Spontonous Supratentorial Intracerebral Hemorrhage: Management Outcome

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Abstract

Background: Spontaneous supratentorial intracerebral hemorrhage refers to a type of cerebral bleeding that occurs within the brain's parenchyma above the tentorium commonly due to hypertension, tumor, drugs or vasculopathy. Management includes medical intervention as warfarin antidote administration or surgical intervention with minimally invasive surgical evacuation as a promising approach.

Objectives: To compare between outcomes of conservative and surgical management of SSICH by evaluating post management ICHGE and GOS Scores and mortality in 30 days.

Patients and methods: This study is a hospital-based cohort study conducted at the Neurosurgery Department, Qena University Hospitals including 60 patients who presented to the emergency department with spontaneous intracerebral hemorrhage who were subjected to full history taking, general examination, neurological examination with Glasgow Coma Scale, then were subjected to either surgical or conservative management.

Results: The average age of the included patients is 55.63±22.25 years. 56.67% were male. The most common comorbidities were HTN (38.33%) and DM (30%). The mean ICHGE score was 1.68 ±1.07, leading to a mean 30-day-mortality rate of 30.08%. ICHGE score of 1 with Mortality in 30 days (13%) was the most prevalent score. The average Glasgow Outcome Scale was 2.82±1.4. There was no significant difference regarding ICHGE Score, 30-day-Mortality and GOS between old age or young age groups and also between conservative and interventional groups.

Conclusion: By following indicators and guidelines for determining treatment course of SSIH patients; both conservative and surgical management may show similar outcome, good improvement and low mortality rate.

Keywords: Supratentorial; Intracerebral hemorrhage; Spontaneous; ICHGE.

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Introduction

Spontaneous supratentorial intracerebral hemorrhage (SSICH) is a type of blood clot that occurs in the brain's parenchyma above the tentorium without any trauma or surgery. It accounts for approximately 10 to 15% of all strokes and is known to have a higher mortality rate compared to ischemic stroke or subarachnoid hemorrhage **(Goel et al., 2022).** The most common causes of SSICH include hypertension, amyloid angiopathy **(Sarfo et al., 2020),** coagulopathy, vascular anomalies, tumors, and certain medications. Among these, hypertension remains the most significant modifiable risk factor for SSICH **(Hallenberger et al., 2022).**

The primary diagnostic tool for SSICH is computerized tomography scanning **(Zhang et al., 2023).** SSICH continues to be a major cause of mortality and morbidity worldwide. Several clinical trials have been conducted to explore medical and surgical interventions for ICH. Although new medical therapies have been developed to treat ICH related to warfarin antidote and non-vitamin K antagonist oral anticoagulants, recent trials have not shown significant benefits from surgical intervention on mortality and functional outcomes **(Huang et al., 2021).**

Nevertheless, certain patients with ICH may still benefit from surgical management under specific clinical contexts and timing **(Leary et al., 2021).**

Additionally, ongoing clinical trials for minimally invasive surgical evacuation methods hold promise and may provide positive evidence **(Zhao et al., 2020).**

This study aimed to compare between outcomes conservative and surgical management of SSICH by evaluating post management ICHGE and GOS Scores and mortality in 30 days.

Patients and methods

This study is a hospital-based cohort study conducted at the Neurosurgery Department, Qena University Hospitals, South Valley University, Egypt. This study included 60 patients who presented to the emergency department with spontaneous intracerebral hemorrhage between March 1, 2022, and February 28, 2023. The study focused on patients with spontaneous supratentorial intracerebral hemorrhage not related to trauma or surgery, regardless of age.

Patients with spontaneous supra tentorial intracerebral hemorrhage not related to trauma or surgery at any age groups were included ,while Patients with post traumatic or post-surgical intracerebral hemorrhage and those with spontaneous infra tentorial intracerebral hemorrhage were excluded.

Every patient was subjected to history taking that covered medical history (stroke, diabetes, hypertension, cardiac issues, bleeding tendency, liver disease, and CKD on dialysis) and drug history (anticoagulant drugs). It also involved general examinations such as vital signs, RBG, and O2 saturation, as well as neurological examinations, particularly using the Glasgow Coma Scale (GCS).

We used specific criteria to determine whether surgical or conservative management was appropriate for each patient.

The following are indicator for surgical or conservative management **(El Khateeb et al., 2023):**

- Surgical management was applied for patients with spontaneous supratentorial intracerebral hge and signs of progressive neurological deterioration referable to the lesion, medically refractory intracranial hypertension, signs of mass effect on computed tomographic (CT) scan.
- Patients with Glasgow Coma Scale (GCS) scores ≤ 8 with hematomes greater than 20 cm3 in volume with

midline shift of at least 5 mm and/or cisternal compression on CT scan, and patients with any lesion greater than 50 cm3 in volume were treated operatively.

- Patients with spontaneous supratentorial intracerebral hge who do not show evidence for neurological compromise, have controlled intracranial pressure **(ICP)**, and no significant signs of mass effect on CT scan may be managed nonoperatively with intensive monitoring and serial imaging.

Cases Management **(Bhaskar et al., 2017)**

- Medical management involved the use of medications to manage blood pressure, reduce brain swelling by dehydrating measures, and prevent complications such as seizures and infections. This modality also included the administration of blood products, such as fresh frozen plasma, platelets, and packed red blood cells, to manage anemia and coagulopathy.
- Surgical management of SSICH involved craniotomy (surgical evacuation, decompressive craniectomy)or minimally invasive surgery to remove the hematoma and reduce intracranial pressure (external ventricular drianage). Surgery was typically reserved for patients with large hematomas and significant neurological deficits, as well as those who have a high risk of herniation or brainstem compression.

Outcome Evaluations: Glasgow coma scale, GOS, ICH score.

Glasgow Outcome Scale (GOS) : The Glasgow Outcome Score was applied to patients with brain damage allowing the objective assessment of their recovery in five categories, (**Table.1**).

Table 1. Glasgow Outcome Scale (Mailles et al., 2012)

GOS Score	Clinical Meaning	Outcome
1	Death	Poor
2	Neurovegetative state; patient unresponsive and speechless for weeks or months	Poor
3	Severe disability; patient dependent for daily support	Poor
4	Moderate disability; patients independent in daily life	Poor
5	Good recovery; resumption of normal life with minor neurological and psychological deficits	Favorable

Intracerebral Hemorrhage (ICH) Score

The ICH score **(0–6)** was calculated as described by **(Hemphill et al., 2001)** , (**Table.2**).

- One point was given for age >80 years,
- one point for infratentorial origin,
- one point for ICH volume >30 ml,
- one point for intraventricular extension of ICH,
- one point for a GCS of 5–12,
- And two points for a GCS of 3–4.

Table 2. Intracerebral Hemorrhage (ICH) Score mortality rate (Hemphill et al., 2001)

Component	Score
Scale of Glasgow score	
3-4	2
5-12	1
13-15	0
Age	
> 80 years	1
< 80 years	0
Site	
Infratentorial	1
Supratentorial	0
Volume	
> 30 cm^3	1
< 30 cm^3	0
Ventricular emptying	
Present	1
Absent	0

Points	Mortality rate
0	**0%**
1	**13%**
2	**26%**
3	**72%**
4	**97%**
5	**100%**

Follow up of surgical cases was up to 6 months with immediate post operative evaluation then every two months evaluation.

Follow up of conservative cases was up to 6 months with follow up evaluation after 48 of management then then every two months evaluation.

Ethical code: SVU-MED-NES014-1-22-4-388

Statistical analysis

Data entry and analysis was made by using SPSS software (SPSS 23.0 Version). Mean and SD for quantitative data and proportion and percentage for qualitative data were calculated. Chi square test was applied for establishing association between groups if data is qualitative. For quantitative data, T. Test was applied in case of normal distribution data and MWU test was applied in case of not normally distributed data. P. Values less than 0.05 was considered significant.

Results

The average age of the included patients is 55.63 years with a standard deviation of 22.25. There are 26 females (43.33%) and 34 males (56.67%) in the group. The medical history of the subjects includes a variety of conditions, with the most common being HTN (38.33%) and DM (30%), **(Table .3).**

Table 3. Demographic data of included patients

Parameters	Value (N = 60)
Age (Years)	55.63 ± 22.25
Sex	
Female	26 (43.33%)
Male	34 (56.67%)
Medical history	
No	25 (41.67%)

DM	18 (30%)
HTN	23 (38.33%)
Other medical chronic diseases	13 (21.67%)

The mean ICHGE score was 1.68 with a standard deviation of 1.07, leading to a mean 30-day mortality rate of 30.08% with a standard deviation of 27.84%. ICHGE score of 1 with Mortality in 30 days (13%) was the most prevalent score. The average Glasgow Outcome Scale score in the group is 2.82, with a standard deviation of 1.4, **(Table.4).**

Table 4. ICHGE and GOS scores and Mortality within 30 days of included patients

Case Management	Value (N = 60)
ICHGE score	
Total	1.73 ± 1.06
0: Mortality in 30 days (0%)	8 (13.33%)
1: Mortality in 30 days (13%)	20 (33.33%)
2: Mortality in 30 days (26%)	17 (28.33%)
3: Mortality in 30 days (72%)	13 (21.67%)
4: Mortality in 30 days (97%)	2 (3.33%)
Mortality in 30 days (%)	31.28 ± 28.08
GOS	
Total	2.82 ± 1.4
1	17 (28.33%)
2	4 (6.67%)
3	18 (30%)
4	14 (23.33%)
5	7 (11.67%)

There was no significant difference between old and young groups regarding ICHGE Score and Mortality in 30 days and GOS, **(Table.5).**

Table 5. Comparison between old and young cases regarding ICHGE and GOS scores

Variables	Old Age group (N = 46)	Young age group (N = 14)	P. Value
ICHGE Score			
Total	1.83 ± 1.1	1.43 ± 0.85	0.2202
0: Mortality in 30 days (0%)	5 (10.87%)	2 (14.29%)	0.72736
1: Mortality in 30 days (13%)	15 (32.61%)	5 (35.71%)	0.82912
2: Mortality in 30 days (26%)	11 (23.91%)	6 (42.86%)	0.16841
3: Mortality in 30 days (72%)	13 (28.26%)	1 (7.14%)	0.10188
4: Mortality in 30 days (97%)	2 (4.35%)	0	0.98
Mortality in 30 days (%)	34.46 ± 30.02	20.86 ± 17.47	0.11325
GOS			
Total	2.64 ± 1.34	2.87 ± 1.42	0.598976
1	13 (28.26%)	5 (35.71%)	0.594
2	3 (6.52%)	0	0.998

3	14 (30.43%)	4 (28.57%)	0.894
4	9 (19.57%)	5 (35.71%)	0.211
5	7 (15.22%)	0	0.1837

There was no significant difference between conservative and interventional cases regarding demographic data, **(Table .6).**

Table 6. Comparison between cases underwent conservative or interventional management regarding demographic data

Variables	Conservative (N = 40)	Interventional (N = 20)	P. Value
Age (Years)	56.55 ± 21.77	53.8 ± 23.66	0.65571
Sex			
Female	19 **(47.5%)**	7 **(35%)**	0.357
Male	21 **(52.5%)**	13 **(65%)**	
Medical History			
No	15 **(37.5%)**	10 **(50%)**	0.3545
DM	12 **(30%)**	6 **(30%)**	>0.99
HTN	15 **(37.5%)**	8 **(40%)**	0.85107
Other medical chronic diseases	11 **(27.5%)**	2 **(10%)**	0.74118

Only ICHGE Score 3 with 72% Mortality in 30 days was significantly increased in conservative group. Only GOS 3 was significantly increased in interventional group, **(Table.7).**

Table 7. Comparison between Conservative and Interventional groups regarding ICHGE Score and GOS.

Variables	Conservative (N = 40)	Interventional (N = 20)	P. Value
ICHGE Score	1.53 ± 1.11	2.15 ± 0.81	0.02935
0: Mortality in 30 days (0%)	7 (17.5%)	5 (25%)	0.49356
1: Mortality in 30 days (13%)	15 (37.5%)	7 (35%)	0.84975
2: Mortality in 30 days (26%)	10 (25%)	8 (40%)	0.232
3: Mortality in 30 days (72%)	6 (15%)	0	<0.0001*
4: Mortality in 30 days (97%)	2 (5%)	0	0.548
Mortality in 30 days (%)	26.35 ± 27.92	41.15 ± 26.34	0.05346
GOS	2.8 ± 1.47	2.85 ± 1.27	0.89726
1	13 (32.5%)	5 (25%)	0.5501
2	3 (7.5%)	0	0.5441
3	8 (20%)	10 (50%)	0.01683*
4	11 (27.5%)	3 (15%)	0.28051
5	5 (12.5%)	2 (10%)	0.77613

There was no significant difference between the two groups (young surgical and conservative) and (old surgical and conservative) regarding GOS, **(Table.8).**

Table 8. Comparison between Young cases and old cases managed with surgical and conservative methods regarding GOS

Variables	Young-Surgical (N = 5)	Young-Conservative (N = 9)	P. Value
GOS	2.8 ± 1.1	2.56 ± 1.51	0.75713
• **1**	1 (20%)	4 (44.44%)	0.36039
• **2**	0 (0%)	0 (0%)	-
• **3**	3 (60%)	1 (11.11%)	0.05235
• **4**	1 (20%)	4 (44.44%)	0.36039
• **5**	0 (0%)	0 (0%)	-
	Old Surgical (N = 15)	**Old Conservative (N = 31)**	**P. Value**
GOS	2.87 ± 1.36	2.87 ± 1.48	0.99247
• **1**	4 (26.67%)	9 (29.03%)	0.86734
• **2**	0 (0%)	3 (9.68%)	0.21271
• **3**	7 (46.67%)	7 (22.58%)	0.09605
• **4**	2 (13.33%)	7 (22.58%)	0.45861
• **5**	2 (13.33%)	5 (16.13%)	0.80455

Case presentations

Case **(1), (Fig.1)**:

Female patient, 65 years old, with a history of diabetes and hypertension, and currently on aspirin medication, presented to our emergency department with altered consciousness and left-sided weakness. The initial evaluation of the patient revealed the following:

Glasgow Coma Scale (GCS) score of 14, Bilateral equal reactive pupils, Left hemiparesis, Stable vital signs, Normal laboratory results, No other comorbidities.

CT brain scan showed a large right parietal intracerebral hemorrhage (ICH) measuring approximately 40 cc with midline shift, (**Fig.1A).**

ICH score: 1 (estimated mortality rate within 30 days: about 13%)

The patient underwent surgical evacuation of the hematoma, (**Fig.1B)**. Postoperatively, the patient was transferred to the Intensive Care Unit **(ICU)** for observation, (**Fig.1C)**.. Follow-up CT brain imaging showed successful evacuation of the ICH with restoration of the midline structure, (**Fig.1D).** The patient was discharged after one month with a Glasgow Outcome Scale **(GOS)** score of 4.

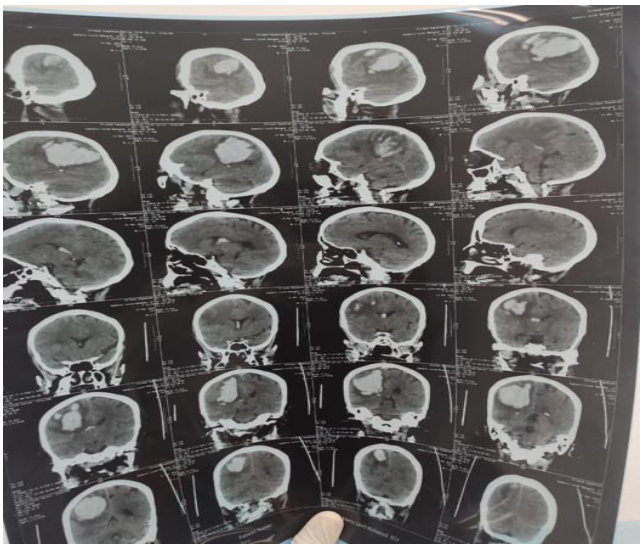

Fig.1A. Pre operative ct head , brain window , coronal and sagittal view showing rt parital intracerebral Hge around 40 cc with midline shift

Fig.1B. Intra operative image of evacuated hematoma

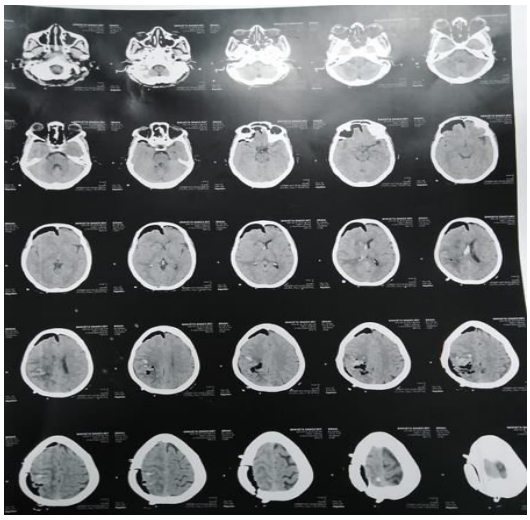

Fig.1C. Immediate post operative ct image, brain window, axial view, showing completely evacuated hematoma

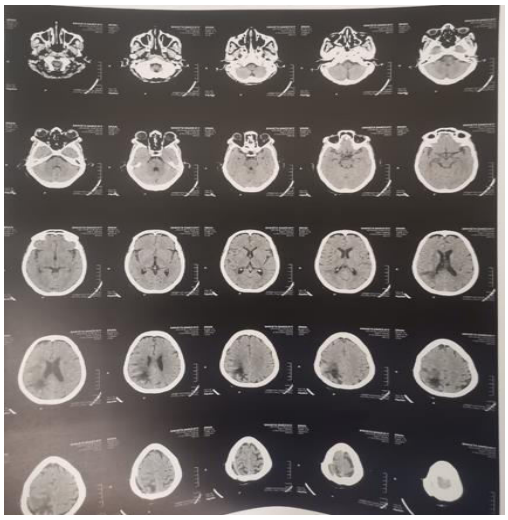

Fig.1D. Follow up ct at time of discharge , brain window, axial view, completely resulted hematoma with restorted midline structure

Case **(2), (Fig.2)**:

Male patient, 65 years old, with no history of medical illness or significant drug use, presented to our emergency department with altered consciousness. The initial evaluation of the patient revealed the following:

GCS score of 9 **(E2V2M5),** Bilateral constricted fixed pupils, Right hemiplegic, Hypertension with a blood pressure of 200/120, Normal laboratory result, No comorbidities

CT brain scan showed a left parietal intracerebral hemorrhage **(ICH)** measuring approximately 25 cc, associated with hydrocephalic changes, **(Fig 2A).**

ICH score: 1 **(estimated mortality rate within 30 days: about 13%)**

The patient underwent surgical evacuation of the hematoma, and an external ventricular

drain **(EVD)** was inserted during the same procedure. Postoperatively, the patient was transferred to the ICU for observation. Follow-up CT brain imaging showed successful evacuation of the intracerebral hematoma and proper functioning of the EVD without hydrocephalic changes. The patient was discharged after 45 days with a GOS score of 3. **(Fig 2B).**

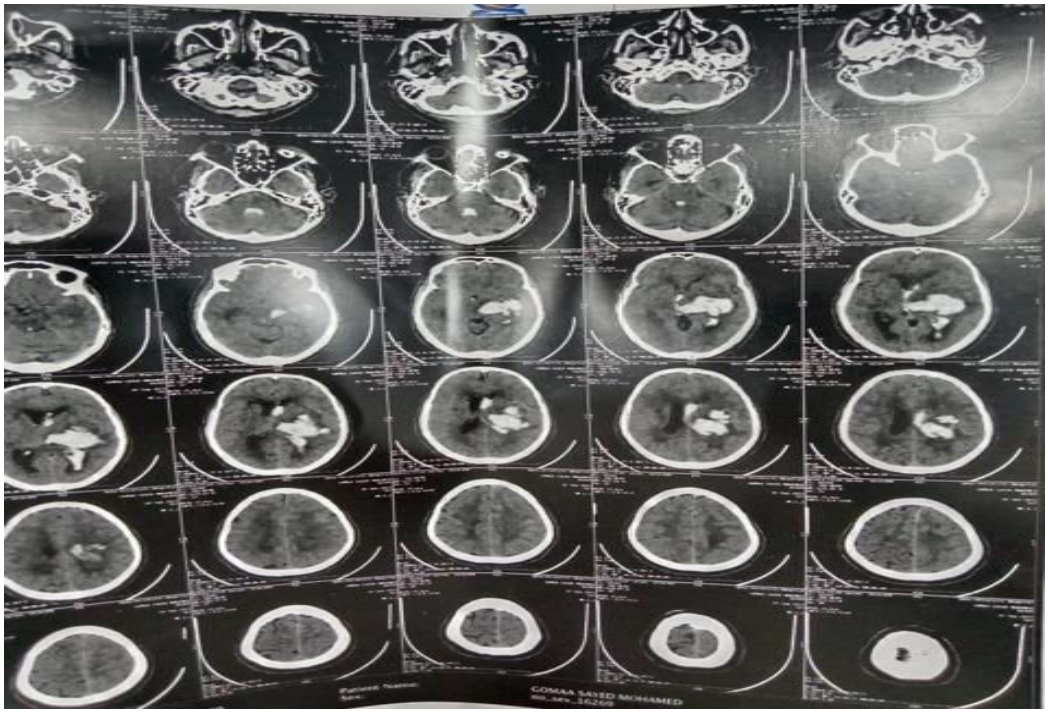

Fig.2.A. Pre operativeCT head, brain window, axial view , showing lt parital IChge around 25 cc with intra ventricualr extension and hydrocephalic changes

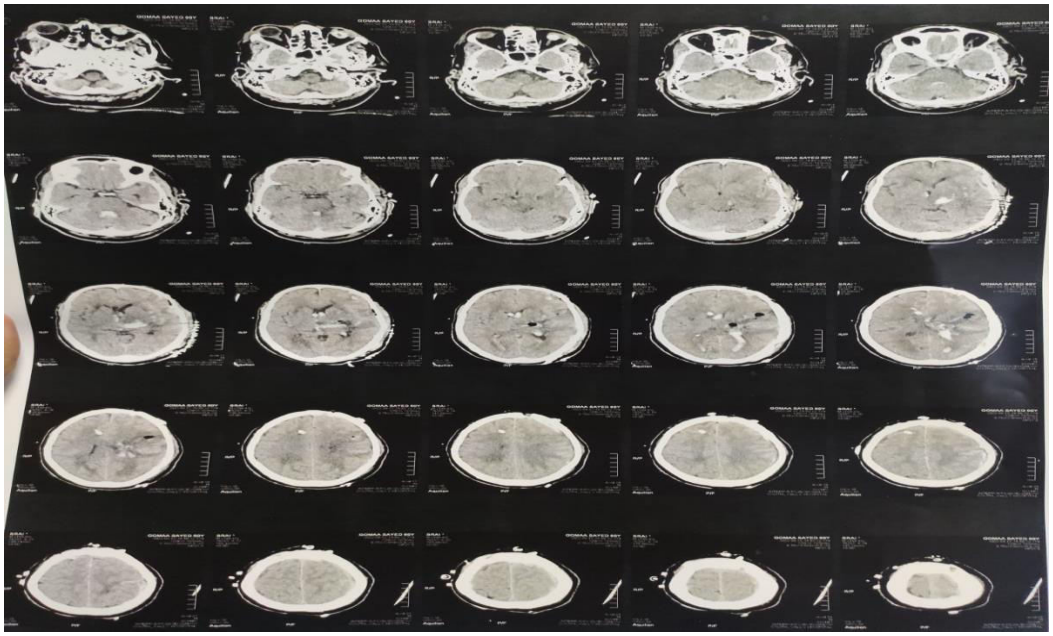

Fig.2.B. Intra operative image of evacuated hematoma

Case (3)

Female patient, 5 years old, with no history of medical illness or significant drug use, presented to our emergency department with altered consciousness,headache and vomiting . The initial evaluation of the patient revealed the following:

GCS score of 12 (E3V4M5),Bilateral sluggish reactve pupils,left hemiparetic ,Normal vitals , Normal laboratory result ,No comorbidities

CT brain scan showed a right paritotemporal intracerebral hemorrhage (ICH) measuring approximately 25 cc.

ICH score: 1 (estimated mortality rate within 30 days: about 13%(

The patient was transferred to the ICU under conservative management and close follo up . Follow-up CT brain imaging showed resolution of the intracerebral hematoma. The patient was discharged after 21 days with a GOS score of 5, (**Figs .7,8).**

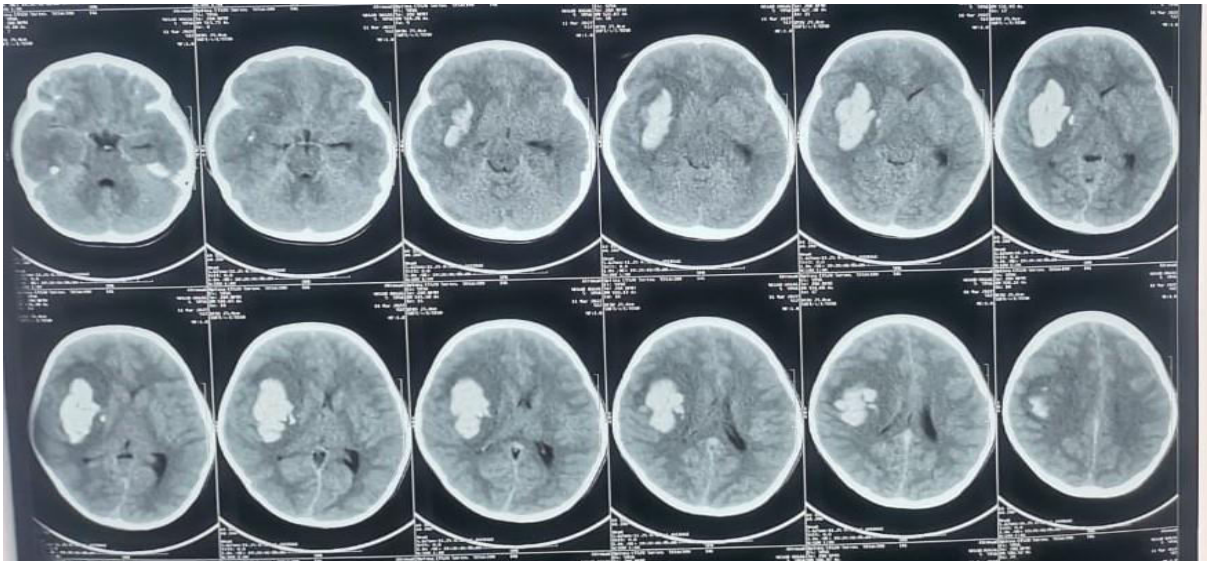

Fig .7. CT head, brain window, axial view , showing rt paritotemporal IChge around 25 cc with mild ventricular compression without midline shift or hydrocephalic changes

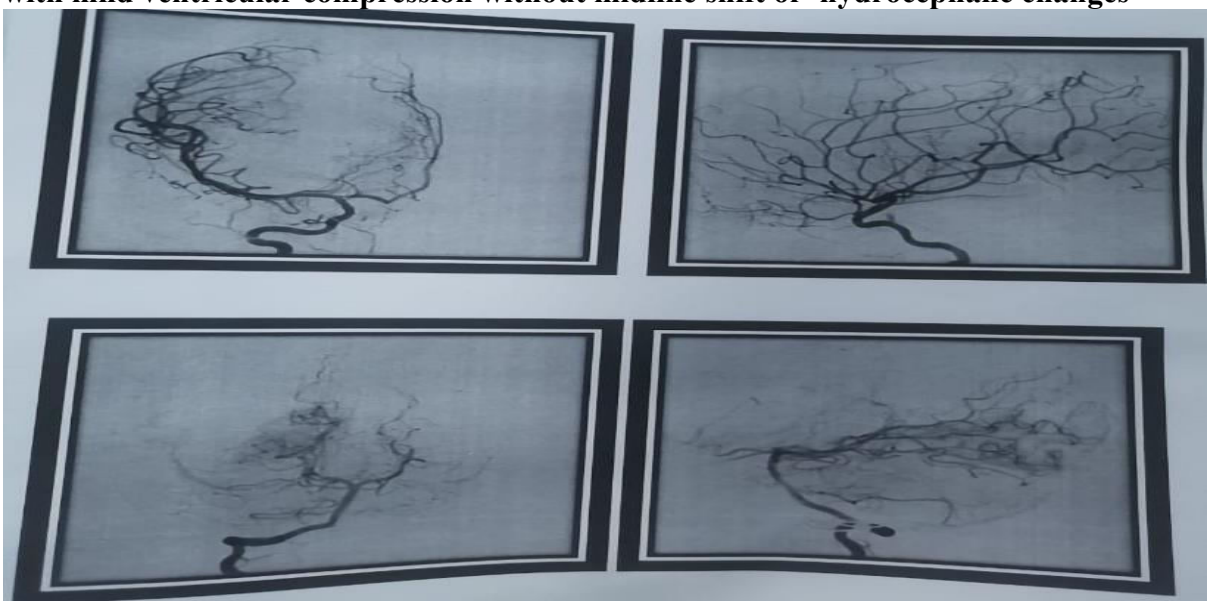

Fig 8. DSA was done for the patient showing no vascular abnormality

Discussion

Spontaneous supratentorial intracerebral hemorrhage (ICH) is a medical emergency demanding prompt evaluation and care. Various approaches are employed to manage this condition) Sheth **et al., 2022).** Medical management includes drug therapy to control blood pressure, alleviate brain swelling, and prevent complications like seizures and infections. Blood products may be administered to address anemia and coagulopathy. Surgical intervention, such as craniotomy or minimally invasive procedures, aims to remove hematomas and alleviate intracranial pressure, primarily for patients with substantial hematomas, neurological deficits, or high herniation risk **(de Oliveira Manoel et al., 2020; Patel et al., 2021).** Both medical and surgical interventions are crucial for enhancing outcomes. Medications to manage blood pressure and brain swelling, alongside surgical procedures for large hematomas, can decrease morbidity and mortality. Timely intervention is linked to better results, including decreased mortality and improved functional recovery. Neuroimaging techniques like computed tomography (CT) and magnetic resonance imaging (MRI) aid in identifying suitable candidates for surgical treatment and aggressive approaches **(Wu et al., 2021; Schrag et al., 2020).** The prognosis of spontaneous supratentorial ICH can vary considerably. Some patients regain significant function, while others face lasting neurological impairments or mortality. Long-term outcomes depend on factors like hematoma size and location, patient age, underlying health conditions, presence of neurological deficits, and treatment timing and type **(Zhang et al., 2023; Sinurat et al., 2022).** Effective management, whether medical or surgical, has the potential to positively influence the course of the condition and improve patient outcomes.

As regard Baseline characteristics, we found an average age of 55.63 years and a slightly higher prevalence in males (56.67%).

Our results were consistent with **Shrestha et al. 2022** which evaluate surgical management among patients with spontaneous supratentorial intracerebral haemorrhage. The mean age of the patient was 54.60±13.45 years with male predominance (69.56%).

Our results were in disagreement with **Kim et al. 2015** which study surgery versus conservative treatment for spontaneous supratentorial intracerebral hemorrhage. Female predominance was observed in patients underwent Surgery.

In this current study, Hypertension (HTN) and diabetes mellitus (DM) were the most common medical history conditions reported. The average systolic and diastolic blood pressures were higher than normal levels as well as the average blood glucose level was also elevated.

Our results were in agreement with Menon et al. 2018 who found that major comorbidities included hypertension in 58.5% and diabetes mellitus in 18.1%.

With conservative therapy, the ICHGE Score suggested that 20% of patients had a fair prognosis, whereas 80% had a bad prognosis in this research. 60% of those treated conservatively had a positive result (GOS 3, 4, 5) and 40% had a negative outcome (GOS 1, 2). In contrast, the outcomes of surgery show that 10% of patients had a fair prognosis, whereas 90% had a dismal prognosis. 75% of patients who had surgery had a favorable result (GOS 3, 4, 5), whereas 25% had a bad outcome (GOS 1, 2). These findings imply that surgical intervention, as compared to conservative care, is linked with a greater chance of a favorable outcome.

The mortality rate at 3 months in **Bhaskar et al. (2017)** research was considerably lower in the surgical group

(61.8%) compared to the conservative group (85.2%) [P = 0.043], which was consistent with our findings.

However, our findings were inconsistent with **Chen et al. (1992),** who found death in 23% of surgical patients and 17% in the medical group. The disparity in findings between our research and Chen et al.'s study is most likely owing to a temporal gap between the two investigations. Chen et al.'s work is quite ancient, but our study is more current. Significant breakthroughs in surgical procedures, imaging technology, and critical care treatment have occurred since then, potentially improving outcomes for patients with SSICH.

In this research, we enrolled 46 patients of an older age group and 14 patients of a younger age group. Surgery was performed on 15 people over the age of 40, whereas conservative care was used on 31 people. In the young age group, however, surgery was performed on five people, while conservative care was used on nine others. Surgery had a better prognosis than conservative care in older age groups and equally in younger age groups, although the difference was negligible.

Our findings were similar with those of **Kim et al. (2015),** who found that surgical treatment of supratentorial ICH in patients was linked with a better prognosis than conservative therapy in both young and elderly patients.

Our findings were inconsistent with **Menon et al. (2018),** who found that surgery dramatically reduces mortality in younger patients compared to older patients.

The Glasgow Outcome Scale (GOS) is a commonly used medical measure for categorizing patients' functional outcomes after a brain injury. The following was the distribution of Glasgow Outcome Scale (GOS) scores in the study: 35% had a bad result (28.33% received a GOS-1 score and 6.67% received a GOS-2 score). On the other hand, 65% of patients had a favorable result (30% had a GOS-3 score, 23.33% had a GOS-4 score, and 11.67% had a GOS-5 score). According to the GOS evaluation, the majority of the patients in the study had a positive result.

Our findings were consistent with those of **Choy et al. (2010),** who investigated the efficacy of surgical evacuation of spontaneous supratentorial ICH. According to the research, only (29%) of the 24 patients had a favorable result (GOS 1-2). The vast majority of patients (71%) had a negative result (GOS 3-5).

In this investigation, there was no significant difference in ICHGE score, GOS, or 30-day death rates between the older and younger patient groups. As a result, age was not a significant factor in predicting the fate of SSICH patients.

Our findings were inconsistent with the findings of **Menon et al. (2018),** who found that surgery substantially reduces mortality in younger patients compared to older patients with a preoperative GCS > 8 and clot sizes between 20- and 40-ml. younger patients have fewer comorbidities, which raises the risk of surgical complications. Comorbidities in older age groups had no effect on outcome or death in our research.

Conclusion

By following indicators and guidelines for determining treatment course of SSIH patients; both conservative and surgical management may show similar outcome, good improvement and low mortality rate.

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