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Original Research Paper

Radio-Diagnosis

INTRACEREBRAL HAEMORRHAGE EVALUATION BY C.T SCAN IN PATIENTS OF CEREBRO VASCULAR ACCIDENTS (CVA)

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ABSTRACT

BACKGROUND: Spontaneous intra-cerebral haemorrhage (ICH) is a major public health problem with an annual incidence of 10–30 cases per 100 000 population, accounting for 2 million (10–15%) of approximately 15 million strokes, which occur worldwide each year. **AIMS AND OBJECTIVE:** The main objective of this study is (i) to correlate volume and location of lesion (hemorrhage) with clinical picture and prognosis, (ii) to determine clinical and CT parameters or findings that could predict prognosis. **METHODS AND MATERIAL:** The study was conducted on 100 Patients with diagnosis of spontaneous ICH and who were diagnosed and admitted to MGM Medical College and LSK Hospital, Kishanganj, Bihar, India from 01/08/19 to 30/07/2021, age ranged between 18 and 75 years. The inclusion criteria were as follows: (1) spontaneous ICHs on the basis of C.T scan and (2) No antecedent disease such as arterio venous malformations, tumour, anticoagulation therapy, cerebral aneurysms, or traumatic events. **RESULT:** The haemorrhagic stroke on the basis of site, putamen is 44, frontal and parietal is 5 and temporal is 3 in numbers with weakness of limbs or focal neurological deficit was commonest presentation associated with hypertension and diabetes as risk factors was 50% and 07% respectively. The lobar and deep haemorrhages constitute 18% and 75% respectively but the mean volume of haemorrhage 28.44cm3 and 36.52cm3. **CONCLUSION:** In present study the location of ICH was lobar in 18% deep ganglionic (+ventricle) in 75%, cerebellar in 3% and pontine or midbrain in 4% of the patients. The location of the hematoma in 13 (72.7%) of the LH patients was confined to a single cerebral lobe, while in 5 (27.2%) of LH patients, hematoma was located in two lobes.

KEYWORDS :

INTRODUCTION

Spontaneous intra-cerebral haemorrhage (ICH) is a major public health problem with an annual incidence of 10–30 cases per 100 000 population, accounting for 2 million (10–15%) of approximately 15 million strokes, which occur worldwide each year [1-4]. It is the most devastating type of stroke, with the greatest rates of morbidity and mortality [5, 6]. ICH can affect the brain parenchyma anywhere, but more commonly affects specific locations, including the basal ganglia, thalamus, pons, and cerebellum [2, 5, 7]. This is because their locations were found to affect the prognosis of the disease. Supratentorial non-lobar haemorrhages include ICHs located in the thalamus, basal ganglia, and internal or external capsules [8]. Stroke is the most common life threatening neurological disease (Warlow-1991) and is the third leading cause of death. Mishra et al reported that in India 1.4% of all hospital admissions were due to stroke[9]. Any abnormality of the brain resulting from pathologic process of the blood vessels and it is the leading cause of death. Those who survive are usually left with permanent disability. With increasing mean population Age, stroke will become even greater medical as well as social problem. Accurate and early diagnosis may improve morbidity and mortality rates in the future as newer and more effective therapies are instituted. Cerebral infarction is responsible for about 80% of all first ever in a life time strokes, Primary intra cerebral haemorrhage for 10% and 5 % cases are due to uncertain causes. Patients with primary intra cerebral haemorrhage and sub arachnoid haemorrhage are more likely to be admitted to hospital and these conditions result in highest early case fatality. Advent of CT in 1972 by G.N Hounsfield represented dramatic and important break-through in medicine. [10] C.T is capable of imaging the specific morphologic appearance of cerebral infarcts and haematomas early enough and with sufficient accuracy to influence the further clinical workup, care and treatment of these patients. In the present scenario of radiological diagnostic possibilities in acute stroke, C.T is still the method of choice.

MATERIAL AND METHODS

Patients coming to department of radiology and admitted to MGM Medical College and LSK Hospital, Kishanganj, Bihar, India from 01/08/19 to 30/07/2021, with the diagnosis of non-traumatic and non-neoplastic intra-cerebral haemorrhages were evaluated. A total of 100 patients were studied with diagnosis of Spontaneous intra-cerebral haemorrhage on the basis of C.T scan. Diseases potentially related to ICH were noted, including chronic Hypertension, bleeding diathesis, atrial fibrillation, prior stroke, dementia, vasculitis, aneurysm and arterio-venous malformation. Exclusion criteria-patients with haemorrhages due to trauma, aneurysmal rupture, tumour, anticoagulation therapy and haemorrhagic transformation of cerebral infarct were excluded. All patients were evaluated by a neurologist. Neurological status at presentation was measured by Glasgow Coma Scale Score and had undergone for C.T within several hours of evaluation. Non contrast CT slices were taken parallel to canthomeatal line with slice thickness either 5 mm or 10 mm. The scan time was 10 sec/section. To determine the actual anatomic structures and extent of pathologic processes the serial slices (Average 10-12) displayed on 14 B/W CRT monitor. The area of lesion (hematoma) was demarcated with the help of a track ball and its multiplication with slice thickness. If lesion was seen in multiple cuts, volume of lesion in each slice was added to get total volume of lesion. The serial scans were recorded at appropriate window level width adjusting display of CT number range on JX (17" x 14") Konica medical imaging film. Volume of the hemorrhage was computed after feeding attenuation values of hemorrhages (+45 to +80 HU) and marking the lesion by ROI – cursor in each slice. The ICH as classified according to the localization of the largest blood clot as lobar (frontal, parietal, temporal or occipital), putamen, thalamic, pontine or cerebellar. Hematoma rupture

into and deformation/dislocation of the ventricles and cisterns were documented. The hematoma volume was estimated by measuring the volume of the blood clot in each CT slice. All available computed tomographic (CT) imaging films were evaluated by the consultant radiologist.

Baseline variables that were most likely relevant to prognosis according to literature were recorded : (1) Age (2) sex (3) Hemorrhage side (left or right) (4) Hemorrhage location (5) hemorrhage volume (6) Midline shift, displacement on CT Scan of > 5 mm (7) Intra-ventricular spread of the hemorrhage (8) Level of consciousness by GCS score (9) Barthel Activity of Daily living score and (10) Outcome recorded as mortality or survival at the end of acute hospitalization. According to the results of univariate analysis and the literature six potential prognostic factors (Shift, Site, GCS, IVH, and Volume and Pulse pressure) were selected for multivariate analysis by logistic regression.

STATISTICAL ANALYSIS:

Statistical analysis was performed to correlate the patient's outcome and prognostic factor with midline shift using X^2 (Chi-square) tests which has shown a significant correlation (X^2 = 20.96, p > 0.01) in the present study. P values of 0.005 or less were considered statistically significant.

RESULT:

TABLE-1: Sex distribution in present study

Sex	Dead	Alive	Total
Male	26	37	63
Female	17	20	37
Total	43	57	100

The analysis of table I show that M: F ratio for this study was 1.7: 1.

Histogram showing Sex distribution in present study

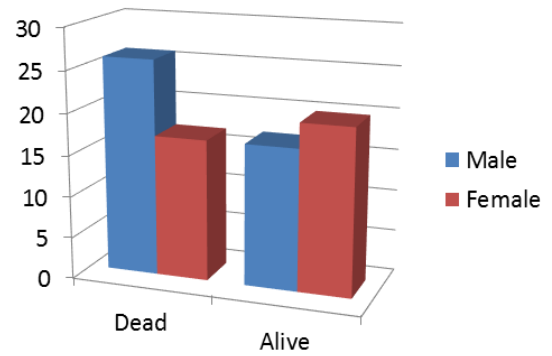
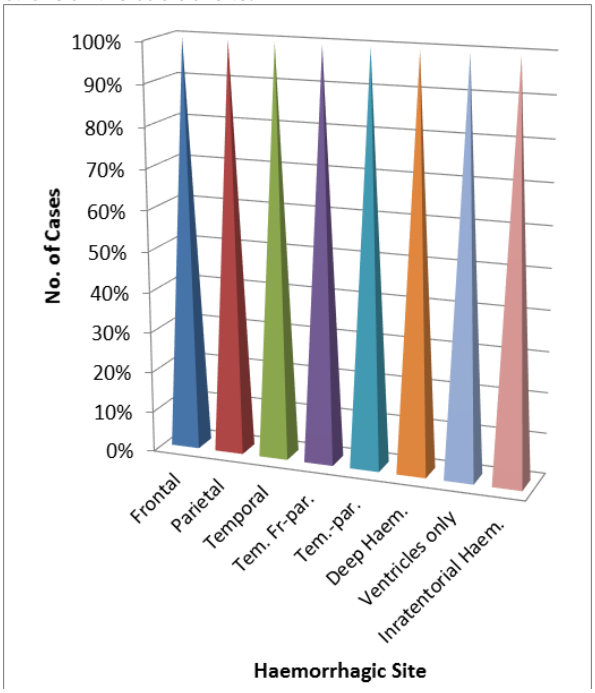


TABLE-2: Shows categorization of cases of hemorrhagic Stroke on the basis of site.

Lobar (n=18)	Number
Frontal	5
Parietal	5
Temporal	3
Temporal Fronto-parietal	3
Temporo-parietal	2
Deep hemorrhage (N = 75)	
Putamen	9
Thalamus	15
Caudate	2
Putamen + IC Putamen + IC + Thalamus Putamen + Thalamus Putamen + Caudate nucleus +External capsule	44
Ventricles only	5
Infratentorial Hemorrhage (N = 7)	
Cerebellar	3
Pons	3
Midbrain	1

Histogram showing categorization of cases of hemorrhagic stroke on the basis of site.



The mean age of patients in present study was 55.91 years, SD = 13.08 years while mean ages of patients with lobar and Deep hemorrhages were 58.09 and 54.93 years respectively.

TABLE- 3: Clinical presentation at the onset of hemorrhagic stroke.

Clinical presentation	Number	Percentage (%)
Headache	27	27
Vomiting	29	29
Loss of consciousness	66	66
Seizure/convulsions	11	11
Aphasia/slurring of speech	11	11
Weakness of limbs or focal neurologic deficit	77	77
Ataxia	2	2
Others – Cranial nerve palsy, deviation of angle of month	7	7

Histogram showing clinical presentation at the onset of hemorrhagic stroke.

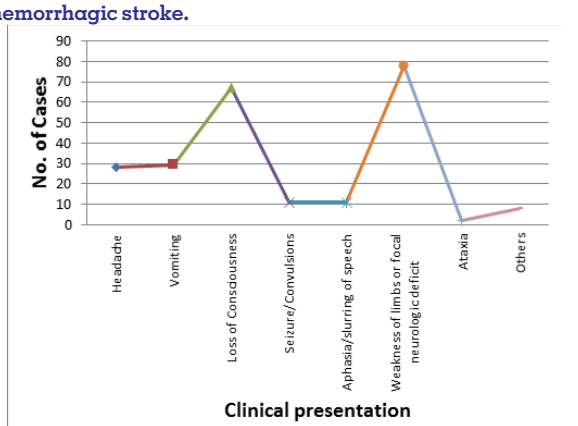


TABLE- 4: Association of risk factors in cases (n = 100)

	Number	Percentage (%)
Hypertension (HTN)	50	50%
Diabetes Mellitus	7	7%
Cardiovascular disease	2	2%
Prior Stroke	6	6%
Nor risk factor present	42	42%

TABLE:- 5 : Study parameters in lobar hemorrhage deep hemorrhage

Parameter	Lobar hemorrhage	Deep hemorrhage
Number of cases	18 (18%)	75 (75%)
Mortality	7 (38.8%)	36 (48%)
Mean age	58.09 yrs.	54.93 yrs.
Mean volume of hemorrhage	28.44 cm^3	36.52 cm^3

Histogram showing Mortality in Patients with HTN as risk factor.

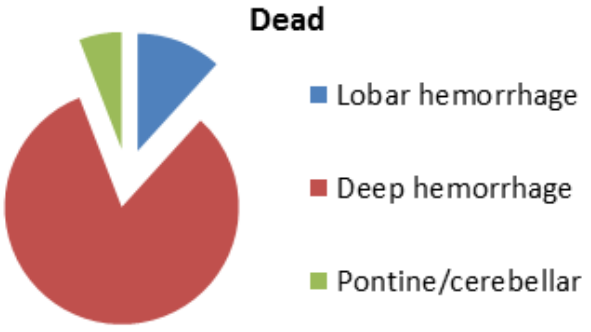


TABLE - 6: Barthel ADL score of all the patients at the end of Hospital stays (Day of discharge/mortality).

Barthel score	No. of cases (Freq.)	Cumulative Freq.
0	45	28
2	3	30
4	3	32
5	2	33
8	18	44
9	1	45
10	3	47
13	1	48
14	2	49
16	7	53
17	2	54
18	5	57
20	7	61
No evaluated	1	62

Mean Barthel ADL score = 6.16
Modal Barthel ADL score = 0
Median Barthel ADL score = 4

TABLE : 7 Shows volume of hemorrhage and associated Outcome

(Measured as mortality or survival)

Hemorrhage volume	Dead	Alive	Total
0 – 29 cm^3	11 (25.58%)	55 (96.5%)	66
30 – 60 cm^3	13 (30.2%)	2 (3.5%)	15
61 or more, cm^3	19 (44.4%)	0 (0%)	19
	43	57	100

Histogram showing volume of hemorrhage and associated outcome (measured as mortality or survival).

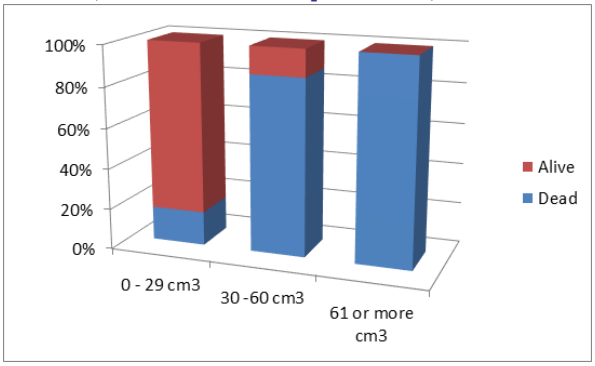


TABLE-8 : Shows presence or absence of ventricular extension or intraventricular hemorrhage in a case with associated outcome.

Intraventricular hemorrhage	Dead	Alive	Total
Present	28 (65.11%)	15 (26.3%)	43
Absent	15 (34.89%)	42 (73.7%)	57
	43	57	100

Histogram showing presence or absence of ventricular extension or intraventricular hemorrhage in a case with associated outcome.

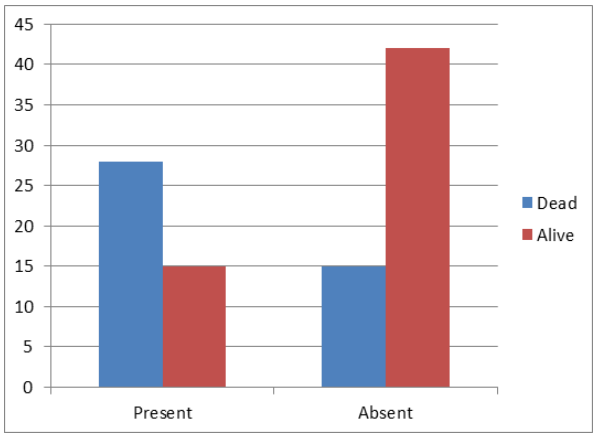


TABLE :-9 Shows Glasgow Coma Scale score at the time of Presentation

Intraventricular hemorrhage	Dead	Alive	Total
Present	28 (65.11%)	15 (26.3%)	43
Absent	15 (34.89%)	42 (73.7%)	57
	43	57	100

C.T images of different types of Haemorrhage

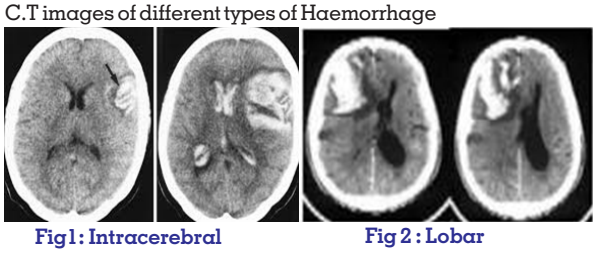


Fig1: Intracerebral Haemorrhage.

Fig 2 : Lobar Haemorrhage.

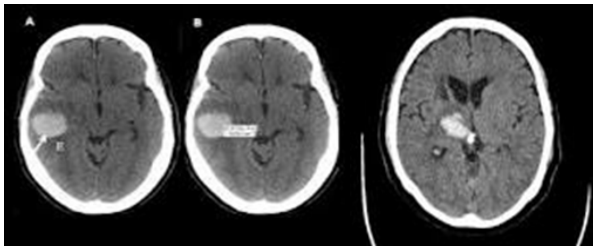


Fig 3 : Deep Haemorrhage.

Fig 4 : Thalamus Haemorrhage.

DISCUSSION

The present study, Computerised tomographic evaluation of site and volume of intra cerebral haemorrhage in patients of CVA and its prognostic correlation was done on 100 patients in department of radiology, Patna Medical College and Hospital, Patna. The purpose of this hospital based prospective study was (i) to correlate volume and location of lesion (hemorrhage) with clinical picture and prognosis, (ii) to determine clinical and CT parameters or findings that could predict prognosis. Among the 100 patients, 63 (63%) were male and 37 (37%) were female (sex ratio: 1.7: 1), age ranged between 18 and 82 years, and the mean age of patients was 55.91 years with S.D. = 13.08 year. The mean ages for lobar and deep hemorrhages were 58.09 and 54.93 years respectively. The mortality rate in acute stage was 43%. Remaining 57 survived till discharge at the end of acute

hospitalization. One of these cases left against medical advice. Intra cerebral hemorrhage has a reported 30 day mortality of 44% to 51% in population studies during the computed tomographic (CT) era. J.P. Broderick (1993), Douglas and Haerer reported a mortality rate of 40% in 1982. Helweg-Larsen et al 27% in 1984 Steiner et al 26% in 1984, Dixon et al. 33% in 1985, and Tuhrim et al 34% in 1988. These figures are strikingly similar if one considers the differences in time of assessment (at discharge from hospital in most cases) and the inclusion of posterior fossa hemorrhage in some series (Steineri I, Gomor J M et al., 1984). Fifty two patients (46%) with ICH died before day 14 following their ictus (Portenoy R.K. Lipton R B et al., 1987). J.P. Broderick et al. (1993) reported that 30 days mortality for patients with ICH was 44% with half of the deaths occurring within first 2 days. Focal neurologic deficit was the commonest presentation observed in 77% of the cases while alteration/loss of consciousness was seen in 66% of the cases in the present study. A.R. Massaro, J.P. Mohr et al., 1991, reported that three major clinical, non-radiologic variables distinguished LH from DH by logistic regression : severe headache (or, 4.1; 95% CL, 1.4 to 8.9), absence of hypertension by history (OR, 3.8; 95% CI, 1.5 to 9.4), and no motor deficit on the first neurologic examination (OR, 6.7, 95% CI, 1.3 to 34.1). Headache at onset was the most important clinical feature in LH patients but was not related to history of hypertension, size of the lesion and outcome (Gorelick PB et al, 1986; (Portenoy R.K. et al, 1984). Some have reported a higher frequency of seizures in patients with cortical involvement, (Kase CS, William JP et al., 1982; while others have not found any seizures in their LH patients (Ropper AH, Davis KR, 1980). Seizures were not associated with a higher early mortality or worsening (Kilpatrick CJ et al, 1990).

A history of hypertension, which in most cases has under treatment was present in 50% of the patients and 6% of the patients had a history of prior stroke before the recent incidence of hemorrhagic stroke (Table IV). Johan A. Radberg et al., 1991 reported that there was no definite correlation between hypertension and hematoma location. Although hypertension is regarded as a relatively common cause of spontaneous LH (Brot T et al, 1986), (Douglas MA, Haerer AF, 1982), hypertension was less frequent in LH than DH in the SDB (Stroke Data Bank) and hypertension did not affect the clinical presentation, volume, or early outcome in LH (A.R. Massaro et al., 1991).

SITE: In present study the location of ICH was lobar in 18%, deep ganglionic (+ventricle) in 75%, cerebellar in 3% and pontine/midbrain in 4% of the patients. The location of the hematoma in 13 (72.7%) of the LH patients was confined to a single cerebral lobe, while in 5 (27.2%) of LH patients, hematoma was located in two lobes. The putamen was most common location followed by thalamus. Putamen and adjacent basal ganglionic region accounted 70.7% of DH (deep hemorrhages) while thalamic (only) hemorrhage was noted in 20% of DH. 48% of the DH patients and 38.8% of LH patients died during acute hospitalization. In comparison to these mortality rates, A.R. Massaro et al., 1991 had reported that patients with either LH or DH had similar prognosis. The 30 days case fatality rate was similar (27.7% and 31.8% for LH & DH respectively) and by 1 year, 48.9% of LH patients and 39.1% DH patients were dead. Worsening and 30 days mortality were more frequent in those with larger hematomas. Broderick et al, 1993 had reported that 30 days mortality for lobar hemorrhage (39%) was slightly less than for deep (45%), pontine (44%) and cerebellar (64%) hemorrhage. The present study revealed that ICH location in infratentorial compartment accounted for 7% (n=7) of the cases and mortality was observed in only one case involving the pons. The statistical analysis to correlate patients outcome with location of ICH using the X^2 (chi-square) test had shown no correlation ($X^2 = 1.33$, $p > 0.50$). Table XIV. Similar conclusion had been drawn by P Daverat et al. 1991 and Broderick et al 1993. Hemorrhage side and hemorrhage location were not significantly correlated with survival at either 30 days or 6 months (P Daverate, J.P. Castel et al., 2001). In the univariate logistic regression analyses, volume of intracerebral hemorrhage (<0.0001), volume of intraventricular hemorrhage (p<,0.0001), and initial Glasgow Coma Scale score (p< 0.0001) were significant predictors of 30 days mortality, whereas age, sex, race, systolic blood pressure and location of hemorrhage were not (J.P. Broderick, T.G. Brott et al., 1993. With adequate statistical methods Daverat et al., 1991, demonstrated that intraventricular spread of the hemorrhage is a factor of mortality per se, while neither putaminal nor thalamic localization of the intraparenchymatous hemorrhage had any influence on mortality.

VOLUME: Level of consciousness in an important determinant of outcome in patients with ICH (Douglas M, Haerer AF, 1982; Fieschi C et al 1988; Steiner I, Gomori JH et al 1984; Portenoy R.K. et al. 1987. Tuhrim S, Dambrosia et al., 1988). In a logistic regression model, with hemorrhage subgroup and five CT findings as independent variables, locations (LH versus DH) was not an independent discriminator of coma defined by a GCS ≤ 8. However IVH (OR, 5.5; 95% CI, 2.6 To 11.4) and hematoma volume (or, 6.1; 95% CI 2.8 to 13.2) were important predictors of coma (A.R. Massaro, J.P. Mohr et al., 1991).

The present study revealed that 82% patients in coma (GCS <8) expired whereas 11.1% (6 out of 55 patients) patients with GCS ≥ 9 died during acute hospitalization. Among those patients who survived 17.7% (patients) had GCS ≤ 8. The statistical analysis performed to correlate the patients' outcome with GCS at the time of stroke onset using the x^2 (Chi-square) test has shown a significant correlation ($x^2 = 30.94$, $p < 0.01$). A.R. Massaro, J.P. Mohr et al, 1991 has concluded that larger hematoma volume in LH and the greater frequency of IVH in DH might account for the overall similar frequency of coma in these two groups.

IVH: Tuhrim et al., 1991 concluded that IVH clearly acted independently of hemorrhage size, lending support to those who have argued that IVH carried an especially grave prognosis in comatose patients. W.B. Young et al, 1990 concluded that he presence of significant amounts of intraventricular blood conveyed a poor prognosis in intracerebral hemorrhage and 20cc of blood was the "lethal volume", that for lateral and putaminal hemorrhages, ventricular blood volume was not significant, however the involvement of multiple ventricles by the hematoma was strongly correlated with an adverse prognosis and that there was a high correlation between ventricular blood volume, the number of ventricles involved, 4th ventricular involvement and extent of hydrocephalus.

In the present study, mortality in patient with IVH or VE was 65.1% whereas mortality in patients with no IVH/VE was 34.9%. Among the patients who survived during acute hospitalization, 26.3% (patients) had IVH/VE (Table X). The statistical analysis performed to correlate the patients' outcome (measured as mortality or survival) with IVH/VE using one X^2 (Chi-square) tests had shown a significant correlation ($X^2 = 10.40$, $p < 0.01$). Volpin et al 1984 has shown that there is a high likelihood of multi-colinearity between hemorrhage size, initial level of consciousness and midline shift (All of which are correlated). To avoid this limitation, Daverate et al., 1991 grouped hemorrhage size, midline shift and initial level of consciousness into one factor for TSL. Analysis and called that combined variable as "mass effect" which was then a powerful predictor ($X^2 = 16.2$, $p = 0.001$) of 30 days survival. Ropper AH and Gress DR in 1991 has stated that more refined criteria for measuring mass effect and edema should be used in future studies to better assess the brain tissue displacement and that horizontal displacement of

the pineal body and septum pellucidum and direct diencephalic destruction or distortion by an extension of the clot might affect structures associated with maintenance of arousal. Bolander MG et al 1983 has reported that grave prognostic CT finding was dilatation of the contralateral ventricle.

Barthel Score: In view of the better inter-observer and intra-observer agreement for the Barthel scale, it was suggested that a Barthel score be assessed and a Rankin score derived to assess handicap (C.A. A Wolfe, 1991). In patients who survived the acute stage, the prediction of functional outcome was of great importance but remained difficult because of methodologic problems including sample selection bias, timing of the initial assessment, criteria for measuring outcome and the role of confounding factors. The present study revealed that mean Barthel core was 6.16 while modal Barthel score was 0 (fully dependent). As the last recorded follow up for most patients included in present study comprised death or discharge after acute hospitalization (average length of hospital stay = 23 days), no conclusion could be drawn regarding the functional outcome. According to the results of univariate analysis and the literature six potential prognostic factors (shift, site, GCS, IVH, volume, and pulse pressure) were selected for multivariate analysis by logistic regression. Multivariate analysis by logistic regression revealed that out of six variables studied, shift GCS and volume of hemorrhage had significant effect on mortality.

According to the analysis the mortality in patients with shift > 5 mm was to be expected 18.7 times more than that in patients with shift < 5 mm. Similarly, mortality in patients with GCS ≤ 8 was to be expected 12.2 times more than that in patients with GCS ≥ 9 and the mortality in patients with volume of hematoma > 29 cm^3 was to be expected 98.5 times more than that in patients with volume < 29 cm^3. On The basis of the classification table, it was evident that those three variables when considered together (Shift GCS and volume), the mortality was predicted with a sensitivity of 88.89% and a specificity of 94.3%.The statistically significant correlates for all hemorrhages were admission status, total blood, and hydrocephalus, number of ventricles containing blood, parenchymal components, ventricular component and extent of 4th ventricular blood. Age and pulse pressure did not correlate with outcomes (W.B. Young et al., 1990). However, Daverat et al 1991, has reported that the probability of mortality in ICH patients appeared to, independent of age until 4 weeks after onset, but greatly increased with age afterward.

CONCLUSION: Following results and conclusion were drawn:

1. Among the 100 patients, 63 (63%) were male and 37 (37%) were female sex ratio was 1.7:1.
2. Age ranged between 18 and 82 years and the mean age of patients was 55.9 year with SD = 13.08 year. The mean ages for lobar and deep hemorrhages were 58.09 and 54.93 years respectively.
3. The mortality rate in acute stage (for most patients the last recorded follow up comprised death or discharge after the acute hospitalization) was 43%. Remaining 57% (57 out of 100 patients survived till discharge at the end of acute hospitalization. One of these patients left against medical advice.
4. Focal neurologic deficit was the commonest presentation observed in 77% of the cases while alteration/loss of consciousness was seen in 66% of the cases in the present study. A history of hypertension, which in most cases has under treatment, was present in 50% (50) of the patients and 6% (6) of the patient had a history of prior stroke before the recent incidence of hemorrhagic stroke.
5. **Site:** The site/location of ICH was lobar in 18%, deep ganglionic (+ventricular) in 75%, cerebellar in 3% and pontine / midbrain in 4% of the patients.

   The location of the hematoma in 13 (72.7%) of the LH patients was confined to a single cerebral lobe, while in 5 (27.27%) of LH patients, hematoma was located in two lobes. Putamen and adjacent basal ganglionic region accounted 70.7% of DH while thalamic (only) hemorrhage was noted in 20% of DH. 48% of the DH patients and 38.8% of LH patients died during acute hospitalization. The ICH location in infratentorial compartment accounted for 7% (7) of the cases and mortality was observed in only one case involving the pons.

   The statistical analysis to correlate patients outcome with location of ICH using X^2 (Chi-square) test has shown no correlation ($X^2 = 1.33$, $p > 0.50$). Similar conclusion has been drawn by P. Daverat et al. 1991 and Broderick et al, 1993.

6. **Volume:** The hematoma volume ranged from 0.06 cm^3 to 177.08 cm^3, mean volume was 32.69 cm^3. Mean volumes for LH/DH and pontine/cerebellar hemorrhages were 28.44 cm^3, 36.52 cm^3 and 6.84 cm^3 respectively. For ICHs with a volume of 61 cm^3, mortality for DH was 81.8% and for LH was 18.18%. For hemorrhage volumes of 30 to 60 cm^3, mortality was 80% for DH and 10% for LH. Hemorrhages with a volume < 29 cm^3 mortality was 12.1% for DH and 2.4% for LH. When hematoma volume exceeded 61 cm^3 (19 patients were in this group), the mortality was 100%. Further, 96% (54 out of 56 patients) of the patients who survived till discharge had volume of hematoma < 29 cm^3 and only 2 patients survived among those who had hematoma volume 30.60 cm^3 (the group 30 to 60 cm^3). One of the patient with pontine hemorrhage volume = 10.14 Cm^3 expired during acute hospitalization, while no mortality was observed in patients with cerebellar hemorrhages. The lower mortality rates observed in the present study as compared to those in series by Broderick et al might be attributed to small sample size for LH (18 out 100 patients, 17.74%) and to smaller mean volume for LH, 28.44 cm^3 as compared to that for DH (=36.52 cm^3).
7. **GCS:** 82% of the patients in coma (GCS ≤ 8) expired whereas 11.1% of the patients with GCS ≥ 9 died during acute hospitalization. Te statistical analysis performed to correlate the patient's outcome with GCS at the time of stroke onset using the X^2 (Chi-square) test has shown a significant correlation ($X^2 = 30.94$, $p < 0.01$).
8. **IVH:** The mortality in patients with IVH or VE was 65.11% whereas mortality in patients with no IVH/VE was 26.3%. The statistical analysis, performed to correlate the patients' outcome with IVH/VE using X^2 (Chi-square) test has shown a significant correlation ($X^2 = 10.40$, $p < 0.01$).
9. **Shift:** The statistical analysis performed to correlate the patient's outcome with midline shift using X^2 (Chi-square) test has shown a significant correlation ($X^2 = 20.96$, $p < 0.01$).
10. **Barthel Score:** The mean Barthel score was 6.16 while modal Barthel score was 0 (fully dependent). As the last recorded follow up for most patients included in present study comprised death or discharge after acute hospitalization (average length of hospital stay = 23 days), no conclusion could be drawn regarding the functional outcome.
11. Multivariate analysis by logistic regression revealed that out six variables studied, sift, GCS and volume of hemorrhage had significant effect on mortality.

According to the analysis the mortality in patients with shift ≥ 5 mm was to be expected 18.7 times more than those in patients with shifts ≤ 5 mm. Similarly, mortality in patients with GCS < 8 was to be expected 12.2 times more than that in patients with ≥ GCS 9 and the mortality in patients with volume of hematoma > 29 cm^3 was to be expected 98.5 times

more than that in patients with volume < 29 cm^3. On the basis of the classification table, it is evident that those three variables when considered together (shift, GCS and volume) the mortality was predicted with a sensitivity of 88.89% and a specificity of 94.3%.

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