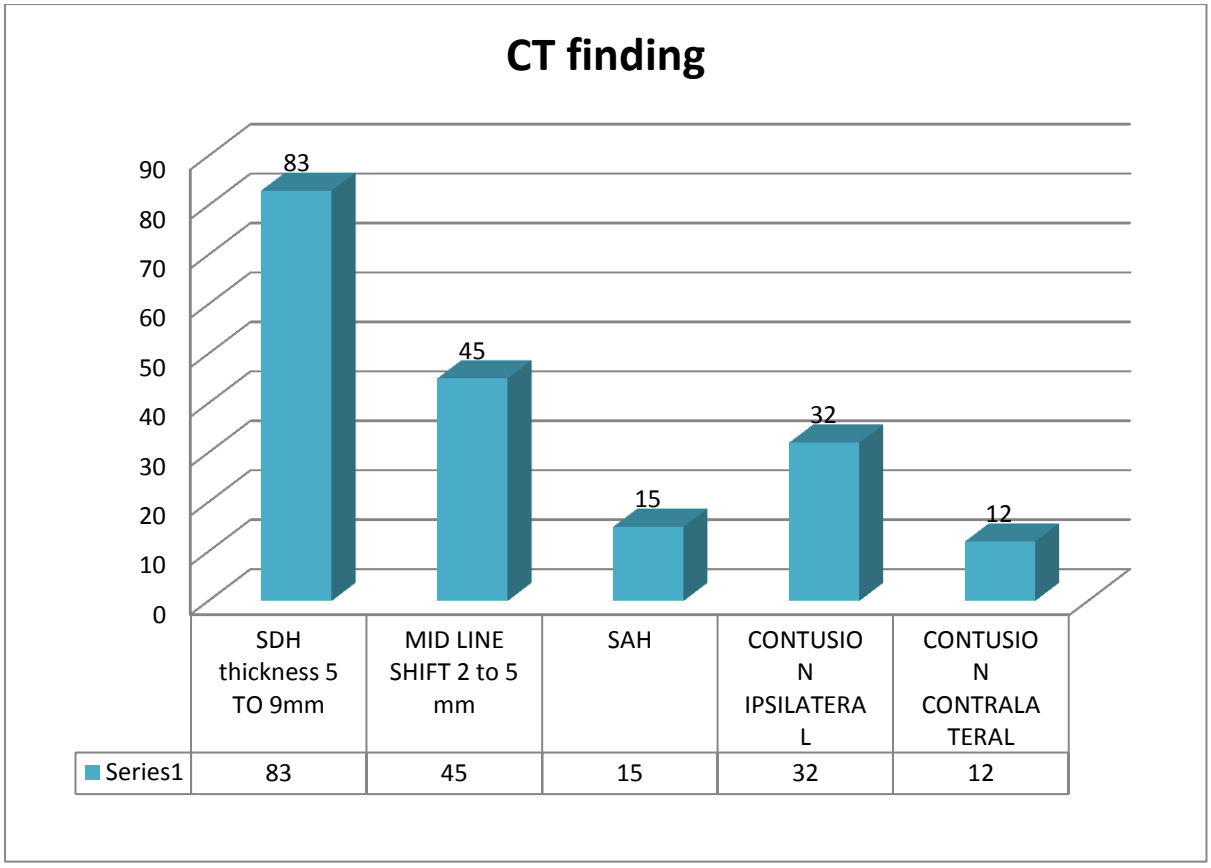


CT FINDINGS:

In the study group, 83 patients had a SDH thickness 5-9mm. SDH thickness less than 5mm was found in 17 patients who had midline shift of 2-5mm.

The most common associated injury has been found to be an ipsilateral intra parenchymal contusion in 32 patients and contralateral contusions was found in 12 patients.

There were associated SAH in 15 patients

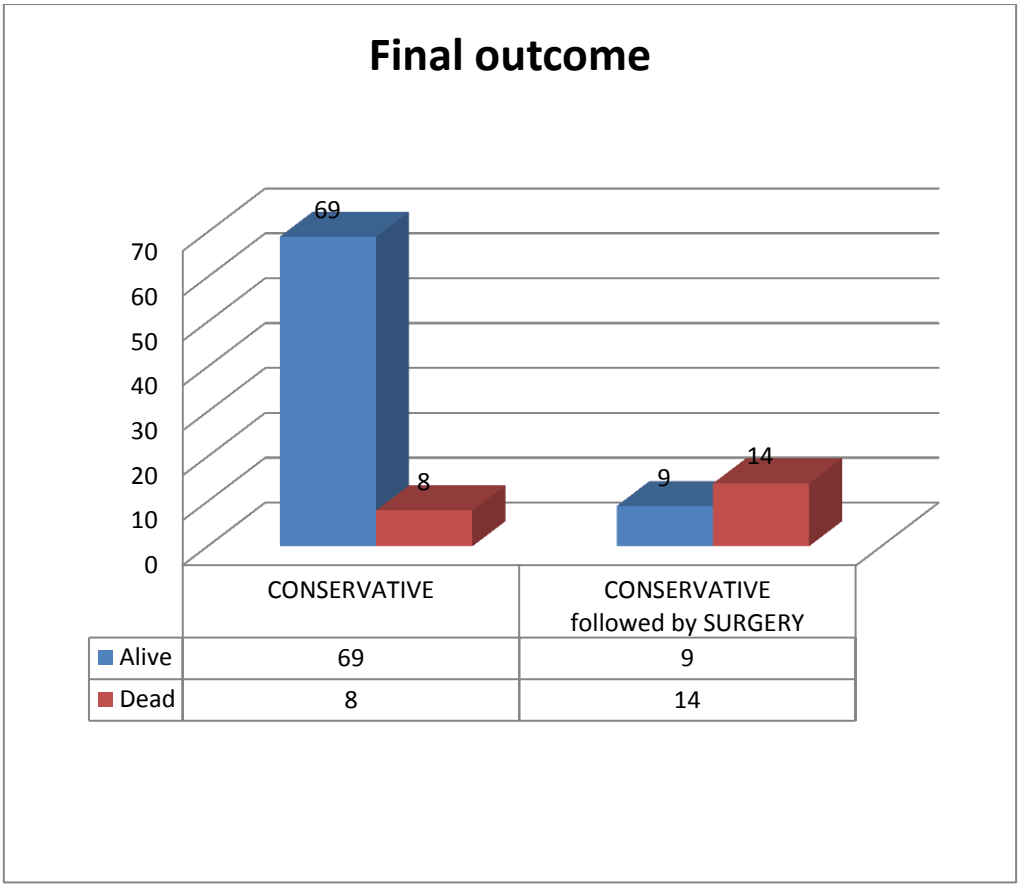


FINAL OUTCOME:

In this study, 100 patients were treated conservatively.

There was failure of non-operative treatment in 23 patients among the 100, requiring surgical evacuation.

Of these 23 patients, 9 patients were alive at 30 days and 14 patients had died. In the conservative group of 77 patients at 30 days, 69 were alive and 8 were dead. In the event of failure of conservative treatment, in those patients requiring surgery 39% survived and 61% expired.



CT AND OUTCOME:

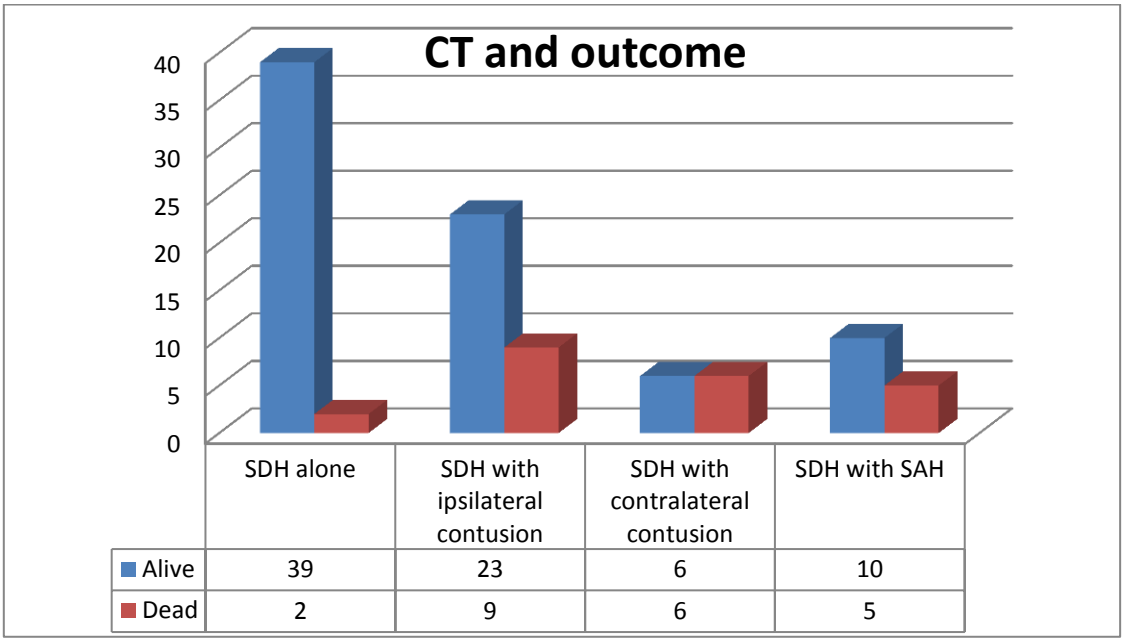
In this study, among 41 patients with SDH only, death occurred in only 2 patients with 39 surviving patients at a survival rate of 95% and mortality of 5%

Of the 32 patients with SDH and ipsilateral contusions, 23 patients were alive and 9 patients expired with a survival rate of 72% and mortality of 28%

In 12 patients with SDH and contralateral contusion, there were 6 survivors and 6 deaths with a survival rate of 50% and mortality 50%

In 15 patients with SDH and SAH, 10 patients survived and 5 expired with a survival rate of 67% and mortality 33%.

Of all the cases, patients with SDH alone had a good prognosis and those with SDH and contralateral contusion had a relatively poor prognosis.



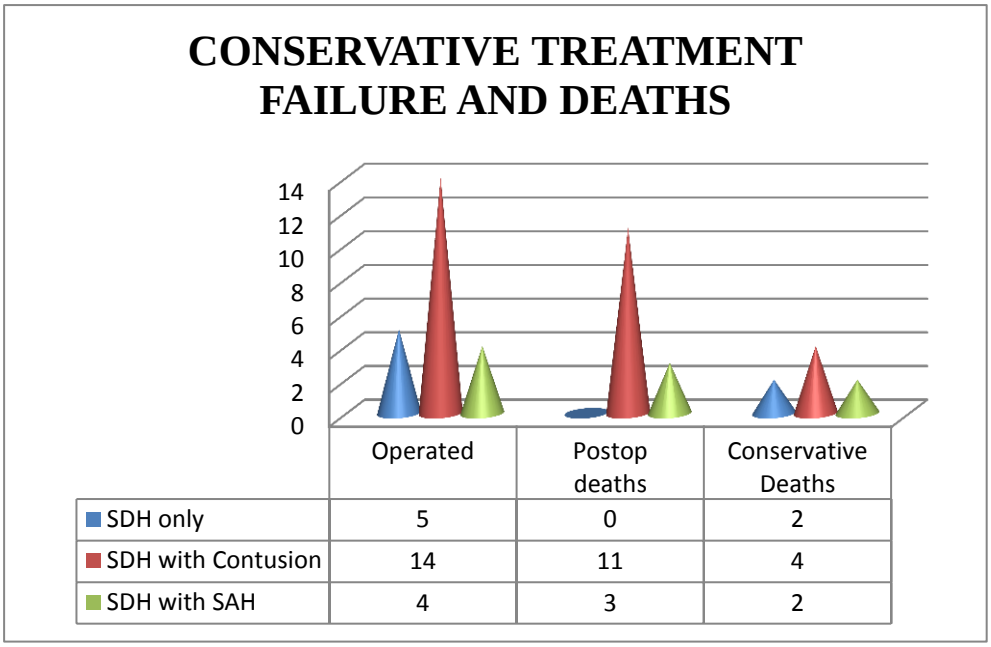
CONSERVATIVE TREATMENT FAILURE AND DEATHS:

Our study showed that in patients with only SDH failure of conservative treatment occurred in 5 out of 41 patients. In patients with SDH and contusion, 14 patients in a group of 44 had conservative treatment failure. There was treatment failure in 4 out of 15 patients in the SDH with SAH group.

So failure of non-operative treatment occurred in 12% of SDH only group.

In the SDH with contusion group, treatment failure occurred in 32% cases.

Treatment failure occurred in 27% cases in SDH with SAH group.



No deaths were observed among patients in the SDH only group who were operated.

In the SDH with contusion group, of the 14 patients operated, there were 11 postoperative deaths with a survival rate of 21% and mortality 79%.

In the SDH with SAH group among the 4 patients operated 3 expired with a survival rate of 25% and mortality 75% . However these statistics were not significant on applying the chi square test.

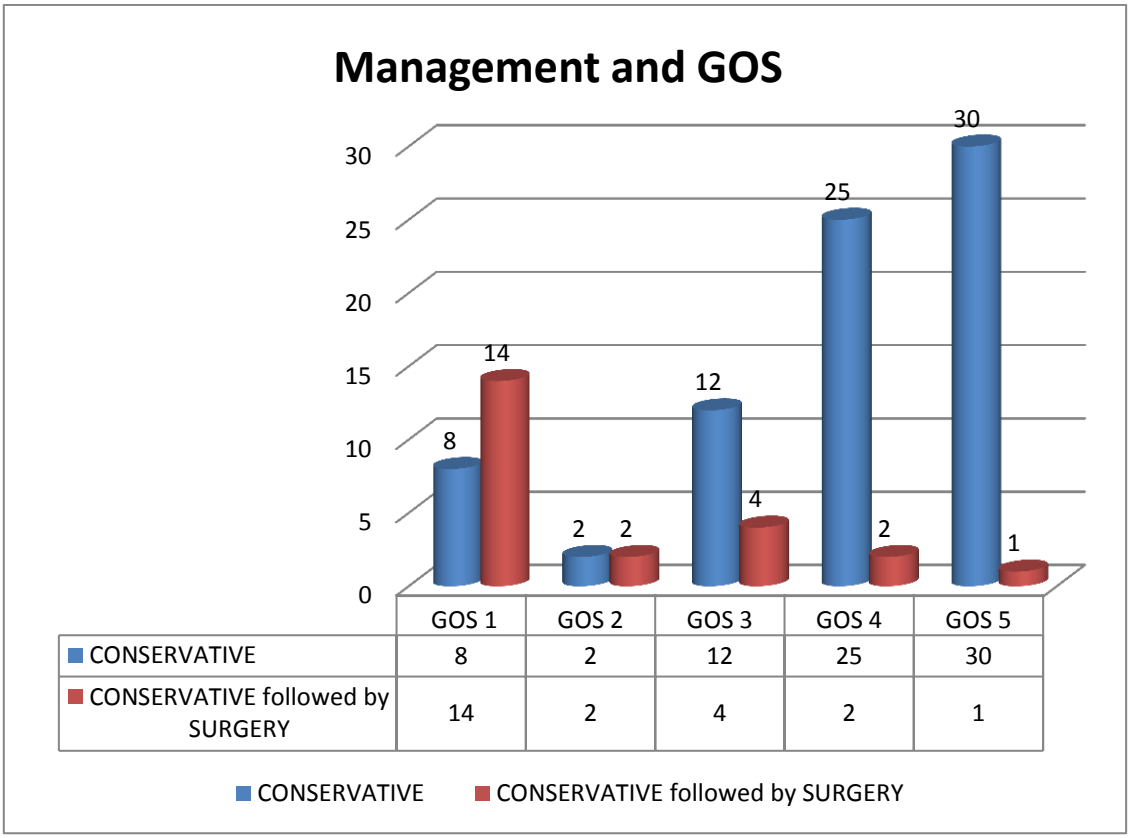
In the conservatively managed groups, the SDH only, SDH with contusion and SDH with SAH had 2, 4 and 2 deaths respectively. The mortality rates were 6% in SDH only group, 13 % in SDH with contusion group and 18 % in SDH with SAH group. Thus mortality rates were 2 to 3 times higher when SDH had an associated contusion or SAH.

MANAGEMENT AND GOS RELATIONSHIP:

In the 77 patients treated conservatively, majority of patients scored GOS 4(32%) and GOS 5(39%) at 30 days.

In the 23 patients who had failure of conservative management, 61% were in GOS 1 score.

In this study, better GOS scores were observed in patients who were treated by conservative therapy successfully. But in case of non-operative treatment failure, GOS scores decreased drastically.

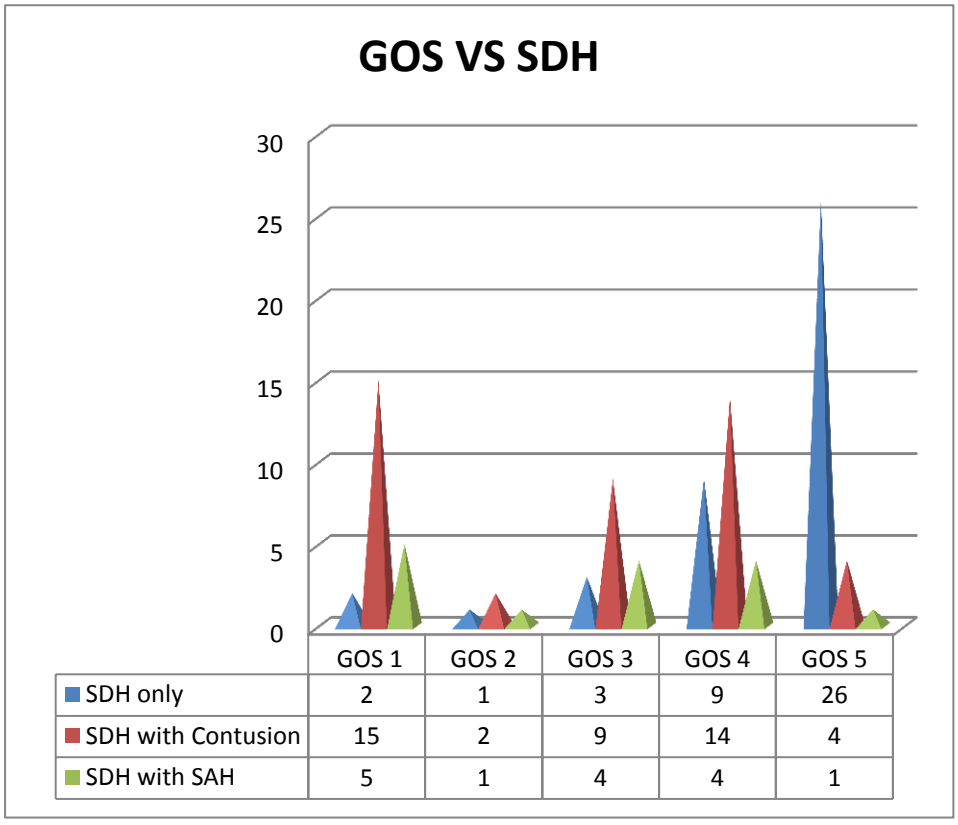


GOS VS SDH TYPE:

In SDH only group, there were 2 GOS I (5%), 1 GOS II (3%), 3 GOS III (7%), 9 GOS IV (22%) and 26 GOS V (63%) scores.

In the SDH with contusion group there were 15 GOS I (34%), 2 GOS II (5%), 9 GOS III (21%), 14 GOS IV (32%) and 4 GOS V (9%) scores.

In the SDH and SAH group, there were 5 GOS I (33%), 1 GOS II (7%), 4 GOS III (27%), 4 GOS IV (27%) and 1 GOS V (7%) scores.

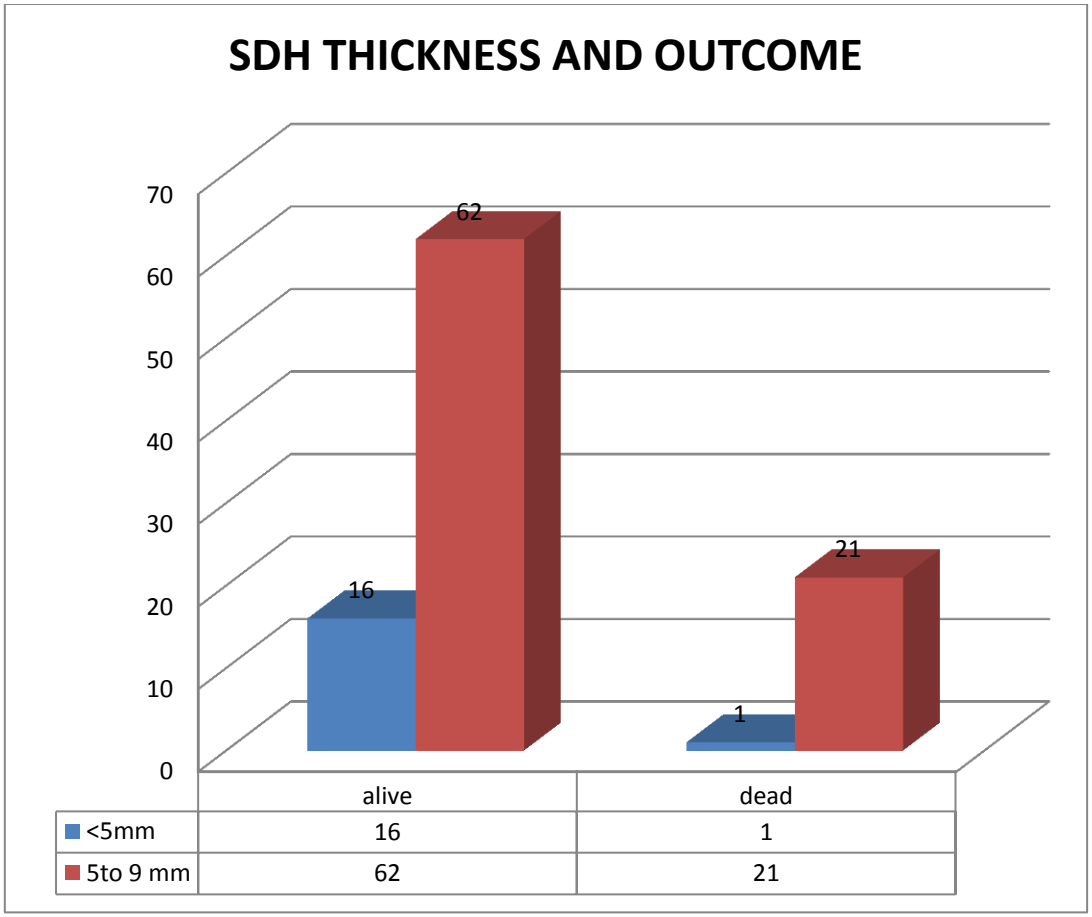


	GOS 1	GOS 2	GOS 3	GOS 4	GOS 5
SDH only	2	1	3	9	26
SDH with Contusion	15	2	9	14	4
SDH with SAH	5	1	4	4	1

SDH THICKNESS AND OUTCOME:

Comparing the SDH thickness and outcome, it was observed that out of 17 cases with SDH thickness less than 5 mm, 16 were alive and 1 case expired with a survival rate of 94%

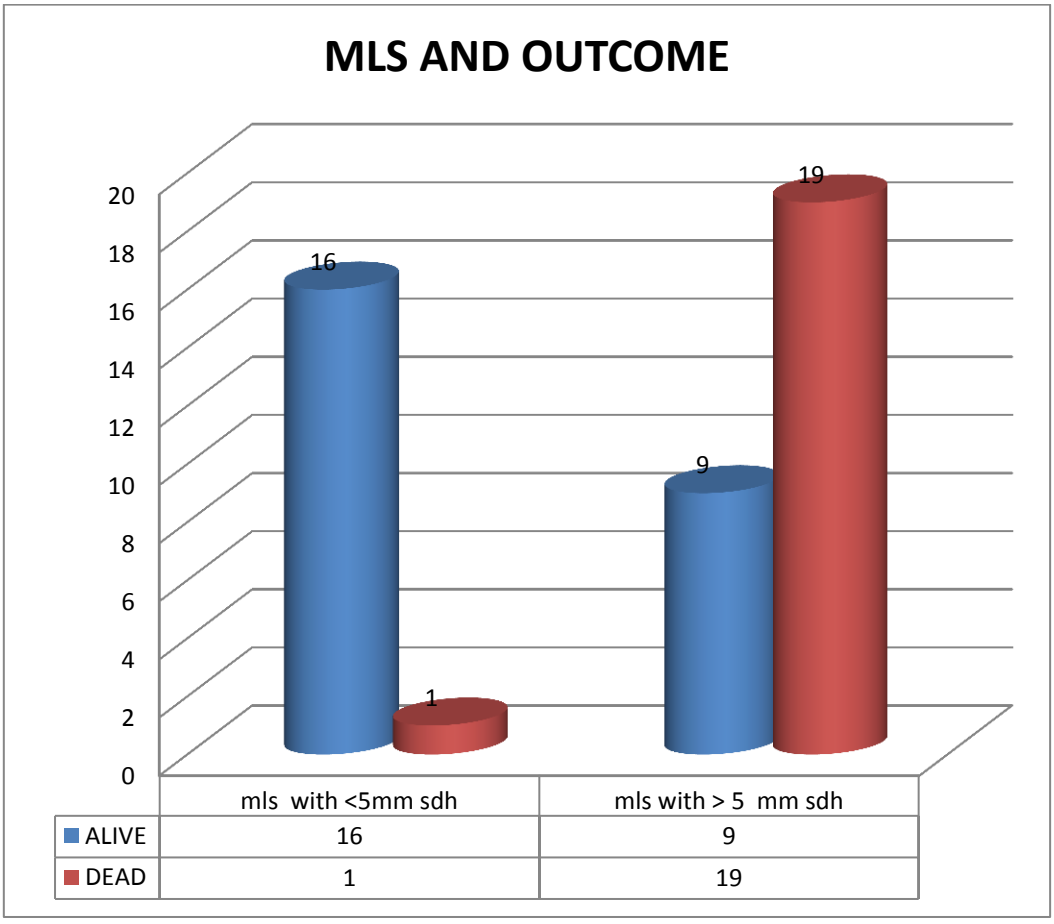
In 83 patients with SDH thickness greater than 5mm, survival rate was 75% with 62 survivors and 21 deaths.



MIDLINE SHIFT AND OUTCOME:

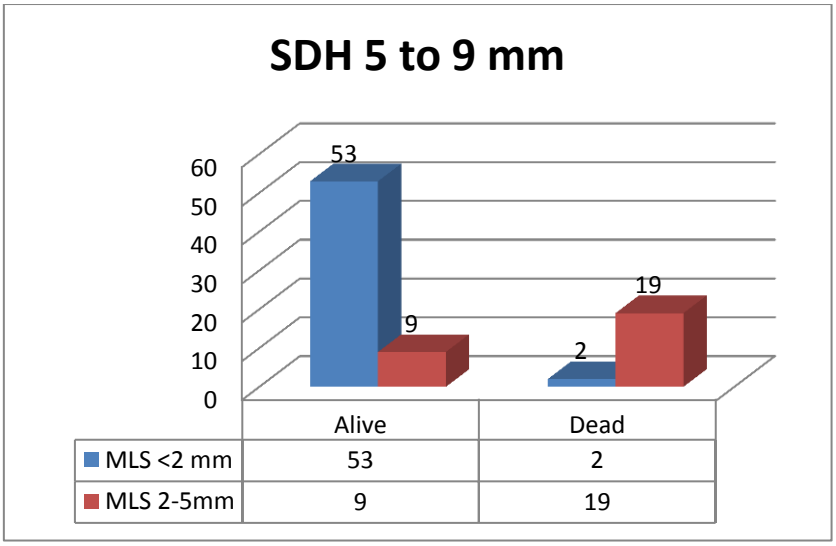
In the group with MLS 2-5 mm and SDH thickness less than 5 mm, there was only one death among 17 patients with 16 survivors. Survival rate was 94% and mortality rate 6%.

In the group with MLS 2-5mm and SDH thickness 5-9 mm, there were 19 deaths with 9 survivors. The survival rate was 47% and mortality 53%.

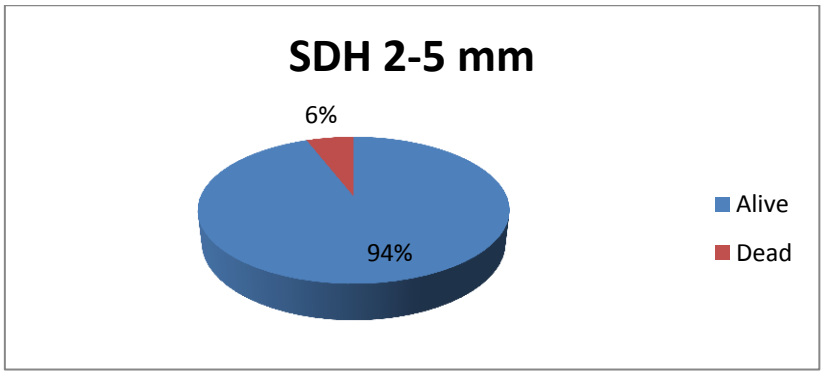


SDH THICKNESS AND MLS:

Of the 55 cases of SDH 5-9mm thick with MLS less than 2mm, at 30 days 53 patients were alive with 2 deaths with a survival rate of 96%. The mortality rate was 4% only. In 28 cases of SDH 5-9mm thick with MLS 2-5 mm there were 9 survivors and 19 deaths. The survival rate was 32% and the mortality rate was 68%



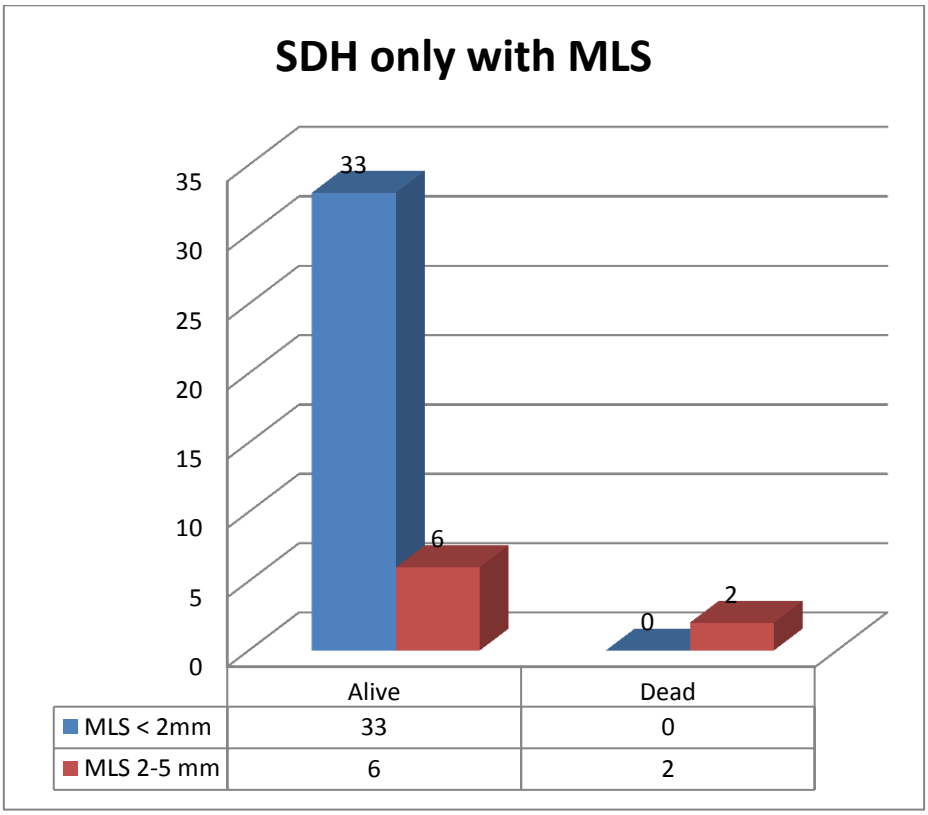
In 17cases of SDH with less than 5mm thickness, MLS 2-5mm was present. In this group, at 30 days there were 16 survivors and one death with a survival rate of 94% and a mortality of 6%.



MIDLINE SHIFT AND SDH ONLY:

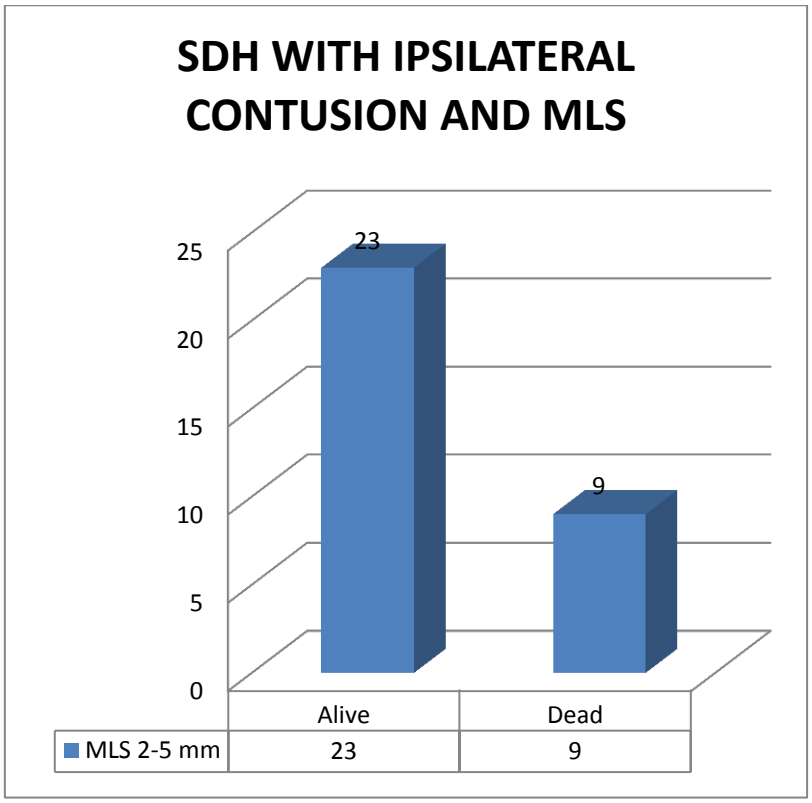
In the 41 patients who had only SDH, 33 patients with MLS less than 2mm were alive at 30 days with no deaths in this group.

In the remaining 8 patients who had MLS 2-5 mm, there were 6 survivors and 2 deaths at 30 days. The survival rate in this group was 75% with a mortality of 25%.



MIDLINE SHIFT AND SDH WITH IPSILATERAL CONTUSION:

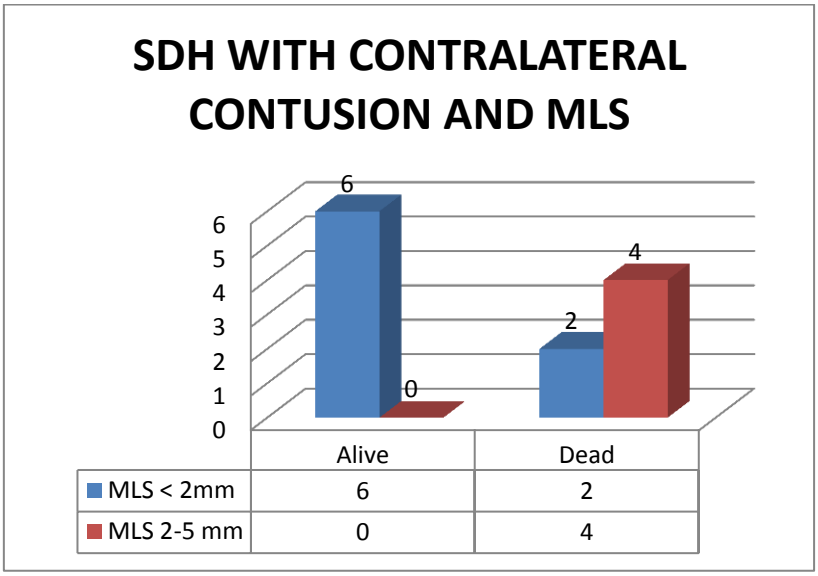
All patients in this group had MLS 2-5 mm. There were 23 survivors and 9 deaths with a survival of 72% and a mortality rate of 28%



MIDLINE SHIFT AND SDH WITH CONTRALATERAL CONTUSION:

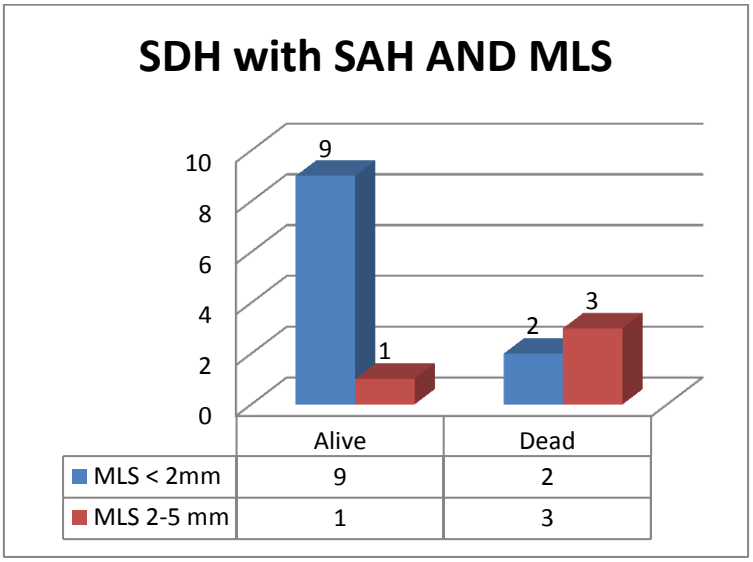
SDH with contralateral contusion consisted of 12 patients. Four patients had midline shift 2-5mm towards the side of the contusion, who did not survive. Of

the remaining 8 patients with no MLS, 6 were alive and 2 were dead at 30 days. Survival was 50%. The mortality in this group was 50%.

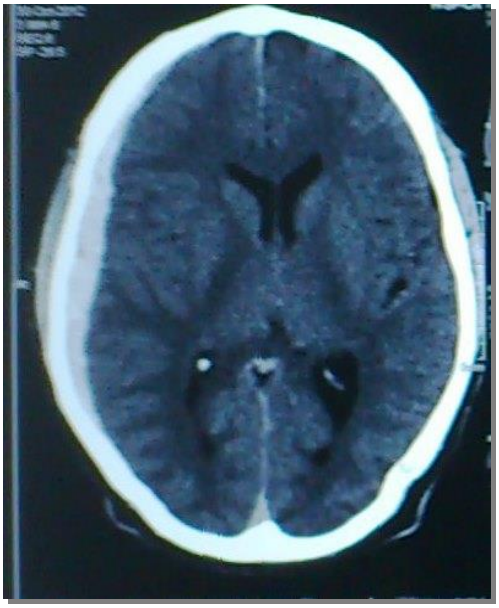


MIDLINE SHIFT AND SDH WITH SAH:

In this group, of the 11 cases with MLS less than 2mm, there were 9 survivors and 2 deaths. In the 4 cases with MLS 2-5 mm, there was one survivor and 3 deaths. The overall survival rate in this group was 65% with a mortality of 35%.



SDH with midline shift

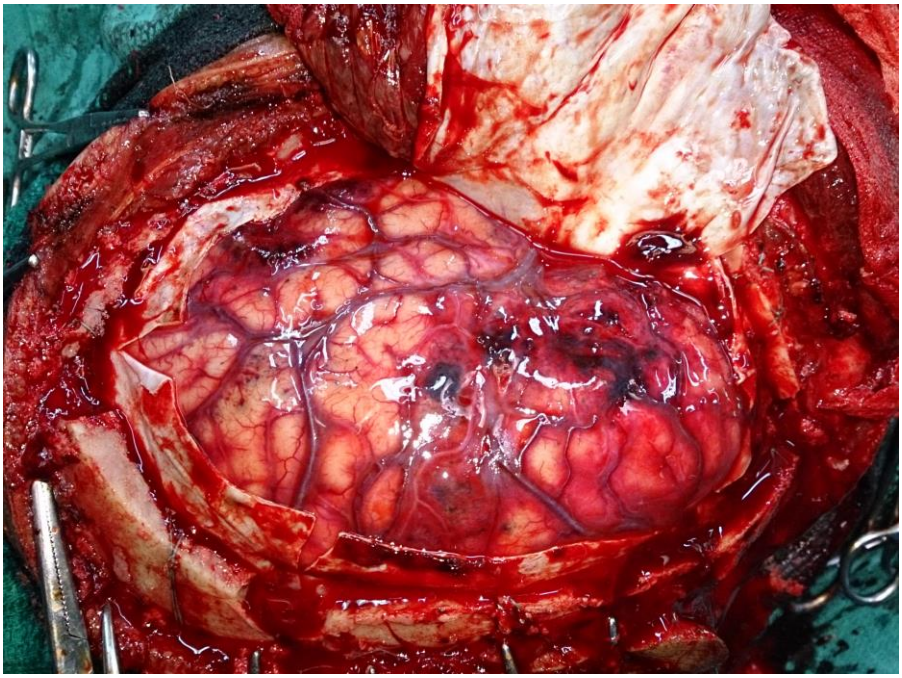


SDH with contusion

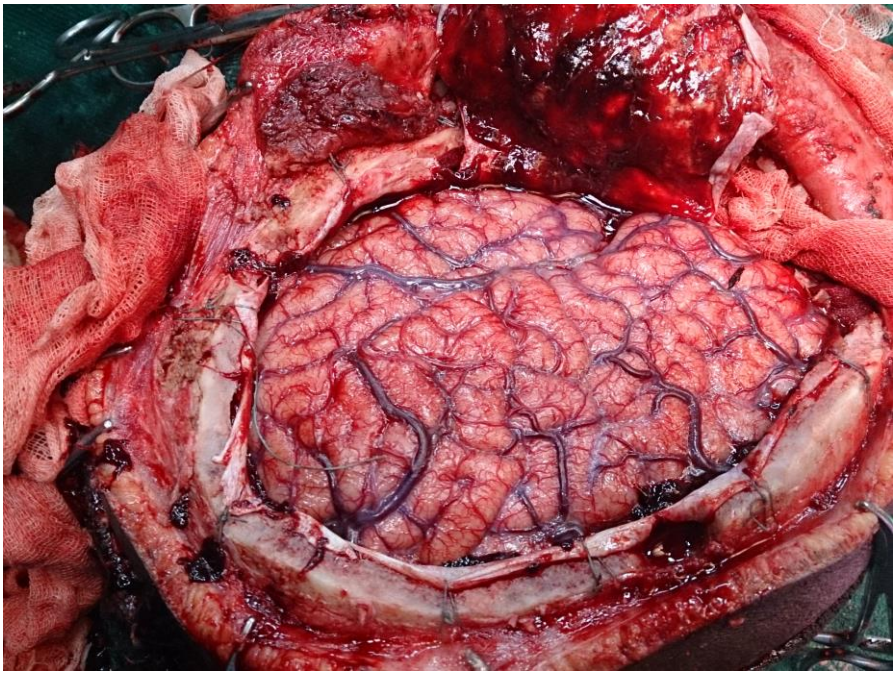
SDH with SAH

SDH with Contusion

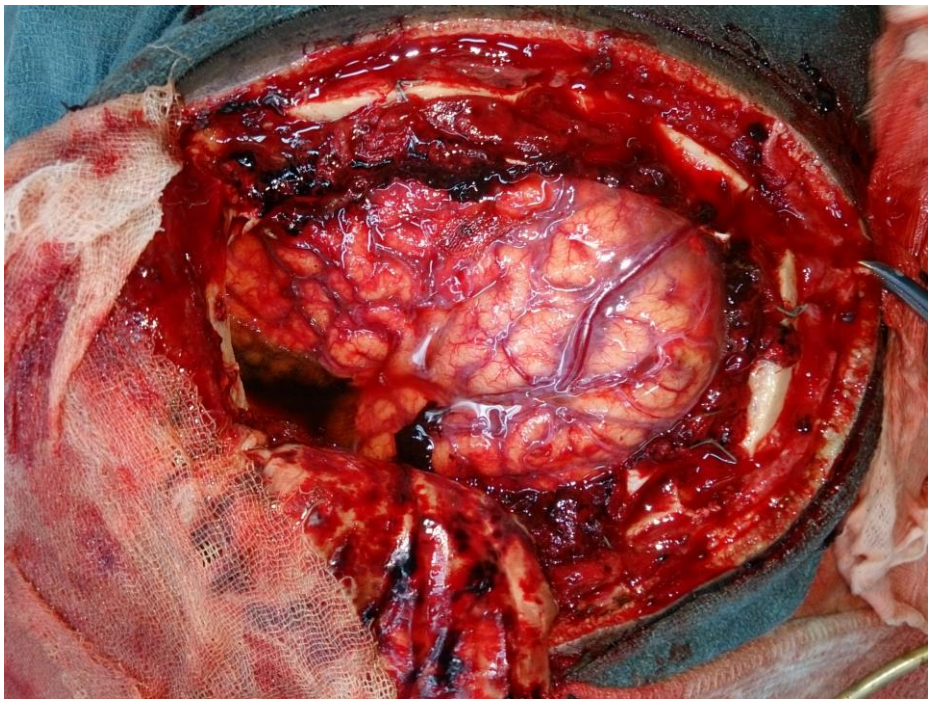
SDH with Contusion



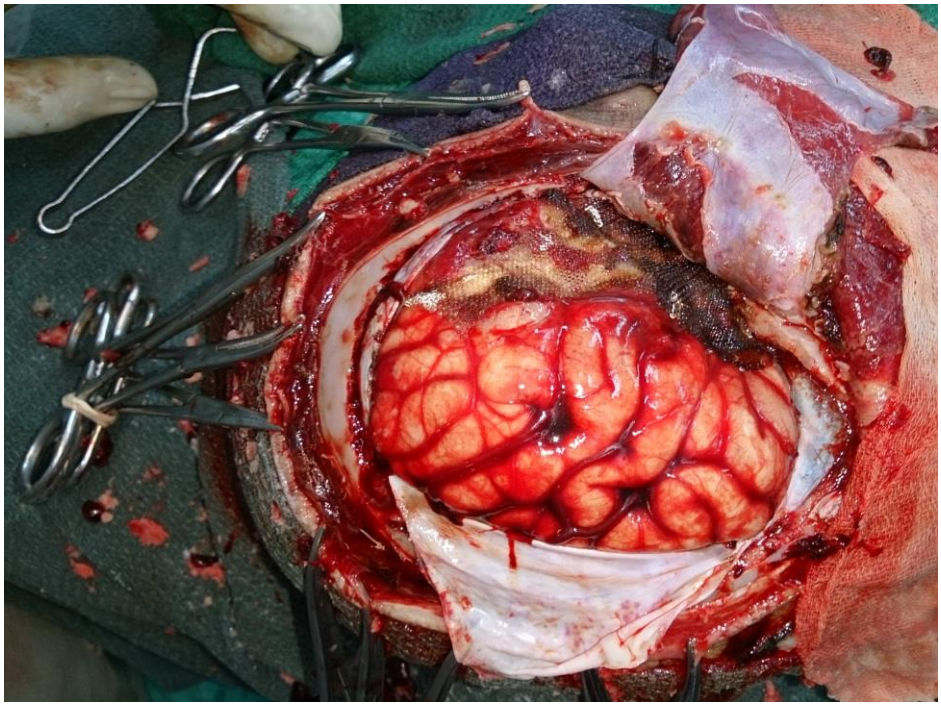
SDH evacuated



SDH evacuated and Decompression done



SDH with contusion- SDH and contusion evacuated



DISCUSSION

Majority of the patients admitted with borderline SDH had mild and moderate head injury. The peak incidence was found in the 31 to 40 age group and predominantly in males (97%). This is accordance to the observations in literature regarding TBI.

RTA (82%) was the main cause of injury with LOC the main presenting symptom (92%) followed by vomiting (64%).

Admission GCS score was from 13 to 15 in SDH only patients (80%). In the presence of associated injury there was fall in the GCS score accordingly. 52% of SDH with contusion had GCS 9-12 and 80% of SDH with SAH had GCS score of 9-12.

During the course of treatment, there was improvement of more than 2 in GCS score in 25% of cases while no major change was observed in 61%. In 14% there was deterioration of more than 2 in GCS score.

Pupillary reaction, size or symmetry did not have a major impression in this study probably due to better GCS at admission.

In the majority of 83% cases SDH thickness was in the 5 to 9mm range. In the remaining patients, MLS was present with a thin SDH. In these cases, MLS was caused by an ipsilateral contusion or in some cases due to edema.

The common intra parenchymal injury associated with borderline SDH was an ipsilateral contusion (32%). SAH (15%) and contralateral contusion (12%) were also present.

Of the 100 patients treated conservatively, failure of conservative treatment was observed in 23%. There was failure of non-operative treatment in 12% of SDH only group.

In the SDH with contusion group, treatment failure was seen in 32% cases.

In 27% cases in SDH with SAH group there was treatment failure.

The primary indication for surgery after initial conservative management was fall in GCS: 52%. Increase in midline shift caused failure of non-operative treatment in 31% and Increase in SDH size accounted for 17%

ANALYSIS OF MORTALITY IN RELATION TO TREATMENT:

Among the patients treated conservatively the mortality was 10%.

The mortality in the patients, who were taken up for surgery after deterioration, was 61%. This poor prognosis reflects the secondary brain damage which is inflicted after the primary trauma and in addition the operative insult also.

Mortality rate associated with fall in GCS (followed by surgery) – 67%

Mortality rate associated with increase in SDH thickness (followed by surgery) - 50%

Mortality rate associated with increase in MLS (followed by surgery)- 57%

ANALYSIS OF MORTALITY IN RELATION TO CT FINDINGS:

Overall SDH only patients had a good prognosis with a mortality of 5%.

All Patients with SDH with ipsilateral contusion had a mortality of 28%. SDH with contralateral contusion cases had a mortality of 50%

SDH with SAH patients had a mortality of 33%

Among the cases which were operated after initial conservative treatment, there were no deaths in the SDH only group. In the SDH with contusion group there were 11 deaths with a post-op mortality of 79%.

In the SDH with SAH group, there were 3deaths with a post-op mortality of 75%. But this was found to be not significant when the chi square test was applied.

The GOS were better in the SDH only group. In the SDH with contusion and SDH with SAH groups the GOS were comparatively lower.

Thus the prognosis is better in those patients with only SDH without any other associated brain injury and in those who are successfully treated with conservative management.

STATISTICAL ANALYSIS DONE BY GRAPHPAD INSTAT 3 ver3.1		
CT findings and outcome: Chi-squared Test for Independence		
Chi-square: 14.309		
Degrees of Freedom: 3		
Table size: 4 rows, 2 columns.		
The P value is 0.0025.		
The row and column variables are significantly associated.		
Chi-Squared Test for Trend.		
Chi-squared for trend = 9.794 (1 degree of freedom)		
The P value is 0.0018.		
There is a significant linear trend among the ordered categories		
defining the rows and the proportion of subjects in the left column.		
Summary of Data		
Row	Total	Percent
1	41	41.00%
2	32	32.00%
3	12	12.00%
4	15	15.00%
Total	100	100.00%
Column	Total	Percent
alive	78	78.00%
dead	22	22.00%

Total	100	100.00%

TOTAL OUTCOME

Fisher's Exact Test

The two-sided P value is < 0.0001, considered extremely significant.

The row/column association is statistically significant.

Relative risk = 2.433

95% Confidence Interval: 1.391 to 4.253

(using the approximation of Katz.)

Difference between the two proportions

Top row (Alive):

Fraction in the left column: 0.8846

95% Confidence Interval of that fraction: 0.7923 to 0.9459

Bottom row (Dead):

Fraction in the left column: 0.3636

95% Confidence Interval of that fraction: 0.1721 to 0.5933

Difference:

Difference between the fractions: 0.5210

Standard error of the difference: 0.1016

95% confidence interval of difference: 0.3218 to 0.7201

Data analyzed

	Conservatve	Surgery group	Total
Alive	69	9	78

	(69%)	(9%)	(78%)
Dead	8	14	22
	(8%)	(14%)	(22%)
Total	77	23	100
	(77%)	(23%)	(100%)

MANAGEMENT and GOS

Chi-squared Test for Independence

Chi-square: 32.250

Degrees of Freedom: 4

Table size: 2 rows, 5 columns.

The P value is < 0.0001.

The row and column variables are significantly associated.

Chi-Squared Test for Trend.

Chi-squared for trend = 30.925 (1 degree of freedom)

The P value is < 0.0001.

There is a significant linear trend among the ordered categories

defining the columns and the proportion of subjects in the top row.

Row	Total	Percent
1	76	76.77%
2	23	23.23%
Total	99	100.00%

Column	Total	Percent

GOS 1	22	22.22%
GOS 2	4	4.04%
GOS 3	16	16.16%
GOS 4	26	26.26%
GOS 5	31	31.31%
Total	99	100.00%

SDH type AND GOS: Chi-squared Test for Independence
Chi-square: 37.697
Degrees of Freedom: 8
Table size: 3 rows, 5 columns.
The P value is < 0.0001.
The row and column variables are significantly associated

Row	Total	Percent
1	41	41.00%
2	44	44.00%
3	15	15.00%
Total	100	100.00%

Column	Total	Percent
GOS 1	22	22.00%
GOS 2	4	4.00%
GOS 3	16	16.00%
GOS 4	27	27.00%

GOS 5	31	31.00%	
Total	100	100.00%	

SDH THICKNESS AND OUTCOME

Fisher's Exact Test

The two-sided P value is 0.1094, considered not significant.

The row/column association is not statistically significant.

Relative Risk

Relative risk = 4.513

95% Confidence Interval: 0.6328 to 32.185

(using the approximation of Katz.)

Difference between the two proportions

Top row (alive):

Fraction in the left column: 0.2051

95% Confidence Interval of that fraction: 0.1222 to 0.3118

Bottom row (deaths):

Fraction in the left column: 0.04545

Difference:

Difference between the fractions: 0.1597

Data analyzed

	SDH <5mm	SDH >5mm	Total
alive	16	62	78
	(16%)	(62%)	(78%)

deaths	1	21	22
	(1%)	(21%)	(22%)
Total	17	83	100
	(17%)	(83%)	(100%)

SDH THICKNESS AND OUTCOME

Odds Ratio

Odds ratio= 5.419

95% Confidence Interval: 0.6767 to 43.402

(using the approximation of Woolf.)

Data analyzed

	SDH <5mm	SDH >5mm	Total
alive	16	62	78
	(16%)	(62%)	(78%)
deaths	1	21	22
	(1%)	(21%)	(22%)
Total	17	83	100
	(17%)	(83%)	(100%)

MLS AND OUTCOME

Fisher's Exact Test

The two-sided P value is < 0.0001, considered extremely significant.

The row/column association is statistically significant.

Sensitivity and specificity

Variable	Value	95% Confidence Interval	
Sensitivity	0.6400	0.4255 to 0.8204	
Specificity	0.9500	0.7513 to 0.9987	
Positive Predictive Value	0.9412	0.7133 to 0.9985	
Negative Predictive Value	0.6786	0.4762 to 0.8414	
Likelihood Ratio	12.800		
Data analyzed			
	ALIVE	DEAD	Total
SDH < 5MM	16	1	17
	(36%)	(2%)	(38%)
SDH 5 TO 9 MM	9	19	28
	(20%)	(42%)	(62%)
Total	25	20	45
	(56%)	(44%)	(100%)
Relative Risk			
Relative risk = 2.928			
95% Confidence Interval: 1.687 to 5.082			
(using the approximation of Katz.)			
Difference between the two proportions			
Top row (SDH < 5MM):			
Fraction in the left column: 0.9412			
Bottom row (SDH 5 TO 9 MM):			

Fraction in the left column: 0.3214
95% Confidence Interval of that fraction: 0.1586 to 0.5238
Difference:
Difference between the fractions: 0.6197
Data analyzed
ALIVE DEAD Total
SDH < 5MM 16 1 17
(36%) (2%) (38%)
SDH 5 TO 9 MM 9 19 28
(20%) (42%) (62%)
Total 25 20 45
(56%) (44%) (100%)
SDH THICKNESS 5-9mm AND MLS
Fisher's Exact Test
The two-sided P value is < 0.0001, considered extremely significant.
The row/column association is statistically significant.
Relative Risk
Relative risk = 2.998
95% Confidence Interval: 1.746 to 5.148
(using the approximation of Katz.)
Difference between the two proportions
Top row (MLS <2mm):

Fraction in the left column: 0.9636			
Bottom row (MLS 2-5 mm):			
Fraction in the left column: 0.3214			
95% Confidence Interval of that fraction: 0.1586 to 0.5238			
Difference:			
Difference between the fractions: 0.6422			
Data analyzed			
	Alive	Dead	Total
MLS <2mm	53	2	55
	(64%)	(2%)	(66%)
MLS 2-5 mm	9	19	28
	(11%)	(23%)	(34%)
Total	62	21	83
	(75%)	(25%)	(100%)
Odds Ratio			
Odds ratio= 55.944			
95% Confidence Interval: 11.074 to 282.62			
(using the approximation of Woolf.)			
Data analyzed			
	Alive	Dead	Total
MLS <2mm	53	2	55
	(64%)	(2%)	(66%)

MLS 2-5 mm	9	19	28
	(11%)	(23%)	(34%)
Total	62	21	83
	(75%)	(25%)	(100%)

Sensitivity and specificity		
Variable	Value	95% Confidence Interval
Sensitivity	0.8548	0.7423 to 0.9314
Specificity	0.9048	0.6963 to 0.9883
Positive Predictive Value	0.9636	0.8748 to 0.9956
Negative Predictive Value	0.6786	0.4762 to 0.8414
Likelihood Ratio	8.976	

Data analyzed			
	Alive	Dead	Total
MLS <2mm	53	2	55
	(64%)	(2%)	(66%)

SDH only and MLS
Fisher's Exact Test
The two-sided P value is 0.0341, considered significant.
The row/column association is statistically significant.

Relative Risk
Relative risk = 1.333
95% Confidence Interval: 0.8936 to 1.989

(using the approximation of Katz.)
Difference between the two proportions
Top row (MLS <2mm):
Fraction in the left column: 1.000
Bottom row (MLS 2-5 mm):
Fraction in the left column: 0.7500
Difference:
Difference between the fractions: 0.2500
Data analyzed

	Alive	Dead	Total
MLS <2mm	33	0	33
	(80%)	(0%)	(80%)
MLS 2-5 mm	6	2	8
	(15%)	(5%)	(20%)
Total	39	2	41
	(95%)	(5%)	(100%)

Sensitivity and specificity

Variable	Value	95% Confidence Interval
Sensitivity	0.8462	0.6945 to 0.9413
Specificity	1.000	0.1581 to 1.000
Positive Predictive Value	1.000	0.8943 to 1.000
Negative Predictive Value	0.2500	0.03184 to 0.6510

Data analyzed			
	Alive	Dead	Total
MLS <2mm	33	0	33
	(80%)	(0%)	(80%)
SDH WITH CONTRALATERAL CONTUSION			
	Fisher's Exact Test		
The two-sided P value is 0.0606, considered not quite significant.			
The row/column association is not statistically significant.			
Relative Risk			
Relative risk = Infinity			
95% Confidence Interval: -Infinity to Infinity			
(using the approximation of Katz.)			
Difference between the two proportions			
Top row (MLS<2 mm):			
Fraction in the left column: 0.7500			
Bottom row (MLS 2-5mm):			
Fraction in the left column: 0.000			
Difference:			
Difference between the fractions: 0.7500			
The standard error and the confidence interval of the difference between			
proportions can only be calculated when each cell is greater than five.			
Data analyzed			

	ALIVE	DEAD	Total
MLS<2 mm	6	2	8
	(50%)	(17%)	(67%)
MLS 2-5mm	0	4	4
	(0%)	(33%)	(33%)
Total	6	6	12
	(50%)	(50%)	(100%)

SDH with SAH and MLS

Fisher's Exact Test

The two-sided P value is 0.0769, considered not quite significant.

The row/column association is not statistically significant.

Relative Risk

Relative risk = 3.273

95% Confidence Interval: 0.5857 to 18.286

(using the approximation of Katz.)

Difference between the two proportions

Top row (MLS <2mm):

Fraction in the left column: 0.8182

Bottom row (MLS 2-5 mm):

Fraction in the left column: 0.2500

Difference:

Difference between the fractions: 0.5682

STATISTICAL ANALYSIS DISCUSSION:

1. In cases of SDH, mortality is 12% if the SDH thickness is less than 5mm.

If the SDH thickness is greater than 5mm, the mortality becomes 24%.

On applying the Fischer test, the P value is 0.3484 which is not statistically significant.

2. On comparing the MLS, in the group with MLS and SDH less than 5mm the mortality was 6% while patients with MLS and SDH 5-9mm had a mortality of 53%. On applying the Fischer test, the P value is <0.0001 which is extremely significant with statistical significant row /column association

3. On comparing MLS with isolated SDH, overall mortality was 5% in the group with MLS less than 2mm. Mortality was significantly increased in the presence of MLS. On applying Fischer's test, this was statistically significant.

4. Mortality was also increased in SDH with other associated injuries, in the presence of MLS. But this was found to be statistically not significant, probably because of the small sample size.

5. On comparing conservatively managed SDH vs. conservative failure mortality rate was statistically significant in cases where conservative management had failed.

Conclusion

Our study had mainly focussed on borderline SDH. According to our study thickness of SDH alone, was not statistically significant in determining the outcome. Sdh when associated with midline shift had very significant influence on both mortality and functional outcome.

Patients with greater midline shift had worse outcome than those with a lesser midline shift.

SDH with associated contusion or SAH has a worse prognosis than SDH alone.

Early surgery in these cases may improve the prognosis. Further studies are needed to confirm this.

The mortality rate among those taken up for surgery after initial conservative management was significantly higher and thus emphasising the need for close monitoring of conservatively managed patients and also to take up for primary surgery at the slightest degree of suspicion regarding conservative management.

The threshold for decision making towards primary surgical management should be lower for patients with moderate head injury as this group may benefit more from aggressive management. Also if the GCS scores fall further, the prognosis becomes dismal and the final outcome is bleak.

Bibliography

1. Brain Trauma Foundation Guidelines 2012
2. Youman's Neurological Surgery sixth edition volume 4
3. Conservative Management of Acute Subdural Hematoma Feliciano CE, et al. PRHSJ Vol. 27 No. 3 September, 2008
4. Dent DL, Croce MA, Menke PG, et al. Prognostic factors after acute subdural hematoma. J Trauma 1995; 39:36-42.
5. Croce MA, Dent DL, Menke PG, et al. Acute subdural hematoma: Nonsurgical management of selected patients. J Trauma 1994; 36:820-827.
6. Subdural Hematoma in Childhood The Internet Journal of Paediatrics and Neonatology. 2004 Volume 5 Number 1 C Pereira, et al
7. Mathew P, Oluoch-Olunya DL, Condon BR, et al. Acute subdural haematoma in the conscious patient: Outcome with initial non-operative management. Acta Neurochir 1993; 121:100-108.
8. Wong CW. CT and Clinical Criteria for conservative treatment of supra tentorial acute subdural haematomas. Acta Neurochir 1995; 135:38-43.
9. Value of serial CT scanning and intracranial pressure monitoring for detecting new intracranial mass effect in severe head injury patients showing lesions type I-II in the initial CT scan.Lobato RD, Alen JF Neurocirugia (Astur). 2005 Jun; 16(3):217-34.

10. Servadei F, Nasi MT, Cremonini AM, et al. Importance of a reliable admission Glasgow Coma Scale score for determining the need for evacuation of posttraumatic subdural hematomas. J Trauma 1998; 44:868-873.
11. Zumkeller M, Behrmann R, Heissler HE, et al. Computed tomographic criteria and survival rate for patients with acute subdural hematoma. Neurosurgery 1996;39:708-713.
12. Ct Prognostic Factors In Acute Subdural Haematomas: The Value Of The 'Worst' Ct Scan
BJS 2000, Vol. 14, No. 2, Pages 110-116 F. Servadei, M. T. Nasi, et al.
13. Traumatic Brain Injury: Patterns of Failure of Nonoperative Management by Patel, Nirav Y. MD et al Journal of Trauma-Injury Infection & Critical Care: March 2000 - Volume 48 - Issue 3 - pp 367-375
14. Ramamurthi and Tandon Textbook of Neurosurgery 3rd edition

Master chart

AGE	SEX	MODE	LOC	VOMITING	ENTBLEED	SEIZURES	AD GCS	PUPIL REACTION	SDH SIDE	SDH SIZE	MLS	I/L CONT	C/L CONT	SAH	TREAT	SDH INCREASE	MLS INCREASE	GCS DECREASE	GOS	OUTCOME
26	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	5	1
29	0	0	1	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	3	1
26	0	0	1	1	1	0	1	1	1	1	1	0	0	0	1	0	1	0	5	1
55	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0	0	0	4	1
60	0	0	1	1	0	0	1	1	0	1	0	0	1	0	0	0	0	0	3	1
35	0	0	1	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	4	1
25	0	0	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	3	1
21	0	1	1	1	0	0	1	1	0	1	0	0	0	1	0	0	0	0	3	1
22	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	4	1
57	0	0	1	0	0	0	0	1	1	1	1	0	0	0	1	0	0	1	3	1
28	0	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
50	0	0	1	1	0	1	0	1	1	1	0	0	1	0	0	0	0	0	4	1
45	0	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	5	1
48	0	0	1	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0	3	1
37	1	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
52	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0	0	0	4	1
55	0	0	1	1	0	0	1	1	1	1	0	1	0	0	1	1	0	0	2	1
35	0	0	1	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
50	0	0	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0
40	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	0
37	0	0	1	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0
45	0	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	3	1
24	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
57	0	0	1	1	0	0	0	0	1	1	1	1	0	0	1	0	1	0	1	0

30	0	0	1	1	1	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0
55	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
24	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	5	1
25	0	0	0	1	1	0	0	1	1	1	1	0	0	1	1	0	0	1	1	0
55	0	0	1	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	4	1
60	0	0	1	0	0	0	1	1	1	1	1	0	1	0	1	0	0	1	1	0
40	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0	0	0	3	1
49	0	0	1	1	0	0	0	1	1	1	1	1	0	0	1	0	1	0	1	0
18	0	0	1	0	1	0	1	1	0	1	0	0	1	0	0	0	0	0	4	1
41	0	0	1	0	0	0	1	1	1	1	0	1	0	0	1	1	0	0	3	1
60	0	0	1	0	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	0
45	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
59	0	0	1	0	1	0	1	1	0	1	1	0	0	1	1	1	0	0	1	0
42	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	3	1
45	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	4	1
35	0	0	1	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0	1	0
29	0	0	1	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0	4	1
50	0	1	1	1	0	0	0	1	1	1	1	0	0	0	1	0	0	1	2	1
65	0	0	1	1	1	0	0	1	0	1	1	1	0	0	1	1	0	0	1	0
15	0	0	1	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	3	1
26	0	0	0	1	0	0	0	1	0	1	1	0	0	1	1	0	0	1	3	1
30	0	0	1	1	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	0
48	0	0	1	1	0	0	0	1	1	1	0	0	0	1	0	0	0	0	2	1
15	1	0	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	4	1
40	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	0
40	0	2	0	1	0	0	0	1	1	1	0	0	0	1	0	0	0	0	3	1
45	0	0	1	1	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0
65	0	0	1	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	5	1
28	0	0	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	5	1

45	0	2	1	1	0	0	0	1	0	1	1	0	0	1	1	0	0	1	1	0
22	0	1	1	1	1	0	1	1	0	0	1	1	0	0	0	0	0	0	3	1
56	0	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0
35	0	0	1	1	0	0	1	1	1	1	0	0	0	1	0	0	0	0	5	1
40	0	0	0	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
72	0	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	5	1
35	1	2	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	4	1
35	0	0	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	5	1
39	0	0	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
60	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	5	1
40	0	1	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	2	1
32	1	2	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
20	0	0	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	5	1
27	0	0	1	1	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0
40	0	0	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
55	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
45	0	1	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
25	0	0	1	0	1	0	1	0	1	1	1	0	1	0	0	0	0	0	1	0
42	1	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
35	0	0	1	0	0	1	1	1	0	0	1	1	0	0	0	0	0	0	4	1
70	0	0	1	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	0
40	0	0	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
38	0	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
45	0	0	1	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	4	1
22	0	2	1	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	1	0
38	0	0	1	1	0	0	1	1	1	0	1	1	0	0	0	0	0	0	5	1
27	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	5	1
70	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	0	1	0
48	0	1	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	4	1

55	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
34	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	4	1
35	0	2	1	1	1	0	0	1	1	1	1	1	0	0	1	0	0	1	4	1
35	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
35	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
45	0	2	1	0	0	1	0	1	1	1	1	0	0	0	1	0	0	1	3	1
52	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
65	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	4	1
36	0	0	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	4	1
50	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	5	1
60	0	0	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	5	1
55	0	0	1	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	4	1
51	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
22	0	1	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4	1
38	1	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
31	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	5	1
34	0	0	1	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	3	1
36	0	0	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4	1

Abbreviations

SEIZURE	0	ABSENT	SDH SIZE	0	<5mm
	1	PRESENT		1	5-9mm
VOMITING	0	ABSENT	MLS	0	<2mm
	1	PRESENT		1	2-5mm
ENT BLEED	0	ABSENT	I/L contusion	0	ABSENT
	1	PRESENT		1	PRESENT
LOC	0	ABSENT	C/L contusion	0	ABSENT
	1	PRESENT		1	PRESENT
GCS	0	09 TO 12	SAH	0	ABSENT
	1	13 TO 15		1	PRESENT
PUPILS	0	SLUGGISH	TREATMENT	0	CONSERVATIVE
	1	REACTING		1	OPERATED
SDH SIDE	0	LEFT	SDH increase	0	NO
	1	RIGHT		1	YES
GCS fall	0	NO	MLS increase	0	NO
	1	YES		1	YES
OUTCOME	0	DEAD			
	1	ALIVE			

Appendix I

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. Ramkumar .R.R,
PG in Neuro Surgery,
Department of Neuro Surgery,
Madras Medical College, Chennai-3.

Dear Dr. Ramkumar .R.R,

The Institutional Ethics Committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled **"A study on Borderline Subdural Haematoma"** No.41032014

The following members of Ethics Committee were present in the meeting held on 11.03.2014 conducted at Madras Medical College, Chennai-3.

1.	Dr. C. Rajendran, M.D.	-- Chairperson
2.	Dr. R. Vimala, M.D. Dean, MMC, Ch-3.	-- Deputy Chairperson
3.	Prof. Kalaiselvi, MD Vice-Principal, MMC, Ch-3	-- Member Secretary
4.	Prof. Nandhini, M.D. Inst. of Pharmacology, MMC, Ch-3.	-- Member
5.	Prof. Bhavani Shankar, M.S. Prof & HOD of General Surgery, MMC, Ch-3.	-- Member
6.	Prof. V. Padmavathi, M.D. I/c Director of Pathology, MMC, Ch-3.	-- Member
7.	Thiru. S. Govindasamy, BABL	-- Lawyer
8.	Tmt. Arnold Saulina, MA MSW	-- Social Scientist
9.	Thiru. S. Ramesh Kumar, Administrative Officer, MMC, Ch-3.	-- Layperson

We approve the proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

13/3/14

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE
CHENNAI-3

Member Secretary, Ethics Committee

Appendix II

Information sheet

Name of the Principal Investigator	:	
Name of the Participant	:	
Place of Study	:	Rajiv Gandhi Govt. General Hospital, Chennai-3.

- We are conducting a study of **"A Study on the management of Borderline Subdural Hematoma "** at the Institute of Neurology, Rajiv Gandhi Govt. General Hospital, Chennai . The purpose is to study the correlation between various factors affecting management of borderline Sub Dural hematoma.

- We study the demographic parameters, CT finding, Clinical Parameters and operative parameters for the patients.

- The privacy of the patients in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

- Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time. Your decision will not result in any loss of benefits to which you are otherwise entitled.

- The results of the study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of the investigator **Signature of the participant**

Date: Date:

Appendix III

PATIENT CONSENT FORM

Study Details
"A Study on the management of borderline Subdural Hematoma "
Study Centre : Institute of Neurology,
Madras Medical College and
Rajiv Gandhi Government General Hospital,
Chennai - 600 003.

Patient may check (□) these boxes:

I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ☐

I understand that the investigator of the clinical study, others working on his behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or wellbeing or any unexpected or unusual symptoms. ☐

I hereby give permission to undergo complete clinical examination and diagnostic tests including hematological, biochemical, radiological, EMG, EEG, NCS, Lumbar puncture and muscle biopsy, appropriate to the clinical diagnosis. ☐

I hereby consent to participate in this study. ☐

Signature / Thumb impression: Place : Date :

Patient Name and Address:

Signature of Investigator: Place : Date

Study Investigator's Name :

Appendix IV

ஆராய்ச்சி தகவல் தாள்

தலைப்பு
விபத்து தலைக்காயம் பற்றிய ஆய்வு

சென்னை இராஜீவ்காந்தி அரசு பொது மருத்துவனையில் விபத்தினால் ஏற்படும் தலைக்காயம் பற்றிய ஓர் ஆய்வு இங்கு நடைபெறுகிறது.

இந்த ஆய்வில் விபத்தினால் வரும் தலைக்காயம் பற்றியும் அதன் சிகிச்சை முறை பற்றி நரம்பியல் அறுவை சிகிச்சைத் துறையில் ஆராய்ச்சி நடைபெற்று வருகிறது.

முடிவுகளை அல்லது கருத்துகளை வெளியிடும்போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது பெயரையோ அல்லது அடையாளங்களையோ வெளியிடமாட்டோம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த சிறப்பு சிகிச்சையின் முடிவுகளை ஆராய்ச்சியின்போது அல்லது ஆராய்ச்சியின் முடிவின் போது தங்களுக்கு அறிவிக்கப்படும் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்பது தங்களுடைய விருப்பத்தின் பேரில் தான் இருக்கிறது. மேலும் நீங்கள் எந்நேரமும் இந்த ஆராய்ச்சியிலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக் கொள்கிறோம்.

.....	.....	.....
பங்கேற்பாளர் பெயர்	கையொப்பம்/ கைரேகை	தேதி
.....	.....	.....
ஆராய்ச்சியாளரின் பெயர்	கையொப்பம்	தேதி

APPENDIXV

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சி தலைப்பு

விபத்து தலைக்காயம் பற்றிய ஆய்வு

ஆராய்ச்சி நிலையம் : **இராஜீவ் காந்தி அரசு பொது மருத்துவமனை,** சென்னை-3.

பெயர் : வயது :

ஆராய்ச்சி சேர்க்கை எண் : தேதி:

பங்கு பெறுபவர் இதனை (✓) குறிக்கவும்

மேலே குறிப்பிட்டுள்ள மருத்துவ ஆய்வின் விவரங்கள் எனக்கு விளக்கப்பட்டது. என்னுடைய சந்தேகங்களை கேட்கவும், அதற்கான தகுந்த விளக்கங்களை பெறவும் வாய்ப்பளிக்கப்பட்டது. ☐

நான் இவ்வாய்வில் தன்னிச்சையாகதான் பங்கேற்கிறேன். எந்த காரணத்தினாலோ எந்த கட்டத்திலும் எந்த சட்ட சிக்கலுக்கும் உட்படாமல் நான் இவ்வாய்வில் இருந்து விலகி கொள்ளலாம் என்றும் அறிந்து கொண்டேன். ☐

இந்த ஆய்வு சம்பந்தமாகவோ, இதை சார்ந்த மேலும் ஆய்வு மேற்கொள்ளும் போதும் இந்த ஆய்வில் பங்குபெறும் மருத்துவர் என்னுடைய மருத்துவ அறிக்கைகளை பார்ப்பதற்கு என் அனுமதி தேவையில்லை என அறிந்து கொள்கிறேன். நான் ஆய்வில் இருந்து விலகிக் கொண்டாலும் இது பொருந்தும் என அறிகிறேன். ☐

இந்த ஆய்வின் மூலம் கிடைக்கும் தகவல்களையும், பரிசோதனை முடிவுகளையும் மற்றும் சிகிச்சை தொடர்பான தகவல்களையும் மருத்துவர் மேற்கொள்ளும் ஆய்வில் பயன்படுத்திக்கொள்ளவும் அதை பிரசுரிக்கவும் என் முழு மனதுடன் சம்மதிக்கின்றேன். ☐

இந்த ஆய்வில் பங்கு கொள்ள ஒப்புக்கொள்கிறேன். எனக்கு கொடுக்கப்பட்ட அறிவுரைகளின்படி நடந்து கொள்வதுடன் 'இந்த ஆய்வை மேற்கொள்ளும் மருத்துவ அணிக்கு உண்மையுடன் இருப்பேன் என்று உறுதியளிகிறேன். எனது உடல்நலம் பாதிக்கப்பட்டாலோ அல்லது வழக்கத்திற்கு மாறான நோய்க்குறி தென்பட்டாலோ உடனை அதை மருத்துவ அணியிடம் தெரிவிப்பேன் என்று உறுதி அளிக்கிறேன். ☐

.....	.....	.....
பங்கேற்பாளர் பெயர்	கையொப்பம்/ கைரேகை	தேதி
.....	.....	.....
ஆராய்ச்சியாளரின் பெயர்	கையொப்பம்	தேதி

APPENDIX VI

Proforma

Name: **Age/Sex:** **IP No:** **DOA:** **DOD:**

Mode of Injury: **Time of Injury:**

History:

Smoker: **Alcoholic:**

DM: **SHT:** **CAD:** **On oral Anticoagulants:**

GCS less than 9: **GCS more than 9:**

Clinical findings:

ASSOCIATED INJURIES:

1. THORACIC:

2. ABDOMINAL:

3. LONG BONES

4. OTHERS

	On Admission	At 24 hrs	At 48 hrs	5th day	10th day	20 days	At discharge
GCS							
Pupils							
Paucity							

RADIOLOGY:	Initial Scan					
1. THICKNESS OF SDH						
2. MIDLINE SHIFT						
3. BASAL CISTERNS						
4. CONTUSION – Ipsilateral						
5. CONTUSION- Contralateral						
6. VOLUME OF CONTUSION						
7. NUMBER OF CONTUSIONS						
8. PRESENCE OF SAH						

INVESTIGATIONS:

TC: **DC:** **Hb:** **PCV:** **RBC:** **Platelet:**

B.Sugar **Urea:** **S.Creat:**

S.Na+: **S.K+:**

BT: **CT:** **PT:** **INR:**

MANAGEMENT:

1. Conservative:

2. Surgery: **Day of Surgery:**

Initial:

Subsequent: **Clinical Deterioration:**

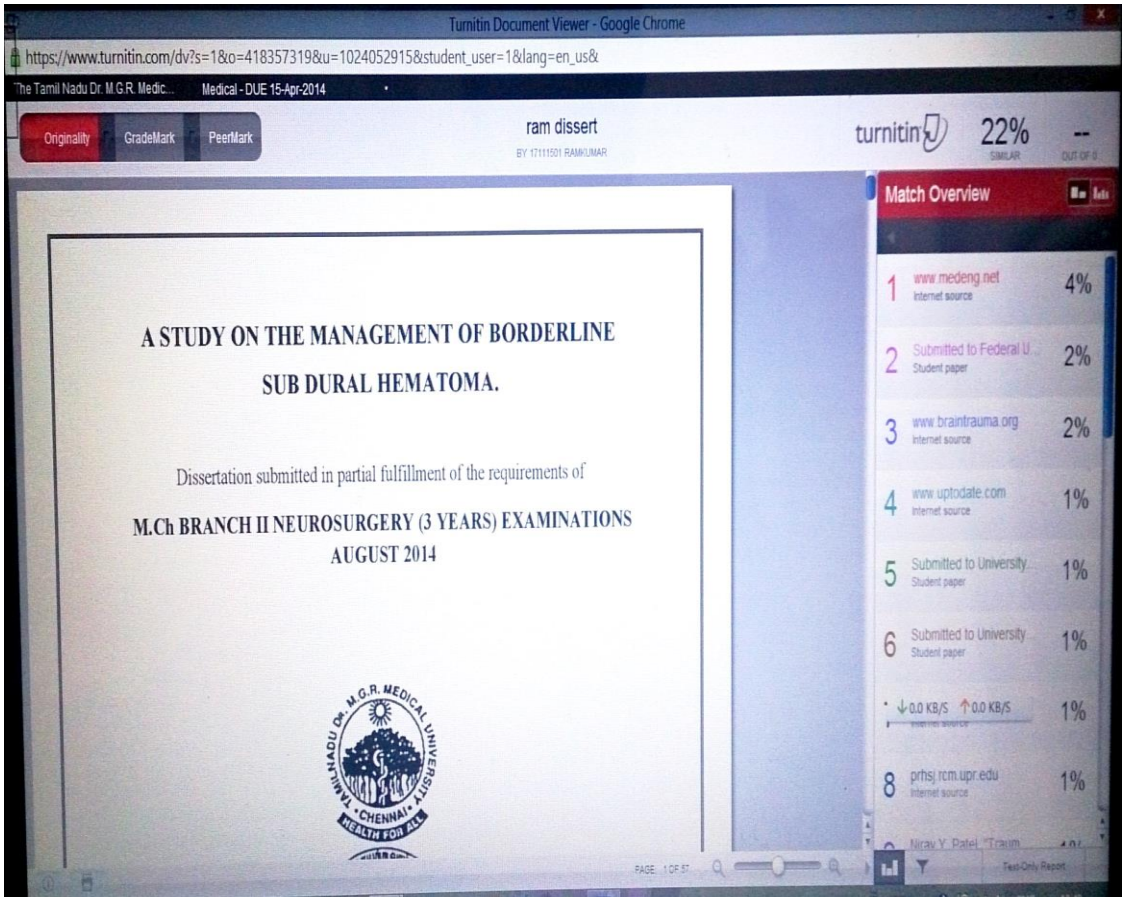
Radiological Increase:

OUTCOME:

1. MORTALITY: **Date of Death:**

2. GOS: **At discharge** **1** **2** **3** **4** **5**

PLAGIARISM-TURNITIN

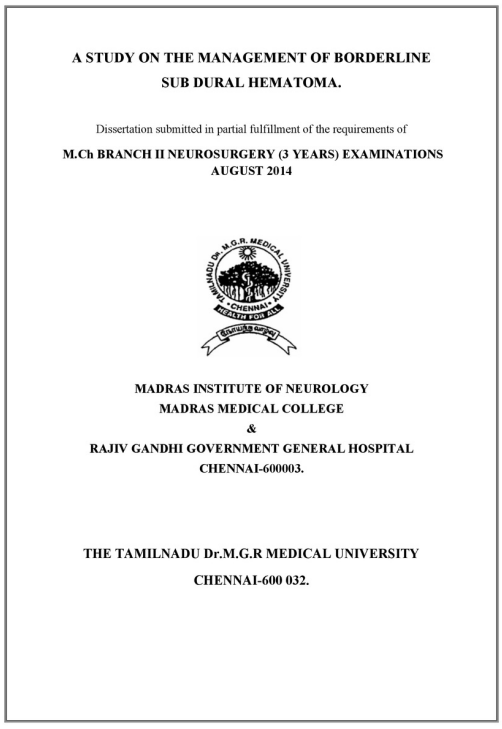


Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	17111501 RAMKUMAR
Assignment title:	Medical
Submission title:	ram dissert
File name:	ram_dissert_FINAL.pdf
File size:	1.74M
Page count:	57
Word count:	6,702
Character count:	31,928
Submission date:	19-Apr-2014 01:39PM
Submission ID:	418357319



A STUDY ON THE MANAGEMENT OF BORDERLINE SUB DURAL HEMATOMA.

Dissertation submitted in partial fulfillment of the requirements of

M.Ch BRANCH II NEUROSURGERY (3 YEARS) EXAMINATIONS AUGUST 2014

MADRAS INSTITUTE OF NEUROLOGY
MADRAS MEDICAL COLLEGE
&
RAJIV GANDHI GOVERNMENT GENERAL HOSPITAL
CHENNAI-600003.

THE TAMILNADU Dr.M.G.R MEDICAL UNIVERSITY
CHENNAI-600 032.