

## Prognostic Factors in Intracerebral Hemorrhage: A Hospital Based Prospective Study

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### ABSTRACT

**Introduction:** Intracerebral hemorrhage (ICH), a form of stroke syndrome results from the rupture of an intracerebral vessel leading to the development of a hematoma in the substance of the brain. Incidence rates are particularly high in Asians and Blacks. Attempts are made to prognosticate ICH patients and manage them accordingly. This is particularly important for the socio-economic profile of the patients availing our services.

**Methods:** All together 90 patients of ICH were taken up in this study done in Gauhati Medical College and Hospital during the period from July 2013 to June 2015. Patients were diagnosed on the basis of a thorough medical history, a full neurological examination, standardized blood tests and CT scan of the brain. Prognostication was done on the basis of clinical and radiological findings. Prognosis was assessed as good or bad outcome on the 15th day based on neurological examination. Statistical analysis was done by using the chi-square test, fisher's t-test and student's t-test wherever applicable.

**Results:** In our study 35.55% patients showed bad outcome. Increasing age, low level of consciousness, low GCS score, bilateral limb weakness, high blood pressure, gaze palsies, pupillary abnormalities and CT brain findings of higher volume ( $\geq 30$  ml) of hematoma, midline shift, intraventricular extension and a high ICH score were associated with bad outcome.

### INTRODUCTION

Intracerebral hemorrhage (ICH) which is a form of stroke syndrome results from the rupture of an intracerebral vessel leading to the development of a hematoma in the substance of the brain<sup>1-3</sup>. Incidence rates are particularly high in Asians and blacks<sup>4</sup>. Intracerebral hemorrhage (ICH) constitutes 10% to 15% of all strokes and has a higher risk of morbidity and mortality than cerebral infarction and subarachnoid hemorrhage (SAH)<sup>5</sup>. The 30 day mortality ranges between 30% to 40% in hospital based studies<sup>6,7</sup>.

Modifiable risk factors that increase the incidence of stroke include hypertension, smoking, alcohol, diabetes, dyslipidemia<sup>8-10</sup> beside some non-modifiable risk factors<sup>11,12</sup>.

Attempts are being made to devise optimal management strategies and to identify those who stand a poor prognosis with the available investigation and treatment options. This is particularly significant for the socio-economic profile of the patients availing our services.

Presence of comorbidities increased the likelihood of poor outcome. However, in our study lipid levels at presentation did not show any significant association with the outcome.

**Conclusion:** The intracerebral hemorrhage score (ICH score) can be considered as a simple and reliable clinical grading scale for predicting short term outcome in patients with spontaneous ICH. However, lipid levels and blood sugar at presentation may not predict outcomes accurately.

**Key Words:** Intracerebral hemorrhage, Prognostic indicators, ICH score.


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Increasing age, low level of consciousness, low GCS score, abnormalities in arterial blood pressures, temperature, respiration at presentation, severity of weakness, speech disturbances, gaze palsies, brainstem involvement, higher volume of ICH, infratentorial origin of ICH, intra-ventricular or sub-arachnoid extension of ICH, midline shift, higher ICH score have all been studied by various workers as important markers of bad prognosis after ICH<sup>5</sup>. Beside these, the presence of one or more co-morbid condition as well as some biochemical parameters at presentation has been found to influence outcome.

### AIMS & OBJECTIVES

- 1) To evaluate, compare and co-relate early clinical and CT scan findings in patients with intracerebral hemorrhage with outcome at 15 days in a hospital based prospective study.
- 2) To evaluate prognosis in relation to risk factors associated with intracerebral hemorrhage.

**MATERIALS AND METHODS**

This was a hospital based prospective study conducted with 90 patients in the department of Medicine and Neurology, Gauhati Medical College and Hospital during the period from July 2013 to June 2015.

**Inclusion criteria**

Patients admitted with a history suggestive of hemorrhagic stroke of less than 7 day duration with a subsequent CT scan of the brain done at the earliest feasible hour confirming the diagnosis were taken up for the study with informed consent from the patient and/or the attendant. Only new cases are enrolled in the study.

**Exclusion Criteria**

Patients with hemorrhage secondary to brain tumors / to trauma or hemorrhagic transformation of cerebral infarct or aneurysmal or vascular malformation rupture or hematologic malignancies or subdural haematoma or cerebral amyloid angiopathy were excluded.

**Patient evaluation**

All patients were screened according to a strict protocol consisting of a complete medical history, a full neurological examination, standardized blood tests and a CT scan of the brain done at the earliest feasible period. The following data were prospectively collected: age, sex, recognized risk factors for spontaneous intracerebral hemorrhage (arterial hypertension, alcohol intake, smoking, diabetes mellitus, serum cholesterol levels, concomitant anticoagulant and antiplatelet treatment), glucose levels at admission, systolic, diastolic and mean blood pressure (defined as diastolic blood pressure plus 1/3 [systolic – diastolic]), GCS scores (table 1), and CT scan findings. Neurological findings were determined from the initial CT scan and classified according to the site of ICH (basal ganglia, thalamic, lobar, pontine or cerebellar), volume of hematoma according to ABC/2 method (explained later), midline shift (the displacement of the septum pellucidum across midline, using as reference a perpendicular line connecting the anterior and posterior insertions of the cerebral falx at the level of the lateral and third ventricle) and intra-ventricular extension of hemorrhage. In every patient intracerebral hemorrhage score (ICH score) was calculated as devised by Hemphil et al (2001)<sup>5</sup> and its utility as a prognostic tool was evaluated.

**Estimating the volume of the hematoma in the CT scan**

The volume of the hematoma was calculated by using a simple and easily reproducible bedside method (Kothari, Brott, Broderick; ABC's of measuring intracerebral volume)<sup>13</sup>.

In this method, the CT slice with the largest area of hemorrhage was first identified. The largest diameter (A) of the hemorrhage on this slice was measured. The largest diameter 90° to A on the same slice was measured next (B). Finally, the approximate number of 10-mm slices on which the ICH was seen was calculated (C). C was calculated by a comparison of each CT slice with the largest hemorrhage on that scan. If the hemorrhage area for a particular slice was greater than 75% of the area seen on the slice where the hemorrhage largest, the slice was considered 1 hemorrhage slice for determining C. If the area was approximately 25% to 75% of the area, the slice was considered half a hemorrhage slice; and if the area was less than 25% of the largest hemorrhage, the slice was not considered a hemorrhage slice. These CT hemorrhage slice values were then added to determine the value for C. All measurements for A and B were made with the use of the centimeter scale on the CT scan to the nearest 0.5 cm.

A, B, and C were then multiplied and the product divided by 2, which yielded the volume of hemorrhage in cubic centimeters.

**Table 1: Showing calculation of ICH score: as devised by Hemphil et al (2001)**

Clinical or Imaging Factor	Point Score
<b>Age</b>	
<80 years	0
80 years	1
<b>Hematoma Volume</b>	
<30 cc	0
30 cc	1
<b>Intraventricular Hemorrhage</b>	
No	0
YES	1
<b>Infratentorial Origin of Hemorrhage</b>	
No	0
YES	1
<b>Glasgow Coma Scale Score</b>	
13-15	0
5-12	1
3-4	2
<b>Total Score</b>	<b>Sum of each category above</b>

GCS score- indicates GCS score on initial presentation (or after resuscitation); ICH volume- volume on initial CT calculated using ABC/2 method; IVH - presence of any IVH on initial CT.

**Assessing prognosis**

All patients were followed up for 2 weeks during which vital signs were recorded and clinical improvement and deterioration was assessed. Follow up ceased with the death of the patient if it occurred within 2 weeks. Prognosis was assessed as good or bad outcome on the 15<sup>th</sup> day. Patients who improved in neurological status from admission were grouped under good outcome whereas those who died or deteriorated from initial neurological status in the form of declining GCS score, increasing or new neurodeficits were grouped under bad outcome.

**Statistical Analysis**

Statistical analysis was done by using the chi-square test, fisher's t-test and student's t-test wherever applicable and these were performed using GraphPad InStat version 3.00 for Windows 7, GraphPad Software, San Diego California USA. All the statistical graphs were prepared using Microsoft Excel, 2007 and Microsoft Word 2007. Ethical committee clearance was taken from the IEC, Gauhati Medical College, Guwahati.

**RESULTS AND OBSERVATIONS**

90 patients of intracerebral hemorrhage (ICH) admitted to the Department of Medicine and Neurology during the 1 year study period starting from July 2013 to June 2015 were evaluated in this study.

32 patients (35.55%) ended up with bad outcome. 50% bad outcome was seen in 20-20 years age group. Overall 42% adverse outcome was noted in the patients of ≥60 years of age. The mean age of cases with bad outcome was 58.32 years as compared to 54.89 years in patients with good outcome, the difference being statistically different (<0.0001). The male: female ratio was 3.5: 1. There was no statistically significant difference in outcome in relation of sex of patients.

Worst outcome were noted in patients with convulsion (48.38%), vomiting (45.45%), hemiparesis (37.6%), headache (33.3%) and altered sensorium (30.2%) in comparison to rest of all presenting features. 32 out of 78 cases with hypertension (41.05%) showed bad outcome. Outcome was poor in diabetes (58%) & in patients with CKD (66%) also. Patients with COAD showed the worst outcome (80%). Patients who had two or more comorbid states had a relatively worse outcome.

**Association of smoking and alcohol with ICH outcome**

50% patients i.e. 15 out of 30 in the smoker group and 48% i.e. 12 out of 25 in ethanolic group had unfavorable outcome. However the difference in outcome in relation to smoking (p value 0.073) and alcohol (0.199) was not statistically significant.

The alert and drowsy patients had better outcome compared with stuporous and comatose patients (63.15% and 75% bad outcome respectively).

**Table 2: Showing presenting features of patients with ICH**

Complaints	Total no. of Cases	%of total cases	Total adverse outcome	% of adverse outcome
Headache	36	40.0	12	33.33
Vomiting	33	36.6	15	45.45
Weakness	85	94.44	32	37.64
Altered Sensorium	53	58.8	16	30.18
Convulsion	31	34.4	15	48.38
Dizziness	27	30.0	8	29.62
Gait Unsteadiness	28	31.1	8	28.57
Confusion	18	20.0	5	27.77
Hemisensory Symptoms	20	22.2	4	20
Visual Disturbances	17	18.8	5	29.41

**Table 3: Showing associated comorbidities and outcome**

Comorbid state	No. Of cases	Good outcome	Bad outcome	% of bad outcome
Hypertension	78 (86.66%)	46	32	41.05
Diabetes Mellitus	12 (13.33%)	5	7	58.33
H/O stroke	7 (7.7%)	5	2	28.51
PVD	4 (4.44%)	3	1	25
COAD	5 (5.55%)	1	4	80
CKD	9 (10%)	3	6	66.66
IHD	6 (6.66%)	4	2	33.33

**Table 4: Showing relation between level of consciousness at presentation and outcome**

Level of Consciousness	Total	Good outcome	Bad outcome	% Bad outcome
Alert	27 (30%)	22	5	18.51
Drowsy	36 (40%)	27	9	25
Stuporous	19 (21%)	7	12	63.15
Comatose	8 (8.8%)	2	6	75

**Table 5: Showing relation between GCS score at presentation and outcome**

GCS	No. of Patients	Good Outcome	Bad Outcome	% Bad Outcome
3-5	13 (14.44)	3	10	76
6-9	24 (26.67)	12	12	50
10-12	25 (27.78)	19	6	24
13-15	28 (31.11)	24	4	14.28

Around 53 (approximately 58%) patients had a GCS >= 10 at presentation & the outcome was relatively good in this group of patients (81%). With GCS < 10, the proportion of poor outcome increased significantly (59.46%) with p-value of <0.0001. 76% of patients with an initial GCS of 3-5 had a poor outcome. Statistically significant impact of systolic BP, pulse pressure &

mean arterial pressure at admission was seen on the bad outcome of the patients. Also patients presenting with an elevated temperature & respiratory rate had a worse prognosis. The difference in pulse rate was not found statistically significant. Thus both gaze palsies and pupillary abnormalities were associated with increased occurrence of bad outcomes.

**Table 6: Showing relation between vitals at presentation and outcome**

(Mean ± SD)	Range	Bad outcome (Mean ± SD)n= 32	Good outcome (Mean ± SD)n=58	P value
Systolic BP (169.22 ± 23.94)	126-230	191.18 ± 13.52	157.10 ± 19.38	<0.0001
Diastolic BP (91.95 ± 10.35)	70-112	98.93 ± 7.98	88.10 ± 9.50	<0.0001
Mean BP (117.20 ± 14.59)	89.33-150	128.95± 11.13	110.76± 12.03	<0.0001
Pulse (71.07 ± 13.89)	48-104	69.75 ± 14.63	71.81 ± 13.53	0.5035
Temperature (°F) (98.2 ± 0.96)	97-103	98.85 ± 1.18	97.82 ± 0.53	<0.0001
Respiratory Rate (15.57 ± 1.98)	12- 21	17.4 ± 1.77	14.56± 1.24	<0.0001

**Table 7: Showing relation between Ocular posture and outcome**

Ocular posture	Total cases	Good outcome	Bad outcome	% bad outcome
Normal orienting	64(71.11)	49	15	23.43
Horizontal gaze palsy	19(21.11)	7	12	63.15
Vertical gaze palsy	7(7.77)	2	5	71.42

**Table 8: Showing relation between Pupil size and outcome**

Pupil size	Total cases	Good outcome	Bad outcome	% bad outcome
Normal	76(84%)	55	21	27.63
Dilated	9(10%)	2	7	77.77
Constricted	5(5.55%)	1	4	80

**Table 9: Showing degree of motor weakness and outcome**

Weakness	Total No. of cases	Good outcome	Bad outcome	% Bad outcome
Bilateral weakness	5 (5.55%)	1	4	80
Complete paralysis of one side	37 (41.11%)	17	20	54.05
Unilateral variable weakness ( ≥ 3/5)	43 (47.77%)	35	8	18.60
Normal Power	5 (5.55%)	5	0	

**Table 10: Showing side of motor weakness and outcome**

Weakness	Total cases	Good outcome	Bad outcome	% of bad outcome	P value
Left	39(43%)	27	12	30.76	0.652
Right	49(54%)	31	18	36.73	

80% adverse outcome was noted in the patients with bilateral motor weakness. Patients with complete one sided weakness had 54% unfavorable outcome. There was no statistically significant difference in outcome in relation to side of motor weakness in the patients of ICH.

There was no significant difference in the outcome in relation to patient's initial random blood sugar level and fasting lipid profile including serum cholesterol, serum triglyceride, LDL and VLDL at presentation. Both patients of brainstem bleed died indicating 100% worst outcome. Other than that no significant difference in the outcome was noted with regard to different bleeding sites. 54.44% of the haemorrhages were left sided & a relatively high proportion of patients (40.81%) in this group had a poor outcome but the difference was not statistically significant.

38 patients had a haematoma volume of ≥30 ml. Significantly higher proportion (p-value<0.0001) of poor outcome (66.66%) was seen in this group as compared to those with haematoma size < 30ml.

The mean midline shift was 0.55 with SD of 0.65. Midline shift was associated with statistically significant mortality (p-value < 0.0001)

One third of the patients in the study had ventricular extension of the bleed. 73.33% in this group of patients had a poor outcome compared to 16.66% among those without ventricular extension & the difference was statistically significant.(p-value < 0.0001).

20% of patients had ICH score 0. None of them died whereas all patients with ICH score ≥ 4 died. Poor outcome was seen with increasing ICH scores.

**Table 11: Investigations At Admission & Outcome**

(Mean ± SD)	Range	Good outcome (Mean ± SD) n= 58	Bad outcome (Mean ± SD) n=32	P value
RBS (118.77±33)	68-251	115.24±33.55)	125.18±33.55	0.1819
S. Cholesterol (188.01±44.29)	108-320	183.21±43.19	197.84±45.93	0.1362
HDL (51.78±10.99)	29-71	52.90±11.38	49.75±10.10	0.194
Triglyceride (158.77±59.13)	55-352	155.44±63.49	164.81±50.67	0.1225
LDL (104.48±42.52)	17-248	99.24± 39.96	113.97±45.94	0.1162
VLDL (431.75±11.83)	16-89	31.06±12.68	33±10.17	0.4594

**CT SCAN FINDINGS**

**Table 12: Site of haematoma and outcome**

Site	Total no of cases	% of total cases	Good outcome	Bad outcome	% of bad outcome
Basal Ganglia	46	51.11	28	18	39.15
Lobar	15	16.6	10	5	33.33
Thalamus	25	27.77	18	7	28
Cerebeller	2	2.22	2	0	
Brain Stem	2	2.22	0	2	100

**Table 13: Side of haematoma and outcome**

Side	Total no of cases	% of total cases	Good outcome	Bad outcome	% of bad outcome	P value
Left	49	54.44	29	20	40.81	0.821
Right	39	43.33	27	12	30.76	

**Table 14: Volume of haematoma and outcome**

Volume of haematoma (ml)	Total	Good outcome	Bad outcome	% bad outcome	P value
≥30	38 (42%)	13	25	65.78	<0.0001
<30	52 (57%)	45	7	13.46	

**Table 15: Relation between midline shift and outcome**

Midline shift (mm)	Total	Good outcome	Bad outcome	% bad outcome	P value
≥5	27 (30%)	9	18	66.66	<0.0001
<5 or no shift	63 (70%)	49	14	22.22	

**Table 16: Ventricular extension of the bleed and outcome**

Ventricular extension of bleed	Total no of cases	Good outcome	Bad outcome	% of bad outcome	P value
Present	30 (33%)	8	22	73.33	<0.0001
Absent	60 (66%)	50	10	16.66	

**Table 17: ICH score and outcome**

ICH Score	No. of total patient	% of total patient	Bad outcome	Good outcome	% of bad Outcome
0	18	20	0	17	0
1	25	27.77	2	23	8
2	28	31.11	13	15	46.42
3	15	16.66	13	2	86.66
4	3	3.33	3	0	100
5	1	1.11	1	0	100
6	0	0	0	0	

## DISCUSSION

ICH is a medical emergency. Studies on prognostic factors in ICH patients are lacking in this part of the country. In this study we have analysed the prognostic factors which may help to predict the outcome of patients with ICH.

Among 90 cases we studied, the incidence of intracerebral hemorrhage was found to have increased with advancing age. The mean age found in our study was  $56.1 \pm 2.12$  years. Though most studies had found similar mean ages<sup>12,14,15</sup>, European studies have shown higher mean ages in the mid 7<sup>th</sup> decades<sup>16</sup>. This discrepancy of age is probably due to lower life expectancy in the Indian population and predisposition to risk factors like diabetes, hypertension etc from a younger age. The difference in mean ages of patients with good and bad outcome was statistically significant ( $p < 0.0001$ ) and 42% bad outcome was noted in the patients of  $\geq 60$  years of age. Most other workers<sup>16</sup> support this data. The male: female ratio was 3.5: 1 though the outcome didn't vary significantly between the two sexes. Several other workers<sup>16-18</sup> also support our observation.

Poor outcome in the patients with hypertension was found to be 41.05% similar to past studies.<sup>8</sup> The outcome in diabetic patients was relatively poorer as compared to non-diabetic population (58% bad outcome for diabetic and 45% for non-diabetic). But the difference was not statistically significant. However, Ülkü Türk Börü et al.(2009)<sup>8</sup> found high adverse outcome in diabetic population. This discrepancy might be due to small sample size in our study. 80% of patients with COAD had a bad outcome similar to some of the previous studies<sup>19</sup>. 33% of the patients were smokers and half of these patients had a bad outcome but statistically significant difference between the smokers and non-smokers were not observed in terms of overall outcome ( $p$  value=0.07) as supported by some past studies<sup>20</sup>. The difference between the bad outcome in ethanolic patients and non-ethanolic was not statistically significant ( $p$  value=0.199), a finding similar to Helen Hansagi et al, (1995)<sup>21</sup>. Not including the duration or amount or type or frequency of alcohol intake may be considered a drawback of this study.

In the present study we did not find any significant association between serum lipids at presentation and adverse outcome in our patients. However, Anuradha Bharosay et al (2013)<sup>22</sup> found that low levels of serum cholesterol and serum triglycerides were associated with increased risks of hemorrhagic stroke and neurological worsening like some other workers.<sup>17,18,20</sup> That cholesterol is known to have effects on the vasculature and is essential for normal membrane fluidity may be an explanation to the above findings<sup>23</sup>. Though earlier studies had showed an inverse relation between serum total cholesterol or high HDL level and hemorrhagic stroke<sup>9,22</sup>, Sugata Roy et al<sup>25</sup> found no such association. Some previous studies found negative results whereas others found a positive association with high serum triglyceride concentrations and risk of stroke<sup>24</sup>. Also we did not find any association of serum blood glucose at the time of presentation with the immediate outcome as shown by other workers also<sup>14,26</sup>. This may be explained by the initial state of stress in such patients leading to high blood sugar levels. However, larger studies with multivariate logistic regression analysis need to be carried out to validate this.

There was poor outcome in the comatose and stuporous patients at admission. Statistically significant difference was noted in

regards to outcome in patients with GCS above and below 10 ( $p < 0.0001$ ). Other studies also found increase in mortality with low level of consciousness and low GCS score at presentation.<sup>8,16,23</sup>

We got statistically significant association between blood pressure (both systolic, diastolic and mean arterial BP) of patients and outcome ( $p$  value  $< 0.0001$ ) which was similar to other studies<sup>27,28</sup>. High body temperature and respiratory rate of the patient at presentation showed an association with bad outcome which was statistically significant ( $p < 0.0001$ ) as found some of the past studies as well<sup>29</sup>.

The outcome in the group of patients with normal orienting eye movements was better (76.6%) than those who had abnormalities of ocular posture. Both horizontal and vertical gaze palsies were associated with more bad outcomes. A study also reported that conjugate eye deviation (CED) was a significant predictor of death or dependency after acute supratentorial intracerebral hemorrhage even after adjusting for initial severity and hematoma volume<sup>30</sup>.

78.57% bad outcome was found in the patients of ICH with abnormal pupil constricted/dilated) in the present study. A previous study also found 96% bad outcome with abnormal pupil<sup>31</sup>.

5.5% patients had bilateral severe limb weakness, out of which 80% had bad outcome while patients with less severe limb weakness (power  $\geq 3/5$ ) the outcome was better (82% good outcome). Other workers have also reported severe motor weakness as an predictor of early mortality<sup>32-34</sup>.

There was 100% mortality in the patients with brain stem bleed followed by 39.15% poor outcome with basal ganglia bleed, 33.33% in lobar and 28% with thalamic bleed in the present study. This finding was similar to past results.<sup>16</sup>

In the present study 42% patients had a hematoma volume  $< 30$  ml and 57% had  $\geq 30$  ml. 65% bad outcome was found in patients had  $\geq 30$  ml whereas only 13% patients who had hematoma volume  $< 30$  ml fared badly. Statistically significant difference was noted in hematoma volume between good and poor responders ( $p$  value  $< 0.0001$ ) as was the result in previous studies as well<sup>12,15,35</sup>.

30% patients had midline shift of  $\geq 5$ mm and the rest 70% had  $< 5$ mm in their CT scan. 66% patients with a midline shift of  $\geq 5$ mm had a bad outcome while only 22% patients with a midline shift  $< 5$  mm had bad outcome; the difference being statistically significant ( $p < 0.0001$ ). Various other workers also found increase in poor outcome with marked midline shift<sup>28,32</sup>.

In the present study, 66% patients with ventricular extension of the bleed in their CT scan had bad outcomes, while only 22% bad outcome was noted in the patients without ventricular bleed. The difference was statistically significant ( $p < 0.00001$ ) similar to several other studies<sup>5,16</sup>.

Bad outcome was associated with increase in ICH score. Various other studies also support this result<sup>5,14,36</sup>. The accuracy of this score in predicting outcome may be considered superior to admission GCS.

The intracerebral hemorrhage score (ICH score) thus can be considered as a simple and reliable clinical grading scale for predicting short term outcome in patients with spontaneous intracerebral hemorrhage.

## CONCLUSION

From the present study it can be concluded that proper assessment of different clinical parameters and findings on CT scan of brain can effectively prognosticate patients of spontaneous intracerebral hemorrhage with respect to short term morbidity and mortality. Clinical parameters that can predict outcome are state of consciousness at presentation, Glasgow coma scale score, systolic and diastolic blood pressure with mean arterial blood pressure, elevated body temperature and increased respiratory rate, vertical and horizontal gaze palsies, pupillary abnormalities and severity of motor weakness. Presence of comorbidities increased the likelihood of poor outcome.

CT findings including the ICH score can also accurately predict the outcome are - volume of hematoma > 30 ml, a midline shift of  $\geq 5$ mm and intraventricular extension of bleed.

However, lipid levels and blood sugar at presentation may not predict outcomes accurately.

Finally the ICH Score was found to be a better predictor of short term outcomes in patients with spontaneous intracerebral bleed.

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