

Research Article

**COMPARATIVE PROSPECTIVE STUDY OF OUTCOME BETWEEN EARLY
VERSUS DELAYED SURGERY IN SPONTANEOUS CEREBRAL BLEED AT GGH,
KAKINADA, (TERTIARY CARE CENTRE)**

**Dr.D.Kodanda Giri Rao¹, Dr.B.Raja Gopikrishna², Dr.Nikhilesh Yalamanchili^{3*}, Dr. Amol
Dahaphale⁴, Dr. M. V. Vijayasekhar⁵**

^{1*} Associate Professor, Department of Neurosurgery, Rangaraya Medical College, Kakinada, AP.

² Assistant Professor, Department of Neurosurgery, Rangaraya Medical College, Kakinada, AP.

³ Assistant Professor, Department of Neurosurgery, Rangaraya Medical College & Government
General Hospital, Kakinada, AP.

⁴ Assistant Professor, Department of General surgery, Swami Ramanand Teerth Rural
Government Medical College, (SRTR GMC), Amabajogai.

⁵ Professor, Department of Neurosurgery, Rangaraya Medical College & Government General
Hospital, Kakinada, AP.

Corresponding Author: Dr.Nikhilesh Yalamanchili

³ Assistant Professor, Department of Neurosurgery, Rangaraya Medical College & Government
General Hospital, Kakinada, AP.

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Abstract

Introduction: Spontaneous intracerebral bleed represents a severe neurological pathology that often results in lifelong disability.^[1] Owing to the variability in bleed location and size, patients have a variety of clinical syndromes and deficits, making standardization of treatment protocols difficult and impossible. There is evidence to support both medical and surgical management; however, the literature is largely lacking in data that can define the optimal management strategy and timing of intervention.

Materials and methods: This prospective analytical observational study was conducted over a 27-month period from January 2021 to March 2023, evaluating a total sample size of 62 participants. All Patients presenting with CT brain finding of spontaneous intracerebral bleeding to the Emergency Department, GGH, Kakinada, during the period of January 2021 to March

2023 are chosen for the study. Patients satisfying the inclusion and exclusion criteria were enrolled into the study. Data is collected by patient history, examination and from attendants.

Results: In this study of 62 patients, 34 Patients were in early surgery group and 28 were in Delayed surgery group. Among early surgery group, age group range was from 39 to 70 years. Maximum number of 16 (47.05%) patients were from age group of 41-50 years, followed by 8 (23.52%) patients each were from age group of 51 to 60 years and 61-70 years. Least number of 2(5.88%) patients were from age group 31-40 years. Among 28 Patients of Delayed surgery group, age group 40 to 80 years, maximum number of 9 (32.14%) patients were from age group of 51-60 years, followed by 7(25%) patients each were from age group of 61 to 70 years and 71-80 years. 4(14.28%) patients were from age group of 41-50 years. Least number of patients 1 (3.57%) were from age group 31-40 years.

Conclusion: The average GOS achieved by early surgery group was 4.15 and by Delayed Surgery group at the end of 3 months was by 3.81 which concludes that early surgical intervention results in better outcome compared to delayed surgery. The mortality rate was 29.41% in Early Surgery group while 42.86% in delayed surgery group with a P-value of 0.0990, which concludes that though it may not be statistically significant but is suggestive of poor outcome in case of delayed surgery compared to early surgery in this study.

Key Words: Spontaneous intracerebral bleed, Mortality rate, CT brain, Lifelong disability.

INTRODUCTION

Spontaneous intracerebral bleed represents a severe neurological pathology that often results in lifelong disability. Owing to the variability in bleed location and size, patients have a variety of clinical syndromes and deficits, making standardization of treatment protocols difficult and impossible. There is evidence to support both medical and surgical management; however, the literature is largely lacking in data that can define the optimal management strategy and timing of intervention.¹

Primary spontaneous intracerebral hemorrhage is hemorrhage within the brain parenchyma or ventricles in the absence of underlying causative pathology, such as tumors, vascular malformations, or aneurysms. Most commonly, these lesions result from hypertension.²

The incidence of spontaneous ICH is 10 to 30 cases per 100,000 people per year and is expected to double by the year 2050. Although it represents only 10% to 15% of all strokes, primary spontaneous ICH is associated with a high rate of mortality. The devastating nature of these hemorrhages is highlighted by the 30-day mortality rate of approximately 50%.³ Of those who survive, 75% will be left functionally dependent and less than 20% of patients will achieve functional independence at 6 months. Secondary spontaneous intracerebral hemorrhage is

defined as non traumatic hemorrhage resulting from underlying structural pathology. Hematoma volume on admission is the critical factor in determining mortality and functional outcomes. Surgical hematoma drainage has many theoretical benefits, such as the prevention of mass effect and cerebral herniation, reduction in intracranial pressure, and the decrease of excitotoxicity and neuro toxicity of blood products.^{4,5}

Also, clinical studies have yielded variable results regarding the importance of penumbra. If a penumbra exists in patients with spontaneous intracerebral hemorrhage, clot evacuation could then restore function to the surrounding brain tissue and improve outcome.^{6,7}

Approximately 40% of patients with hypertensive ICH die and there has been always controversy regarding the optimal timing of intervention in those who require surgical evacuation of hematoma.⁸ Therefore, this study is undertaken to assess the outcome using Glasgow Outcome Scale, in patients undergoing early surgery (<24 hours) versus delayed surgery (>24 hours).

AIMS AND OBJECTIVES

1. To compare the outcome between the early surgery and delayed surgery in spontaneous intracerebral bleed.
2. To study incidence of death and disability with Glasgow Outcome Scale at 3 months.

MATERIALS AND METHODS

Type of Study: Prospective analytical observational study.

Period of Study: January 2021 to March 2023

Sample size: 62.

Source of Data: All Patients presenting with CT brain finding of spontaneous intracerebral bleeding to the Emergency Department, GGH, Kakinada, during the period of January 2021 to March 2023 are chosen for the study.

Patients satisfying the inclusion and exclusion criteria were enrolled into the study. Data is collected by patient history, examination and from attendants.

Inclusion criteria:

Patients having spontaneous cerebral bleed on CT with any of the following indications of surgery-

1. Volume >30 ml
2. Associated mid line shift ->5mm
3. GCS <15

4. Any signs of raised intra cranial pressure.

Exclusion criteria:

1. Patients with history of Traumatic Brain Injury
2. Tumor bleed
3. Hemorrhage due to an aneurysm or an angiographically proven arteriovenous malformation.
4. Associated hemorrhagic infraction.
5. GCS- ≤ 4
6. Any Bleeding disorders.
7. Pregnancy
8. Patients with cardiac disease

Investigations required and Outcome measurement:

Investigations

CT Brain (Plain).

CT Contrast / CT Angiography / MRI / MR Angiography in some special circumstances.

Other biochemical investigations required for planning surgical intervention.

Outcome measurement:

I. Glasgow Outcome Scale (GOS)

1. Death
2. Persistent vegetative state: Minimal responsiveness
3. Severe disability: Conscious but disabled; dependent on others for daily support
4. Moderate disability: Disabled but independent; can work in sheltered setting
5. Good recovery: Resumption of normal life despite minor deficits

RESULTS

In this study of 62 patients, 34 Patients were in early surgery group and 28 were in Delayed surgery group. Among early surgery group, age group range was from 39 to 70 years. Maximum number of 16 (47.05%) patients were from age group of 41-50 years, followed by 8 (23.52%) patients each were from age group of 51 to 60 years and 61-70 years. Least number of 2(5.88%) patients were from age group 31-40 years. Among 28 Patients of Delayed surgery group, age group 40 to 80 years, maximum number of 9 (32.14%) patients were from age group of 51-60 years, followed by 7(25%) patients each were from age group of 61 to 70 years and 71-80 years.

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4(14.28%) patients were from age group of 41-50 years. Least number of patients 1 (3.57%) were from age group 31-40 years. (Table 1), (Fig. 1)

Age Group	Early Surgery (n=34)	Delayed Surgery (n=28)
31-40	2 (5.88%)	1 (3.57%)
41-50	16 (47.05%)	4 (14.28%)
51-60	8(23.52%)	9 (32.14%)
61-70	8 (23.52%)	7 (25%)
71-80	0	7 (25%)

Table 1: Age distribution

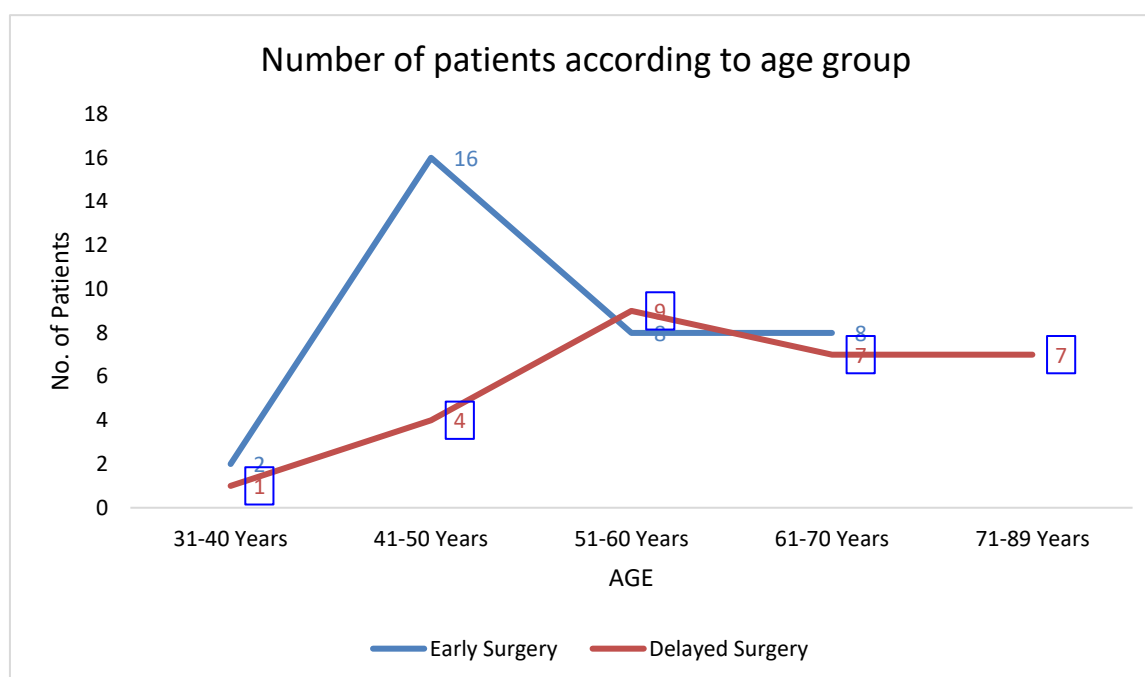


Fig 1: Age distribution

In Early surgery group, average age of patients is 53 years (52.82), with patient with maximum age was 70 years and minimum age was 39 years. In Delayed surgery group, average age of patients is 61 years (61.39), with patient with maximum age was 80 years and minimum age was 40 years. (Table-2)(Fig.2)

Group	Average age	Maximum age	Minimum age
Early (<24 hours)	52.82	70	39

Table 2: Average age, maximum age, minimum age of patients

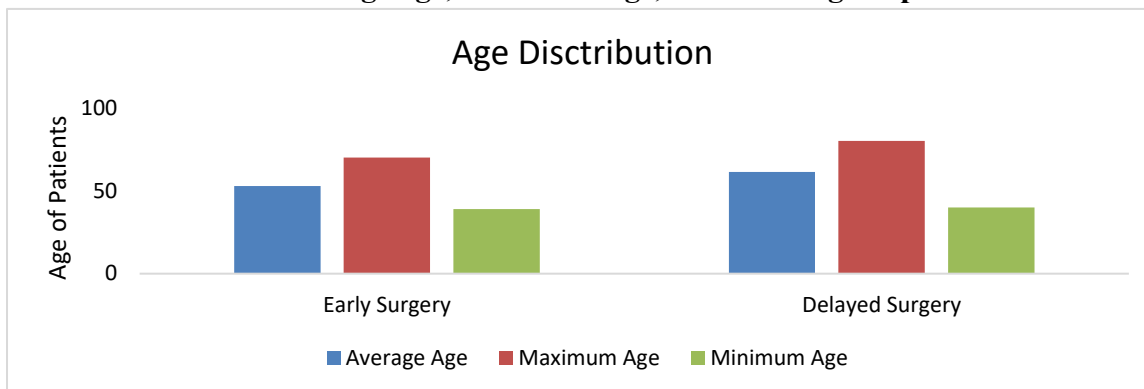


Fig. 2: Average age, maximum age, minimum age of patients

Gender Distribution:

Out of total 62 patients studied 45 (72.58%) were males and 17 (27.42%) were females. Among 34 patients of Early surgery group, 26 (76.47%) were males and 8 (23.53%) were females. Among 28 patients of delayed surgery group, 19 (67.85%) were males and 9 (32.14%) were females. (Table 3, Fig.3) In both groups, males were more than females.

Group	Male	Female	Total
Early	26 (76.47%)	8 (23.53%)	34
Delayed	19 (67.85 %)	9 (32.14 %)	28
Total	45 (72.58%)	17 (27.42%)	

Table 3: Gender Distribution

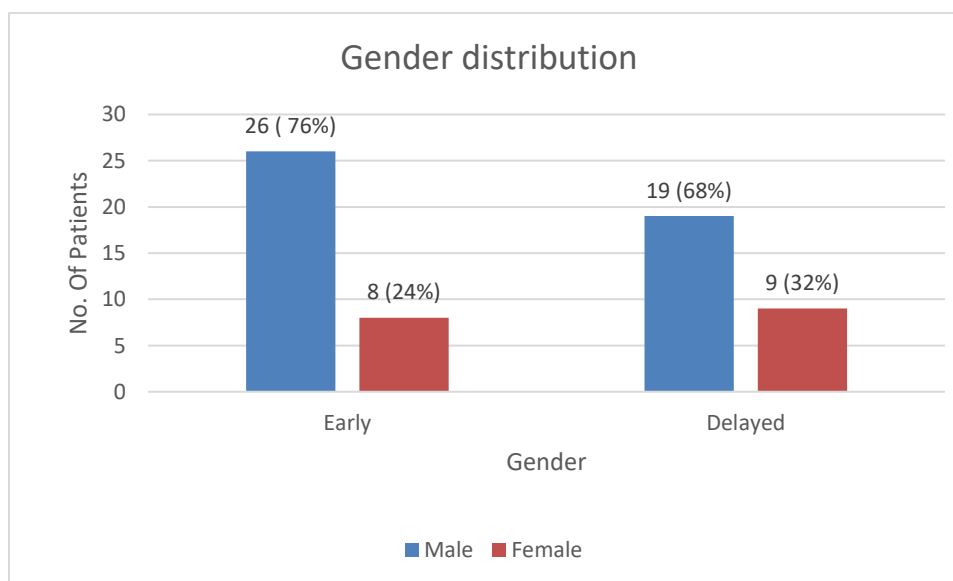


Fig 3: Gender distribution

Average Time of Event to Surgery

In Early surgery group the Average time of event to surgery 16 hours, with minimum of 6 hours to maximum of 24 hours. In Delayed surgery group the Average time of event to surgery 32.46 hours, with minimum of 25 hours to maximum of 48 hours. (Fig. 4)

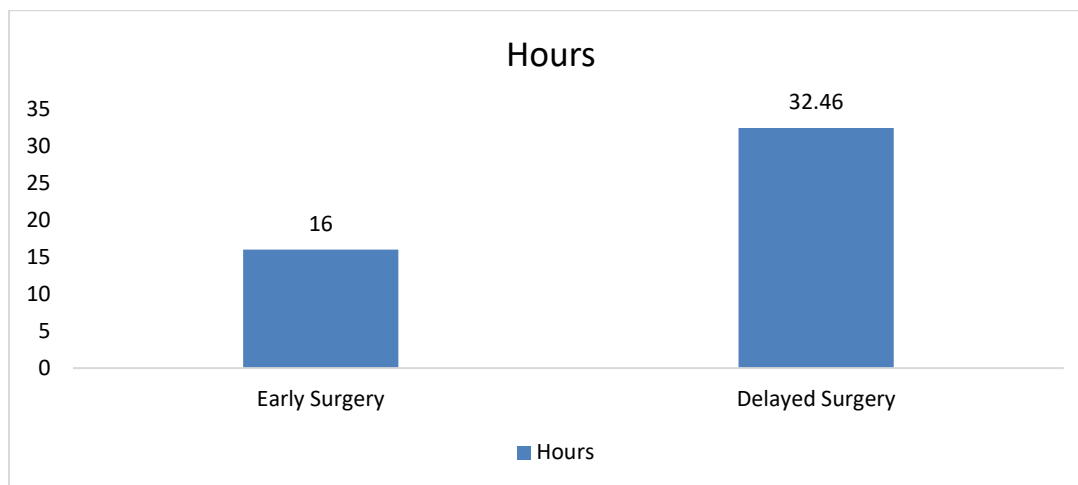


Fig. 4: Average Time of Event to Surgery

GCS (Glasgow Coma Scale) at presentation-

In this study, among 34 patients of early group, maximum 22(64.70%) patients presented with GCS 9-12 at presentation, 8(23.52%) patients presented with GCS < 8 and 4 (11.78%) patients presented with GCS 13-15. In Delayed surgery group, out of 28 patients, maximum number of 13(46.42%) patients presented between GCS of <8, followed by 12 (42.85%) patients presented with GCS between 9-12 and 3 (10.73%) patients were between GCS of 13-15.

	Ealy Surgery	Delayed Surgery
GCS 13-15	4 (11.78%)	3 (10.73%)
GCS 9-12	22 (64.70%)	12 (42.85%)
GCS 1-8	8 (23.52 %)	13 (46.42%)

Table 4: GCS (Glasgow Coma Scale)

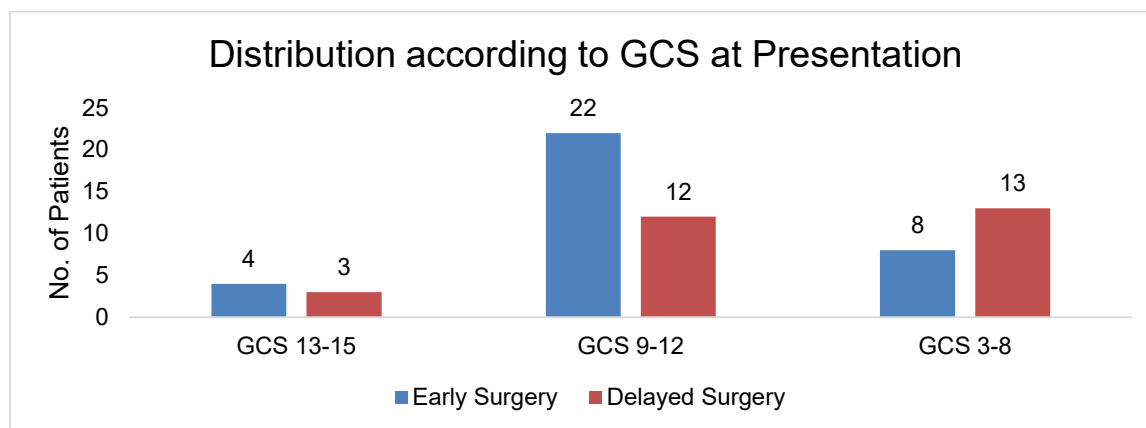


Fig. 5: GCS (Glasgow Coma Scale)

Average GCS at presentation in Early Surgery group was 10.03, with minimum GCS at presentation was 6 and maximum GCS was 13. Average GCS at presentation in Delayed Surgery group was 9.42, minimum GCS at presentation was 7 and maximum GCS was 13.

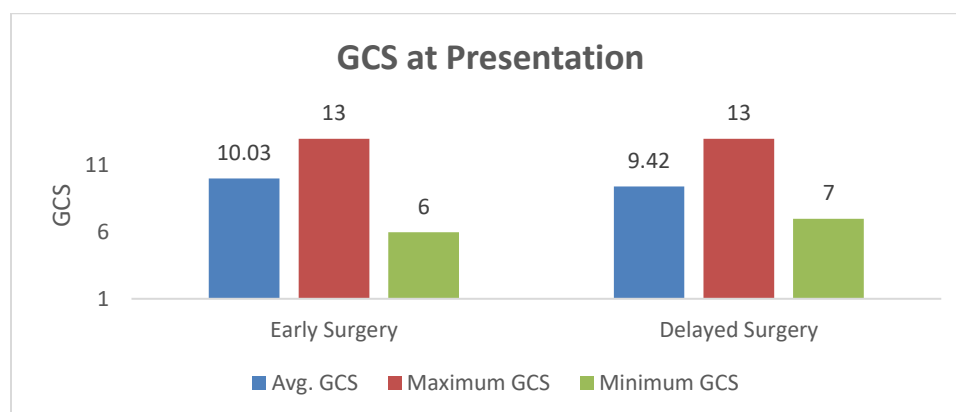


Fig 6: GCS at Presentation

Duration of Hospitalization

The average duration of hospitalization in early surgery was 9 days, with minimum 8 days and maximum 15 days. While in delayed surgery, average duration was 13 days, with minimum 12 days and maximum 18 days of hospitalization

	Early surgery	Delayed surgery
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Minimum duration of hospitalization	8	12
Average duration of hospitalization	9	13
Maximum duration of hospitalization	15	18

Table- 5: Duration of Hospitalization

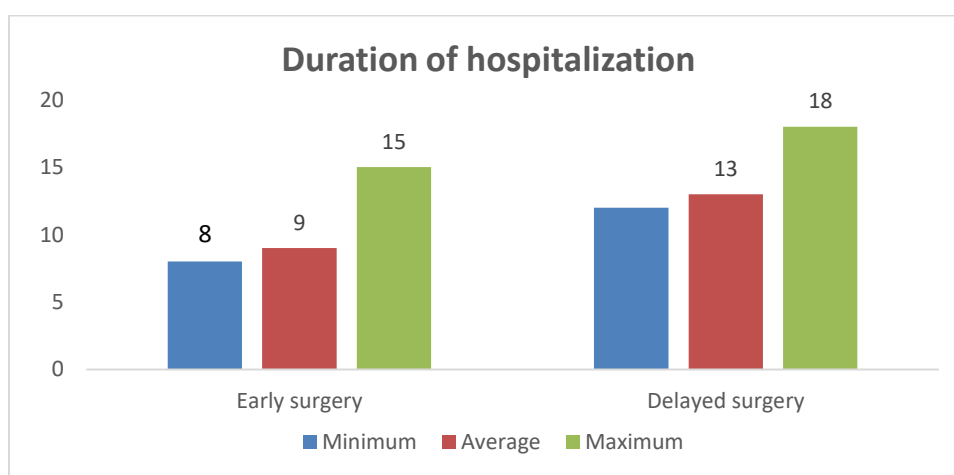


Fig. 7: Duration of hospitalization

Volume of hematoma

The average volume of hematoma in Early Surgery Group was 54.50, with minimum volume of 35 ml and maximum volume of 110 ml and in Delayed Surgery Group average volume was 64.85 ml, with minimum volume 45 ml and maximum volume of 110 ml.

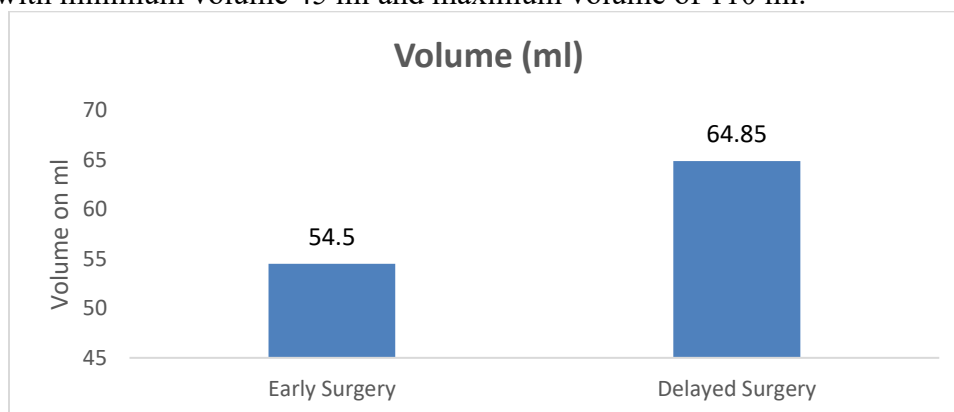


Fig. 8: Volume of hematoma

Location of Hematoma

In early surgery group, the most common location was Putamen 16 (47%), followed by Parietotemporal lobe 7 (20%), parietal lobe 5 (15%), thalamus 4 (12%) and frontal lobe 2 (6%) respectively. In delayed surgery group, the most common location was Putamen 14 (50%), followed by Parietotemporal lobe 6 (21%), parietal lobe 3 (11%), thalamus 3 (11%) and frontal lobe 2 (7%) respectively.

Group	Location of Hematoma				
	Putamen	Lobar			Thalamus
		Parietal	ParietoTemporal	Frontal	
Early Surgery (n=34)	16	5	7	2	4
Delayed Surgery (n=28)	14	3	6	2	3

Table 5: Location of Hematoma

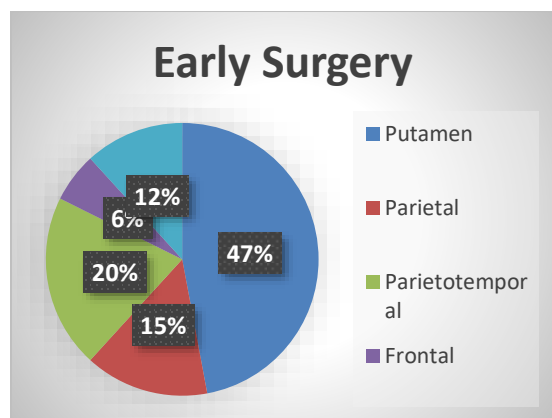


Fig.- 9

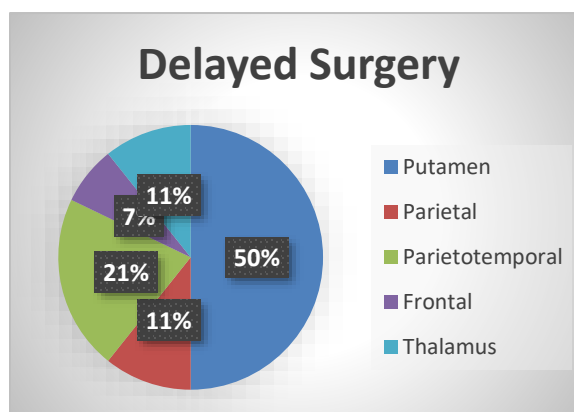


Fig.- 10

Comorbidities

Group	Hypertension	Diabetes+ Hypertension	HTN+CKD
Early Surgery	24	9	1
Delayed Surgery	15	11	2

Table 6: Comorbidities

In both Early and Delayed surgery group most common comorbidity was hypertension. Hypertension was present in 24 patients of early surgery group, hypertension and diabetes was present in 9 patients and hypertension and CKD was present in 1 patient. In Delayed surgery

group, Hypertension was present in 15 patients, hypertension and diabetes was present in 11 patients and hypertension and CKD was present in 2 patients.

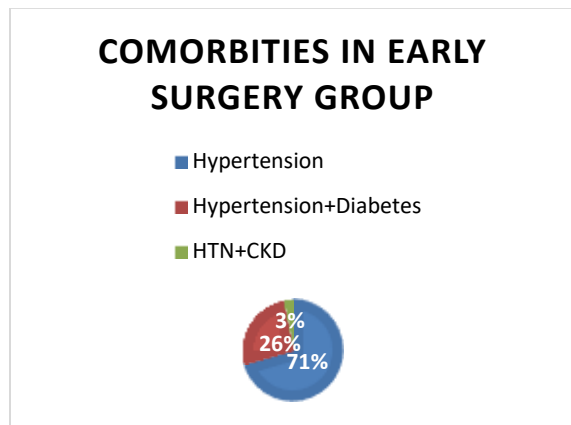


Fig- 11: Comorbidities in Early Surgery Group

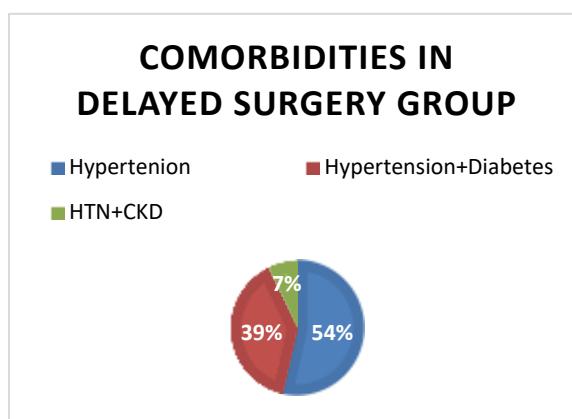


Fig- 12: Comorbidities in Early Surgery Group

Outcome

The outcome was assessed in both groups using Glasgow Outcome Scale at discharge and at the end of 3 months. Among 34 patients of early surgery group, 10 patients had GOS 1 (expired), 10 patients had GOS 3 and 14 patients had GOS 4. Among 28 patients of delayed surgery group, 12 patients had GOS 1 (expired), 3 patients had GOS 3 and 13 patients had GOS 4.

GOS	Early Surgery	Delayed Surgery
1	10	12
2	0	0
3	10	3
4	14	13
5	0	0
Total	34	28

Table 7: Outcome

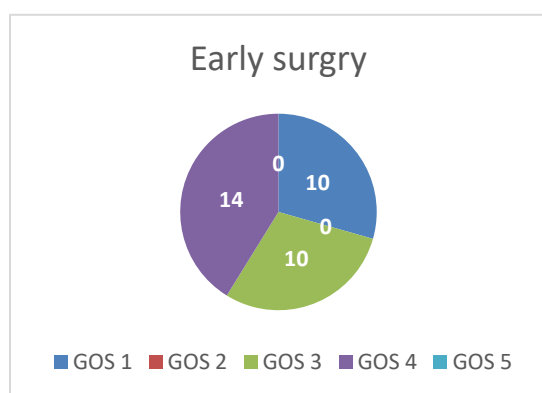


Fig. 13

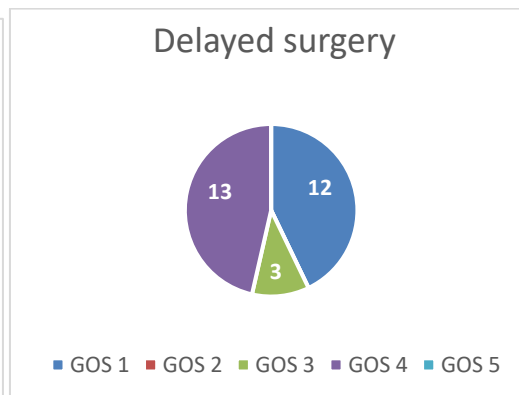


Fig. - 14

In Early surgery group, average GOS at discharge was 3.80 and at 3 months 4.15. In Delayed surgery group, average GOS at discharge was 3.15 and at 3 months 3.81.

Group	GOS	
	At Discharge	At 3 Months
Early Surgery	3.80	4.15
Delayed Surgery	3.15	3.81

Table - 8

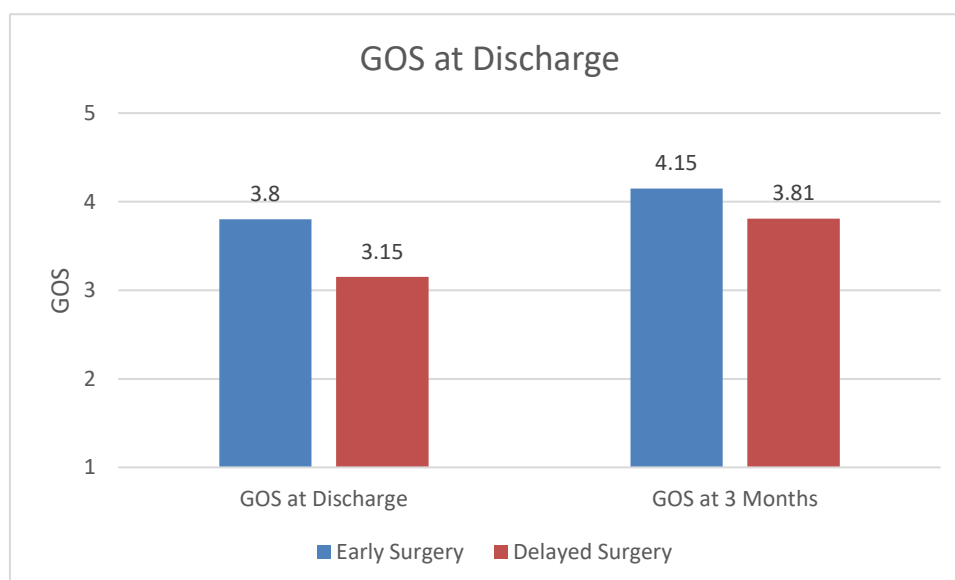


Figure 15

Mortality

In the present study out of total 62 patients were 22 (35.48%) expired. Among 34 patients of Early surgery group, 10 (29.41%) patients expired. Among 28 patients of delayed surgery group, 12 (42.86%) expired.

Group	“n”	Deaths	Percentage
Early Surgery	34	10	29.41%
Delayed Surgery	28	12	42.86%
Total	62	22	35.48%

Table- 9: Mortality

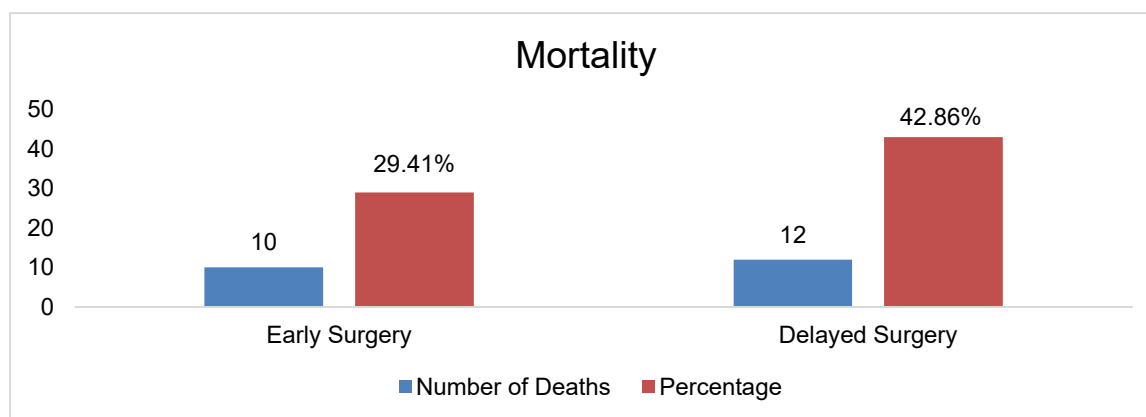


Figure 16: Mortality

DISCUSSION

The study included a total of 62 patients, out of which 34 patients underwent surgical intervention within 24 hours and were included in “**Early Surgery Group**”. While “**Delayed surgery Group**” includes another 28 patients who underwent surgical intervention after 24 hours of onset of symptoms due to reasons like delayed presentation to hospital, delayed referral from peripheral hospitals, relatives not willing for surgical intervention initially or increase in size of hematoma after initial medical management and clinical deterioration in patients of conservative management.

Age

In this study of 62 patients, 34 Patients were in Early surgery group and 28 were in Delayed surgery group. Among early surgery group, age group range was from 39 to 70 years. Maximum

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number of 16 (47.05%) patients were from age group of 41-50 years, followed by 8 (23.52%) patients each were from age group of 51 to 60 years and 61-70 years. Least number of 2(5.88%) patients were from age group 31-40 years.

Among 28 Patients of Delayed surgery group, age group 40 to 80 years, maximum number of 9 (32.14%) patients were from age group of 51-60 years , followed by 7(25%) patients each were from age group of 61 to 70 years and 71-80 years. 4(14.28%) patients were from age group of 41-50 years. Least number of patients 1 (3.57%) were from age group 31-40 years.

The average age was 53 years in the early surgery group and 61 years in delayed surgery group.

Age Group	Early Surgery (n=34)	Delayed Surgery (n=28)
31-40	2 (5.88%)	1 (3.57%)
41-50	16 (47.05%)	4 (14.28%)
51-60	8(23.52%)	9 (32.14%)
61-70	8 (23.52%)	7 (25%)
71-80	0	7 (25%)

Pingping Wang et. al. reported average age of participants in their multi center trial on spontaneous intracerebral hematoma as 58 years. Similarly, Chaoran Ma et. al. in their study found that average age of patients with ICH was 51 years.

Sex

In the present study incidence of spontaneous intracerebral hematoma was significantly higher among males. Out of total 62 patients studied 45 (72.58%) were males and 17 (27.42%) were females. Among 34 patients of Early surgery group, 26 (76.47%) were males and 8 (23.53%) were females. Among 28 patients of delayed surgery group, 19 (67.85%) were males and 9 (32.14%) were females. P-value is 0.002 in early surgery group and 0.0588 in delayed surgery group.

Group	Male	Female	Total	P-Value
Early	26 (76.47%)	8 (23.53%)	34	0.0020
Delayed	19 (67.85 %)	9 (32.14 %)	28	0.0588
Total	45 (72.58%)	17 (27.42%)		

In general, the incidence of ICH is significantly more among males in both early and delayed surgery groups. In one study the ratio of males to females in the 25-44-year-old age group was reported as 2.36:1 which is almost similar to the ratio of 2.65:1 in present study.⁹

Average Time of Event to Surgery

In the early surgery group, the average time from onset of symptoms to surgery was 16 hours while in delayed surgery group 32.46 hours.

T. Steiner et.al. in their study in 2010 noted that the mean time from onset of ictus to surgery was 30 hours.

Dekker SE et.al noted in their 2018 study, reported that mean time from ictus to surgery was 27 hours.

GCS

In this study, among 34 patients of early group, maximum 22(64.70%) patients presented with GCS 9-12 at presentation, 8(23.52%) patients presented with GCS < 8 and 4 (11.78%) patients presented with GCS 13-15. In Delayed surgery group, out of 28 patients, maximum number of 13(46.42%) patients presented between GCS of <8, followed by 12 (42.85%) patients presented with GCS between 9-12 and 3 (10.73%) patients were between GCS of 13-15.

	Ealy Surgery	Delayed Surgery
GCS 13-15	4 (11.78%)	3 (10.73%)
GCS 9-12	22 (64.70%)	12 (42.85%)
GCS 1-8	8 (23.52 %)	13 (46.42%)

Table 4

The average GCS in Early Surgery group was 10.03 and the average GCS in Delayed Surgery group was 9.42 at presentation. Wang CW also reported a similar value of overall GCS score of 9.8 ± 4.3 in their study on ICH.

Duration of Hospitalization

The average duration of hospitalization in early surgery was 9 days, with minimum 8 days and maximum 15 days. While in delayed surgery, average duration was 13 days, with minimum 12 days and maximum 18 days of hospitalization.

Volume of hematoma

The average volume of hematoma in Early Surgery Group was 54.50, with minimum volume of 35 ml and maximum volume of 110 ml. In Delayed Surgery Group average volume was 64.85 ml, with minimum volume 45 mi and maximum volume of 110 ml.¹⁰

The volume of hematoma was calculated on CT scan using ABC/2 formula.

JA Radberg in their study on 220 patients found that average volume of ICH was 35 ml.

Similarly, CW Wang reported that average volume of 50 ml was associated with poor outcome.

Location of Hematoma

The most common location of hematoma in both groups was Putamen followed by parietotemporal lobe, parietal lobe, thalamus and frontal lobe.

In early surgery group, the most common location was Putamen 16 (47%), followed by Parietotemporal lobe 7 (20%), parietal lobe 5 (15%), thalamus 4 (12%) and frontal lobe 2 (6%) respectively.

In delayed surgery group, the most common location was Putamen 14 (50%), followed by Parietotemporal lobe 6 (21%), parietal lobe 3 (11%), thalamus 3 (11%) and frontal lobe 2 (7%) respectively.

Maria I. et. al. reported that the most common location for spontaneous ICH was basal ganglia and internal capsule (35%-70%), brain stem (5%-10%), cerebellum (5%-10%), and lobar in 15%-30% cases.¹¹

BT Andrews in their work also studied risk of herniation in related to location of ICH and concluded that no patient with a frontal or parieto-occipital hematoma developed clinical signs of trans tentorial herniation at admission or subsequently, whereas 41% of those with temporal or Temporoparietal lesions had signs of herniation ($p < 0.05$)

Comorbidities

In early surgery group, 24 patients (71%) had only hypertension, and 9 patient hypertension with diabetes mellitus (26%), and 1 patient (3%) hypertension with chronic kidney disease.

In delayed surgery group, 15 patients (54%) had only hypertension, and 11 patient hypertension with diabetes mellitus (39%), and 2 patient (7%) hypertension with chronic kidney disease.

A. Arboix in their study reported that only 15.3% patients with ICH had diabetes mellitus^[65] which is far less than that found in this study (26% and 39%) which can be best attributed to higher prevalence of diabetes mellitus in India.¹²

Outcome and Mortality

The outcome was assessed in both groups using Glasgow Outcome Scale at discharge and at the end of 3 months. Among 34 patients of early surgery group, 10 patients had GOS 1 (expired), 10 patients had GOS 3 and 14 patients had GOS 4. Among 28 patients of delayed surgery group, 12 patients had GOS 1 (expired), 3 patients had GOS 3 and 13 patients had GOS 4.

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GOS	Early Surgery	Delayed Surgery
1	10	12
2	0	0
3	10	3
4	14	13
5	0	0
Total	34	28

The average GOS achieved by Early surgery group was 4.15 and by Delayed Surgery group at the end of 3 months was by 3.81 which again signifies that early surgical intervention results in better outcome.¹³

Group	GOS		P- Value
	At Discharge	At 3 Months	
Early Surgery	3.80	4.15	0.7055
Delayed Surgery	3.15	3.81	1.0000

Mortality

In the present study out of total 62 patients were 22 (35.48%) died. Among 34 patients of early surgery group, 10 (29.41%) patients died. Among 28 patients of delayed surgery group, 12 (42.86%) died, with P-value of 0.0990 which may not be statistically significant but is suggestive of poor outcome in case of delayed surgery.¹⁴

Group	"n"	Deaths	Percentage of deaths	P- Value
Early Surgery	34	10	29.41%	0.0990
Delayed Surgery	28	12	42.86%	
Total	62	22	35.48%	

Tetri S. in their study on spontaneous intracerebral hematoma also reported an overall mortality rate of 28%. Steiner et. al. reported a mortality rate of 9% to 45% in spontaneous intracerebral hematoma depending upon the presence or absence of various risk factors.¹⁵

CONCLUSION

The average age was 52.82 years in the early surgery group and 61.39 years in delayed surgery group. The incidence of spontaneous intracerebral hematoma was significantly higher among males with a P-value 0.002 in early surgery group and 0.0588 in delayed surgery group. In the early surgery group, the average time from onset of symptoms to surgery was 16 hours while in delayed surgery group 32.46 hours. The average GCS at presentation in Early Surgery group was 10.03 and the average GCS in Delayed Surgery group was 9.42 at presentation. The average duration of hospitalization in early surgery was 9 days while in delayed surgery 13 days. The volume of hematoma was calculated on CT scan using ABC/2 formula. The average volume of hematoma in the Early Surgery Group was 54.50 ml and in Delayed Surgery Group 64.85 ml. The most common location of hematoma in both groups was Putamen followed by parietotemporal lobe, parietal lobe and thalamus. In early surgery group, 24 patients (71%) had only hypertension, and 9 patient hypertension with diabetes mellitus (26%), and 1 patient (3%) hypertension with chronic kidney disease. In delayed surgery group, 15 patients (54%) had only hypertension, and 11 patient hypertension with diabetes mellitus (39%), and 2 patient (7%) hypertension with chronic kidney disease.

The average GOS achieved by early surgery group was 4.15 and by Delayed Surgery group at the end of 3 months was by 3.81 which concludes that early surgical intervention results in better outcome compared to delayed surgery. The mortality rate was 29.41% in Early Surgery group while 42.86% in delayed surgery group with a P-value of 0.0990, which concludes that though it may not be statistically significant but is suggestive of poor outcome in case of delayed surgery compared to early surgery in this study.

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