

Demographics and Prognostic Value of Computed Tomography in Spontaneous Intracranial Haemorrhage

D. Venkata Ramana Rao¹, Vinay N.V.P², Sunil Kumar Ravuri³, Pottala Krishna Mohan⁴

¹Associate Professor, Department of Radiology, GSL Medical College and General Hospital, Andhra Pradesh.

²Assistant Professor, Department of Radiology, GSL Medical College and General Hospital, Andhra Pradesh.

³Resident, Department of Radiology, GSL Medical College and General Hospital, Andhra Pradesh.

⁴Associate Professor, Department of Radiology, GSL Medical College and General Hospital, Andhra Pradesh.

ABSTRACT

BACKGROUND

The type of haemorrhage that occurs inside the cranium is called intracranial haemorrhage. Worldwide, Computed Tomography (CT) is a widely used method in the evaluation of patients with intracranial haemorrhage. We wanted to determine the age group and sex distribution of spontaneous intracranial haemorrhage and assess the prognostic value of CT findings in spontaneous intracranial haemorrhage.

METHODS

This observational cross-sectional study was conducted over a period of 18 months using Toshiba Alexion 16 slice CT machine. CT examination was performed in supine position. Serial CT sections of brain were obtained from orbitomeatal line at 5 mm intervals in posterior fossa and 10 mm interval thereafter. CT Images were analysed for location, size, number, margins, surrounding oedema, mass effect, effect on ventricles, calcification and contrast enhancement. Statistical analysis was performed by SPSS Software Trial Version 21 and MS Excel 2007.

RESULTS

All 104 cases above 10 years of age referred to the Department of Radiodiagnosis at GSL Medical College, Rajahmundry, with suspected spontaneous ICH were studied.

CONCLUSIONS

CT is useful in detecting the site, size, mass effect and ventricular extension of the intracranial bleed which aid in assessing the prognosis. CT scan has added a new dimension in preoperational evaluation of patients with intracranial haemorrhage.

KEYWORDS

Computed Tomography, Intracranial Haemorrhage, Intracerebral Haemorrhage, Aneurysm, Prognosis

Corresponding Author:

*Dr. Pottala Krishna Mohan,
Associate Professor,
Department of Radiology,
GSL Medical College and General
Hospital, Andhra Pradesh.
E-mail: gslcentralresearchlab@gmail.com
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BACKGROUND

The type of haemorrhage that occurs inside the cranium is called intracranial haemorrhage. Spontaneous intracranial haemorrhage is bleeding into the brain due to aetiologies other than trauma. Intracerebral haemorrhage is classified as either primary or secondary depending on the underlying cause. Primary intracerebral haemorrhage (PICH) accounts for about 78-88% of cases, which originate from spontaneous rupture of small vessels damaged by chronic hypertension or Amyloid angiopathy.¹ About 10% of all cases with acute stroke would have suffered a primary intracerebral haemorrhage.¹ It is associated with 20-50% mortality if ventricular extension has been diagnosed.² The size of the initial bleed has been shown to be a predictor of mortality and morbidity.³ Secondary intracerebral haemorrhages occur in minority of patients in association with vascular abnormalities such as (arteriovenous malformations (AVMs) and aneurysms), tumours or impaired coagulations.⁴ Subarachnoid haemorrhage (SAH) forms about 10% of all bleeding events in the brain.⁵ Median age of incidence for both is about 60 years.⁶ Females are majorly affected than males i.e. 1.6 times more. Forty seven percent of patients with SAH of unknown origin in females.⁷ Forty seven percent patients may be expected to die as result of their first SAH.³ Extensive subarachnoid clot and marked intraventricular haemorrhage are usually correlated with poor prognosis.³ Primary intraventricular haemorrhage is a rare event, can sometimes be traced to a vascular malformation or neoplasm in the choroid's plexus. Peak incidence of hypertensive bleed is in the age group between 50 and 60 years.⁸ The overall mortality rate of hypertensive haemorrhage is approximately 50% with increasing mortality depending upon the size of the hematoma and the presence of degree of intraventricular extension.⁹ Site and size of the hematoma will influence the prognosis and patients with superficial lobar hematoma have a better outlook than those with clots in basal ganglia.⁵ Midline shifts findings by Computed tomography (CT) implies a bad prognosis. Ruptured aneurysm is the 4th most common cause of cerebrovascular disorder. Ruptured aneurysm contributes 25% of all causes of intracranial haemorrhage (ICH).⁸ Bleeding into the brain parenchymal occurs in up to 40% of ruptured intracranial aneurysms and is associated with much higher mortality rates. Autopsies of cases with fatal aneurysm ruptures reveal that nearly three fourths have ICH.

Haemorrhage from ruptured AVM forms 1-2% of all strokes.⁵ the peak incidence of AVM is in the third decade of life. The first haemorrhage may be fatal but in more than 90% of cases patient survives. Non-contrast head CT characteristics are also predictive of patient outcome, and a worse prognosis is associated with the initial size of the hematoma^{5,6} intraventricular extension of the haemorrhage,⁷ and expansion of the hematoma on serial imaging.^{10,11}

We wanted to determine the age group and sex distribution of spontaneous intracranial haemorrhage and

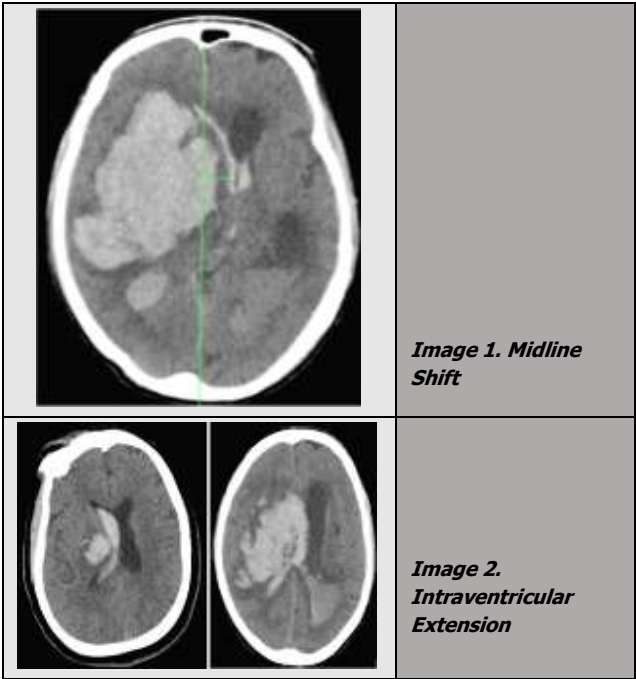
assess the prognostic value of CT findings in spontaneous intracranial haemorrhage.

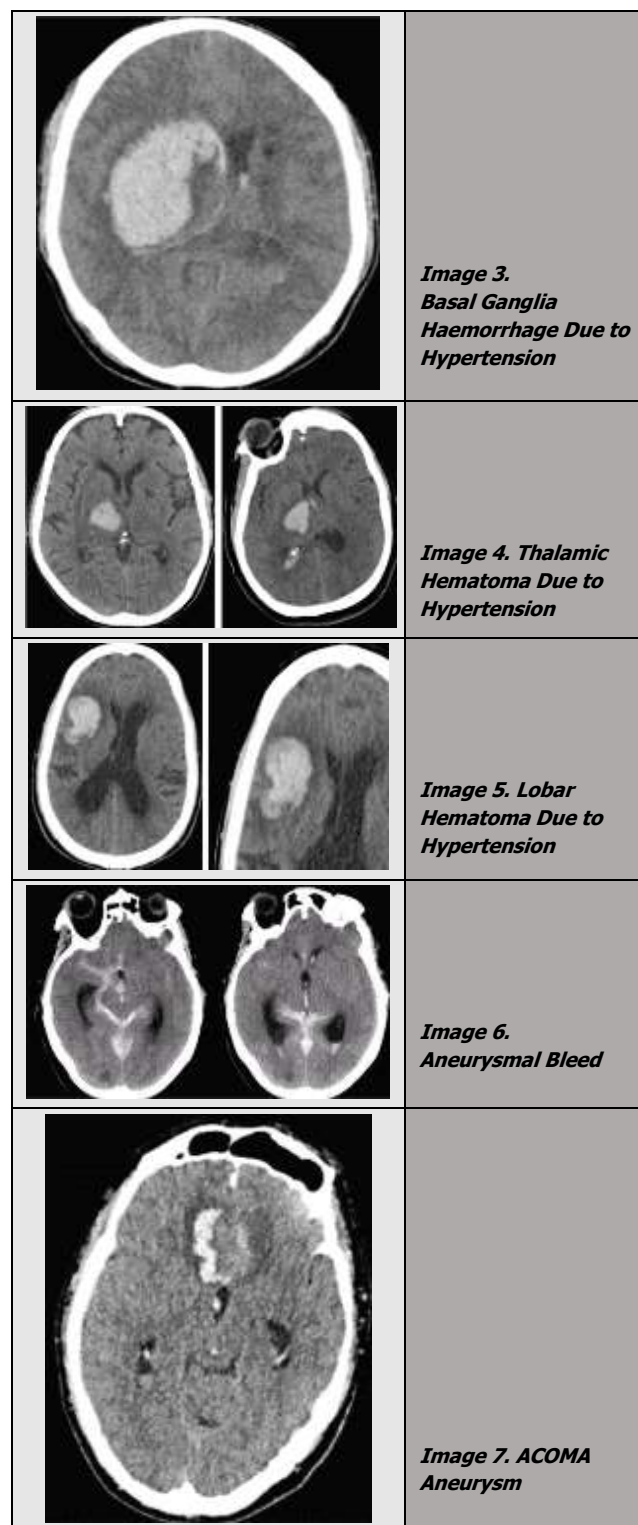
METHODS

All cases of both gender above 10 years of age referred to the department of Radio Diagnosis at GSL Medical College, Rajahmundry with suspected spontaneous ICH were included in this study. This hospital based observational cross-sectional study was conducted using Toshiba Alexion 16 slice CT machine between 1st January 2016 to 30th June 2017. CT examination was performed in supine position. Serial CT sections of brain were obtained from orbitomeatal line at 5 mm interval in posterior fossa and 10 mm interval thereafter. Post contrast images are obtained if required. Thinner sections are taken for the region of interest where required. CT Images were analysed for location, size, number, margins, surrounding oedema, mass effect, effect on ventricles, calcification and contrast enhancement. Rapid simplified method was used to measure the volume of the ICH. The formula used $(A \times B \times C)/2$ is an approximation for the Volume of an ellipsoid where A is the greatest haemorrhage diameter on axial CT scan, B is the largest diameter 90° to A and C is the number of slices with haemorrhage multiplied by slice thickness. Statistical analysis was performed by using SPSS Software trial version 21 and MS Excel 2007.

RESULTS

All 104 cases above 10 years of age referred to the department of Radio Diagnosis at GSL Medical College, Rajahmundry with suspected spontaneous ICH were studied.





Age	No. of Cases	Percentage of Cases
10-19	1	1
20-29	8	8
30-39	12	11
40-49	11	11
50-59	20	19
60-69	33	32
70-79 and above	19	18

Table 1. Age Distribution of Spontaneous Intracranial Haemorrhage

Sex	No. of Patients
Male	60
Female	44

Table 2. Sex Distribution

Prognosis	No. of Patients
Hospital death	30
Discharged on request	10
Underwent surgery for aneurysm	7
Referred to higher center	5
Could not follow	10

Table 3. Prognosis of Intracranial Haemorrhage

CT Findings	No. of Patients	No. of Deaths
Size >3 cm	35	16
Ventricular extension	27	10
Mass effect	38	12
Midline shift	16	7
Oedema	35	6
Location		
Basal ganglia	20	5
Thalamus	12	5
Cerebellum	7	4
Brain stem	3	1
Lobar	37	3

Table 4. Computed Tomography Findings in the Prognosis of Intracerebral Haemorrhage

DISCUSSION

CT provides a useful means of diagnosing intracranial haemorrhage. Most of the studies have been done to determine the radiological outcome of intracranial haemorrhage. Statistically age is important prognostic indicator with non-traumatic spontaneous intracranial haemorrhage. The maximum incidence of intracranial haemorrhage noted in our study was in the 6th and 7th decade.

The incidence reported to be maximum between the age group 50-80 from various studies.¹² Study conducted by Ozer et al showed that men are more likely to suffer from ICH than women and the likelihood increases with age.¹³ Cerebral Amyloid Angiopathy is now recognized as common in the older age groups (upto 40-60% of patients older than 80) and is the primary ICH in a substantial population in the elderly.¹⁴ In our study, 50 patients were having hypertensive hematoma which corresponds with the incidence reported literature.¹⁵ A male preponderance was noted (58: 42) and 41 (51.8%) of the patients were above 45 years of age. In our series, the maximum numbers of aneurysmal haemorrhage were in age group of 60-70 (68.5%). The report incidence of 72% of cases between the age group of 30-60. Half of the cases of AVMs were seen in the second and third decades in our study. Male to female ratio was 4:1. The peak incidence of haemorrhage is reported to occur more in the elderly part of the third decade.¹⁶ Intracerebral haemorrhage accounts for 10% of all stroke deaths and is fatal in 50% of cases. It is associated with 20-35% of mortality. Prognosis of a patient with ICH is based on its location, severity and aetiology. In this study 30 patients died in the hospital while 10 patients with poor prognosis were discharged.

A case fatality rate of ICH is approximately 40% at 1st month and 54% at 1st year. Only 12% to 39% of patients achieve long-term functional independence. A meta-analysis of ICH outcomes between 1980 and 2008 showed no appreciable change in case fatality rate over that time period.¹⁷ A worldwide stroke epidemiology study revealed that early stroke case fatality (21-day to 1-month) varied

substantially among countries and study periods; the case fatality rate was 25-30% in high-income countries while it was 30-48% in low to middle-income countries.¹⁸ Gambhir et al in 1993 reported that prognosis has significant correlation with location, volume of the haemorrhage, ventricular extension and mass effect.¹⁹ A large bleed on CT, correlates with a poor outcome. Mortality in Pilot Stroke Data was 145 in small hematomas (size < 0.5 lobe) and 74% in larger ones (size > 1 lobe). A hematoma is considered massive if it is more than 3 cm. In our study, out of 35 patients with a hematoma of size more than 3 cm, 16 died. There was no correlation between size of hematoma and degree of mass effect and cerebral oedema. In our study, 18 patients (48.6%) with ventricular extension died in hospital. Weisberg noted 25-25% mortality if ventricular extension occurred. 3 Blood in the ventricle is a poor prognostic sign. The mass effect is a major factor in determining mortality. Weisberg noted 40% of the patients who died showed significant midline shift (more than 13 mm).³ Oedema is not a major factor, which determines the prognosis. Twelve out of 51 patients who showed significant oedema died in this study. Cerebral oedema per se without mass effect did not carry bad prognosis as seen in earlier studies.¹⁹

Patients with superficial lobar hematoma have a better prognosis than those with clot in basal ganglia. Majority of hypertensive bleed occurs in basal ganglionic area. In this study, 5 patients with basal ganglionic bleed died, while only 2 patients with lobar hematoma died. Thalamic 4, brain stem 3 and cerebellar 2 also showed high mortality correlating with other studies.¹⁹ Out of 50 patients with history of hypertension, who showed hematoma, 12 patients (24.8%) died. The overall mortality rate of hypertensive haemorrhage reported is 50% with increasing mortality depending upon the size of hematoma and presence of ventricular extension.⁹ In our study, 6 patients out of 15 died in the hospital. Eight patients with aneurysmal rupture underwent surgery. Rinkel reported that 43% of patients are expected to die as a result of their first subarachnoid bleed, one showing complicated intracerebral hematoma and intraventricular haemorrhage had poor neurological status.²⁰ Three patients showing intracerebral extension and another 4 patients with intraventricular extension died in our study. Six patients out of 12 with aneurysmal bleed died. Tandon et al showed 76% of mortality in conservatively managed group.²¹ Out of 5 patients with AVMs who showed a bleed, all were with good neurological status and referred to higher centers. It has been noted that ruptured AVMs cause an average morbidity and mortality of approximately 10% and 30% respectively.²² Out of 4 patients with tumoral haemorrhage in our study, 2 patients with pituitary macro adenoma and choroids plexus tumour died in the hospital and the other patient was discharged. The intracerebral tumours showing bleed are associated with poor prognosis.²³

CONCLUSIONS

CT is useful in detecting the site, size, mass effect and ventricular extension of the intracranial bleed which aid in assessing the prognosis. CT scan findings are very helpful in assessing the prognosis of a patient with intracranial haemorrhage. CT scan has added a new dimension in preoperational evaluation of patients with intracranial haemorrhage.

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