EVALUATION OF FACTORS INFLUENCING THE NEUROSURGEON'S DECISION REGARDINGSURGICAL TREATMENT OF INTRACEREBRAL HAEMORRHAGE

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Abstract:

Background: *Spontaneous intracerebral haemorrhage (ICH) poses challenging decisions in neurosurgical practice. In fact, selection between surgical and conservative treatment is the main dilemma for the clinicians in the management of patients of all intracerebral haematoma. We conducted this study to evaluate characteristics and prognoses in patients with ICH .Another objective of the study were to evaluate the pattern of indications for surgical intervention.*

Patients and methods: *Between January 2008 and July 2009, 125 patients with ICH who fulfilled our surgical criteria were hospitalized, in the Neurosurgery Department of Dhaka Medical College Hospital, and included in this prospective study. Of these 125, 52 patients' relatives agreed to surgery and the remaining 73 declined surgery. Thus, those 73 patients were accepted as a control group, and underwent conservative treatment. All patients were selected mainly according to GCS and the volume of the hematoma on CT scans. We used the GCS to categorize our patients into the following 4 grades: GCS scores of 13 to 15, 9 to 12, 5 to 8, and 3 to 4 .The hematoma volumes were graded as (a) mild (<25cm3),(b) moderate (25–60cm3) or (c) massive (>60 cm3). Eligibility criteria for a surgical procedure consisted of (a) impaired consciousness as assessed according to the GCS score (GCS 9–12), (b) evidences of a neurological deficit, (c) deterioration or non-improvement within 3 days after beginning medical therapy, and (d) haematoma volumes >25 ml. Surgical treatment included open craniotomy, and external ventricular drainage. Preoperative GCS score and ICH volume were the major evaluating factors, and comparison of the 30-day mortality rate and Barthel index were used for outcome evaluation.*

Findings: *Our series consisted of 88 (70.4%) male and 37 (29.6%) female patients (Sex ratio 2.38). Peak of incidence at the sixth decade, very closely followed by the fifth decade of life. Patients with GCS score of 13 to 15, had shown no difference in mortality between Conservative and surgical treatments. But GCS score between 9 to 12 and ICH volume of more than 30 ml, the mortality rate with surgical treatment (17.86%) was lower than that with conservative treatment (42.85%,).GCS score Between 3 to 8 and ICH volume of at least 30 mL; surgical treatment was for life saving. When the GCS score was 5 to 12 and ICH volume less than 30 mL, the Mortality rates were lower for surgical treatment than for conservative treatment.*

Conclusions: *Intracerebral hematoma is a clinical entity that carries high risk of both mortality and morbidity.ICH volume is a more important factor than GCS score in determination of treatment .We advocate surgical treatment for patients with ICH when the ICH volume is30 mL or above at any range of GCS scores, and specifically when GCS score in between 9 and 12. Based on our experience, we also advocate delayed surgery (surgery after 36 hours but within 7 days).Conservative treatment is suggested for patients with ICH when GCS score is 13 and above, when the ICH volume is less than 30 mL at any range of GCS scores.*

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Introduction:

Spontaneous intracerebral haemorrhage (ICH) poses challenging decisions in neurosurgical practice. ICH accounts for 8 to 14% of all strokes in Europe and the United States but between 20 to 35% of strokes in Asia.[1] Albeit representing the minor fraction of total strokes, ICH is a formidable disease, with a morbidity and mortality twofold to six fold higher than that for ischemic stroke.[2] Age, lesion size, intraventricular extension, limb paresis, communication disorder and level of consciousness have all been reported as predictors of unsatisfactory outcome.[3] Multiple clinical risk factors have been associated with a higher

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incidence of ICH and controversy still remains about management (conservative non-surgical versus surgical evacuation) [4].

In fact, selection between surgical and conservative treatment is the main dilemma for the clinicians in the management of patients of all intracerebral haematoma. With regards to the indication for surgical removal of the haematoma, there certainly is wide consensus that alert patients with small haematomas (25 ml or less) but no neurological deficits do not require surgical evacuation, as moribund patients with extensive haemorrhage (85 ml or more) also may not.[5] Vice versa, many neurosurgeons would recognize the role of surgery as a life saving in cases of rapid deterioration from an initially good level of consciousness. Vigorous controversy, however, still remains regarding the question of whether surgical removal of clots improves outcome in primarily noncomatose patients who do have neurological deficits.[2] But fact is that, in addition to the initial destructive effect of the haemorrhage, there is experimental and clinical evidence that ICH produces a 'penumbra' of oedema and ischemic neuronal damage which is potentially recoverable.[5] Removal of haematoma improves perfusion of compromised brain parenchyma prevents intracranial hypertension and may also enhance the clearance of blood breakdown products, thus preventing secondary brain oedema and other potential neurotoxicity.[2]

As a result, there has been great interest in the potential benefits of acute hematoma evacuation. The efficacy of surgical evacuation was most recently studied in the ISTICH. Mendelow et al reported that there were no significant benefits in early surgery vs initial conservative treatment for spontaneous supratentorial intracerebral haematomas in the international STICH study. However, in their study, about 26% of the patients needed a treatment shift from conservative treatment to surgical treatment after an initial period of observation. Rebleeding and clinical neurological deterioration were the major determinants for the treatment shift.[6] Other clinical studies showed that early surgical treatment would be an effective treatment for hemorrhagic stroke in certain situations but the surgical criteria and surgical intervention time need to be more precise and strictly observed under the criteria of the neurological condition (GCS) and the ICH volume changes.[7] Some small, randomized, controlled trials of surgery for supratentorial spontaneous intracerebral hemorrhage have been conducted in Europe and North America [8] but none in our country. We conducted this prospective study to evaluate characteristics and prognoses in patients with ICH .Another objective of the study were to evaluate the pattern of indications for surgical intervention.

Materials and Methods:

Patient collection

Between January 2008 and July 2009, 168 Patients with ICH were admitted or referred to Neurosurgery Department of Dhaka Medical College Hospital. Of the 168, 125 selected patients who fulfilled our surgical criteria were hospitalized and included in this prospective study. Of those 125, 52 patients' relatives agreed to surgery and the remaining 73 declined authorization for surgery. Thus, those 73 patients were accepted as a control group, and underwent conservative treatment. The timing of surgery (as an emergency procedure or due to neurological deterioration) and technique (open surgery and ventriculostomy, mainly) were studied according to the time elapsed since onset of symptoms. All these 52 patients were followed for at least a period of 3 months, and the follow-up results of their treatments were obtained, in some cases, by direct examination, and in others through communication with the patient's family. The patient outcomes were assessed according to the Glasgow Outcome Scale (GOS).

Selection of Patients

The diagnosis of spontaneous intracerebral hemorrhage was made on acute onset of neurologic symptoms and signs in the absence of trauma and confirmed by CT scan. Patients were given additional diagnostic tests such as brain magnetic resonance imaging at the discretion of each medical team. Patients were excluded from the study if diagnostic tests suggested hemorrhage due to ruptured aneurysm, arteriovenous malformation, hemorrhagic transformation of cerebral infarcts, neoplasm, trauma, or any source other than spontaneous intracerebral hemorrhage. Our acute stroke team members subjectively provided different information regarding surgical intervention and conservative treatment to families during admission. Owing to ethical considerations in this very emergent condition, we did not completely randomize our patients for study. Informed consent was obtained from each patient's family for surgical or conservative treatment after the family indicated full understanding of the options provided.

Grading of Neurological Status and CT Findings

All patients were selected mainly according to GCS and the volume of the hematoma on CT scans. The hematoma volumes were calculated according to the dimensions measured in the axial CT scans (height X width X length X 0.5) and graded as (I) mild (<25cm3), (II) moderate (25–60cm3) or (III) massive (>60 cm3)[4, 9, 10]. Side, location of the haematoma and intraventricular extension were carefully recorded. The intracerebral haemorrhage was defined as deep (basal ganglia, thalamus, internal capsule, deep periventricular white matter) or lobar (specific cortex and subcortical white matter). Large haematomas were classified according to the lobe most affected (for deep or lobar division) [4].

Outcome classification

The 30-day mortality and 3-month BI scores (0-100) was collected for evaluation. The outcome is compared to that conservatively managed intracerebral haematomas. For comparison ,we used the GCS to categorize our patients into the following 4 grades: GCS scores of 13 to 15, 9 to 12, 5 to 8, and 3 to 4 [7].

Surgical treatment criteria

Eligibility criteria for a surgical procedure consisted of (a) impaired consciousness as assessed according to the GCS score (GCS 9–13), (b) evidences of a neurological deficit, (c) deterioration or non-improvement within 3 days after beginning medical therapy, and (d)haematoma volumes >25 ml. Exclusion criteria comprised a comatose (GCS d" 8) or alert state (GCS > 14), patients without neurological deficits, patients showing improvement within 3 days after initiation of medical management, and patients harboring haematomas <25 ml.Under the hypothesis that early surgery would give a better outcome, the operative procedure was performed as soon as possible. However, delayed transportation from the local hospitals or the availability of neurosurgeon and an operating suite in our institution resulted in the variable time interval from the symptom onset to the operation. Aim of the surgery was complete haematoma evacuation. No fibrinolytic therapy has been performed.

Conservative Treatments

All patients received conservative treatment according to current practices. Treatment was not rigidly regimented, and the primary attending neurosurgeon was allowed to use his best medical judgment. Therapy included blood pressure control, intravenous fluids, hyperosmolar agents, H_2 blockers, maintenance of normoglycemia, early nutritional support, and physical therapy. We classified patients as hypertensive if systolic and/or diastolic blood pressure levels were raised above or were equal to 160mm Hg and 95mm Hg, respectively, during their hospital stay and follow up, and those with a well-known history of systemic hypertension with adequate treatment or not [4].We used medication for blood pressure control. The mean arterial pressure was maintained in a range of 90 to 120 mm Hg with antihypertensive medication (labetalol, perindopril, indepamide, ramipril etc). We also used a hypertonic agent (mannitol) when the CT scan indicated mass effect, when or clinical symptoms showed signs of raised ICP.

Surgical Treatment

The choice of operation depends on the neurosurgeon's preference. Surgical techniques included open craniotomy, and external ventricular drainage. The intention of surgical treatment was to control elevated intracranial pressure. An EVD tube was set into the lateral ventricle for drainage, if it was associated with IVH.

Results:

From 2007 to July 2009, 125 patients with ICH were treated in our department, including 52 patients who received surgical treatment and 73 patients who received conservative treatment. Our series consisted of 88 (70.4%) male and 37 (29.6%) female patients (Sex ratio 2.38).The age distribution showed the highest peak of incidence at the sixth decade followed by the fifth decade of life with a mean age of 61.2 years (Fig.-1).In the surgically treated group, 33 (63.4%) were male and 19 (36.5%) female, with an overall age span from 46 to 75, giving a mean age of 60.7. In the conservative treatment group, on the other hand, 55 (75.4%) were male and 18 (24.6%) female, their age ranging from 55 to 72 with a mean age of 62.1. The follow-up ranged from 3 months to 1 year.

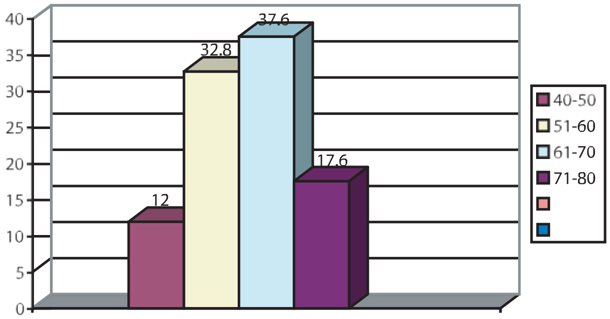

Fig.-1: *Age Distribution of population (n =125)*

Table-I

The patients' demographics are presented

The patients	Conservative treatment (n=73)	Surgical treatment (n=52)
Mean age (y)	60.7 ± 12.8	62.1 ± 13.0
Sex (M/F)	55/18	55/18
Right/Left	31/42	24/28
Lobar/Deep	44 /29	34/18
IVH	23	14

Regarding the previous medical history (Figure 2), 11(8.8%) Patients had suffered from previous ICH and 18 (14.4%) from cerebral infarction or transient ischemic attack. Eighty two patients (65.6%) were classified as hypertensive: 49 (59.8.4%) were on antihypertensive drug treatment, 16 (19.5%) known hypertensive patients were on irregular medication and 17 (20.7%) were not known to have elevated level of arterial blood pressure until catastrophe. Thirteen (10%) patients had atrial fibrillation and three (2.4%) had ischemic myocardiopathy. Sixty eight (54.4%) patients were diabetics and among them nineteen (28%) patient were treated with diet, thirty five (51.4%) treated with oral hypoglycemic therapy and ten (14.7%) patient were treated with insulin therapy; four patient (5.9%) received no treatment whatsoever (Table-II).

Table-II

Previous medical history

Diseases	Number of population	Percentages
Previous H/0 ICH	11	8.8
Cerebral infarction or transient ischemic attack.	18	14.4
Hypertension	82	59.4
Diabetics	68	54.4
Atrial fibrillation	13	10
Ischemic myocardiopathy	3	2.4

The level of consciousness on admission determined by the GCS was as follows: 44 (35.2%) patients with a GCS below 9, 40 (32%) between 9 and 12, and 41 (32.8%) above 12 (Table-III).

Table-III

The level of consciousness on admission determined by the GCS

GCS	Conservative treatment	Surgical treatment
15-13 (n)	31	10
12-9 (n)	11	29
8-5 (n)	13	8
4-3 (n)	18	5

Forty seven (37.6%) haematomas were deep ((basal ganglia, thalamus, internal capsule, deep periventricular white matter) and seventy eight (62.4%) were lobar (specific cortex and subcortical white matter), the parietal, being the most frequently involved lobe 32(42.1%) followed by temporal lobe 18 (23.7%).

Seventy (56%) haematomas were left and fifty five (44%) right sided. When GCS was considered, we found that among the 40 (32%) cases with a GCS between 9 and 12, in 26 (65.0%) the haematoma was located in the dominant hemisphere, and in 14 (35%) in the non-dominant hemisphere. On the contrary, when the GCS was above 12, the distribution was: 11 (26.8%) left and 30 (73.2%), right.

Thirty-seven (29.6%) haematomas spread into the ventricular space, without secondary hydrocephalus in 26 (70.3%) patients, with moderate ventricular dilatation in 7 (18.9 %) and with severe hydrocephalus in 14 (3.2%).

We analyzed the time elapsed from onset of symptoms and signs to arrival at our hospital: 6 (4.8%) patients arrived within 6 hours from the onset, 46 (36.8%) between 6 and 24 hours and 53 (42.4%) after 24 hours. In 20 (16%) patients, onset time was unknown. Among the 52 (41.6%) patients who underwent surgery, 19 (36.5%) were operated on urgently (Within 24 hours), and in 33 (63.5%) cases surgery was delayed for the next hours or days after admission and initial evaluation. Time elapsed from onset of symptoms to arrival at the hospital was not different in patients who underwent immediate surgery (arrived within 24 hours) as compared with patients who underwent delayed surgical treatment (after 24 hours).

When we consider the haematoma volume and its relation to treatment provided, we found that in the conservatively treated group, 31 (42.6%) haematomas had a volume below 30 ml, 12 (16.4%) between 30 and 60 ml and 30 (41%) above 60 ml. In the surgical group, 8 (15.4%), 32(61.5%) and 12 (23.1%) patients had haematomas with a volume <30 ml, between 30 and 60 ml and above 60 ml, respectively.

Table-IV

ICH volume for comparison

ICH volume	Conservative treatment	Surgical treatment
< 30 mL (n)	31	8
> 30 mL (n)	12	32
> 60 mL (n)	30	12

Table-V

The 30-day mortality rate of conservative or surgical treatment under different GCS scores and ICH volumes

	Mortality rate (%)	Conservative treatment (n=73)
Surgical treatment (n = 52)		
GCS score of 15-13		
ICH d" 30 mL	15(1) 6.67	2(0)0
ICH e"30 mL	16 (5) 31.25	8(1)6.5
GCS score of 12-9		
ICH d" 30 mL	4(0) 0	1(0) 0
ICH eŠ30 mL	7(3) 42.85	28(5)17.86
GCS score of 8-5		
ICH dŠ 30 mL	6(4) 66.67	3(1) 33.3
ICH eŠ30 mL	7 (7) 100	5(2) 40.0
GCS score of 4-3		
ICH dŠ 30 mL	6 (5) 83.4	2(1) 50.0
ICH eŠ30 mL 12 (12) 100.0 3(2) 66.67.0		

Clinical results by combination of GCS grading and ICH volume are shown in Table 5. In cases of GCS score of 13 to 15, there was no difference in mortality rate between conservative and surgical treatments. In patients with a GCS score of 9 to 12 and an ICH volume of at least 30 mL, surgical treatment had a lower mortality rate (12.5%) than conservative treatment (31.28%). In patients with a GCS score of 3 to 8 and an ICH volume of at least 30 mL, surgical treatment also had a lower mortality rate than conservative treatment.

The ICH volume influenced the functional outcome. As the ICH volume increased, the BI score of both treatments decreased. When the ICH volume was less than 30 mL, the conservative treatment posted a better BI score than surgical treatment did.

Discussion

4.1. There appears to be no general agreement on the management of intracerebral haematomas. It is asserted that perifocal elevation of intracranial pressure, persistent reduction of blood flow, and biochemical factors from the intraparenchymal blood clot can cause secondary brain damage outside the primarily affected tissue around the hematoma, and that early surgical evacuation might be of benefit.[11]

Our aim of this study was to assess the efficacy of surgical treatment relative to medical treatment of spontaneous intracerebral hemorrhage and evaluation of our decision making criteria. Interestingly, over the period of our study the number of patients admitted to Neurosurgery that did not undergo Haematoma evacuation remained relatively large: 73 in 125 patients (58.4 % of ICH admissions in Neurosurgery Department.).In this interventional study, the patients who underwent surgery, including craniotomy and ventricular drainage, appeared to have better outcomes. Surgery is usually avoided for severely disturbed patients in deep coma.[8] But we have seen that surgical outcome is better than medical treatment even in this apparently hopeless victims. We believe that these positive results in surgical patients are due, on the one hand, to the dramatic reduction in clot volume, thus discontinuing an ongoing pathophysiological cascade leading to secondary damage of brain tissue [2]. We are convinced, however, that the essential issue for determining who will truly benefit from neurosurgical evacuation of a haematoma and who will not is appropriate patient selection and optimal timing of surgery. In this study, rigorous selection criteria for a surgical procedure were applied.

Stroke in Bangladesh

In our series, age distribution showed the highest peak at the sixth decade of life with a mean age of 61.2 years. Men (70.4%) have a higher incidence of spontaneous ICH than women especially among those more than 55 years old with sex ratio 2.38. Like many other studies [2, 4, 7] we have found that the most important nonepidemiologic risk factor for spontaneous ICH is hypertension. The level of education may also be risk factor. We found that lower the level of education, the higher the incidence of an ICH. This was attributed to a lower awareness of the value of primary health care in lesser educated people. As for other risk factors, only diabetics (54.4%) had significant devastating effect. The location of the ICH at the lobar and deep accounted for (62.4%) and (37.6%) of patients with ICH respectively. In this cooperative study, the 30-day mortality rate was 23.1 % with surgical treatment and 49.3% with control group (surgically indicated but received conservative treatment).

Location of haematoma is related to surgical outcome

There is a strong correlation with the location and site of the hematoma with the clinical deficits, comorbidity and the overall outcome. In a multivariate analysis, sensory deficit was significantly associated with ICH in the thalamus; lacunar syndrome and hypertension with ICH in the internal capsule–basal ganglia; seizures, nonsudden stroke onset, and hypertension with lobar ICH; ataxia and sensory deficit with cerebellar ICH; cranial nerve palsy with brainstem ICH; and limb weakness, diabetes, and altered consciousness with multiple topographic involvement. Although the overall in-hospital mortality rate was 31%, it varied among sites: 65% for multiple topographic involvement, 44% for intraventricular ICH, and 40% for brainstem ICH to 16% for ICH in the internal capsule–basal ganglia.[5, 12] The risk of a fatal outcome was reduced by 73.2% in patients with lobar haematoma as compared to those with ganglionic haematoma [13]. In our series, the lobar haematoma (specific cortex and subcortical white matter) has better outcome than those of deep haematoma (basal ganglia, thalamus, internal capsule, deep periventricular white matter).

Although size or volume may influence surgery-related decisions, the actual surgical accessibility of the clot is deemed more important. Lobar hematomas and those located nearer to the cortical surface are much more likely to be surgically treated than those located deeper in the thalamus and putamen. Overall, it seems that neurosurgeons remain optimistic about the benefits of surgery, but most are more strongly influenced by the lesion's surgical accessibility than by other patient- or hemorrhage-related features.[5]

Determination of Surgical indications more dependent on ICH volume than GCS score

The volume of ICH is a crucial point for determining decision making criteria for surgical intervention. Broderick et al [14] reported that the volume of ICH was the strongest predictor of 30-day mortality for all locations of ICH. Patients with a hematoma volume of 60 mL or more and a GCS score of 7 or less had a predicted 91% mortality rate within 30 days in the series of Broderick et al. There is no significant difference in outcome for conservatively and surgically managed patients in our study with an ICH volume of less than 30 mL regardless of GCS level. It is in agreement with the series of Cho DY et al.[7]In a prospective study of a series of 356 patients with ICH, Bilbao G et al.[4] observed that surgical rates when volume was moderate (between 30 and 60 ml) or large (above 60 ml), were 33% and 34% respectively and only 14% of patients with a volume below 30ml where operated on . Thus, it appears that the volumes of haematomas greater than 30 ml is linked to a poorer prognosis and are preferentially considered for surgical treatment.

In this present prospective study on patients with a GCS score of 13 to 15, regardless of ICH volume, surgical treatment for deep haematoma ((basal ganglia, thalamus, internal capsule, deep periventricular white matter)) was not significantly beneficial. At GCS score of less than 12 and ICH volume of at least 30 mL, surgical treatment is definitely better than conservative treatment. It is in agreement with the series of Cho DY et al.[7],Kanaya and Kuroda [14]. The Kanaya and Kuroda study[14] concluded that the result of surgical treatment (craniotomy) was less satisfactory than conservative treatment in patients with neurologic grade I or II (GCS score, 12-15) except when accompanied by a large hematoma (CT grades III and IV). Surgical treatment is the preferred treatment for patients with a neurologic grade of III or IV (GCS score, 9-12) except when dealing with a small hematoma (CT grades I and II).Surgical treatment in neurologic grade IV (GCS score, b8) will preserve life but will not necessarily provide a satisfactory functional outcome.[7]

Optimal time for surgical evacuation of haematoma. Timing of surgery still remains a matter of discussion. Some recommend early surgery [11, 15, 16], while others, over 70% of neurosurgeons felt that delayed surgery (i.e. that carried out after 48 h post ictus) would be helpful [5, 17, 18]. In our study surgery after 36 hours had better outcome than surgery within 36 hours which shows variation with the above mentioned international study. Until a more definite answer emerges, the practical approach is that of initial close clinical observation and use of clinical judgments.

Treatment shift from conservative to surgical intervention

In determining the surgical criteria, though the ICH volume, GCS score and location of hemorrhage are most crucial deciding factors we should alert regarding clinical shift of patient. ICH volume is closely related to the GCS score. A more than 3 points decreases of GCS score usually reflect the expansion of the ICH volume and an increase in the surrounding edema [7, 19].A CT scan should do immediately for evaluation the patent. Usually Rebleeding or mass effect causing focal ischemia may be culprit and if it is positive shifting treatment from conservative to surgery should considered.

Recent advances

Great variability exists in the management of intracerebral hemorrhage around the world.[8, 20, 21] In agreement with our findings, some randomized controlled trials have recently shown that surgery tends to reduce the chances of death and dependency in patients with supratentorial intracerebral hemorrhage[7, 8,22,23,24] especially in superficial lobar hematoma; it is likely to be beneficial [7]. In this interventional study, the patients who underwent surgery, including craniotomy, and ventricular drainage, appeared to have better outcomes. We find that surgical intervention still has its role for deep-seated hematoma.

Conclusion

Intracerebral hematoma is a clinical entity that carries high risk of both mortality and morbidity. ICH volume is a more important factor than GCS score in determination of treatment. We advocate surgical treatment for patients with ICH when the ICH volume is 30 mL or above at any range of GCS scores, and specifically when GCS score in between 9 and 12.Based on our experience, we also advocate delayed surgery (surgery after 36 hours but within 7 days). Conservative treatment is suggested for patients with ICH when GCS score is 13 and above, when the ICH volume is less than 30 mL at any range of GCS scores.

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