THE TAMILNADU Dr.M.G.R MEDICAL UNIVERSITY

CHENNAI-600032.

Intra Operative Prognostic Scoring (IPS) in mild and moderate traumatic brain injury patients with Traumatic Acute Subdural Hematoma (TASH) undergoing decompressive craniectomy.
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

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CERTIFICATE

This is to certify that this dissertation titled **"Intra Operative Prognostic Scoring (IPS) in mild and moderate traumatic brain injury patients with Traumatic Acute Subdural Hematoma (TASH) undergoing decompressive craniectomy"** submitted by **Dr.Raja.S.Vignesh**, 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.

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DECLARATION

I, Dr.Raja.S.Vignesh, solemnly declare that this dissertation **"Intra Operative Prognostic Scoring (IPS) in mild and moderate traumatic brain injury patients with Traumatic Acute Subdural Hematoma (TASH) undergoing decompressive Craniectomy"** was done by me at the 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 RAJA.S.VIGNESH

Date: 31-03-14

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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.

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ABBREVIATIONS USED

TASH-TRAUMATIC ACUTE SUBDURAL HEMATOMA

SAH-SUB ARACHNOID HEMORRHAGE

EDH-EPIDURAL HEMATOMA

SDH- SUDURAL HEMATOMA

IVH-INTRA VENTRICULAR HEMORRHAGE

GCS –GLASGOW COMA SCALE

MRS-MODIFIED RANKIN SCALE

CT- COMPUTERISED TOMOGRAPHY

IPS-INTRA OPERATIVE PROGNOSTIC SCORE

B.P-BLOOD PRESSURE

PRE-OP- PRE OPERATIVE

POST –OP –POST OPERATIVE

Intra Operative Prognostic Scoring (IPS) in mild and moderate traumatic brain injury patients with Traumatic Acute Subdural Hematoma (TASH) undergoing decompressive craniectomy.

Abstract

Aims and objectives

1. To identify intra operative parameters those affect the outcome in patients undergoing decompressive craniectomy for traumatic acute subdural hematoma.

2. To devise a concise scoring system using those intra operative parameters for prognostication of outcome.

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. 100 Patients who were admitted with head injury and acute SDH were included based on the devised inclusion and exclusion criteria.

Inclusion Criteria

1. Age-adults (13 years and above)

2. GCS 9 to 15 on admission

3. Either a single coup or a single contre coup TASH

4. TASH without contusion or IVH in pre op CT.
5. No evidence of pre op hypotension (b.p > 90/60 without inotropes),
6. No evidence of pre op fall in SpO2 (>95% without O2 before induction)
7. No pre-operative clinical evidence of brain stem dysfunction.

Exclusion Criteria

1. Age less than 13 years
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3. Bilateral TASH
4. TASH with SAH identified on CT.
5. TASH with IVH on CT.
6. TASH with contusion on CT.
7. Pre op Shock (b.p < 90/60 with or without) inotropes
8. Pre op SpO2 < 95 with O2.
9. Diffuse cerebral edema/effaced cisterns in pre op CT
10. Severe life threatening musculo skeletal/spine/thoraco abdominal injuries
11. Evidence of brain stem dysfunction
12. Conservatively managed TASH.

13. Patients who dissent for inclusion in the study.

Among the above criteria 4 to 9 have been extensively studied and found to influence outcome in previous studies and hence they have been excluded in the present study to improve the validity of intra operative parameters. Patients were assessed pre operatively by the anaesthesia team and categorized as per American association of anaesthesiologists anaesthesia risk grading. Surgical indication was based on brain trauma foundation guidelines 2012.

Results

One month mortality was 53%. patients with Grade A IPS had better survival rates whereas patients with Grade C IPS had the highest mortality rates among all. The outcome measured by MRS was also significant.

Conclusion:

To the best of our knowledge, the present study is probably the first attempt to include only the intra operative parameters in a prognostic scale in patients with SDH in mild and moderate traumatic brain injuries undergoing surgical management. Our study shows IPS is a good prognostication tool to assess the mortality and functional outcome in TBI patients undergoing de compressive craniotomy for unilateral traumatic acute subdural hematoma and is better than pre-operative GCS and imaging in predicting mortality at 30 days and functional outcome at 2 months.

INTRODUCTION

Traumatic subdural hematomas continue to have a high rate of mortality and morbidity in spite of improvement in transportation facilities, access to CT scan, surgical intervention and better intensive care facilities.

Patients with Traumatic acute subdural hematomas are associated with high mortality and morbidity among traumatic brain injuries. The associated brain damage and effects of the injury is complex and hence the outcome is highly variable among patients. This is particularly more relevant in patients who undergo decompressive craniectomy.

As evidenced in various studies, the mortality rates are as high as 60 to 70 % even after surgery. Many factors have been identified to influence the morbidity and mortality in such patients. And hence, prognostication is very difficult.

Multivariate analysis has identified age, clinical severity, CT abnormalities, systemic insults (hypoxia and hypo-tension), and laboratory variables as relevant factors to include in models to predict outcome in individual patients. Current prognostic scales do not have intra operative findings as factor in the scoring system. This study is an attempt to devise a prognostic scoring system using only intra operative parameters in the management of traumatic brain injury patients with acute subdural hematoma.

AIMS AND OBJECTIVES OF THE STUDY

1.To identify intra operative parameters those affect the outcome in patients undergoing decompressive craniectomy for traumatic acute subdural hematoma.

2.To devise a concise scoring system using those intra operative parameters for prognostication of outcome.

3.To assess the primary outcome on the 30^{th} day as alive or dead and functional outcome by MRS on 60^{th} day and whether any significant correlation between the score and the outcome exists and to compare with admission GCS, CT findings and outcome.

4.To enable the neurosurgeons and anaesthesiologists and intensivists to understand and take appropriate measures for effective intra and post-operative care to improve outcome.

REVIEW OF LITERATURE

Many of the studies reported thus far have shown the importance of pre-operative GCS as the single most important predictor of outcome after surgery. In case of severe TBI, admission GCS correlated well with the outcome. Patients with low GCS had high mortality rates nearing 90 to 100%**.**

Many patients with moderate and mild TBI undergoing decompressive craniectomy have better outcomes when compared with those with low GCS. The other parameters that are well studied are those of age, associated contre coup injury, contusion , presence of sub arachnoid haemorrhage, pre op hypoxia, pre-op hypo tension , coagulation disorders, anisocoria, time to surgical intervention from injury, duration of surgery, associated co morbidities like diabetes, duration of post-operative ventilator requirement etc.

An injured brain is more vulnerable to systemic secondary insults (i.e., hypoxia and hypotension) than is a normal, healthy brain. Secondary insults are common after TBI, and can increase the degree of damage. The association of secondary insults with poorer outcome is well established. Most studies have used a cut-off value for early hypotensive and hypoxic events (e.g., any episode with a systolic blood pressure <90 mm Hg). However, analysis of the association between the blood pressure measured on admission and outcome showed that this relation is continuous: low and high blood pressure are both associated with poorer outcome .studies indicate that

higher blood pressure values are merely indicative of more severe brain injuries and could possibly be caused by raised intra cranial pressure.

The prognostic value of CT characteristics has been well documented, including the status of basal cisterns, mid line shift, the presence and type of intracranial lesions, and traumatic subarachnoid haemorrhage[1, 2, 8]. Obliteration of the basal cisterns and the presence of subarachnoid haemorrhage are the strongest CT predictors of outcome[8]. In 1991, Marshall and colleagues introduced a descriptive classification of head injury based on CT characteristics, which focuses on the presence or absence of a mass lesion and differentiates diffuse injuries by signs of increased intracranial pressure (compression of basal cisterns, mid-line shift).

Wilberger and colleagues (2006) reported that the time interval between operation and injury and cerebral edema were the most important parameters that influence outcome after DC in TASH.

Seelig and colleagues[6] (1981) reported a considerable low mortality rates in those patients who are operated earlier. Bullock MR and colleagues[7] (2006) reported there was no such significance between operations done within four hours after trauma and those performed beyond this time.

In our set up the time taken to get a CT scan done from the time of injury is highly variable and even more so is the time of actual surgical management

after the initial CT scan which is often more than 6 hours after the injury. Various factors like delay in transporting the patient from the site of injury to a scan centre and then referring to a neurosurgical centre play an important part in the outcome. Under such circumstances where there is a delay in surgical management even after scanning, the scan reflects the PAST status of the injured brain and not the real time scenario that is present before durotomy. On many occasions the initial CT scan may not have indications for surgical management but a repeat CT may be otherwise. Sometimes there may be delays in taking up the patient for surgery even when the CT shows clear indication for surgery. Delay in getting operating table, equivocal cases where surgical intervention was not indicated at that point of time, co morbid conditions like coagulopathies, bleeding disorders, hemodynamic instability, diabetes etc. are also factors for delay in surgery.

Under the above circumstances too, the last CT may not reflect the actual intra cranial brain status when the patient is being operated. Studies[1, 2, 3, and 5] have also identified many molecular level changes that occur after durotomy which result in altered CSF dynamics, re perfusion injuries, rupture of thin subarachnoid vessels, cellular cytotoxicity, cerebral edema, brainstem dysfunction, hypoxia, and cardiovascular changes resulting in hypotension which further aggravates brain damage, and resulting in vicious

cycle. These factors are inter - dependant on each other and they influence the overall outcome in brain injury.

Even in a patient with a GCS of 13, brain bulge, hypoxia, hypotension are associated with a poor outcome when compared to a patient with a GCS of 10 without these. This study was conducted to prognosticate using parameters at the time of surgery irrespective of the last CT scan which many other studies have enlightened upon already.

All the studies done thus far have come out with prognostication parameters that rely on CT scan[8], pre hospital setting hemodynamic status and admission GCS[3]. Presently to the best of our knowledge, there is no study so far conducted taking in to consideration the intra operative factors alone for devising a scoring system to prognosticate outcome in mild and moderate traumatic brain injury patients with acute subdural hematoma undergoing surgery.

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)
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11. Evidence of brain stem dysfunction

12. Conservatively managed TASH.

13. Patients who dissent for inclusion in the study.

Among the above criteria 4 to 9 have been extensively studied and found to influence outcome in previous studies and hence they have been excluded in the present study to improve the validity of intra operative parameters.

Methodology

Patients admitted with TASH following head injury at our hospital were included in the study based on the above inclusion and exclusion criteria. Patient and their attenders were informed about the study and informed consent was obtained for enrolment in our study. Data regarding the demographic characteristics such as age, sex, mode of injury, clinical evaluation pertaining to GCS, pupil, pulse, respiration, brain stem reflexes, CT findings, SpO2, blood pressure were recorded.

Laboratory investigations including basic blood investigations; coagulation tests, blood grouping and Rh typing were also done. Pre-operative therapeutic measures like anti edema, anti-epileptics, intra venous fluids, blood transfusions were also recorded.

Patients were assessed pre operatively by the anaesthesia team and categorized as per American association of anaesthesiologists anaesthesia risk grading. Surgical indication was based on brain trauma foundation guidelines 2012.

Brain trauma foundation guidelines 2012 -Indications for Surgery

1.An Acute Subdural (SDH) with a thickness greater than 10 mm or a midline shift greater than 5mm on computed tomographic (CT) scan should be surgically evacuated, regardless of the patient's Glasgow Coma Scale (GCS) score.

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

3. 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.

Surgical procedure

All the Patients in the study underwent decompressive craniectomy. All were placed in supine position with 30 degree head end elevation and side of surgery turned up facing the surgeon. General anaesthesia was used for all the patients. All patients were catheterised and urine output monitored. Pulse oximetry, capnography, B.p, and ECG were monitored intra operatively. Loading dose of phenytoin was administered.

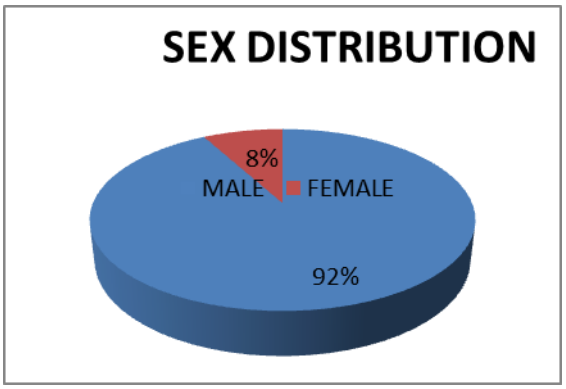
After draping, Fronto temporo parietal scalp flap (trauma question mark – shaped) was raised. 200 ml of intravenous mannitol was routinely given before the first burr hole. A Standard 6 burr hole craniotomy was done. Approximately 15 x 10 cm free bone flap was removed. Temporal bone was nibbled up to the base. Sphenoid ridge was drilled. After craniotomy the tension in the Dura was noted. The Dura was widely opened sylvian based .The clot volume was noted. SDH was evacuated using gentle suction and irrigation. After durotomy, Presence of brain bulge, brain pulsations, contusion, burst lobe, subarachnoid haemorrhage Blood pressure, SpO2 were noted. Haemostasis was achieved with bipolar diathermy, surgicel and gel foam. Dura was left open and exposed brain was covered with either temporalis fascia or pericranium .The scalp was closed in two layers; galea with 1-0 vicryl interrupted suture and skin with 1-0 ethilon interrupted suture.

All patients with a pre op GCS <12 were on Post-operative ventilation. Post op CT scan was done routinely on the 1st and 7th post-operative day and also when there was deterioration in the status. Regular post-operative wound inspection and dressing done. Physiotherapy and frequent posture change were done for patients with low GCS. Sutures were removed on the 8th post-operative day. Outcome assessed on the 30th day as survivor or dead and applying MRS on the 60th day to evaluate functional outcome. Observations were entered in the Master Data Sheet.

OBSERVATIONS AND RESULTS

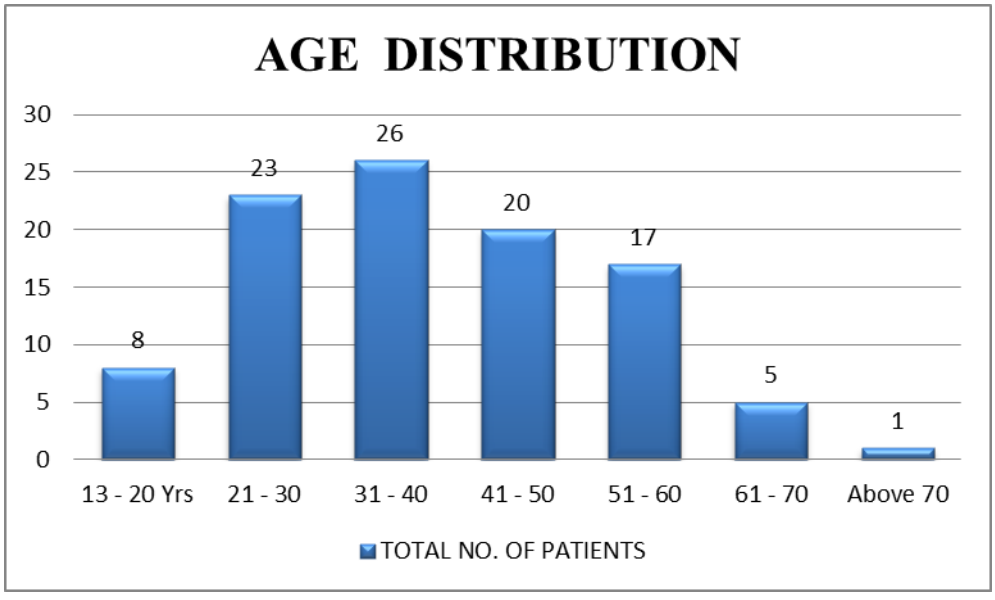
The overall results of this study are tabulated below.

Sex distribution: Majority of patients were male (92) when compared to (8) females.



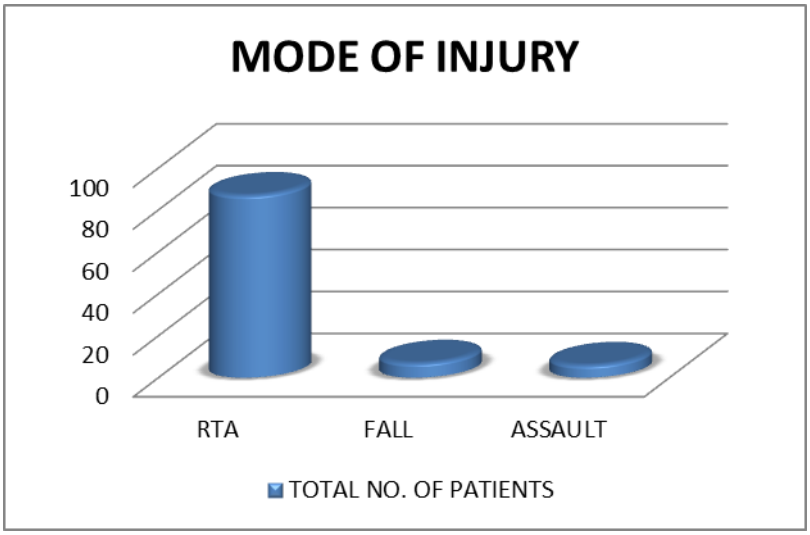
Age distribution:

Age wise distribution varied from 13 years to 72 years with maximum cases (76) clustered between 20 years to 60 years



Mode of injury:

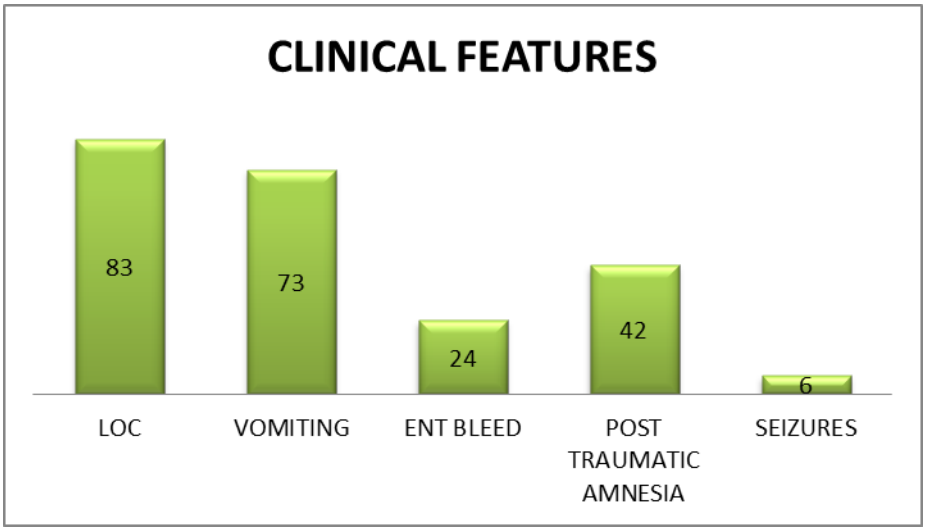
Most of the patients were admitted following road traffic accidents (87)



Clinical features:

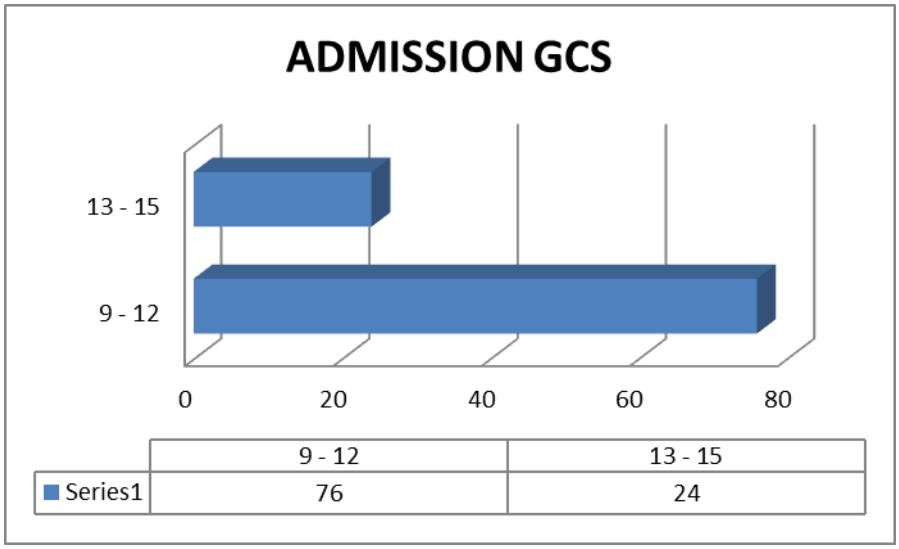
Major clinical features specific to head injury were as follows.

LOC 83%, ENT bleed 24 %, vomiting 73%, seizure 6%.post traumatic amnesia was found in 42% of patients.

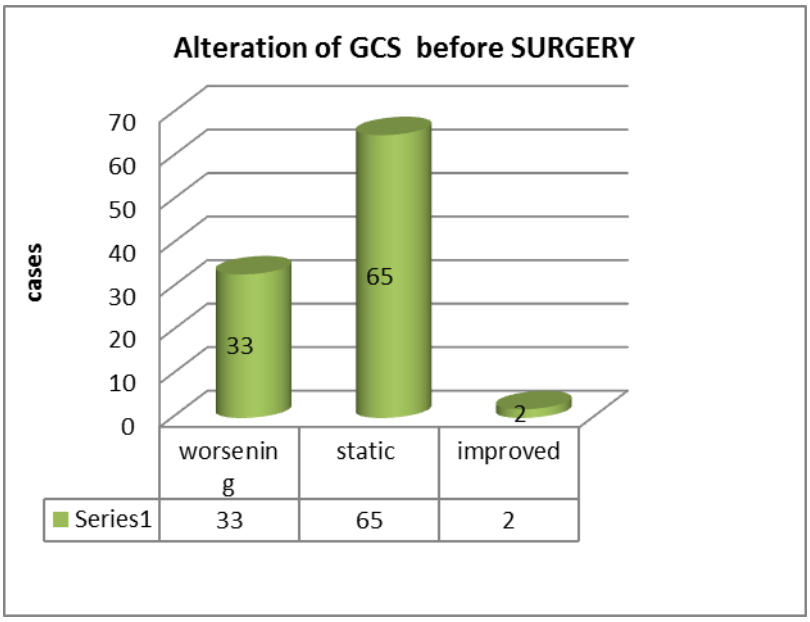


Admission GCS:

76% of patient were admitted with a GCS score from 9 to 12 whereas the remaining 24% had a score 13 and above.

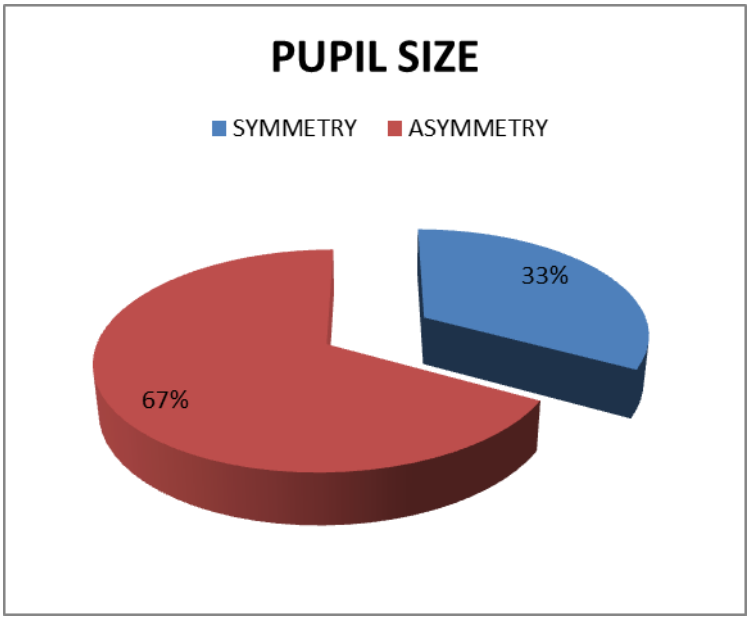


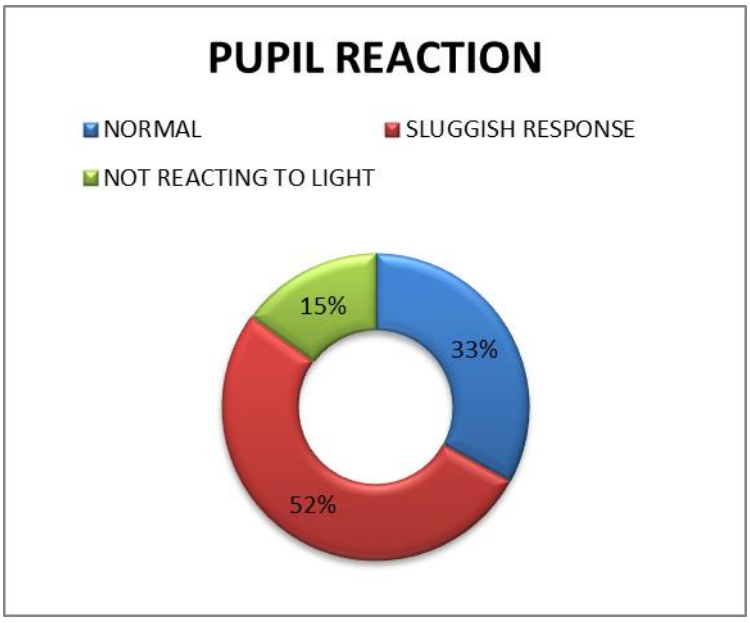
Alteration in GCS before surgery: 33% had worsening of GCS while 65% had static course whereas 2 % had improvement in the GCS score before surgery.



Pupils:

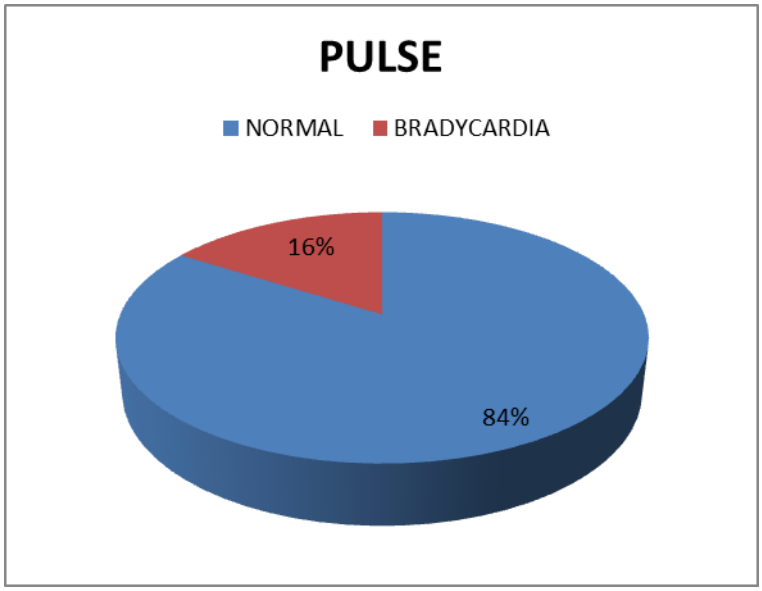
Anisocoria was found in 67% of the cases. Among which 15 % had dilated non reacting pupils.





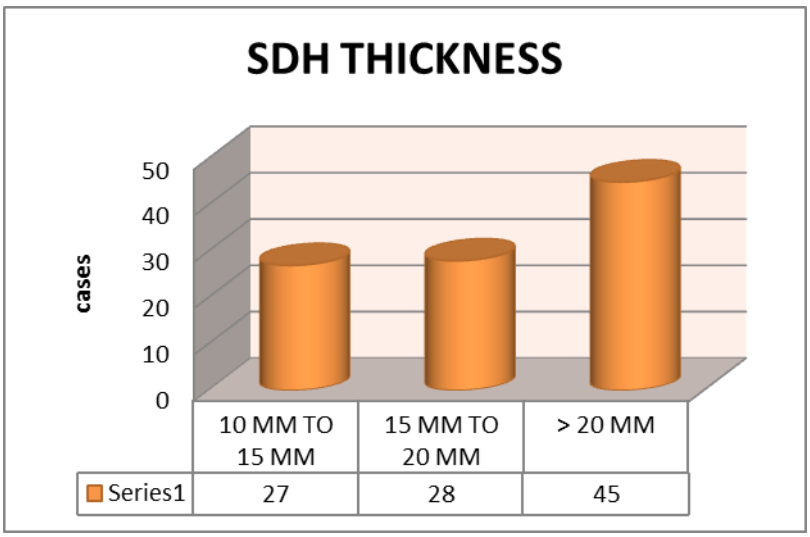
Pulse:

Bradycardia with hypertension was found in 16% of patients.



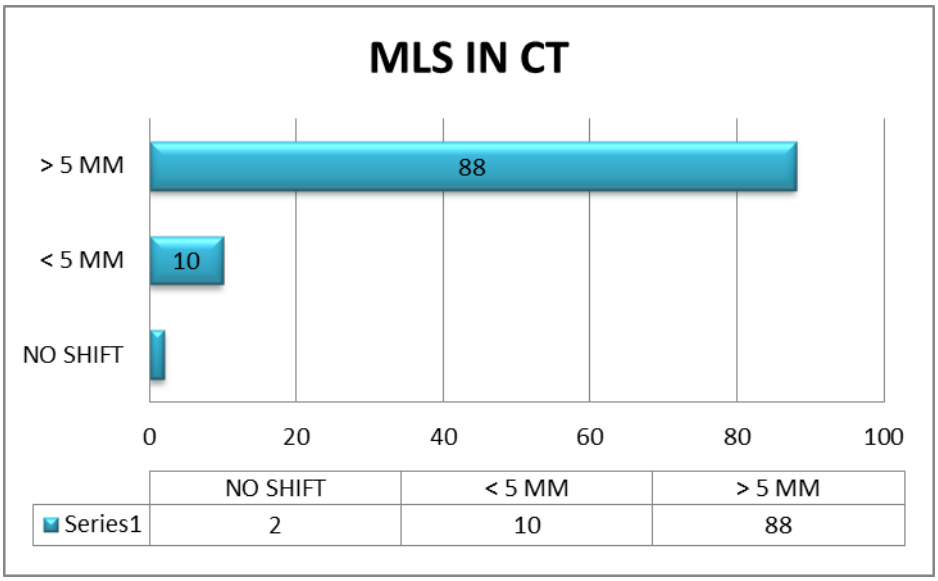
SDH thickness in last CT before surgery:

In the CT scan, SDH thickness was more than 2 cm in 45% of patients, between 1.5cm and 2 cm in 28% and 1cm to 1.5 cm in 27% of cases.

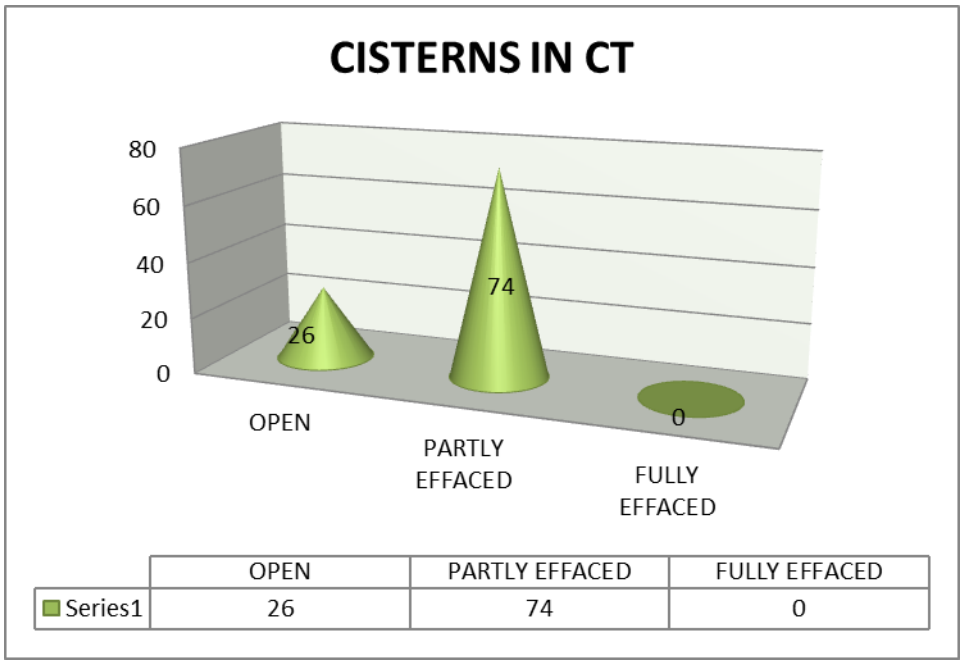


Midline shift in CT

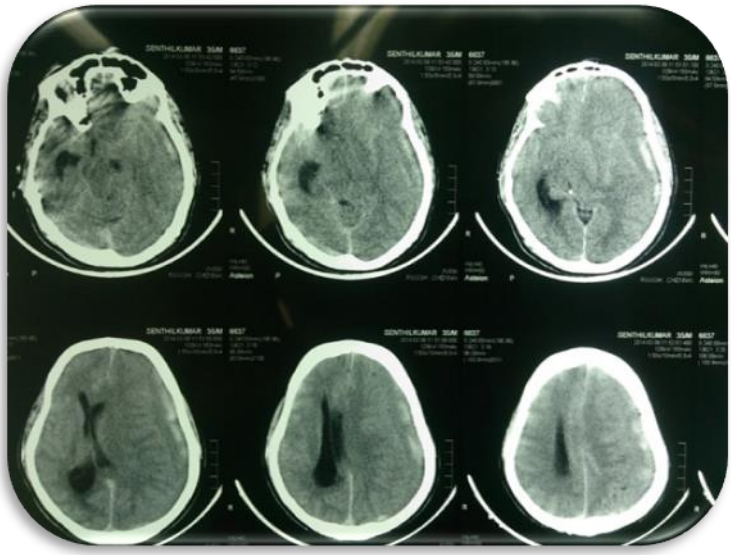
Midline shift in CT was more than 5mm in 88% of cases, less than 5mm in 10% of cases. There was no midline shift in 2 patients.



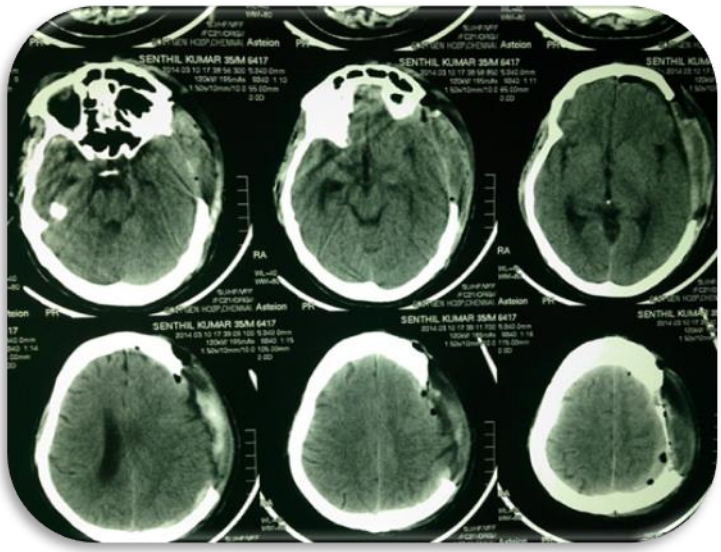
Cisterns were open in 26 % of the cases and partly effaced in 74%.



Pre –op CT scan showing acute left fronto temporo parietal SDH with MLS



Post - op scan showing complete evacuation, open cisterns and no MLS



Analysis

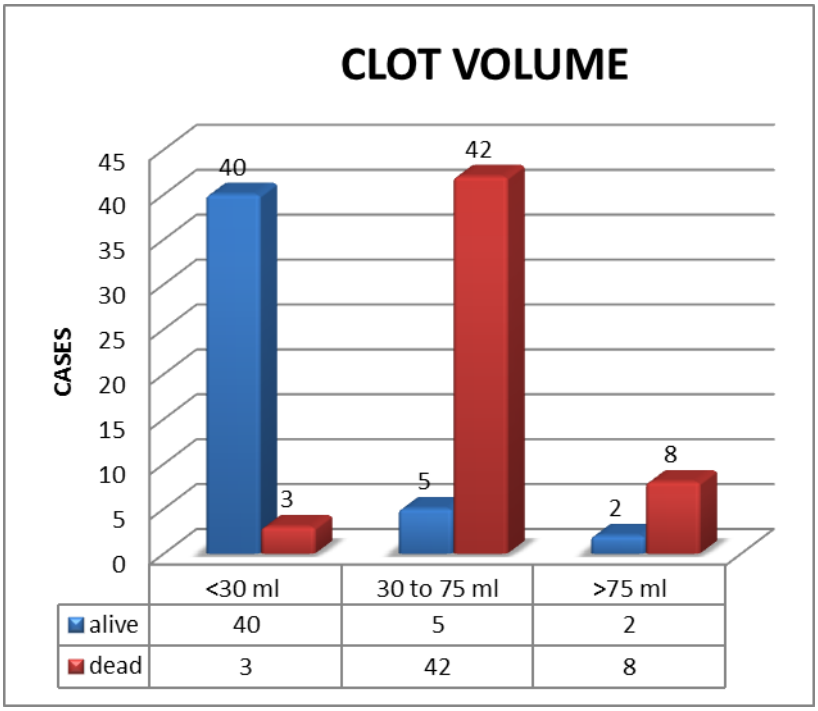
The following intra operative parameters, Duration of fall in Blood pressure, fall in SpO2, presence of intra operative SAH, presence of burst lobe or contusion, brain bulge after SDH evacuation; brain pulsations before closure were carefully analysed using GRAPHPAD stat software. Statistical Tests like chi square test, fisher tests, sensitivity, specificity predictive values were done and a scoring system was devised based on the following parameters. The intra operative prognostic score is as follows

Parameter /score	2	1	0
Duration of BP fall	No	Less than 5 min	More than 5 minutes
Duration of fall in SpO2	No	< 5min	> 5 min
Degree of brain bulge after clot evacuation	No surface below the inner table	Moderate - surface below the outer table	Severe-surface out of the bone margins
Brain pulsations	Good	Moderate	Absent
Clot volume	Up to 30 ml	30 to ml	> 75 ml
SAH	No	Focal < 2cm	diffuse
Burst lobe/ contusion Yes/no	No	Small < 1 cm	Large > 1 cm

The sum of individual points was taken up and categorised in to three grades as Grade A: 12 to 14, Grade B: 9 to 12 Grade C: less than 8

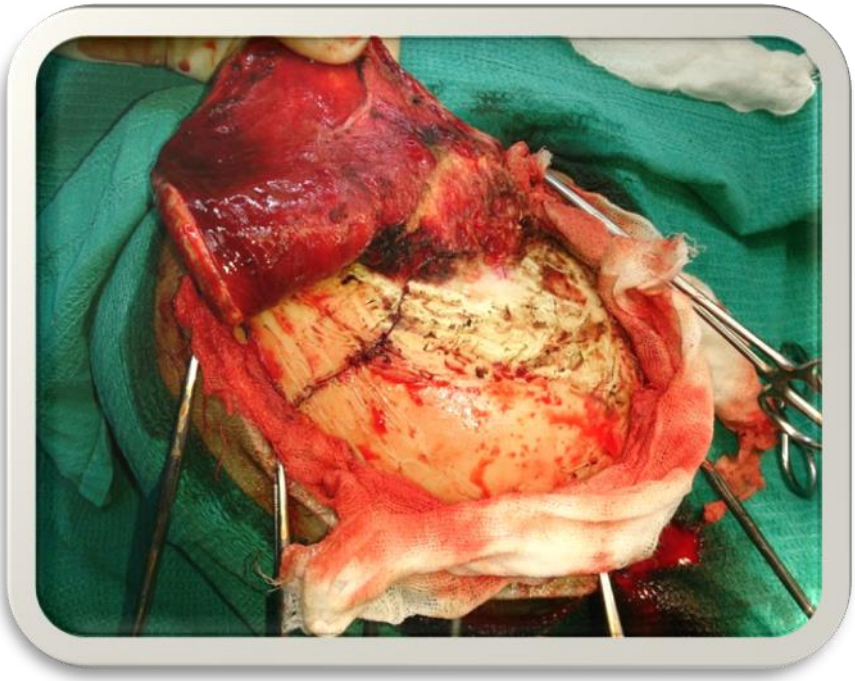
Clot volume:

Clot volume more than 50 ml was found in 45 out of 53 patients who had died and hence clot more than 50 ml was associated with poor outcome. Among 47 survivors the clot was less than 30 ml in 40 patients. 5 patients had a clot of 50 ml and only 2 of those with a clot of above 75 ml had survived. Chi square test and Fischer tests showed p value <0.001 which was statistically significant.

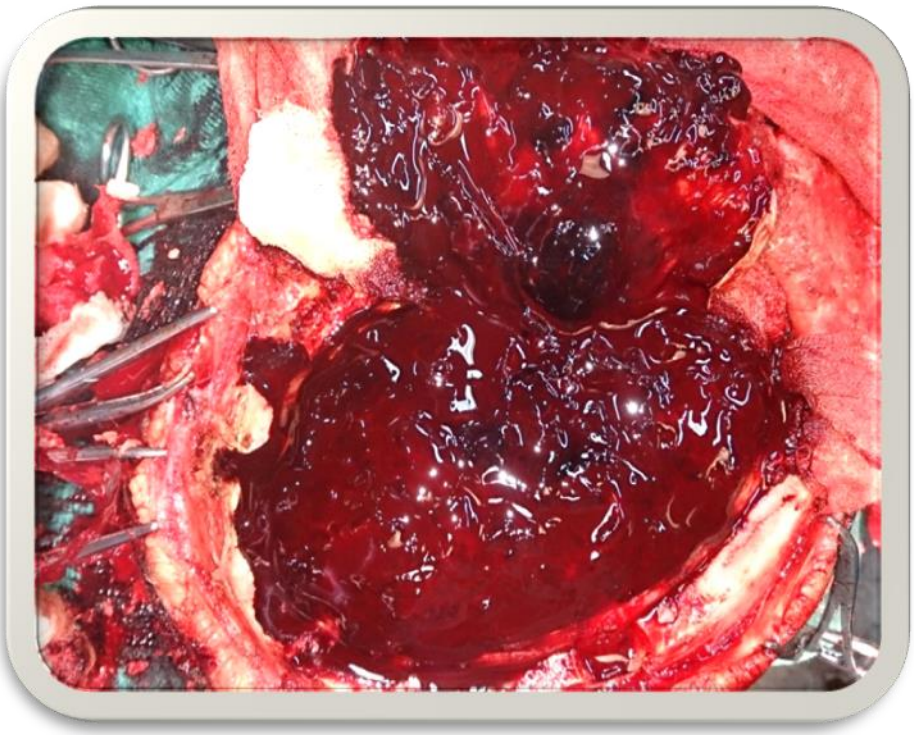


SDH after durotomy

Fracture

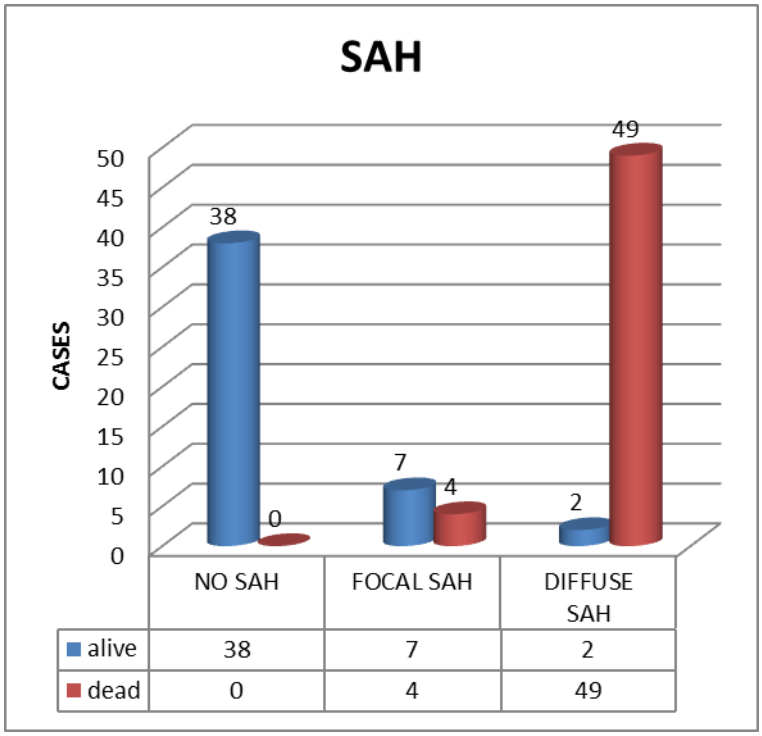


Massive SDH-clot >100 ml

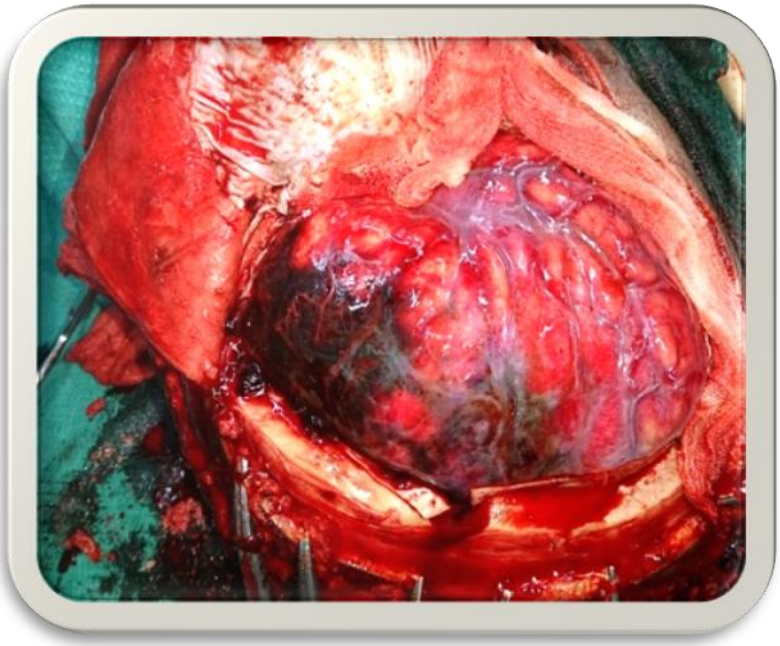


SAH:

Presence of SAH was highly significant. Diffuse SAH was found in 51 patients overall .49 patients among 53 who died had diffuse SAH mortality (92%). Among 47 survivors, 2 patients had diffuse SAH, while 7 had focal SAH and 38 did not have SAH. Chi square test and Fischer tests showed p value <0.001 which was statistically significant.

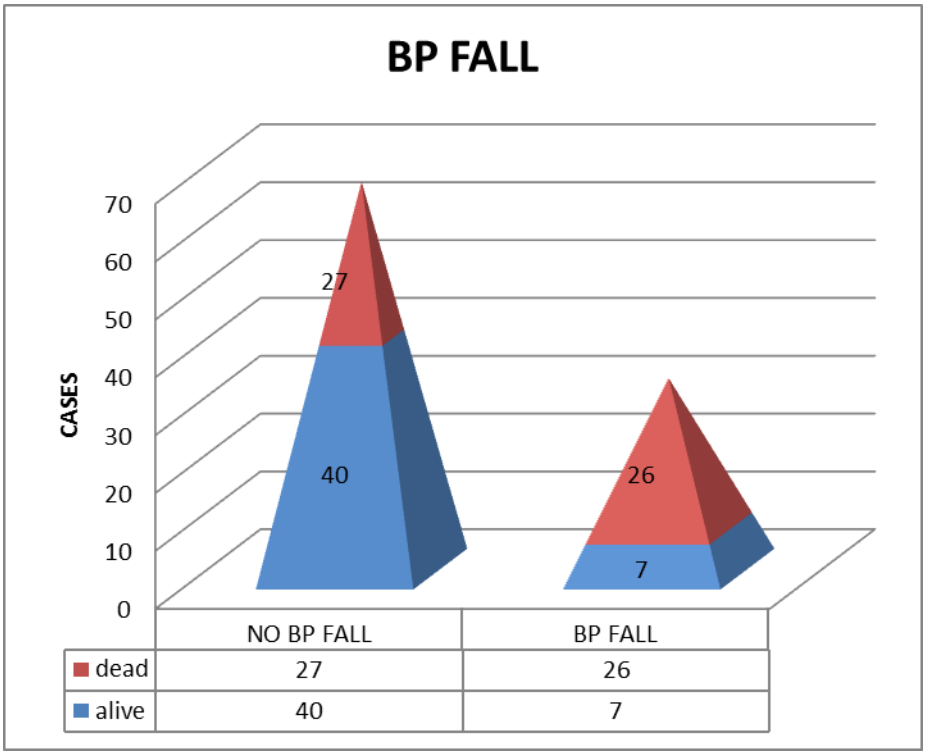


Diffuse SAH and massive bulge- Pre op GCS 13 IPS grade-C, outcome -dead



B.P and SpO2:

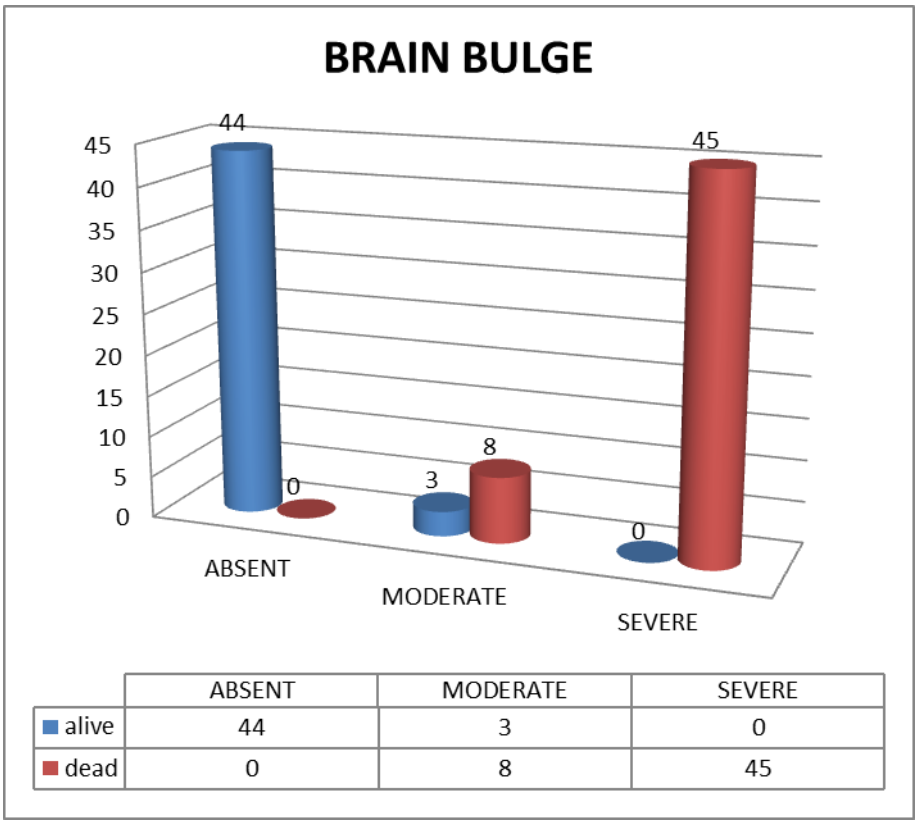
B.p fall was found in 33 Patients and 26 of the 33 who had a fall in blood pressure and SpO2 for more than 5 minutes among had died reflecting a mortality of 78 %. Chi square test and Fischer tests showed p value <0.001 which was statistically significant.



Brain bulge:

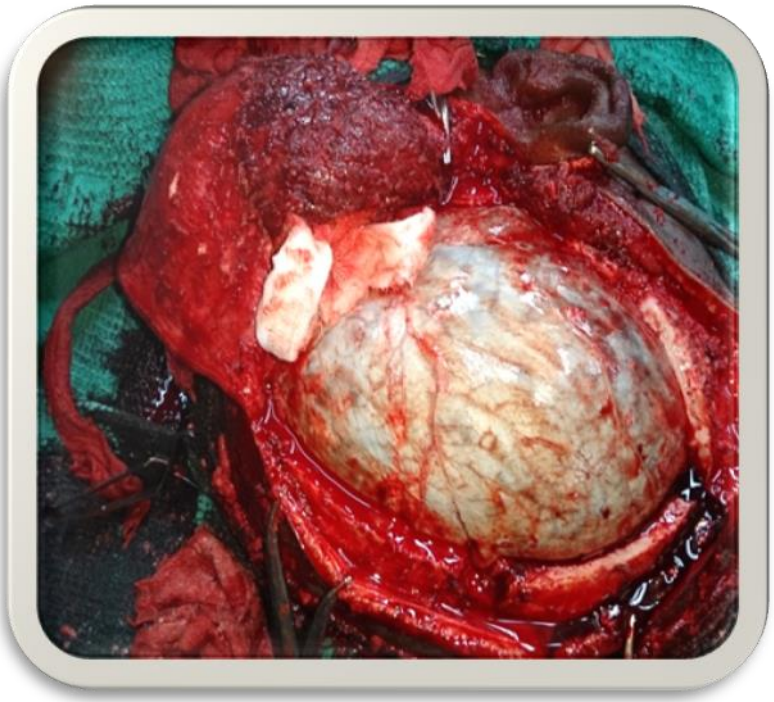
45 patients among 53 who died had severe brain bulge, 8 had moderate bulge. Among 47 survivors 3 patients had mild bulge and the brain was lax in 44 of them. Brain bulge was one of the most significant parameters that determined

outcome. It reflected the real time state of raised ICP. In patients who had Gcs more than 12 pre operatively but had brain bulge the outcome was worse with 5 of them dying among which 3 patients had pre op GCS 15. Chi square test and Fischer tests showed p value <0.001 which was statistically significant.



	ABSENT	MODERATE	SEVERE
alive	44	3	0
dead	0	8	45

Tense, bulging Dura.Grade C - IPS-outcome –dead.

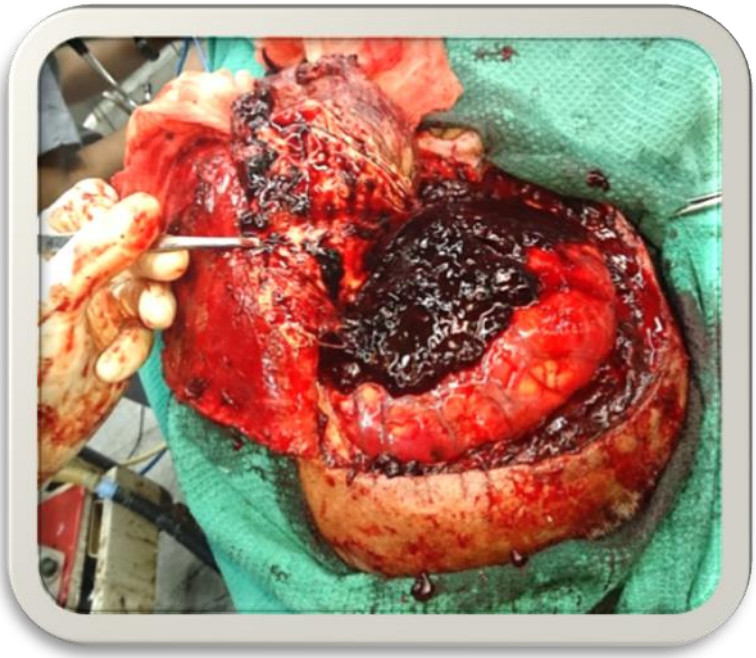


Severe brain bulge, diffuse SAH and contusion

Pre op GCS 15, IPS grade C - outcome dead

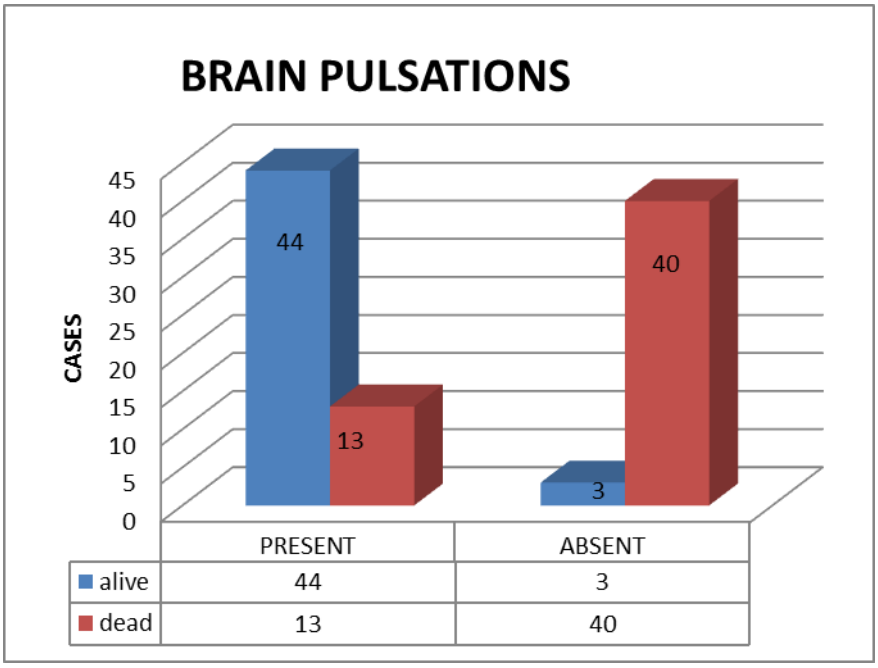
Large SDH with diffuse SAH with bulging brain

IPS grade C- pre op GCS 10, outcome –dead.



Brain pulsations:

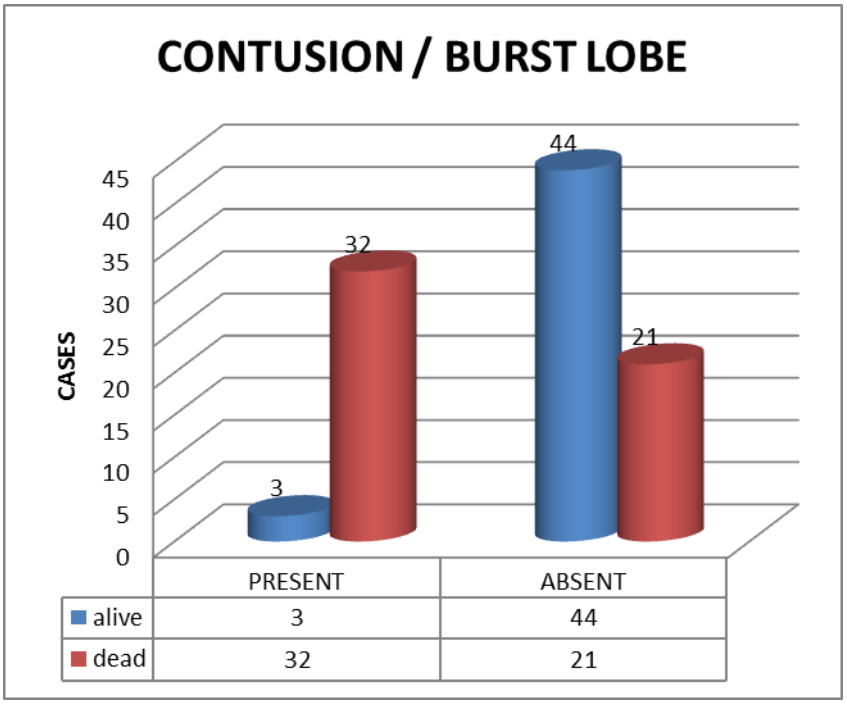
Brain pulsations were absent in 40 of the 53 patients who had died including 3 with GCS 15. Only 3 of the 47 survivors had absent brain pulsations. Patients with poor brain pulsations had increased morbidity and mortality when compared to those with good pulsations. Chi square test and Fischer tests showed p value <0.001 which was statistically significant.



Contusions and burst lobe:

Intra operative Presence of burst lobe or contusions (not present in last CT) more than 1cm size was associated with high mortality.

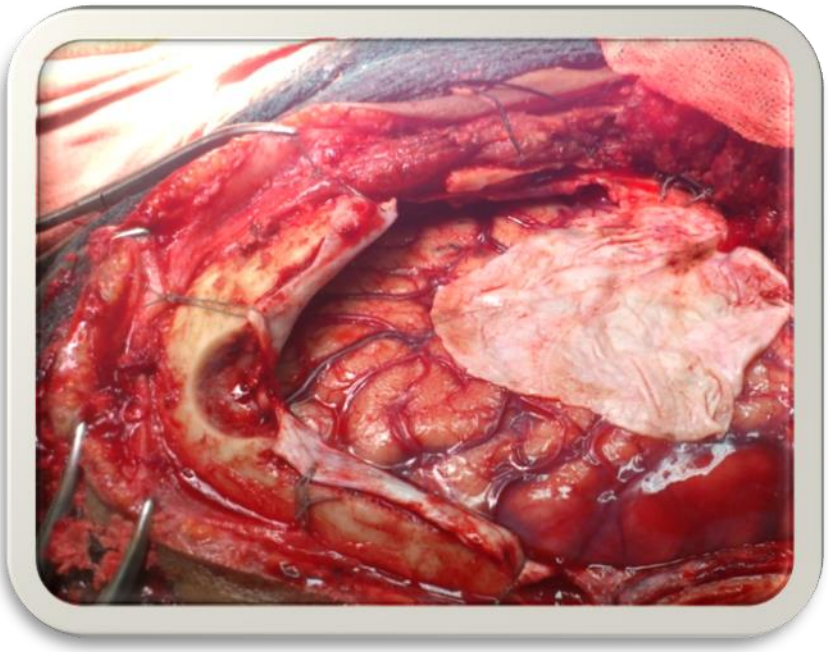
12 patients among 53 who had died had burst lobe more than 2 cm .only 3 patients among the 47 survivors had burst lobe. Chi square test showed p value <0.001 which was statistically significant.



SAH, burst lobe 5 cm Pre op GCS 12- IPS grade C-outcome -dead

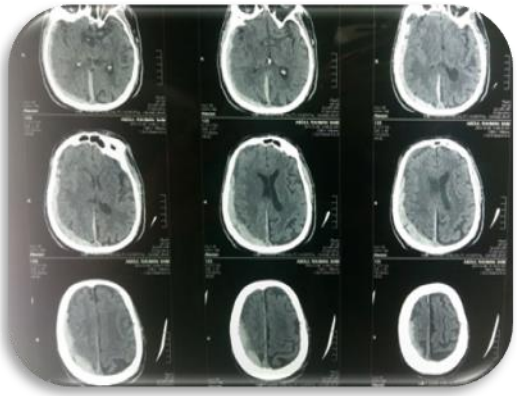
Lax brain, no SAH, no contusion, Pre op Gcs 12 - IPS grade A –outcome - survived

Lax brain, no SAH, clot - 30ml, Pre op GCS 13-IPS grade A- outcome survived.

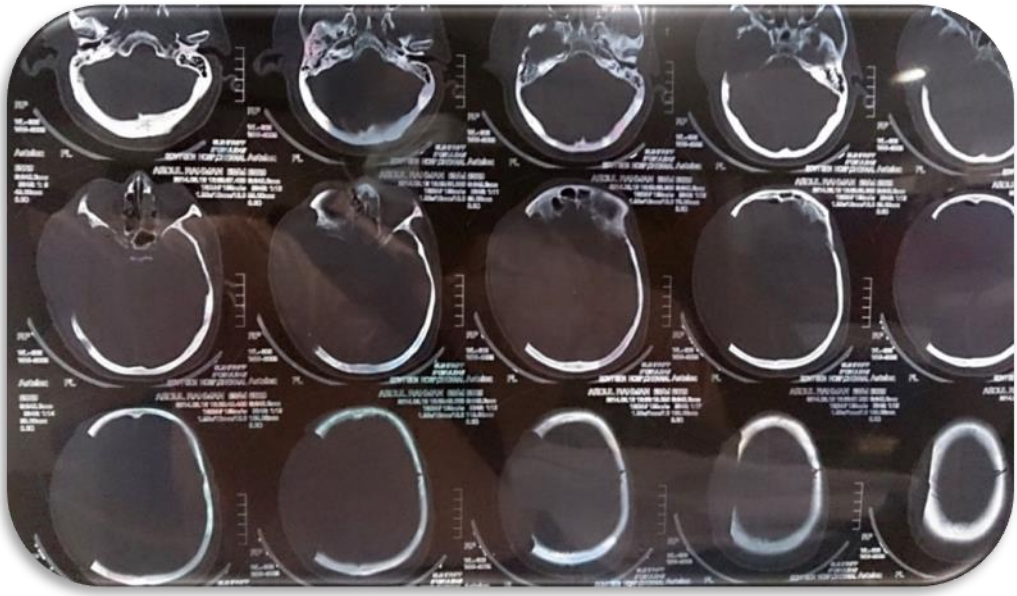


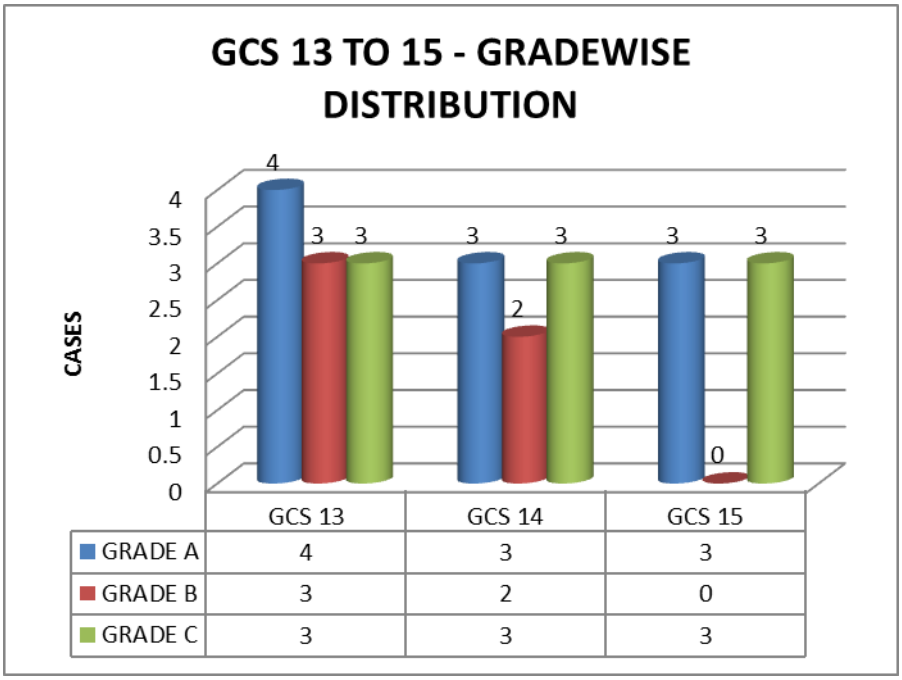
Right -Pre op scan- acute fronto temporo parieto occipital SDH with MLS

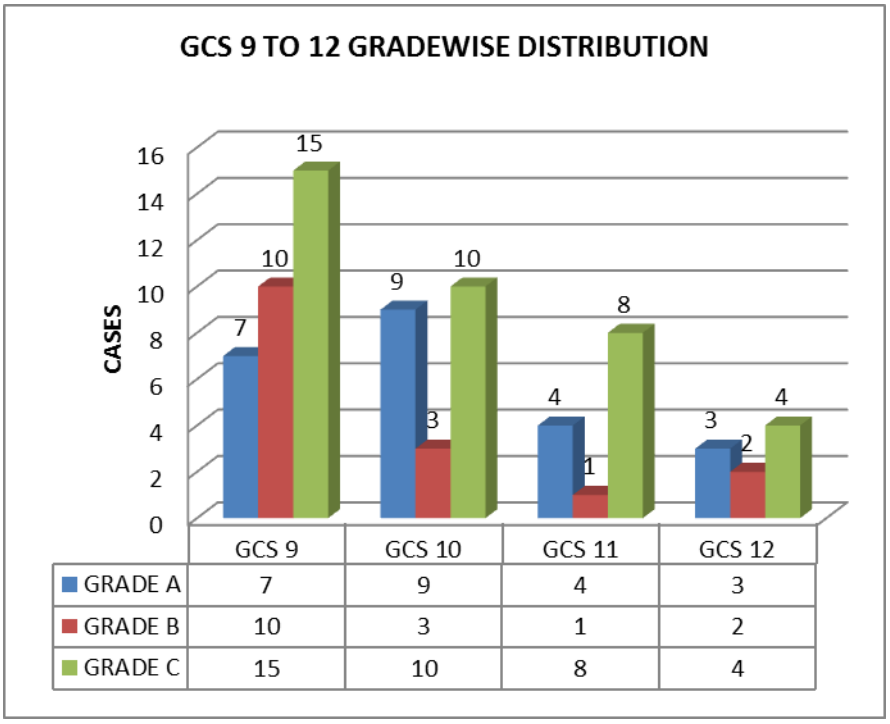
Left- Post ops scan showing complete evacuation and no MLS.



Below - Post op scan bone window showing adequate decompression up to temporal base.

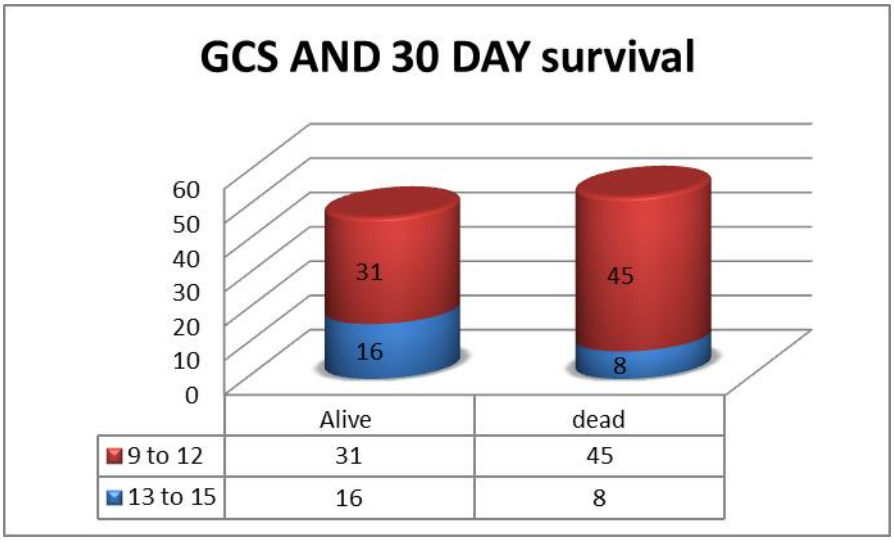



GCS 13 TO 15 - GRADEWISE DISTRIBUTION
CASES
4
3
3
3
3
3
2
3
3
0
3
4
3.5
3
2.5
2
1.5
1
0.5
0
GCS 13
GCS 14
GCS 15
GRADE A 4 3 3
GRADE B 3 2 0
GRADE C 3 3 3

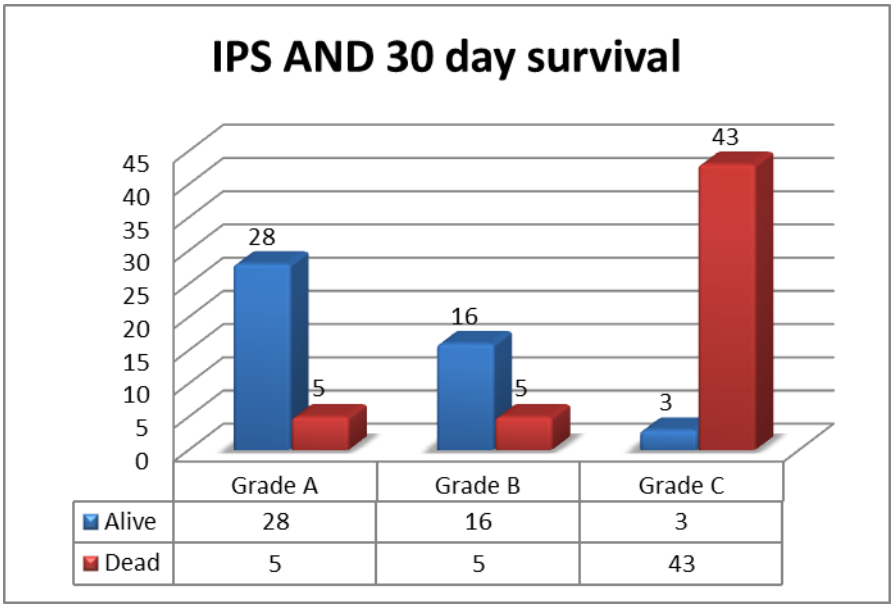

GCS 9 TO 12 GRADEWISE DISTRIBUTION
CASES
7
10
15
9
3
10
4
1
8
3
2
4
16
14
12
10
8
6
4
2
0
GCS 9
GCS 10
GCS 11
GCS 12
GRADE A 7 9 4 3
GRADE B 10 3 1 2
GRADE C 15 10 8 4

GCS and 30 day survival:

56 patients among 76 with GCS 9 to 12 had died with 73 % mortality, While 8 patients among 24 with GCS 13 to 15 had died with 33% mortality.

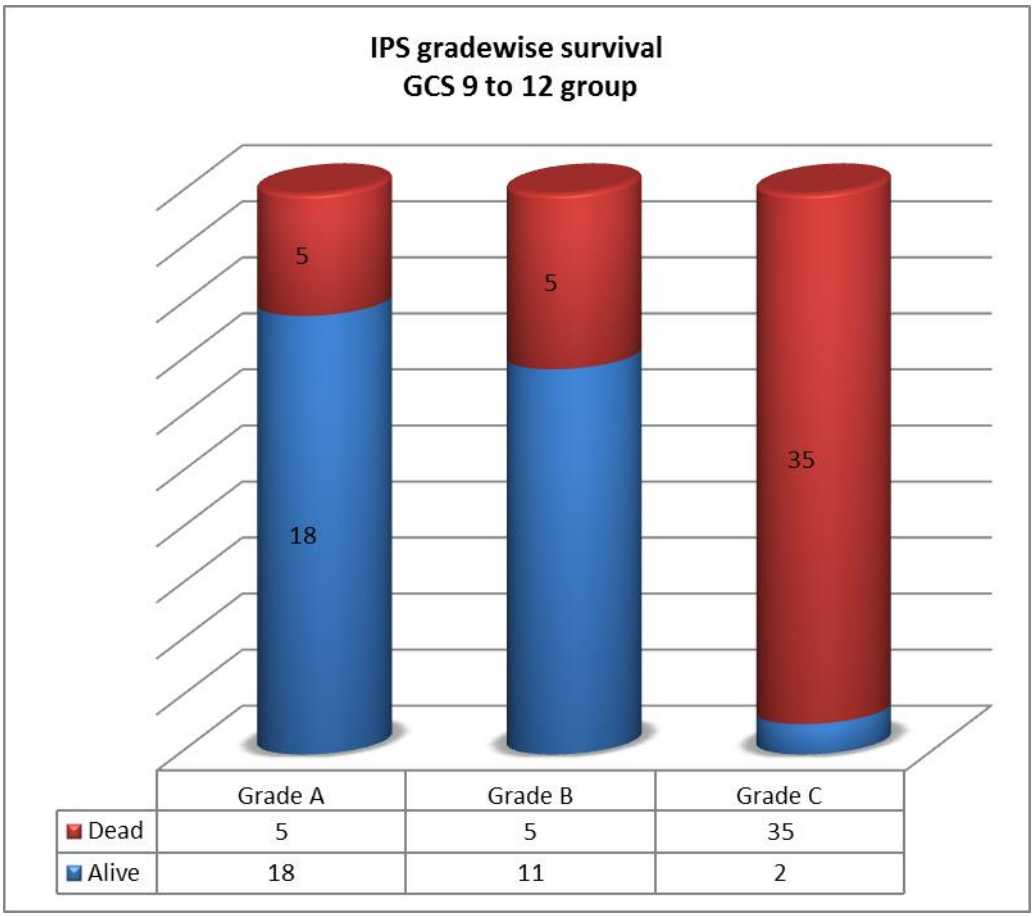


IPS and 30 day survival



Mortality rates in IPS Grade A on the whole were 15%, grade B was 24% and in grade C was 93%. Thus it was significant and higher the IPS grade better was the survival rate and lower grades have very high mortality. Chi square test showed p value <0.001 which was statistically significant.

IPS- grade wise - GCS 9 to 12 survival in group



<u>Grade A-IPS</u>

18 Patients among 23 had survived at 30 days thereby reflecting a survival rate of 78%. And a mortality rate of 22%.

Grade B-IPS

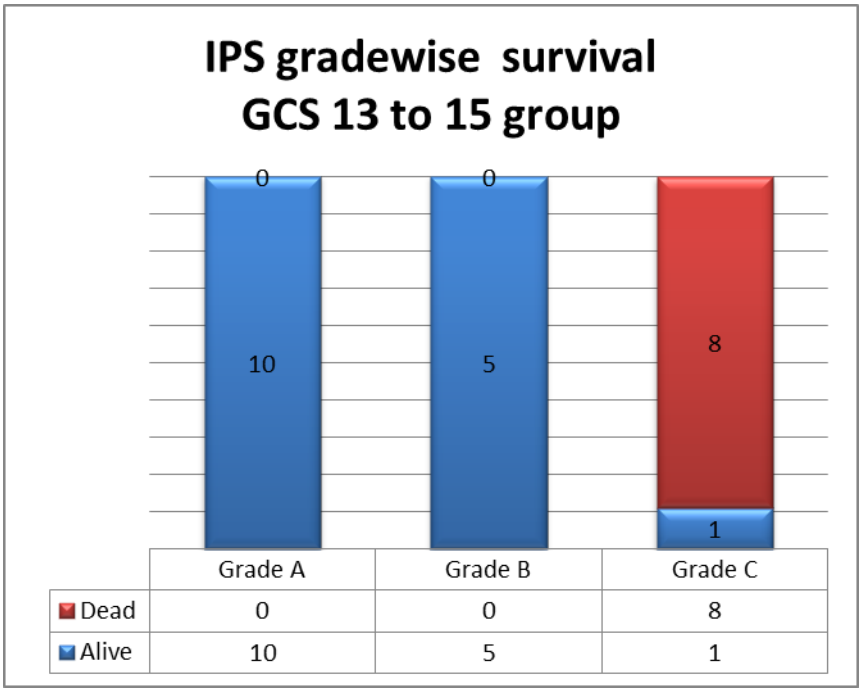
11 out of 16 patients had survived-survival rate- 69%, mortality rate 31%.

The above facts reflect the point that even with poor admission GCS the survival rate is better for patients with Grade A and Grade B scores which probably reflect lesser brain injury and secondary insults.

Grade C-IPS

Only 2 out of 37 patients' survived-survival rate- 5% mortality rate 95%. Chi square test showed p value <0.001 which was statistically significant.

IPS- grade wise survival in GCS 13 to 15 group

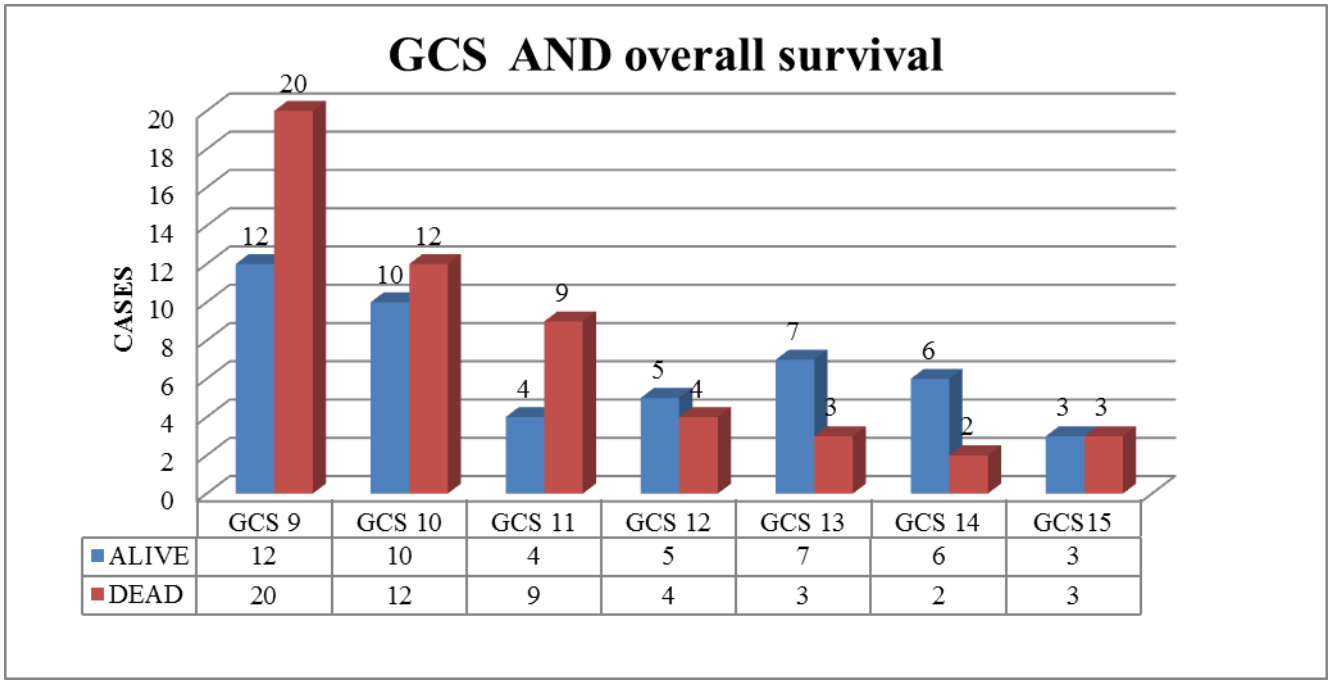


Grade A –IPS All 10 patients survived – survival rate 100%.

Grade B-IPS 5 out of 5 patients had survived-survival rate- 100%. There was no mortality in Grade A and B patients.

Grade C-IPS Only 1 out of 9 patients' survived- survival rate - 11 % mortality rate 89%. This showed that even patients with GCS above 13 died probably because of the secondary insults that had occurred which were reflected by the poor intra operative parameters. Chi square test showed p value <0.001 which was statistically significant.

GCS distribution in overall survival



The chart shows the fallacies of admission GCS and mortality. Contrary to expectation the mortality in GCS 15 patients is about 50%, which is almost

similar to 54% that is seen in GCS 10 patient and is higher than patients in GCS 12 (33%), 30% in GCS 13 and 25% in GCS 14.

The survival rate on the 30th day did not differ according to gender, hemispheric location of injury, Patients with good scores had low period of ventilator support and hence the complications associated with ventilation that increase mortality like ARDS, ventilator associated pneumonia were lower

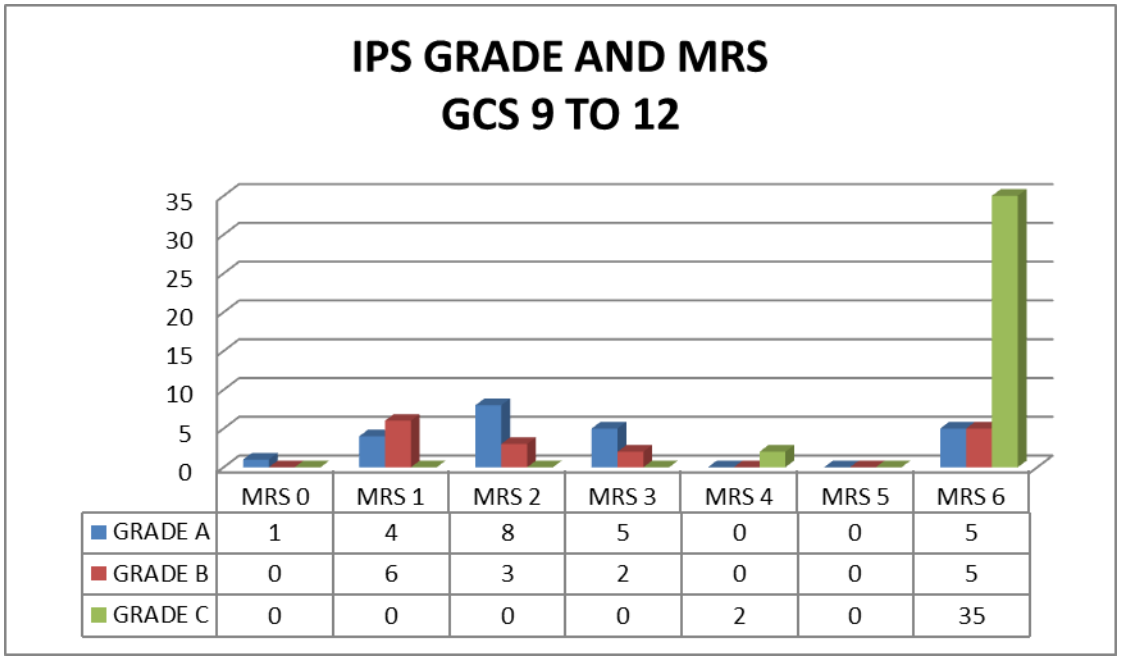
Complications such as wound infection and CSF leak were common with patients with severe brain bulge. Patients with low scores had high mortality rates and worst outcome.

Modified Rankin score:

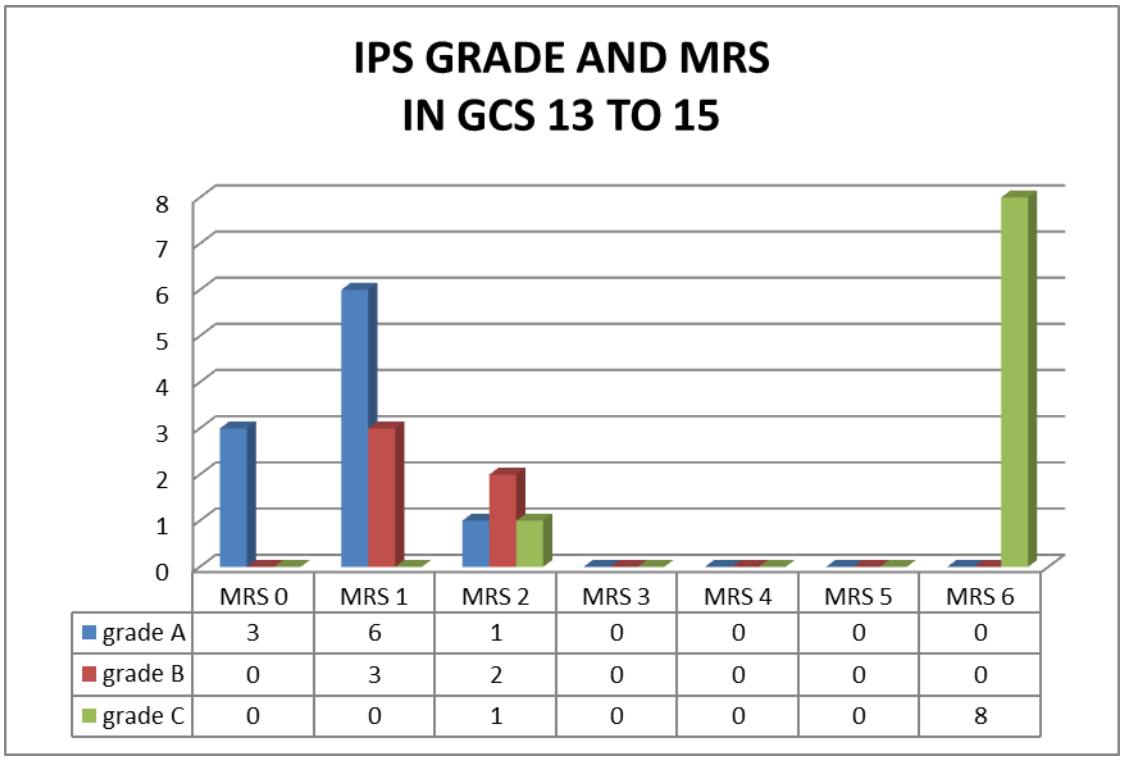
The Modified Rankin score was applied to all patients at the end of 2 months and relationship between the IPS scoring and scale was done.

SCORE	DESCRIPTION
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

IPS grade and MRS on 60 days



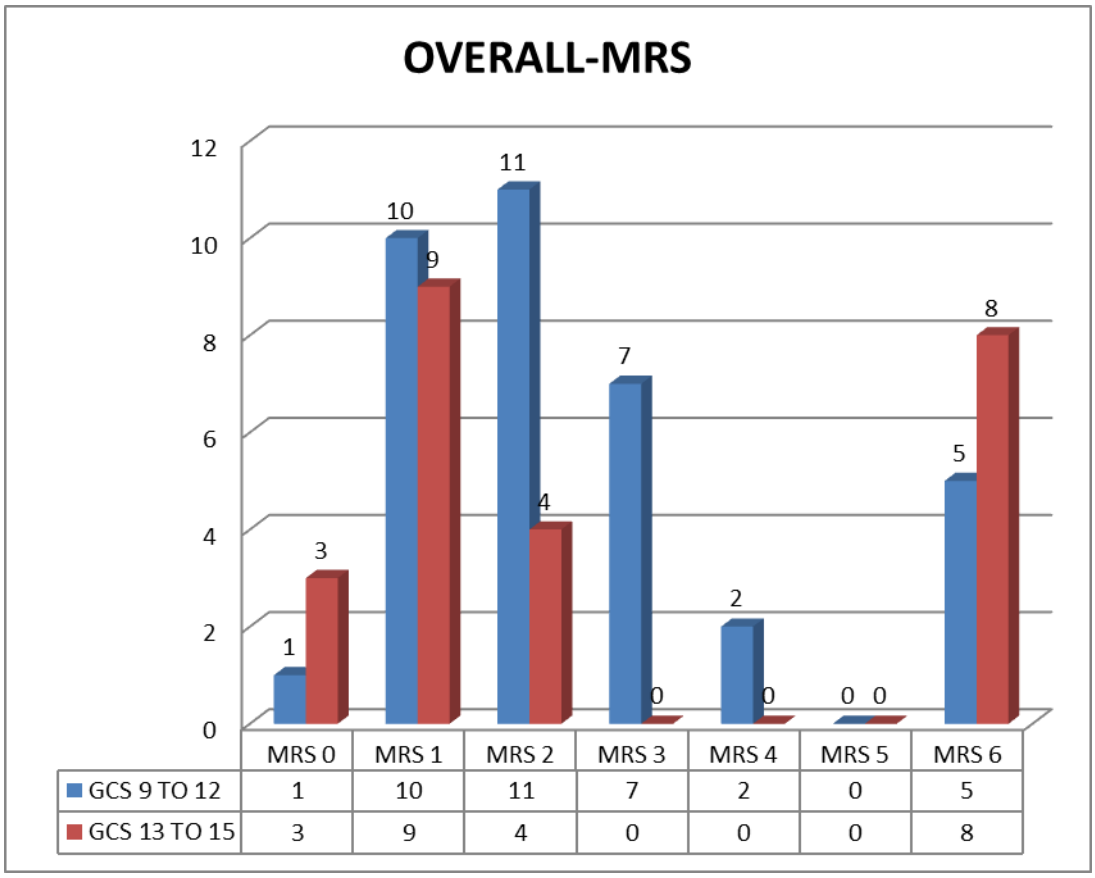
	MRS 0	MRS 1	MRS 2	MRS 3	MRS 4	MRS 5	MRS 6
GRADE A	1	4	8	5	0	0	5
GRADE B	0	6	3	2	0	0	5
GRADE C	0	0	0	0	2	0	35



	MRS 0	MRS 1	MRS 2	MRS 3	MRS 4	MRS 5	MRS 6
grade A	3	6	1	0	0	0	0
grade B	0	3	2	0	0	0	0
grade C	0	0	1	0	0	0	8

IPS grade wise MRS in both GCS group shows consistently that patients with IPS GRADE C have a poor MRS grade of 6 while IPS grade A patients in both Gcs groups have a better outcome. Chi square test showed p value <0.001 which was statistically significant.

GCS and MRS

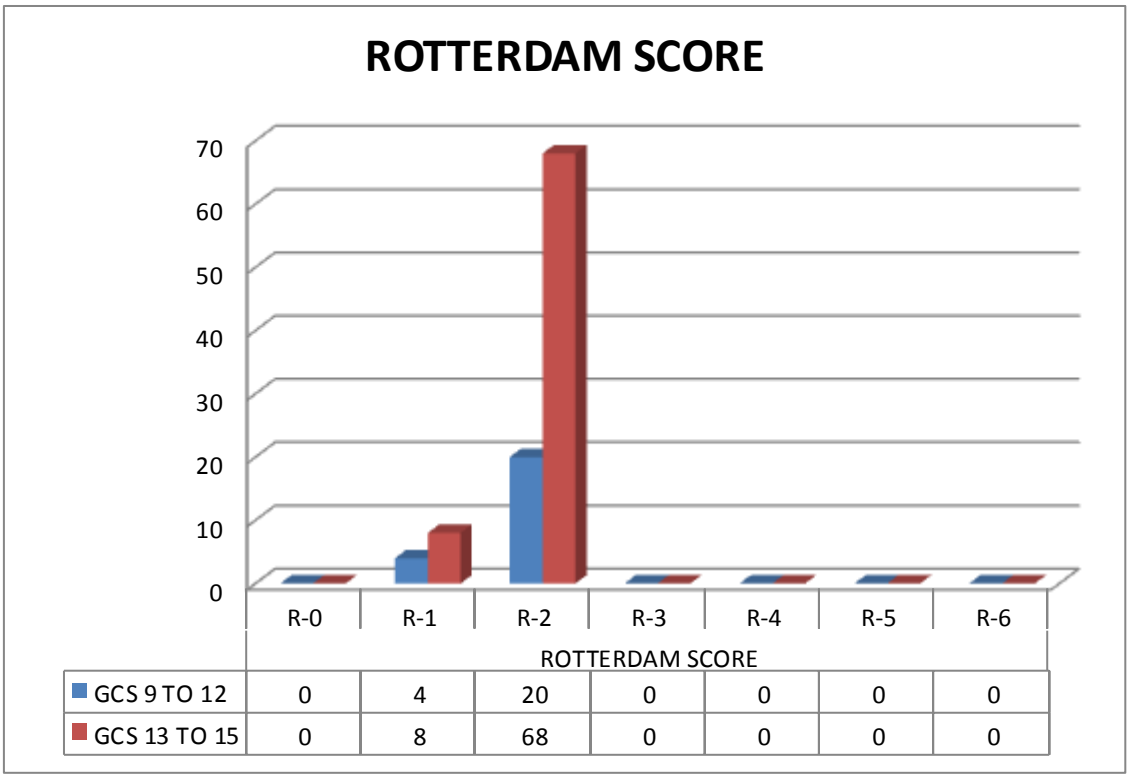


Modified Rankin scale with respect to GCS shows paradoxically 8 patients with better GCS scores in MRS grade 6, while in the lower GCS category there are only 5 cases in grade 6. Similarly patients in MRS 2 and MRS 3 lower GCS patients outnumber patients with better GCS.

Rotterdam CT score

	Score
Basal cisterns	
Normal	0
Compressed	1
Absent	2
Midline shift	
No shift or shift ≤5 mm	0
Shift >5 mm	1
Epidural mass lesion	
Present	0
Absent	1
Intraventricular blood or traumatic subarachnoid haemorrhage	
Absent	0
Present	1
Sum score	+1

GCS and Rotterdam score



	R-0	R-1	R-2	R-3	R-4	R-5	R-6
GCS 9 TO 12	0	4	20	0	0	0	0
GCS 13 TO 15	0	8	68	0	0	0	0

As our study did not include EDH, IVH patients all the patients had a score of 2 or less. 88% had score of 2 and 12 % had a score of 1. As per the Rotterdam score the mortality should have been less than 7 % which was far lower than the actual mortality of 53%. This was mainly due to the fact that patients who had contusions and IVH in the pre op CT were excluded.

Statistics analysis reports

BRAIN PULSATIONS
Chi-squared Test for Independence
Chi-square: 91.241
Degrees of Freedom: 2
Table size: 2 rows, 3 columns.
The P value is < 0.0001.
The row and column variables are significantly associated.
Chi-Squared Test for Trend.
Chi-squared for trend = 89.211 (1 degree of freedom)
CLOT VOLUME
Chi-squared Test for Independence
Chi-square: 64.437
Degrees of Freedom: 2
Table size: 2 rows, 3 columns.
The P value is < 0.0001.
The row and column variables are significantly associated.
Chi-Squared Test for Trend.
Chi-squared for trend = 48.219 (1 degree of freedom)
SAH
Chi-squared Test for Independence
Chi-square: 82.067

Degrees of Freedom: 2
Table size: 2 rows, 3 columns.
The P value is < 0.0001.
The row and column variables are significantly associated.
Chi-Squared Test for Trend.
Chi-squared for trend = 81.533 (1 degree of freedom)
BP FALL
Chi-squared Test for Independence
Chi-square: 13.149
Degrees of Freedom: 1
Table size: 2 rows, 2 columns.
The P value is 0.0003. The row and column variables are significantly associated.
Summary of Data
Row Total Percent
1 53 53.00%
2 47 47.00%
Total 100 100.00%
Column Total Percent
A 67 67.00%
B 33 33.00%
Total 100 100.00%
BRAIN BULGE

Chi-squared Test for Independence		
Chi-square: 91.241		
Degrees of Freedom: 2		
Table size: 2 rows, 3 columns.		
The P value is < 0.0001.		
The row and column variables are significantly associated.		
Chi-Squared Test for Trend.		
Chi-squared for trend = 89.211 (1 degree of freedom)		
The P value is < 0.0001.		
There is a significant linear trend among the ordered categories		
Summary of Data		
Row	Total	Percent
1	47	47.00%
2	53	53.00%
Total	100	100.00%
Column	Total	Percent
A	44	44.00%
B	11	11.00%
C	45	45.00%
Total	100	100.00%
CONTUSION/BURST LOBE		

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	0.08571	0.01805 to 0.2304	
Specificity	0.3231	0.2124 to 0.4501	
Positive Predictive Value	0.06383	0.01335 to 0.1754	
Negative Predictive Value	0.3962	0.2645 to 0.5399	
Likelihood Ratio	0.1266		
Data analysed			
	PRESENT	ABSENT	Total
Alive	3	44	47
	(3%)	(44%)	(47%)
Dead	32	21	53
	(32%)	(21%)	(53%)
Total	35	65	100
	(35%)	(65%)	(100%)
BRAIN PULSATIONS			
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	0.7719	0.6418 to 0.8727	
Specificity	0.9302	0.8094 to 0.9854	
Positive Predictive Value	0.9362	0.8246 to 0.9866	
Negative Predictive Value	0.7547	0.6175 to 0.8625	
Likelihood Ratio	11.064		
Data analysed			
	PRESENT	ABSENT	Total
Alive	44	3	47
	(44%)	(3%)	(47%)
Dead	13	40	53
	(13%)	(40%)	(53%)
Total	57	43	100
	(57%)	(43%)	(100%)
IPS AND 30 DAY SURVIVAL;			
Chi-squared Test for Independence			
Chi-square: 56.418			
Degrees of Freedom: 2			
Table size: 3 rows, 2 columns.			
The P value is < 0.0001.			
The row and column variables are significantly associated.			

Chi-Squared Test for Trend.		
Chi-squared for trend = 50.256 (1 degree of freedom)		
The P value is < 0.0001.		
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	33	33.00%
2	21	21.00%
3	46	46.00%
Total	100	100.00%
Column	Total	Percent
ALIVE	47	47.00%
DEAD	53	53.00%
Total	100	100.00%
IPS SURVIVAL - GCS 9 TO 12		
Chi-squared Test for Independence		
Chi-square: 37.732		
Degrees of Freedom: 2		
Table size: 3 rows, 2 columns.		
The P value is < 0.0001.		
The row and column variables are significantly associated.		

Chi-Squared Test for Trend.		
Chi-squared for trend = 33.988 (1 degree of freedom)		
The P value is < 0.0001.		
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	23	30.26%
2	16	21.05%
3	37	48.68%
Total	76	100.00%
Column	Total	Percent
ALIVE	31	40.79%
DEAD	45	59.21%
Total	76	100.00%
IPS SURVIVAL - GCS 13 TO 15		
Chi-squared Test for Independence		
Chi-square: 20.000		
Degrees of Freedom: 2		
Table size: 3 rows, 2 columns.		
The P value is < 0.0001.		
The row and column variables are significantly associated		

Chi-Squared Test for Trend. .
Chi-squared for trend = 16.484 (1 degree of freedom)
The P value is < 0.0001.
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	10	41.67%
2	5	20.83%
3	9	37.50%
Total	24	100.00%
Column	Total	Percent
ALIVE	16	66.67%
DEAD	8	33.33%
Total	24	100.00%

DISCUSSION

The mortality from acute SDH ranges from 55% to 90 % even with surgical management[1,2,8] .Trauma is associated with cytotoxic and vasogenic brain edema both of which are responsible for the raised intra cranial pressure and the effects of it. The overall mortality for patients undergoing decompressive craniotomy in our study is about 53% which is comparable to that reported in literature[1, 2,3,4,8] and various studies. The intra operative parameters taken in to the study for devising the prognostic score have been individually analysed to have found to determine outcome.

With regards to the intra operative parameters following were observed. Clot size varied from less than 30 cc in 14% to more than 75 cc in 30% of cases. There was intraoperative SAH in 48% of cases ranging from focal (less than 1 cm) to diffuse (more than 2 cm).There was brain bulge in 35% of cases ranging from mild to severe. Fall in Blood pressure and SpO2 were observed in 25 cases and the duration was more than 5 minutes in about 18 of them. Brain pulsations were absent in 8 cases while there were good pulsations in 8 cases. Contusion found intra operatively but not found in the last CT was associated with SDH in about 20 cases and burst lobe was seen in 15 cases.

Our institute is a tertiary care neurosurgical centre, we get patients from all over Tamilnadu and neighbouring states, Time from injury to surgery could not be analysed as a variable since most of the patients are operated more than 8 hours

after the injury due to various factors that result in delay in arrival at our institute. Patient's poor economic status is also one of the important parameters for delay when they cannot afford for surgery though they may reach a tertiary neurosurgical centre and are referred late to us. These factors were beyond our control and caused delay in surgical intervention.

As reported in various studies the presence of SAH was associated with poor outcome[1, 2, 4, and 8] with more than 90% mortality in our study too. The presence of sub arachnoid blood alters the cerebral micro circulation, cause ischemia to vital structure even without signs of herniation. This leads to brain dysfunction including the centres responsible for maintaining respiration, sympathetic activity and cardiac activity.

Brain bulge was associated with poor outcome in our study. Presence of contusions and burst lobe increased mortality. Fall in blood pressure was associated with poor outcome. Large clot size was associated with poorer outcome in our study similar to standards.

Contusions and SAH have been noted only during surgery which were absent in the pre op CT scan. This also implicates significant changes probably due to secondary insult and they finally influence the outcome. Under these circumstances CT based prognostication fails and therefore reiterating the fact that intra operative parameters based scoring system is better than CT based prognostication.

Whatever be the time between intervention and injury, the intra operative scoring takes in to account the current status which is the end result of all the insults that have occurred prior to evacuation of clot and therefore is a better prognostic indicator than the admission GCS and CT.

The intra operative parameters taken in to the scoring system reflect the maximum damage suffered by brain due to injury thus includes the primary brain injury and secondary insults as well, suffered till the time of durotomy.

The secondary insults accounting for the poor outcome in TBI is indirectly reflected by the IPS. Our study indicated that a poor IPS score had better indication of mortality than CT and admission GCS. This is because the time taken from the imaging to the final surgical intervention is highly variable in our setup and thus the admission GCS and CT status is actually a reflection of the PAST status of brain injury and the secondary mechanisms that influence the outcome may not have operated at all at the time of initial GCS evaluation and imaging.

Conclusion

To the best of our knowledge, the present study is probably the first attempt to include only the intra operative parameters in a prognostic scale in patients with SDH in mild and moderate traumatic brain injuries undergoing surgical management.

The available studies [3,4,7,8] had agreed that secondary insults contribute to death in TBI .our study takes in to account the end result of all of those secondary factors which reflect clinically during the intra operative period.

Our study shows IPS is a good prognostication tool to assess the mortality and functional outcome in TBI patients undergoing de compressive craniotomy for unilateral traumatic acute subdural hematoma and is better than pre-operative GCS and imaging in predicting mortality at 30 days and functional outcome at 2 months.

The need for monitoring blood pressure, saturation, measures to lower ICP thereby reducing brain bulge to improve outcome is emphasised.

Larger sample size and studies from many more centres will be required to strongly validate its utility.

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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. Raja .S. Vignesh,
PG in Neuro Surgery,
Department of Neuro Surgery,
Madras Medical College, Chennai-3.

Dear Dr. Raja .S. Vignesh,

The Institutional Ethics Committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled **"Intra Operative Prognostic Scoring (IPS) in Mild and Moderate Brain Injury (TBI) patients with Traumatic Acute Subdural Hematoma (TASH) Undergoing Decompressive Craniectomy"** No.37032014

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-600 003

Member Secretary, Ethics Committee

Appendix II

Information sheet

Name of the principal investigator: **Name of the participant:**

Place of study: Rajiv Gandhi Government General Hospital .Chennai

We are conducting a study of **"**Intra Operative Prognostic Scoring (IPS) In Mild And Moderate traumatic brain injury (TBI) Patients With Traumatic Acute Subdural Hematoma (TASH) Undergoing De compressive Craniectomy**"** at the Institute of Neurology, Rajiv Gandhi Govt. General Hospital, Chennai.

We will perform standard procedure of decompressive craniotomy as per standard brain trauma foundation guidelines

It helps to prognosticate the outcome to the patients and to the community

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**

Appendix III

PATIENT CONSENT FORM

Study Details: "Intra Operative Prognostic Scoring (IPS) In Mild And Moderate traumatic brain injury (TBI) Patients With Traumatic Acute Subdural Hematoma (TASH) Undergoing De compressive Craniectomy**"**

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

விபத்தினால் ஏற்படும் மூளை இரத்தக் கட்டியின் அறுவை சிகிச்சை பற்றிய ஆய்வு

சென்னை இராஜீவ்காந்தி அரசு பொது மருத்துவனையில் விபத்தினால் ஏற்படும் மூளை இரத்தக் கட்டியின் அறுவை சிகிச்சை பற்றிய ஆய்வு இங்கு நடைபெறுகிறது.

இந்த ஆய்வில் விபத்தினால் வரும் மூளை இரத்தக்கட்டி பற்றியும் அதற்கு அதற்கு சிகிச்சை செய்யும்போது ஏற்படும் பல்வேறு வரையறைகள் 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

APPENDIX V

ஆராய்ச்சி ஒப்புதல் படிவம்

ஆராய்ச்சி தலைப்பு

விபத்தினால் ஏற்படும் மூளை இரத்தக் கட்டியின் அறுவை சிகிச்சை 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
Address

DOA DOS

DOD / Death

Mode of Injury Time of Injury

Helmet Yes/ No Alcohol Yes / No

Injury time Admission Time
CT time

Surgery Time and Duration

Smoker/alcohol/DM/HT/CAD/CVD/ anti platelets/ anti-coagulants

Pre op Clinical finding

GCS Respiration DEM Anisocoria Paucity

Pulse BP

Associated injuries

Investigations TC DC Hb Plt
Sugar Urea Creatinine Na K
BT CT PT INR

Intra op findings:

1. BP fall duration
2. SpO2 fall duration
3. Brain bulge
4. Brain pulsations
5. Clot volume
6. SAH size
7. Burst lobe size
8.

Intra operative prognostic score (IPS)

Parameter /score	**2**	**1**	**0**
Intra operative Duration of BP fall			
Intra operative Duration of fall in SpO2			
Degree of brain bulge after clot evacuation			
Brain pulsations at the time of closure			
Clot volume			
Intra op sub arachnoid haemorrhage (SAH)			
Burst lobe/ contusion Yes/no			

Intra op score grade

Grade A 12 to 14

Grade B 9 to 11

Grade C 0 to 8

Post op GCS Post op Ct

Tracheostomy yes/no

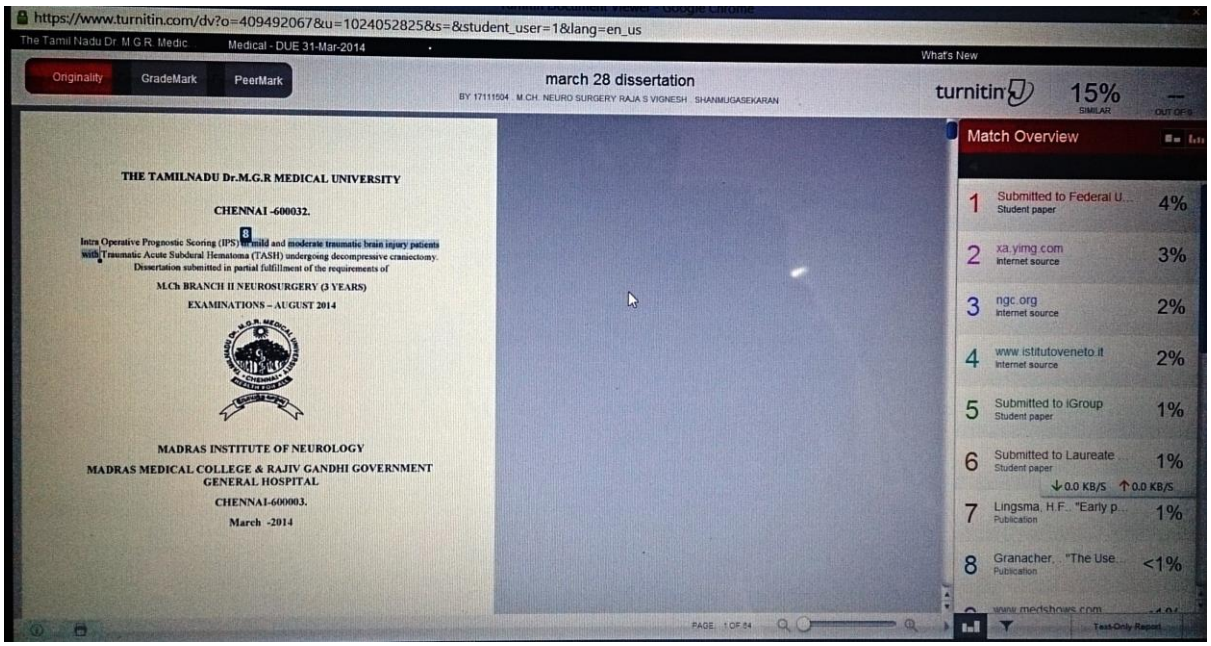
Intra operative prognostic score grade A/B/C

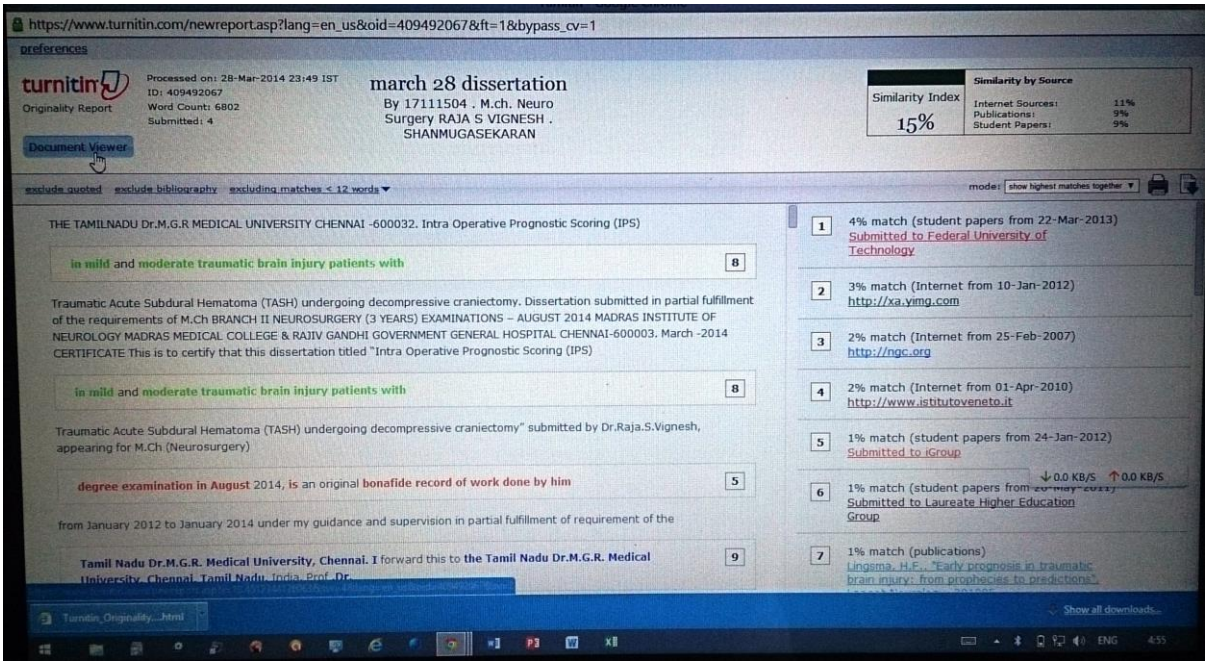
Outcome

1. Alive / dead on 30th day

2. Modified Rankin scale grade at 2 months

PLAGIARISM-TURNITIN





MASTER CHART

S.NO.	AGE	SEX	MODE	SEIZURE	VOMITING	ENT	PTA	LOC	AD. GCS	SDH THICK	CLOT VOL	SAH	BP FALL	BRAIN BULGE	CONT/BURST	BRAIN PULS	IPS GRADE	IPS OUTCOME	MRS
1	13	M	0	0	0	0		1	1	0	0	0	0	0	0	0	0	1	0
2	22	M	0	0	0	0		1	1	2	2	2	1	2	0	1	2	0	6
3	30	M	2	0	1	0		1	1	1	0	1	0	0	0	0	0	1	1
4	29	M	0	0	1	0		1	0	0	1	0	0	0	0	0	0	1	0
5	51	M	0	0	1	0		1	1	0	1	0	1	0	0	0	0	1	1
6	22	M	0	0	1	0		1	0	1	1	2	0	2	1	1	0	0	6
7	53	M	0	0	1	0		1	1	1	1	1	0	0	0	0	0	1	1
8	21	M	0	0	1	0		1	0	1	1	0	0	1	0	0	0	1	1
9	60	M	0	0	1	1		1	0	0	1	0	0	0	0	0	1	1	1
10	42	M	0	0	1	0		1	1	1	1	0	0	0	0	0	0	1	0
11	26	M	0	0	1	0		1	1	0	1	0	0	1	0	0	0	1	0
12	45	M	0	0	1	0		1	0	2	1	0	0	1	0	0	1	1	0
13	60	M	0	0	1	0		1	0	1	1	2	0	2	0	1	0	0	6
14	16	M	1	0	1	0		1	1	2	1	2	1	0	0	0	0	1	0
15	47	M	0	0	1	0		1	0	2	1	1	0	0	0	0	1	1	0
16	20	M	0	0	1	1		1	0	1	0	0	1	0	0	0	1	1	0
17	31	M	0	0	0	1		1	0	0	0	0	0	0	0	0	0	1	0
18	26	M	0	0	1	0		1	0	2	2	0	0	0	0	0	0	1	0
19	19	M	0	0	1	0		1	1	2	0	2	0	1	0	0	0	1	0
20	40	M	0	0	0	0		1	0	2	0	0	0	0	0	0	1	0	0
21	48	M	0	0	1	0		1	1	2	0	1	0	0	0	0	0	1	1

22	19	M	1	0	1	0		1	1	2	0	2	0	2	0	0	2		6
23	58	M	0	0	1	0		1	0	2	0	2	0	2	0	1	2	0	6
24	29	M	1	0	1	0		1	0	2	0	0	1	0	0	0	0	1	1
25	42	M	0	1	1	0		1	0	2	2	0	1	0	0	0	1	1	1
26	17	M	0	0	1	0		0	0	0	1	0	0	0	0	0	0	1	0
27	38	M	0	0	1	0		1	1	2	1	0	0	0	0	0	1	1	2
28	17	F	0	0	1	0		1	0	0	1	0	1	0	0	0	1	0	0
29	44	M	0	0	1	0		0	0	2	1	2	0	2	0	1	2	0	6
30	15	M	0	0	0	0		0	1	0	0	0	1	0	0	0	1	1	0
31	30	M	1	0	0	0		1	0	2	0	0	0	0	0	0	0	1	0
32	55	M	0	0	0	0		1	0	2	0	2	0	2	0	1	2	0	6
33	24	M	2	0	1	1		1	0	0	0	1	1	1	0	0	0	1	0
34	29	F	0	0	1	0		1	0	2	2	0	0	0	0	0	0	1	0
35	44	M	0	1	1	1		1	0	2	0	0	1	1	0	0	0	1	0
36	25	M	1	0	1	0		1	0	2	0	2	0	0	1	0	2	0	6
37	37	M	0	0	1	0		1	0	2	0	0	1	0	0	0	2	1	0
38	22	M	0	0	0	1		1	0	0	1	0	0	0	0	0	1	1	0
39	46	M	0	0	0	1		1	1	0	1	0	0	0	0	0	1	1	2
40	28	M	0	0	0	1		1	0	2	1	1	0	0	1	0	2	0	6
41	58	M	2	0	0	0		0	0	0	1	2	1	0	1	1	2	0	6
42	26	M	0	0	1	1		1	0	2	1	0	0	0	1	0	0	1	1
43	21	F	0	0	1	0		1	0	0	1	2	0	0	1	1	2	0	6
44	57	M	0	0	1	0		1	0	2	1	2	1	2	1	0	2	0	6
45	22	M	0	0	1	1		1	0	0	1	1	1	0	0	0	0	1	0
46	23	M	0	0	1	1		1	1	2	1	2	0	2	1	1	2	0	6
47	47	M	0	0	0	0		1	0	2	1	2	1	2	1	1	2	0	6
48	36	M	0	1	0	0		1	0	2	1	2	0	1	1	0	1	0	6
49	33	M	0	1	1	0		1	0	0	0	1	0	2	0	0	2	0	6
50	56	M	0	0	1	0		0	0	2	0	2	0	2	1	1	2	0	6

51	49	M	0	0	1	1		1	0	0	2	2	0	0	0	0	2	1	0
52	39	M	0	0	1	1		1	1	2	0	0	0	0	0	0	2	1	0
53	34	M	0	0	0	0		1	0	2	0	0	1	0	0	0	0	1	0
54	31	M	0	0	1	0		0	0	2	0	2	0	2	1	0	2	0	6
55	26	M	0	0	1	0		1	0	2	0	2	0	0	1	1	2	0	6
56	32	M	0	0	1	1		1	0	2	2	2	0	2	0	1	2	0	6
57	49	F	0	0	0	1		1	0	2	0	1	1	0	0	0	0	1	0
58	33	M	0	0	1	1		1	0	0	1	2	1	2	1	1	2	0	6
59	48	M	0	0	0	0		0	0	2	1	0	1	0	1	0	1	1	0
60	32	M	0	0	1	1		1	1	2	1	0	1	0	0	0	1	1	0
61	29	M	0	0	1	0		0	0	1	1	2	0	2	0	1	2	0	6
62	32	M	1	0	1	1		1	0	1	1	2	1	2	1	0	0	0	6
63	68	F	0	1	0	0		1	0	1	1	2	1	2	1	1	2	0	6
64	33	M	1	0	0	1		0	0	1	1	0	0	1	0	0	1	1	0
65	47	M	2	0	0	0		1	0	1	1	2	0	2	0	1	2	0	6
66	32	M	0	0	1	0		0	0	2	1	0	0	0	0	0	0	1	0
67	49	M	0	0	1	0		1	0	2	1	1	0	1	1	0	1	1	0
68	48	M	0	0	1	0		1	0	0	1	2	1	2	0	1	2	0	6
69	28	M	0	0	0	0		1	1	2	1	2	0	2	1	0	2	0	6
70	59	M	0	0	0	0		1	0	0	0	2	0	2	0	1	2	0	6
71	56	M	0	0	1	0		1	0	2	0	2	1	2	1	1	2	0	6
72	62	M	0	0	1	0		1	0	0	0	2	0	2	1	1	2	0	6
73	37	M	0	0	1	0		1	0	2	0	2	0	2	0	1	2	0	6
74	47	M	0	0	1	+		1	0	1	0	2	1	2	1	1	2	0	6
75	39	M	0	0	1	0		1	0	1	1	0	1	1	0	1	0	1	0
76	55	M	0	0	1	0		0	0	1	1	2	0	2	1	1	2	0	6
77	47	M	0	0	1	0		1	0	1	1	2	0	1	1	1	1	0	6
78	25	M	0	0	1	0		1	1	1	1	2	0	2	0	1	2	0	6
79	40	F	0	0	1	1		1	0	1	1	2	0	2	1	1	2	0	6

80	56	M	0	0	1	0		1	0	1	1	0	0	0	0	1	0	1	0
81	51	M	0	1	1	0		1	1	1	0	1	1	2	1	1	2	0	6
82	40	M	0	0	1	1		1	0	1	2	2	0	2	1	1	1	0	6
83	65	M	0	0	1	0		0	0	1	0	2	1	2	1	1	2	0	6
84	38	M	0	0	1	0		1	0	1	0	2	0	2	0	1	2	0	6
85	49	M	0	0	0	0		0	0	1	1	2	0	2	1	1	2	0	6
86	32	M	2	0	1	0		0	0	1	1	2	0	2	1	1	2	0	6
87	26	M	0	0	0	1		1	0	2	0	0	1	0	0	0	0	1	0
88	35	F	0	0	1	0		1	0	1	2	2	0	2	1	0	2	0	6
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92	32	F	0	0	1	0		1	1	0	2	0	1	1	0	1	1	1	0
93	24	M	0	0	1	0		1	0	2	0	0	0	0	0	0	0	1	0
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98	53	M	0	0	0	1		1	1	0	0	0	0	1	0	0	0	1	0
99	50	M	0	0	0	0		1	0	2	0	0	0	1	0	0	0	1	0
100	61	M	0	0	0	0		0	1	0	0	2	0	2	0	1	2	0	6

	1	OPEN		0	ABSENT
			SEIZURE	1	PRESENT
CISTERN	0	PARTLY EFFACED		0	ABSENT
	0	10 TO 15 MM	VOMITING	1	PRESENT
	1	15 TO 20 MM		0	ABSENT
SDH THICKNESS	2	>20 MM	ENT BLEED	1	PRESENT
	1	ALIVE		0	ABSENT
OUTCOME	0	DEAD	LOC	1	PRESENT
MRS	0	MRS 0		2	9 - 12
	1	MRS 1	GCS	1	13 - 15
	2	MRS 2		0	NO
	3	MRS 3	DET.GCS	1	YES
	4	MRS 4		0	NORMAL
	5	MRS 5		1	SLUGGISH
	6	MRS 6	PUPILLARYREACTION	2	NOT REACTING
BRAIN PULS	0	PRESENT		0	PRESENT
	1	ABSENT	CONTUSION / BURST LOBE	1	ABSENT
IPS	0	GRADE A		0	NO
	1	GRADE B		1	MODERATE
	2	GRADE C	BB	2	SEVERE
PTA	0	ABSENT		0	RTA
	1	PRESENT		1	FALL
	2	DIFFUSE	MODE INJURY	2	ASSAULT
	0	ABSENT		0	< 3O ML
SAH	1	FOCAL		1	30 TO 75 ML
	0	ABSENT	CLOT SIZE	2	> 75 ML
BP FALL	1	PRESENT		2	NO SHIFT
				1	<5 MM
			MIDLINE SHIFT	0	>5 MM

ABBREVIATIONS	
M	MALE
F	FEMALE
RTA	ROAD TRAFFIC ACCIDENT
ASS	ASSAULT
ENT	ENT BLEED
LOC	LOSS OF CONSCIOUSNESS
AD. GCS	GCS AT ADMISSION
PUP REA	PUPILLARY REACTION
SYM	SYMMETRY OF PUPILS
EOM	EXTRAOCCULAR / DOLLS EYE MOVEMENT
PR	PULSE RATE
INC SIZE	INCREASE IN CONTUSION SIZE
SHIFT	MIDLINE SHIFT
CIST	CISTERNS
TREAT	TREATMENT
IPS	INTRA OP PROGNOSTIC SCORE
DET GCS	DETERIORATED GCS
MRS	MODIFIED RANKIN SCORE
CLOT VOL	CLOT VOLUME
SDH THICK	SDH THICKNESS
BRAIN PULS	BRAIN PULSATIONS
CONT/BURST	CONTUSION/BURST LOBE

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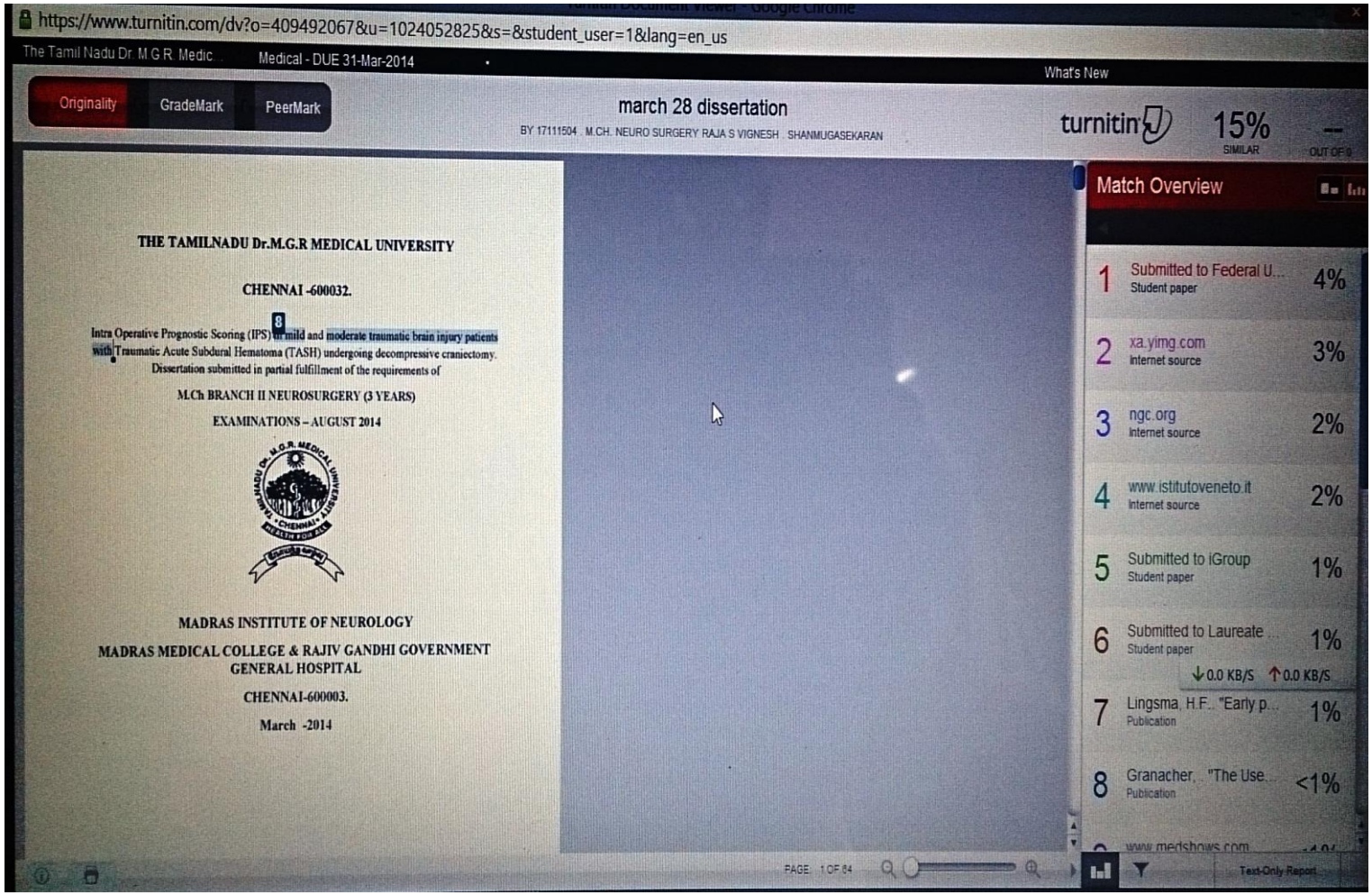
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Dissertation submitted in partial fulfillment of the requirements of
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EXAMINATIONS – AUGUST 2014
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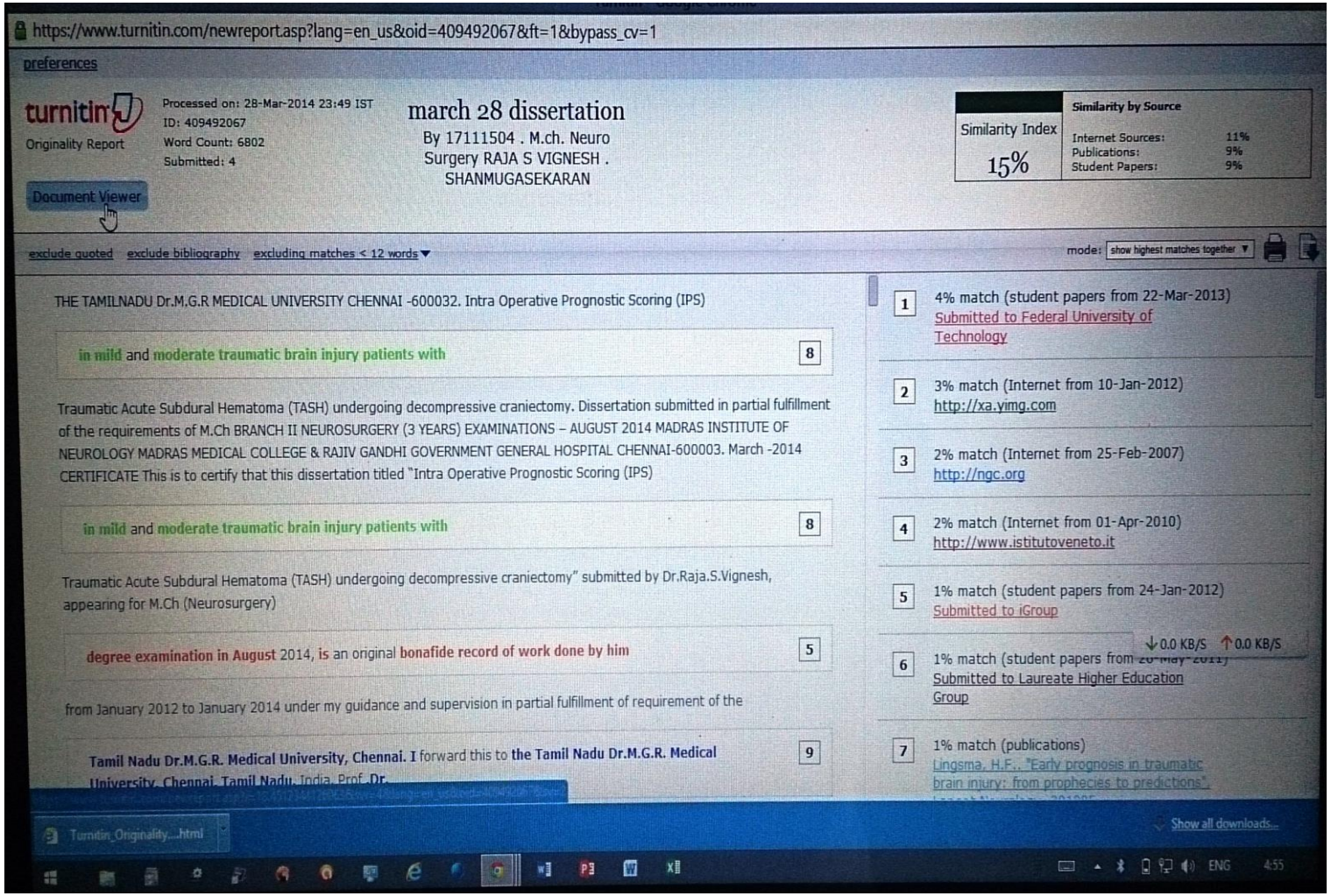
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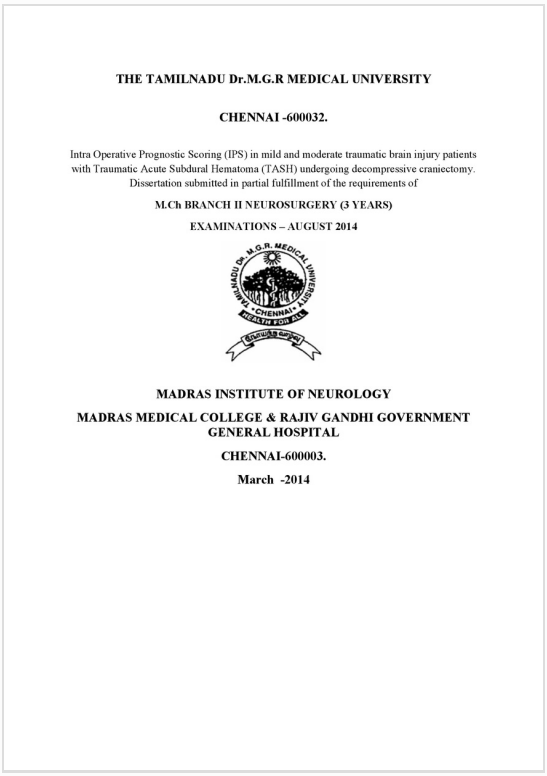

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