Intracerebral Hemorrhage Score and Volume as an Independent Predictor of Mortality in Primary Intracerebral Hemorrhage Patients

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Abstract We studied how well the original intracerebral hemorrhage (ICH) score would predict mortality. All nine patients with an ICH score of 0 survived, whereas those having scores of 1, 2, 3, and 4 had 10, 53, 71, and 100 % mortality, respectively. Thirty-nine patients were found to have hematoma of <30 mL (56 % survived), whereas 11 patients were found to have volume of >30 mL (only 10 % survived). The ICH score and volume is a simple clinical grading scale that allows risk stratification on presentation with ICH. The use of a scale such as the ICH score could improve standardization of clinical treatment protocols.

Keywords Intracerebral hemorrhage (ICH) · Glasgow coma scale (GCS) · Computed tomography (CT)

Introduction

Primary (nontraumatic) intracerebral hemorrhage (ICH) accounts for approximately 10–15 % of strokes [1]. Its clinical importance derives from its frequency and accompanying high mortality. Although the latter strongly depends on hematoma size and, to a lesser extent, on location, the overall mortality rate for this stroke subtype varies between 25 and 60 %.

There has been a general decline since the 1980s in the incidence of stroke, including ICH, because of improved detection and treatment of hypertension. However, ICH continues to be a major public health problem, especially in populations at high risk, such as young and middle-aged Blacks and Hispanics, in whom this

stroke subtype occurs significantly more frequently than in Whites, and the medically indigents who lack hypertension treatment [1].

In computed tomography (CT) scans, fresh blood is visualized as a white mass as soon as it is shed. The mass effect and the surrounding extruded serum and edema are hypodense. After 2–3 weeks, the surrounding edema begins to recede and the density of the hematoma decreases, first at the periphery. Gradually, the clot becomes isodense with the brain. There may be a ring of enhancement from the hemosiderin-filled macrophages and the reacting cells that form a capsule for the hemorrhage. At one point several weeks after the bleed, the appearance may transiently simulate a tumor or abscess [2, 3].

Massive refers to hemorrhages several centimeters in diameter; *small* applies to those 1–2 cm in diameter and <30 mL in volume. The volume and location relate to the outcome and the nature of the initial neurologic deficit [4].

Material and Methods

The present study was a 1-year cross-sectional study, conducted in the medical and neuromedical department of a large teaching hospital on patients with intracranial hemorrhage during the period of January 2010 to December 2010 after obtaining an informed written consent.

Fifty patients with primary (nontraumatic) ICH admitted in the wards and intensive care units of the medical department of a tertiary care hospital and who have undergone CT imaging were evaluated with following inclusion and exclusion criteria.

Inclusion Criteria

1. Patients with age ≥ 12 years

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Table 1 Mortality according to ICH score

ICH score	Patients, % (number)	Survived, % (number)	Expired, % (number)
0	18 % (9)	100 % (9)	0 % (0)
1	40 % (20)	90 % (18)	10 % (2)
2	26 % (13)	46.16 % (6)	53.84 % (7)
3	14 % (7)	28.58 % (2)	71.42 % (5)
4	2 % (1)	0 % (0)	100 % (1)

2. Patients with spontaneous ICH of nontraumatic origin detected on CT/magnetic resonance imaging or angiographic study
 - (a) Who have presented with history of acute severe headache, altered sensorium, slurring of speech, acute hemiparesis, and accelerated hypertension—suggestive of acute cerebrovascular stroke

Exclusion Criteria

1. Patients <12 years of age
2. Patients with history of trauma
3. Patient with ischemic stroke and venous thrombosis

All raw data were collected, and ICH score and volume were calculated.

The ICH score is a simple clinical grading scale that allows risk stratification on presentation with ICH. The use of a scale such as the ICH score could improve standardization of clinical treatment protocols and clinical research studies in ICH [5].

Components of score are as follows:

1. GCS 3–4=2, 5–12=1, and 13–15=0
2. ICH volume (in milliliter) [6]: >30 mL=1, <30 mL=0
3. Intraventricular hemorrhage: yes=1, no=0
4. Age: >80=1, <80=0
5. Infratentorial: yes=1, no=0

Thirty-day mortality can be calculated, and thus, it helps to decide the prognosis.

With scores of 4, 3, 2, and 1, mortality ranges from 100, 71, 53, and 10 %, respectively [7]. We do not include any patients with a score of 5 (Table 1).

ICH volume is measured by ABC/2 formula (ellipsoid method) [7], where A =longest diameter, B =diameter

Table 2 Mortality in patient with primary ICH according to its volume

ICH volume, % (number)	Survived, % (number)	Expired, % (number)
<30 mL (78 %) (39)	56 % (28)	22 % (11)
>30 mL (22 %) (11)	10 % (5)	12 % (6)

Table 3 Risk factors for the ICH and percentage

Risk factor	Patients, % (number)
History of CV disease	56 % (28)
Smoking	26 % (13)
Alcohol	8 % (4)
Antihypertensives	50 % (25)
Oral anticoagulants	4 % (2)

perpendicular to A , and C =number of slices multiplied by their thickness. The data obtained were tabulated and analyzed by proportion and percentages.

Results

In present study, 39 patients had <30 mL volume of hematoma, whereas 11 patients were found to have volume of >30 mL (Table 2). It is observed that mortality was higher as the volume of hematoma increases. Those who had smaller size but still high mortality had either brain stem hemorrhage or intraventricular seepage.

The lethal volume of parenchymal hemorrhage varied greatly by location. All patients with a pontine hemorrhage >5 mm or cerebellar hemorrhage >30 mL died within 30 days. Of the 11 patients who died with deep hemorrhages with an initial parenchymal volume of <30 mL, 7 had hemorrhages of thalamic in origin. The volume of intraventricular hemorrhage, on the other hand, is a strong independent predictor of 30-day mortality. However, the difficulty of accurately measuring the volume of intraventricular blood on the CT film at the bedside severely limits its usefulness as a practical predictor of mortality [8].

In present study, the role of CT imaging in primary (nontraumatic) ICH in 50 patients has been studied with the objective to find out correlation with clinical features, to obtain prognosis. The most common risk factor observed was hypertension (primary/secondary). Smoking, alcohol, use of anticoagulant, and antiplatelet drugs are other commonly observed associated risk factors (Table 3).

Demographic analysis showed that females were observed to be more affected than males, 52 and 48 %, respectively.

Table 4 Site of ICH and percentage

Site of hemorrhage	Patients, % (number)
Basal ganglia	40 % (20)
Thalamus	25 % (13)
Lobar	23 % (11)
Brain stem	8 % (4)
Cerebellum	4 % (2)

respectively. Average age of presentation in males and females was found to be 58.6 and 62.4 years, respectively. Average age group at presentation was 50–70 years. The most common risk factor in my study is hypertension. The most common site of primary ICH due to hypertension observed was basal ganglia followed by thalamus, lobar, brain stem, and cerebellum, respectively; however, the most common site of primary ICH was also basal ganglia followed by thalamus, lobar, brain stem, and cerebellum, respectively, regardless of etiology (Table 4).

Discussion

Neurologic worsening in patients with ICH was earlier thought to be due to hemorrhage-induced mass effect. Precise lesion dimensions may permit utilization of hematoma volume and ICH score and changes as clinical correlates end points for therapeutic outcomes. CT is presently the imaging modality of choice to identify ICH. This method has the potential to provide quantitative data, with implications for use as a predictor of treatment benefit.

According to study by Broderick et al., volume of ICH in combination with initial GSC is a powerful and easy-to-use predictor of the 30-day mortality and morbidity in patients with spontaneous ICH. According to that study, the simple ellipsoid method, which can easily estimate hemorrhage volume within 1–2 min, predicts 30-day mortality nearly as well as the more exact method of computerized image analysis.

According to study done by Divani et al., measurement techniques such as ABC/2 may introduce significant errors. Protocols for measurement of hematoma volume and its characteristics should be incorporated into CT scanner consoles, which would allow the operator to obtain such information accurately in a timely manner [6].

Hematoma volume measurement is an effective method to predict the mortality in patients of ICH within 30 days of presentation. The greater the volume, the higher the mortality. Increment in mortality rate was observed with volume >30 mL.

Conclusion

Hematoma volume measurement is an easy and bedside tool to assess mortality within first 30 days. ICH score is a sensitive bedside tool to assess prognosis within 24 h.

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