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RESEARCH ARTICLE

A COMPARATIVE STUDY OF SURGICAL AND CONSERVATIVE MANAGEMENT OF INTRACEREBRAL HEMORRHAGE

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ABSTRACT

Context: Intracerebral hemorrhage is a serious medical emergency because they increase intracranial pressure. The mortality rate for intraparenchymal bleeds is over 40%. ICH patients show worst outcome of all stroke subtypes (30-day mortality 30% - 50%). **Aims:** To find the morbidity and mortality indicators and to evaluate the correlation between the GCS, volume and prognostic outcome in ICH. To compare the outcome between conservative and surgically managed ICH. **Settings and design:** Retrospective analysis of 40 cases admitted between 2015 and 2016 in the Institute of Neurosurgery, Rajiv Gandhi Government General Hospital, Chennai was done. Patients admitted within 24 hours of ICH were included. Clinical and radiological data collected. Patients managed based on institutional protocol. Outcome was analysed based on GOS and Rankin score. **Results:** Increased incidence of ICH in men and in 40 – 50 years age (25%). Six months mortality was 18% and 28% for surgical and medically managed patients respectively but statistically insignificant. There was minimal better outcome of good and moderate GOS in surgically treated patients. Rankin scoring showed a minimal better outcome with surgical intervention but statistically insignificant. **Conclusions:** ICH patients with GCS 13-15 can be safely observed. There is a strong evidence to support operating on ICH patients with GCS 9-12. For GCS < 9, surgical intervention appears to be less effective. Surgical intervention has better outcome in large hematoma. Presence of IVH significantly reduces the outcome

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INTRODUCTION

Intracerebral hemorrhage is an intraaxial hemorrhage that occurs within the brain parenchymal tissue. The other variety of intracranial hemorrhage is extra-axial hemorrhage, such as epidural, subdural and subarachnoid hemorrhage, which occurs within the skull but outside of the brain tissue. There are two main kinds of intra-axial hemorrhages : intraparenchymal and intraventricular hemorrhages. Intraparenchymal hemorrhages are a serious medical emergency because they can increase intracranial pressure, which if left untreated can lead to coma and death. The mortality rate for intraparenchymal bleeds is over 40%. Spontaneous intracerebral hemorrhage accounts for 10-15% of all strokes worldwide or 10-30 cases per 100,000 people per year (Qureshi *et al*., 2001). Patients with ICH show the worst outcome of all stroke subtypes with a 30-day mortality rate of 30% to 50%. ICH is more frequently seen in men than women. The incidence increases with advanced age.

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ICH from spontaneous rupture of small arteries or arterioles damaged by chronic hypertension or amyloid angiopathy is primary ICH and those resulting from trauma, rupture of an aneurysm/vascular malformation, coagulopathy or other causes are secondary ICH (2). Patients with intraparenchymal bleeds have symptoms that correspond to the functions controlled by the area of the brain that is damaged by the bleed. Other symptoms include those that indicate a rise in intracranial pressure caused by a large mass putting pressure on the brain. A severe headache followed by vomiting is one of the more common symptoms of intracerebral hemorrhage. Some patients may also go into a coma before the bleed is noticed. Intracerebral bleeds are the second most common cause of stroke, accounting for 10% of hospital admissions for stroke. High blood pressure raises the risks of spontaneous intracerebral hemorrhage by two to six times. More common in adults than in children, intraparenchymal bleeds are usually due to penetrating head trauma, but can also be due to depressed skull fractures. Acceleration-deceleration trauma, rupture of an aneurysm or arteriovenous malformation (AVM) and bleeding within a tumor are additional causes. Treatment depends substantially of the type of ICH. Rapid CT scan and

other diagnostic measures are used to determine proper treatment, which may include both medication and surgery.

Conservative management: Antihypertensive therapy to bring down the blood pressure to stabilize the mean arterial pressure at 110mmHg in acute phases appears to improve outcomes (Brott *et al*., 1986). Giving Factor VIIa within 4 hours limits the bleeding and formation of a hematoma. However, it also increases the risk of thromboembolism (Mayer *et al*., 2005). It thus overall does not result in better outcomes in those without hemophilia. Mannitol is effective in acutely reducing raised intracranial pressure. Acetaminophen may be needed to avoid hyperthermia, and to relieve headache. Frozen plasma, vitamin K, protamine, or platelet transfusions are given in case of a coagulopathy (Flibotte *et al*., 2004). Fosphenytoin or other anticonvulsant is given in case of seizures or lobar hemorrhage. H2 antagonists or Proton pump inhibitors are commonly given for stress ulcer prophylaxis, a condition somehow linked with ICH. Corticosteroids were thought to reduce swelling. However, in large controlled studies, corticosteroids have been found to increase mortality rates and are no longer recommended. Glibenclamide (Glyburide), is being studied as a promising treatment for preventing secondary brain injury and cerebral edema post-hemorrhage or infarction.

Surgery: Surgery is required if the hematoma is greater than 3 cm causing mass effect inside cranial cavity, if there is a structural vascular lesion or lobar hemorrhage in a young patient (Morgenstern *et al*., 2010). This study aims to compare surgical and conservative management of intracerebral hemorrhage.

Aims of the study

- To analyse and compare surgical and conservative management in ICH Patients
- To develop a protocol for selecting patients with ICH for undertaking surgery
- To analyse the prognostic factors of intracerebral hemorrhage

Objectives of the study

- To find the morbidity and mortality indicators in ICH
- To evaluate the correlation between the GCS and prognostic outcome in ICH
- To evaluate the correlation between volume of ICH and prognostic outcome in ICH
- To compare the outcome between conservative and surgically managed ICH

MATERIALS AND METHODS

Retrospective analysis of 40 cases admitted between 2015 and 2016 in the Institute of Neurosurgery, Rajiv Gandhi Government General Hospital, Chennai was done. Those patients who were admitted within 24 hours of ICH were included in the study. Patients with GCS < 3/15, received steroids within 3 weeks, hypotensive, polytrauma, severe cardiac, renal or hepatic diseases, severe neurological or psychiatric illness and substance abuse, sepsis were excluded from the study

Clinical datas including history of hypertension, vascular anamolies of brain, coagulopathy, bleeding disorders, treatment history, raised intracranial pressure features, GCS, ICH volume , intraventricular hemorrhage of all ICH patients who got admitted were collected. The radiological data included the CT brain findings like location of ICH, hematoma size, surrounding oedema and midline shift. CT angiogram or Digital Substraction Angiogram of brain was done if indicated. Compiling the clinical and radiological features along with the surgical procedure for the present scenario, ICH scoring system was applied (7). Patients underwent medical/surgical management based on institutional protocol, the outcome of the patients was analysed based on Glasgow outcome scale and Rankin scoring system.

ICH SCORE		
COMPONENTS		SCORE
Glascow Coma Scale	3-4	2
	5-12	1
	13-15	0
ICH Volume (ml)	>30	1
	<30	0
Intraventricular Hemorrhage	YES	1
	NO	0
Age (Years)	>80	1
	<80	0
Infratentorial Origin	YES	1
	NO	0

30 Days mortality

TOTAL ICH SCORE	PERCENTAGE
5+	100
4	97
3	72
2	26
1	13

Statistical analysis

The study subjects were described according to their demographic characteristics in terms of proportions and means, which ever applicable. Primary outcome and mortality at six months of ICH patients managed both conservatively and surgically were statistically analysed by fischers test. Variables of Glasgow outcome scale and Rankin score at six months of both groups were studied by paired t test. The above statistical procedures were performed by the statistical package namely IBMSPSS statistics20. The p values less than or equal to 0.05 ($p <= 0.05$) were treated as statistically significant in two test.

OBSERVATIONS AND RESULTS

Overall results of the study are as shown below. Forty patients with intracerebral hemorrhage due to various causes were evaluated during the period between 2015 and 2016. All the patients included in the study presented within 24 hours of symptoms were evaluated clinically followed by CT brain and CT Angiogram brain and DSA as indicated

Demography: The studied subjects were described according to their demographic characteristics such as age, gender, sex and clinical features. The table 1 describes the age and sex distribution of the study subjects. The youngest patient included in the study was 15 years old and oldest patient was 72 years old. The maximum (25%) were in the age group of 41 – 50 years.

Table 1. Description and sex wise comparison of age structure

AGE GROUP (YEARS)	MALE		FEMALE		TOTAL	
	NO	%	NO	%	NO	%
10 – 20	2	8	0	0	2	5
21 – 30	3	12	1	6.6	4	10
31 – 40	6	24	3	20	9	22.5
41 – 50	7	28	3	20	10	25
51 – 60	4	16	5	33.3	9	22.5
61 – 70	2	8	3	20	5	12.5
71 – 80	1	4	0	0	1	2.5
TOTAL	25	62.5	15	37.5	40	100
MEAN AGE = 45.28						

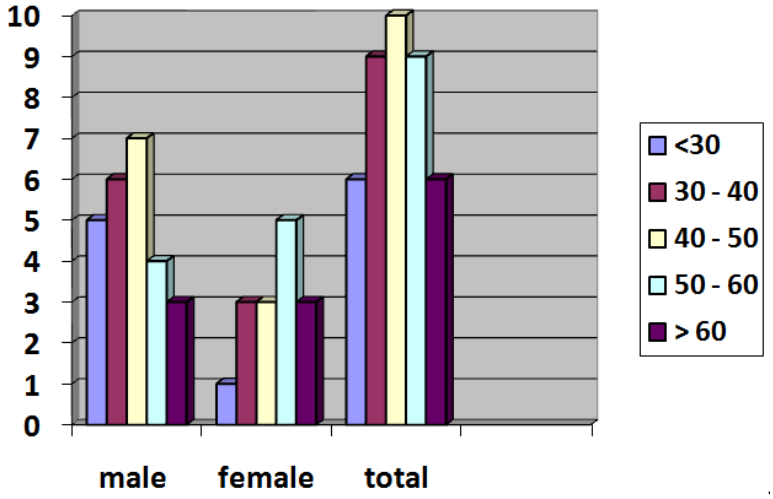

Chart 1. Age distribution of ICH patients

Table 2. Age & sex distribution

AGE	<50 YEARS	>50 YEARS
MALE	18	07
FEMALE	08	07
TOTAL	26	14

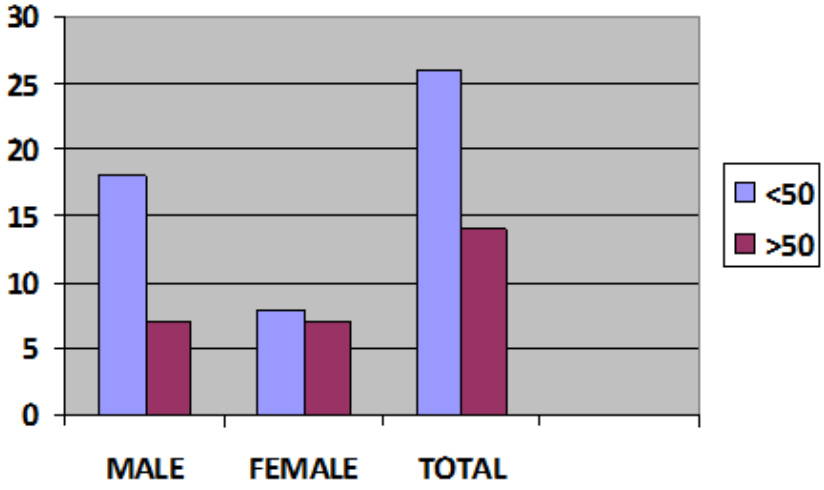

Table 3. Sex distribution of study subjects

	MALE	FEMALE	TOTAL
SURGERY	14	08	22
CONSERVATIVE	11	07	18
TOTAL	25	15	40

Table 4. Glasgow coma scale (gcs) scores of subjects

	GCS 3 – 8	GCS 9 – 12	GCS 13 – 15
SURGERY	06	10	06
CONSERVATIVE	05	09	04
TOTAL	11	19	10

Table 5. Volume of hematoma

Volume of hematoma	<30 ml	>30 ml
Surgery	05	17
Conservative	08	10
Total	13	27

Table 6. Glasgow outcome scale (gos)

	GOOD	MODERATE	SEVERE	VEGETATIVE	DEAD
SURGERY	6	7	5	0	4
CONSERVATIVE	4	5	4	0	5
TOTAL	10	12	9	0	9

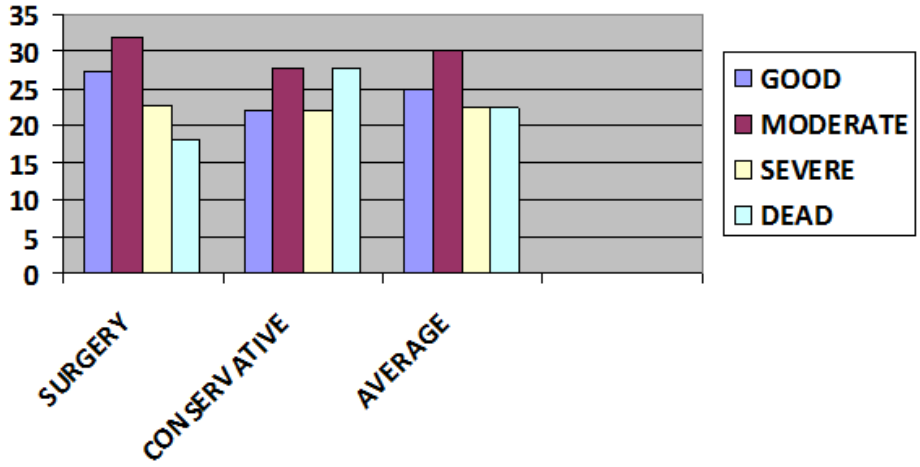

Chart 3. Percentagewise statistics of glasgow outcome scale

Table 7. Rankin score

RANKIN SCORE	1	2	3	4	5	6
SURGERY	6	0	3	5	4	4
CONSERVATIVE	4	0	3	2	3	6
TOTAL	10	0	6	7	7	10

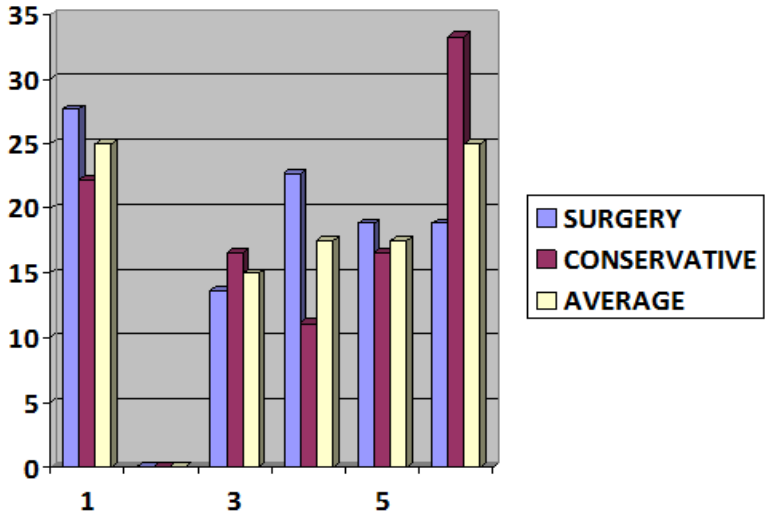

Chart 4. Rankin score (%)

Table 8. Mortality at 6 months follow up

MORTALITY AT 6 MONTHS (%)	SURGERY	CONSERVATIVE	TOTAL
DEAD	04 (18)	05 (28)	09 (23)
ALIVE	18 (82)	13 (72)	31 (78)

Table 9. Analysis of primary and secondary outcomes in ICH patients

	SURGERY	CONSERVATIVE	TOTAL	TEST P VALUE	ODDS RATIO 95 % CI
PRIMARY OUTCOME (%)	N = 22	N = 18			
FAVOURABLE	13 (59)	09 (50)	22 (55)	FISHER TEST	1.444
UNFAVOURABLE	09 (41)	09 (50)	18 (45)	P =0.7504	(0.4115 to 5.070)
SECONDARY OUTCOME (%)	N = 22	N = 18			
MORTALITY AT 6 MONTHS(%)					
DEAD	04(18)	05(28)	09(23)	FISHER TEST	0.5778
ALIVE	18(82)	13(72)	31(78)	P = 0.7053	(0.1294 TO 2.580)
GLASGOW OUTCOME (%)					
DEAD	4.0	5.0		PAIRED t TEST	-0.08187 TO 2.419
VEGETATIVE	0.0	0.0		P = 0.2420	
SEVERELY DEPENDENT	5.0	4.0			
MODERATELY DEPENDENT	7.0	5.0			
GOOD	6.0	4.0			
RANKIN					
1	6.0	4.0		PAIRED t TEST	-1.171 TO 2.505
2	0.0	0.0		P = 0.3939	
3	3.0	3.0			
4	5.0	2.0			
5	4.0	3.0			
DEAD	4.0	6.0			

The least (2.5%) age group of subjects was 71 – 80 years. The male and female participation of the study was 25 and 15, i.e. 62.5 and 37.5 respectively. The mean age is 45.2 years

ANALYSIS AND DISCUSSION

Incidence of intracerebral hemorrhage: In our study there was an increased incidence of ICH in men than in women. Various studies have reported that intracerebral hemorrhage is more common in men and ours also support the report. Analysis of the age group incidence of the intracerebral hemorrhage it appears to be more common in 40 – 50 years age group forming 25% of the total subjects. The initial clinical assessment of the subjects Glasgow coma scale indicate that more number of patients in the study have a GCS of 9-12, nearly 47.5% of the total subjects involved in the study. The predominant location of ICH within the brain varies in different populations: deep cerebral ICH is most common, followed closely by lobar hemorrhages originating in the gray matter or subcortical white matter. In most populations, cerebellar hemorrhage accounts for approximately 10% of ICH and brainstem hemorrhage for 5-10 % of ICH.

Outcome analysis: Overall outcome of the study subjects can be simply classified into favorable and unfavorable based on six months follow up of mortality and morbidity status. The favorable outcome subjects are those alive and leading an independent life without morbid disability and unfavorable outcome includes death and disability. In six month Glasgow outcome scale, dead, vegetative and severe disability were classified as unfavorable and moderate disability and good recovery as favorable.

Primary outcome: In our study patients with favorable outcome was 55% totally, surgically managed patients had 59% and conservatively managed patients had 50%, unfavorable outcome was 41% and 50% for surgical and conservatively managed patients, the p value was 0.750 which is statistically insignificant (Gregson *et al*., 2012).

Secondary outcome: Mortality at six months was 18% and 28% for surgically and conservatively managed patients respectively. P value was 0.705 which is statistically insignificant. Glasgow outcome scale measures the outcome of neurological disorders based on mortality and disability free survival which is calculated on the basis of level of independency. In this study the Glasgow outcome scale at six months follow up is used as an outcome indicator. There was a minimal better outcome of good and moderate GOS in surgically treated patients compared to conservatively managed. Rankin scale was used for measuring the outcome of this study at the end of six months follow up. Rankin scale grades the outcome into six grades, minimal score of one for healthy good outcome to a maximum score of six for death of the subject. Rankin scoring showed a minimal better outcome with surgical intervention than conservative management but paired t test is not statistically significant p = 0.3939.

Conclusion

The study concludes that there is no firm conclusion that can be drawn about whether or not to operate on patients with intracerebral hemorrhage. Analysis of the study has helped to identify subgroups of patients that are most likely to benefit from surgery. Clinical and imaging characteristics of ICH including GCS score on admission, intra-parenchymal hematoma size, and presence and quantity of IVH can be used to predict the outcome of the patients with ICH and to plan for surgical or medical management. Patients planned initially on medical management can be altered in the course of treatment for surgery, depending on patients clinical outcome. Though surgery has minimal advantage in certain cases, surgical morbidity and healthcare cost should also be considered before proceeding to surgery. ICH patients with GCS between 13 and 15 can be safely observed and only require craniotomy if they deteriorated. There is a strong evidence to support operating on patients with ICH who have a GCS of 9-12. Those with GCS 13 to 15 can be observed carefully for any deterioration because there is a safety margin, which diminishes when the

GCS of the patient descends. It is about to perform a craniotomy before other secondary pathological events such as brain edema, mass effect with herniation, and reduced CPP from elevated ICP causes more harm. Once the GCS has descended below 9, surgical intervention appears to be less effective (Rost *et al*., 2008). Hematoma volume is the most powerful predictor of neurological deterioration, functional outcome and mortality. Large volume hematoma with mass effect with impending herniation is an unequivocal indication for decompression. Surgical intervention has better outcome in large hematoma with volume more than 30ml (Broderick *et al*., 1993). Surgical intervention is not better than conservative management in smaller volume hematoma. Presence of IVH significantly reduces the outcome. Large IVH needs surgical intervention like external ventricular drainage (EVD) initially and later if they develop hydrocephalus they may need ventriculoperitoneal shunt (Bhattathiri *et al*., 2006). Superficial clots treated by open craniotomy resulted in better outcomes than surgery for deep seated clots. Our study has certain drawbacks as it is basically an analytical study, there is no randomization of subjects, the study group is small and from single centre. Hence data cannot be extrapolated to a larger diverse population. A larger multicentric randomized trial is necessary to confirm the beneficial effect of earlier surgery.

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