



## **Utilization of ICH Score on Patient Outcome in Intracerebral Hemorrhage**

**Waseem Muhammed Ilyas<sup>1\*</sup> and Gajanan Chavan<sup>1</sup>**

<sup>1</sup>*Department of Emergency Medicine, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Deemed to be University, India.*

### **Authors' contributions**

*This work was carried out in collaboration between both authors. 'All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Background:** There is a very high morbidity and mortality rate in patients who have intra cerebral hemorrhage. The ICH Score is a very good predictor of outcome of 30-day mortality as found in multiple studies. The ICH Scores range from 0 to 5 and higher Score is associated with increased mortality after 30 days and thus it was found to be a good predictor of outcome. So it was decided to apply it in the assessing of patients with intra cerebral hemorrhage and to study it's outcome.

**Aim:** To study the ICH score utility in management of patients with intracerebral bleed

**Objectives:** To improve the quality indicators of Emergency Department, to cater the right management at right time in patients with intracerebral bleed and Inclusion of ICH score in the assessment sheet for screening.

**Materials and Methods:** In the study, the patients brought to Emergency Department who are diagnosed to have ICH on CT Brain will be evaluated for GCS, Age, Infratentorial origin, volume of the ICH, absence or presence of Intraventricular Hemorrhage to determine ICH score and outcome of the patients.

**Expected Results:** Patients having lower ICH score are expected to have poorer prognosis. Inclusion of ICH score in assessment of patients with ich is expected to provide better treatment for these patients.

\*Corresponding author: E-mail: [dr.waseem.ilyas@gmail.com](mailto:dr.waseem.ilyas@gmail.com);

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## 1. INTRODUCTION

Intra cerebral hemorrhage is a major cause of mortality and morbidity in the world. So early diagnosis and early initiation of treatment is crucial in providing a good outcome for the patient [1]. Missing the diagnosis can be fatal to the patient. Among those patients who take anti coagulants the treatment outcome is still poorer. Anticoagulation therapy with warfarin was found to increase the risk of intra cerebral hemorrhage [2].

Intracerebral hemorrhage is the second most common cause of stroke [3] and there is an approximate increase of 2 to 6 times the risk of spontaneous intracerebral hemorrhage in patients with hypertension [4]. Intra cerebral hemorrhage affects 2.5 per 10,000 people a year and 44% die within one month. 20% of patients with intra cerebral hemorrhage have a good outcome [4].

Intra cerebral hemorrhage is more seen in patients with chronic hypertension, arterio venous malformation, anticoagulant therapy, arterial aneurysms, patients on drugs which are sympathomimetic like cocaine phenylpropanolamine, intra cranial tumors, and amyloid angiopathy in elderly patients. Menopause, Smoking, Diabetes mellitus excessive consumption of alcohol are also risk factors for intracerebral bleed [5]. Other risk factors for ICH include an excess of alcohol consumption and severe migraine [3]. Insidious headache, nausea, vomiting, blurring of vision are clinical signs of increased intra cranial tension which precede the neurological deficits seen in patients with intra cerebral hemorrhage [5].

The neuroanatomical sites associated with intra cerebral hemorrhage are putamen, thalamus, pons, cerebellum in patients with intra cerebral hemorrhage caused due to hypertension. Patients with cerebellar bleed are more at risk of rapid deterioration and have poorer prognosis. To generalize infra tentorial hemorrhages have poorer prognosis than supra tentorial hemorrhages comparatively. So infra tentorial hemorrhages need more aggressive treatment than other intra cranial hemorrhages. It is also seen that there is poorer prognosis in elderly patients who are above the age of 80 [5].

Intra cerebral hemorrhage and other types of intra cranial hemorrhage are best diagnosed by CT brain scan. A lot of doctors frequently follow it up with a CT angiography or Magnetic resonance angiography later to search for any aneurysm or other arteriovenous malformations. Ct brain very accurately shows the extent of the bleed and the volume is also routinely calculated in intra cerebral bleed. The intra cerebral bleed volume of above 30ml is associated with poorer prognosis. The bleed appears white on CT brain scan [5].

Intracerebral bleed can be easily identified in CT brain Scans as it appears denser than rest of the surrounding brain parenchyma [6].

The type of ICH decides the treatment. For major bleed causing mass effect it becomes necessary for surgical evacuation of the bleed whereas for minor bleeds medical management with vigorous monitoring is done. . Tracheal intubation will be required in patients with decreased GCS score or if there is any threat to airway patency [7]. It has been found in various studies that decreasing the blood pressure can improve prognosis. It is recommended by the American Heart Association and American Stroke Association guidelines in 2015 to decrease the systolic blood pressure to 140 mmHg [8].

It has been found in studies that within 4 hours of factors via is given out will limit the bleeding and the formation of intra cerebral hematoma, but at the same time it also increases the risk of thromboembolism [7]. So giving factor VIIa does not give a better overall outcome in patients without hemophilia [9]. In patients with coagulative disorders, Frozen plasma, vitamin K, protamine, platelet transfusions can be given [7] but in patients with spontaneous intracerebral bleeding on antiplatelet medication it has been found that giving platelets could paradoxically even lead to worsening of the outcome [2,7].

Fosphenytoin or phenytoin or other anti-epileptics like leviteracetam is given in case of seizures [7]. ICH is associated with stress gastric ulcers. So to prevent this doctors routinely give antacids [7]. Initially it was thought that Corticosteroids, due to their anti inflammatory will reduce swelling but in multiple studies it was found that corticosteroids increase the mortality and so are no longer recommended in the

routine treatment of ICH [10]. If there is a intra cranial space occupying vascular lesion or lobar hemorrhage in a young patient or if the size of the ICH is greater than 3 cm, then surgery may be required [7]. A craniectomy may be done by the neurosurgeon, where part of the skull is removed so that the swollen brain enough space without being compressed .

For treatment of any pathological condition, clinical grading scales play a very significant role in assessment, predicting prognosis and treatment plan. They help in standardization and consistency of assessment in patients and help in the communication between doctors and health care providers. For this it is imperative that the grading scale be simple enough and most importantly those scales that are related to clinical assessment should be associated with outcome of the patient. [8,11-13]

In the treatment of patients with intra cerebral hemorrhage, one such scale which has been studied and validated is the ICH score. In multiple studies across the world it has shown to be a good clinical scale which can predict the outcome of the patient. The ICH Score is composed of GCS score, age of the patient, and initial neuroimaging parameters ICH volume, presence of intra ventricular hemorrhage, whether the hemorrhage is infratentorial/ supratentorial in origin. These five parameters which composes the ICH score are each independently proved to be associated with the outcome of the patient and based on the strength of association with the patients outcome, these parameters are each allotted points and total score will be calculated as the sum of these points [8].

The following table shows the calculation of ICH score as has been determined in multiple previous studies.

To elaborate the GCS score which will be taken is the score calculated during the time of shifting of the patient from the emergency medicine department to the neurosurgery/stroke intensive care unit or the Emergency operation Theatre or the neurosurgery/stroke general ward. This is because this is the period at which the patient would be planned for the initial definitive management [8].

ICH volume will be measured as per the general practice by measuring it on the CT brain scan by the ABC/2 Formula where A represents the

largest diameter of the hemorrhage on the CT brain slice having the largest diameter of the hemorrhage. B represents the diameter of the hemorrhage which is perpendicular to A on the same CT brain slice. C represents the CT brain slice thickness multiplied by the number of CT brain slices showing the hemorrhage. C can also be calculated as the craniocaudal diameter of the hemorrhage on the sagittal section [8].

In the Emergency Department the proportion of patients coming with hemorrhagic stroke is low but still significant. This study subjects in this study are those patients presenting to the Emergency Department diagnosed to have intra cerebral hemorrhage. In the Emergency department although the potential usefulness of the ICH score in initial assessment of patients with ICH has been proven , it is not part of standard assessment of patients with intra cerebral hemorrhage in the Emergency Medicine department.

Therefore we sought to determine whether we could apply it in our Emergency Department to provide a standard and rapid assessment tool to physicians for clinical decision making, ease of communication between health care providers and to provide a standard criteria which is reliable to assess the efficacy of new treatments being introduced in clinical care and clinical research of intra cerebral hemorrhage.

## 2. RATIONALE

Intra Cerebral hemorrhage has a high rate of morbidity and mortality. The use of ICH Score in patients with intra cerebral hemorrhage has been showed to be a very good predictor of patients mortality after 30 days and outcome of the patient in multiple studies. Despite this potential applicability in the initial assessment of patients with intra cerebral hemorrhage, the ICH score is not being used in most Emergency departments around the world. Therefore we decided to apply it in our Emergency Department of AVBRH Sawangi ,as a standard and rapid assessment tool for doctors to assess the patients with intra cerebral hemorrhage so that they could provide a better treatment plan and care for the patient.

**Aim:** To study the ICH score utility in management of patients with intracerebral bleed.

**Table 1. calculation of ICH score**

|                              | <b>0 point</b> | <b>1 point</b> | <b>2 point</b> | <b>Points allotted</b> |
|------------------------------|----------------|----------------|----------------|------------------------|
| GCS Score                    | 13 - 15        | 5 - 12         | 3 - 4          | 2 /                    |
| ICH Volume                   | < 30ml         | >= 30ml        |                | 1 /                    |
| Intra Ventricular Hemorrhage | NO             | YES            |                | 1 /                    |
| Infratentorial Origin        | NO             | YES            |                | 1 /                    |
| Age                          | <80 years      | >= 80 years    |                | 1 /                    |
| ICH score                    |                |                |                | 6 /                    |

### 3. OBJECTIVE

1. To improve the quality indicators of Emergency Department
2. To cater the right management at right time in patients with intracerebral bleed.
3. Inclusion of ICH score in the assessment sheet for screening.

**Duration of Study:** The duration of study will be from November 2020 to December 2022 ( 2 years 1 month)

**Study design:** Prospective observational study.

**Study Site:** Department of Emergency Medicine, AVBRH, Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha.

**Study Population:** Patients brought to Emergency department AVBRH, Sawangi (Meghe) diagnosed to have ICH .

**Inclusion Criteria:** Patients who are brought to Emergency Medicine department 20 years and above, irrespective of sex who are diagnosed to have intra cerebral hemorrhage.

**Exclusion Criteria:** Those patients who do not give consent. Patients with extradural hemorrhage, subdural hemorrhage are not included.

SAMPLE SIZE = 75 patients  
 SAMPLE SIZE WITH DESIRED ERROR OF MARGIN= calculated by following formula

$$n = \frac{Z_{\alpha/2}^2 pq}{d^2}$$

Where:

- Z  $\alpha/2$  = level of significance at 5%, i.e 95% confidence interval = 1.96
- p = prevalence= prevalence of Intra cerebral hemorrhage = 10% = 0.10
- q = 1 - p
- d = Desired error of main = 7% = 0.07
- n = 1.96<sup>2</sup> x 0.10 x (1 - 0.10) / 0.07<sup>2</sup> = 70.56

So n = 75 patients needed in the study

- Formula reference : VK Chadha sample size determination in health studies, NTI Bulletin, 2006, 42/3 and 4, 55-62
- Study reference : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5307940/>

### 4. METHODOLOGY

In the study, patients who are brought to the Emergency Medicine department and diagnosed to have intra cerebral hemorrhage on CT Brain will be assessed for the following five parameters - GCS score, age of the patient, presence of intra ventricular hemorrhage, volume of the hemorrhage. Each of these parameters will be given a score based on their strength of association with the outcome of patient with intra cerebral hemorrhage as has been studied in previous studies.

The following table shows the calculation of ICH score as has been determined in multiple previous studies.

To elaborate the GCS score which will be taken will be score during the shifting of the patient from the emergency medicine department to the neurosurgery/stroke intensive care unit or the

**Table 2. Score format**

|                              | <b>0 point</b> | <b>1 point</b> | <b>2 point</b> | <b>Points allotted</b> |
|------------------------------|----------------|----------------|----------------|------------------------|
| GCS Score                    | 13 - 15        | 5 - 12         | 3 - 4          | ____ /<br>2            |
| ICH Volume                   | < 30ml         | >= 30ml        |                | ____ /<br>1            |
| Intra Ventricular Hemorrhage | NO             | YES            |                | ____ /<br>1            |
| Infratentorial Origin        | NO             | YES            |                | ____ /<br>1            |
| Age                          | <80 years      | >= 80 years    |                | ____ /<br>1            |
| ICH Score                    |                |                |                | ____ /<br>6            |

Emergency operation Theatre or the neurosurgery/stroke general ward. This is because this is the period at which the patient would be planned for the initial definitive management.

ICH volume will be measured as per the general practice by measuring it on the CT brain scan by the ABC/2 Formula where A represents the largest diameter of the hemorrhage on the CT brain slice with the largest diameter of the hemorrhage. B represents the diameter of the hemorrhage which is perpendicular to A on the same CT brain slice. C represents the CT brain slice thickness multiplied by the number of CT brain slices showing the hemorrhage. C can also be calculated as the craniocaudal diameter of the hemorrhage on the sagittal section.

Whether Intra ventricular hemorrhage is present on the initial CT brain scan is also noted and given points accordingly. The origin of the hemorrhage on the infratentorial surface of the brain is also given 1 point.

**Expected Results** : Patients having lower ICH score are expected to have poorer prognosis.

## 5. DISCUSSION

Many studies have proven the efficacy of the ICH score in predicting the thirty day mortality and outcome of the patient with intra cerebral hemorrhage.

Hemphil et al carried out the very important study on patients with acute ICH and they developed the ich score based on predictors of mortality in

ich. These predictors ie - Glasgow Coma Scale score, age  $\geq 80$  years, infratentorial origin of ICH, ICH volume, and presence of intraventricular hemorrhage were given points based on their strength of association and the total ICH Score was the sum of these individual points . In their study 26 patients with an ICH Score of 0 survived, and 6 patients with an ICH Score of 5 died in their study and they found that the thirty-day mortality increased with increase in ICH Score. They concluded that The ICH Score could be used for risk stratification in patients with ICH and it could improve standardization of clinical treatment protocols and clinical research studies in ICH [1].

Piyush Ojha et al conducted a study in Kota, Rajasthan, India from January 2016 to August 2016 on 120 patients with acute ICH in which they studied the treatment outcome on discharge, 30 days and 60 days follow-up. In their study they used the Modified Rankin score (mRS) to assess the outcome. Among the 120 patients with Acute ICH (of which 108 had bleed in the supratentorial region and 12 had bleed in the infratentorial region) studied, 48 ie 40% patients died during the period of hospital stay. The independent predictors of increased mortality were found to be vomiting ,higher ICH score, loss of consciousness, lower GCS ( $\leq 8$ ), ventilator requirement and seizures. Radiological features associated with mortality were mainly infratentorial location, midline shift, intraventricular extension of bleed, hydrocephalus, and a high volume hematoma .It was found that the ICH score on admission was proportional significantly with the Modified Rankin score at the time of discharge and also at 1 month ,2 months follow-up.

So they concluded that ICH Score could be used to predict outcome during hospital stay, at discharge, follow up at 1st and 2nd month follow up. They suggested that it should be a standard in emergency department to assess the ICH score and also during the follow up of these patients [14].

Aimee M. Aysenne et al conducted a study on patients presenting with ICH retrospectively from hospital records and studies the ICH scores. They found that the ICH score changed in 38% patient's from the initially assessed score after 24 hours. They found that ICH score at 24 hours was an important tool to predict mortality in patients with ICH [15].

Sonia Rodríguez-Fernández et al conducted a study in ICU patients with Intracerebral Hemorrhage in three hospitals from 2009 to 2012 in Spain. They collected data of ICH, Glasgow Coma Scale and APACHE-II scores, Demographics, location, volume of haematoma and 30-day mortality rate of 336 patients out of which 105 underwent surgery and they found that the In-hospital mortality was 54.17% and the APACHE-II predicted mortality was 57.22%. They also found that 30-day mortality was 52.38% compared with the ICH score predicted mortality of 48.79%. They concluded that ICH score was useful to predict mortality rates in patients with ICH [16]. Pote et. al. reported on Computed Tomographic evaluation of intracerebral hemorrhage [17]. Few of the studies on brain scans and related injuries were reviewed [18-21].

By introducing the ICH Score to our Emergency Department we could be able to predict the mortality and thus provide better treatment plan and care for the patient. It could also help the treating physician in better explaining the prognosis of the patient to the bystander thereby helping them to cope up mentally with the outcome of the patient [22-25].

## 6. CONCLUSION

ICH Score could be used to predict outcome during hospital stay, at discharge, follow up at 1st and 2nd month follow up.

## ETHICAL APPROVAL

Legal approval of the Institutional Ethics Committee will be obtained (IEC).

## CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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