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# Clinicoetiological and Imaging Profile of Intracerebral Haemorrhage

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## I. Introduction

Cerebrovascular diseases are the third leading cause of death after heart disease and cancer in developed countries. Intracerebral hemorrhage (ICH) is a common devastating neurologic event that causes high morbidity and mortality with profound economic implication. ICH will seem to continue to be an important problem in both India and other developed countries. Nontraumatic ICH occurs due to bleeding from a vascular source directly into the brain substance. It is a major public health problem[1] with an annual incidence of 10–30/100,000 population,[1,2] accounting for 2 million (10–15%)[3] of about 15 million strokes worldwide each year.[4]

Primary or Spontaneous intra-cerebral hemorrhage (ICH), which is defined as spontaneous rupture of the intra-cerebral small vessels following cerebral vessel wall degeneration due to frequent chronic hypertension or rarely to cerebral amyloid angiopathy. The risk factors for ICH are identified as hypertension, advancing age, male sex, excessive alcohol intake, anticoagulation therapy, smoking, and diabetes.[5,6,7,8] To determine these risk factors is very important in terms of developing preventative measures.

Hospital admissions for ICH have increased by 18% in the past 10 years,[9] probably because of increases in the number of elderly people,[10] many of whom lack adequate blood pressure (BP) control, and the increasing use of anticoagulants, thrombolytics, and antiplatelet agents. Incidence might have decreased in some populations with improved access to medical care and BP control.[11,12,13]

Hence, we aimed to study, the clinical, radiological profile in patients of ICH. In clinical profile risk factors, symptomatology and physical findings were studied. In radiological profile, size, and location of hematomas, correlation of the size of hematomas with size were also studied. We also studied mortality, morbidity, and predictive factors of clinical outcome of ICH.

## II. Materials & Methods

A. **PLACE OF STUDY:**
DEPARTMENT OF GENERAL MEDICINE, VIMSAR, BURLA
B. **PERIOD OF STUDY:**
NOVEMBER 2017 TO OCTOBER 2019
C. **STUDY DESIGN:**
HOSPITAL BASED OBSERVATIONAL STUDY
D. **STUDY POPULATION:**
All patients admitted to Department of General Medicine, VIMSAR diagnosed with intracerebral haemorrhage
E. **SAMPLE SIZE:**
All the patients diagnosed with intracerebral haemorrhage with maximum of 200 patients.
F. **SAMPLING TECHNIQUE:**
Simple random sampling
**G. INCLUSION CRITERIA**

- All patients admitted to Department of General Medicine, VIMSAR with a confirmed diagnosis of intracerebral haemorrhage based on neuroimaging techniques.

**H. EXCLUSION CRITERIA**

- Patients presenting with traumatic intracerebral haemorrhage
- Patients with primary subarachnoid, extradural, subdural haemorrhage
- Patients who do not give consent for the same.

**I. CONSENT**

A written informed consent was taken from all the patients or immediate relatives in case of incapacitated patient, before they were included in the study.

**J. INTERVENTION**

– No invasive intervention required for the purpose of the study

**K. DATA COLLECTION:**

The following parameters were recorded with the help of a structured proforma.

– Demographics
– Co morbidities
– Addictions
– Presenting complaints at admission
– Vital signs – Pulse rate, Blood pressure, Respiratory rate and Glasgow coma scale at the time of admission
– Investigations
• Biochemical- plasma glucose, serum electrolytes, blood urea, serum creatinine, liver function tests, urine analysis, lipid profile
• Complete blood count
• Serology for HIV, HBV and HCV
• CT scan of brain – Non contrast CT scan
• MRI scanning if available
• Special investigations that might be required in selected patients:
• Coagulation profile- BT, CT, PT with INR, aPTT
– Events and treatments during course of hospital stay.

**L. DATA ANALYSIS**

All recorded data were analysed through standard statistical methods including standard diagrams and graphs and findings are discussed in detail to draw appropriate conclusions.

**M. LIMITATIONS**

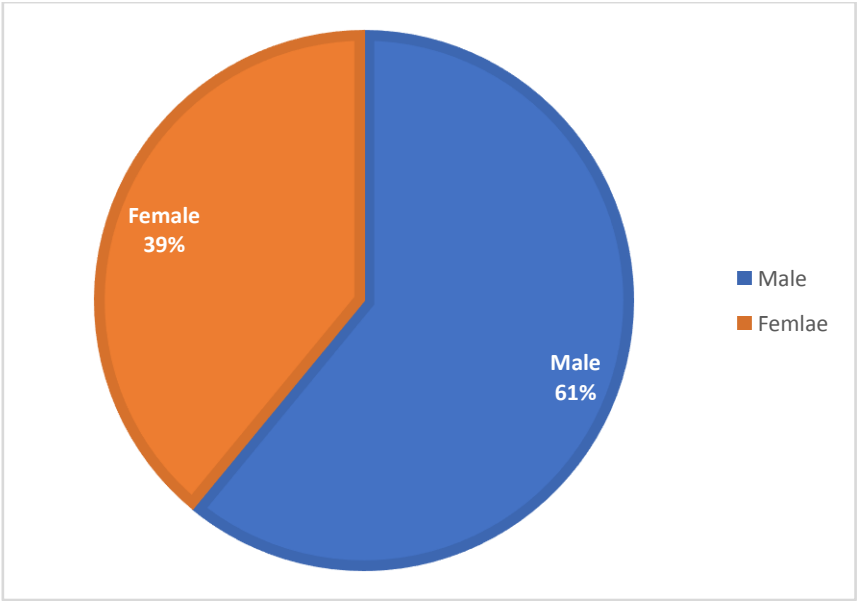
- As the sample size were smaller, it could have affected our observations and conclusions.
- Due to limited resources in our setting, we could not do CT angiography,MR angiography to localise the vessels.
- As the study was done only in our centre,there may be regional variations in etiology and also management strategies for which we cannot generalise to the whole population

## III. Observations

**TABLE 1: SEX DISTRIBUTION**

| Sex | Number | Percentage |
|---|---|---|
| Male | 64 | 61% |
| Female | 41 | 39% |
| Total | 105 | 100% |

**GRAPH 1: SEX DISTRIBUTION**

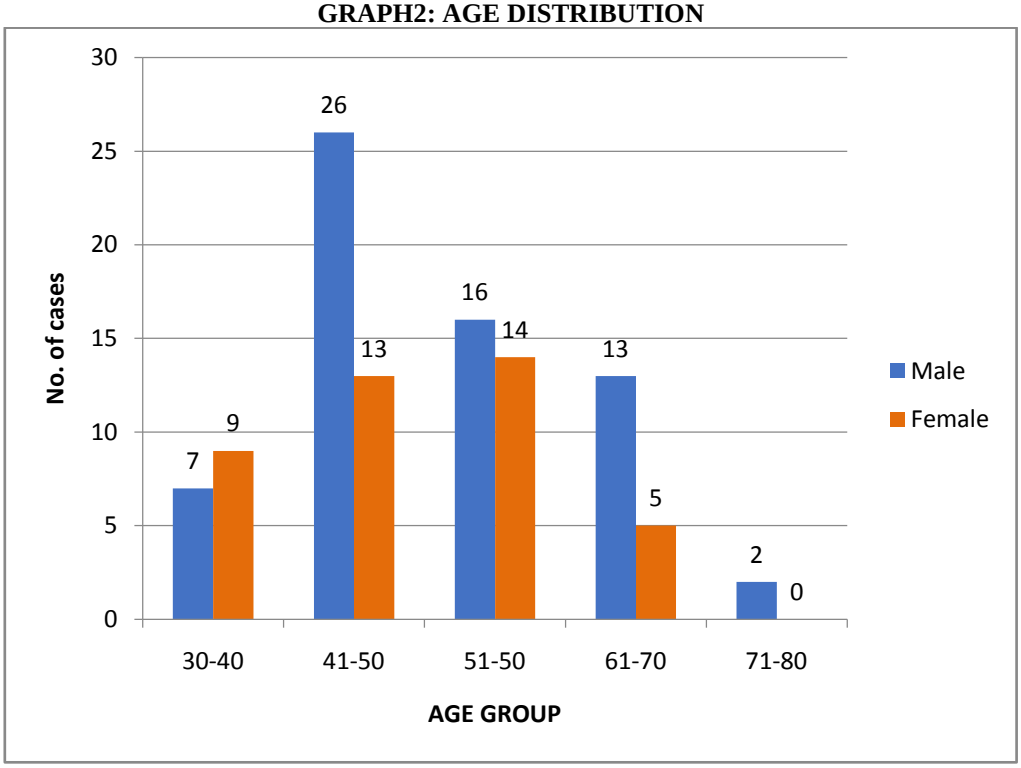


Out of 105 patients of IC bleed who were prospectively studied from 2017 to 2019, 64 (61%) were males and 41(39%) were females.

**TABLE2: AGE DISTRIBUTION**

| Age Group | Sex | Number | Total | Percentage |
|---|---|---|---|---|
| 30-40 | Male | 7 | 16 | 15.23% |
| | Female | 9 | | |
| 41-50 | Male | 26 | 39 | 37.14% |
| | Female | 13 | | |
| 51-60 | Male | 16 | 30 | 28.57% |
| | Female | 14 | | |
| 61-70 | Male | 13 | 18 | 17.14% |
| | Female | 5 | | |
| 71-80 | Male | 2 | 2 | 1.9% |
| | Female | 0 | | |
| Total | Male | 64 | 105 | 100% |
| | Female | 41 | | |

**GRAPH2: AGE DISTRIBUTION**

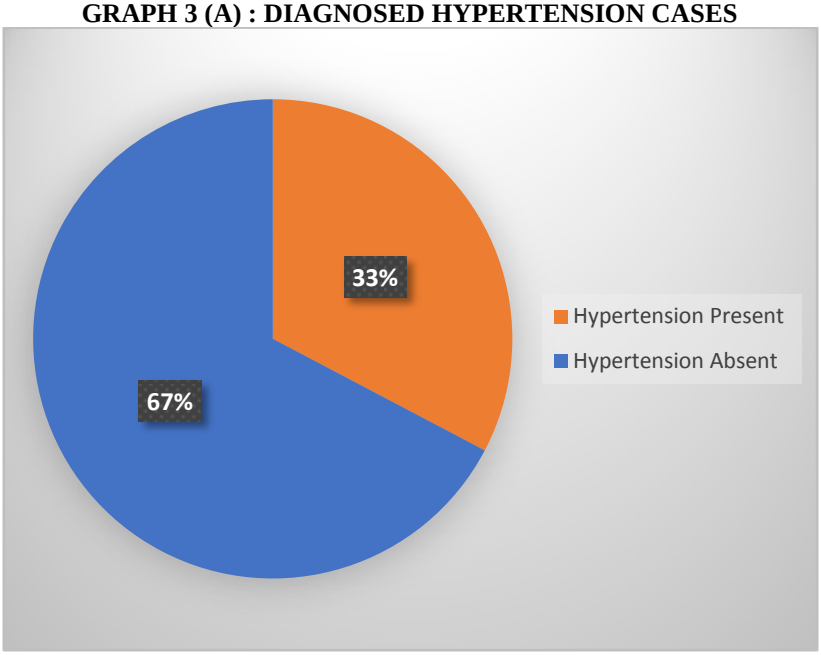



Out of 105 patients, 15.23% patients were in the 30-40 age group, 37.14% in the 41-50 age group, 28.57% in the 51-60 age group, 17.14% in the age group and 1.9% in the age group.

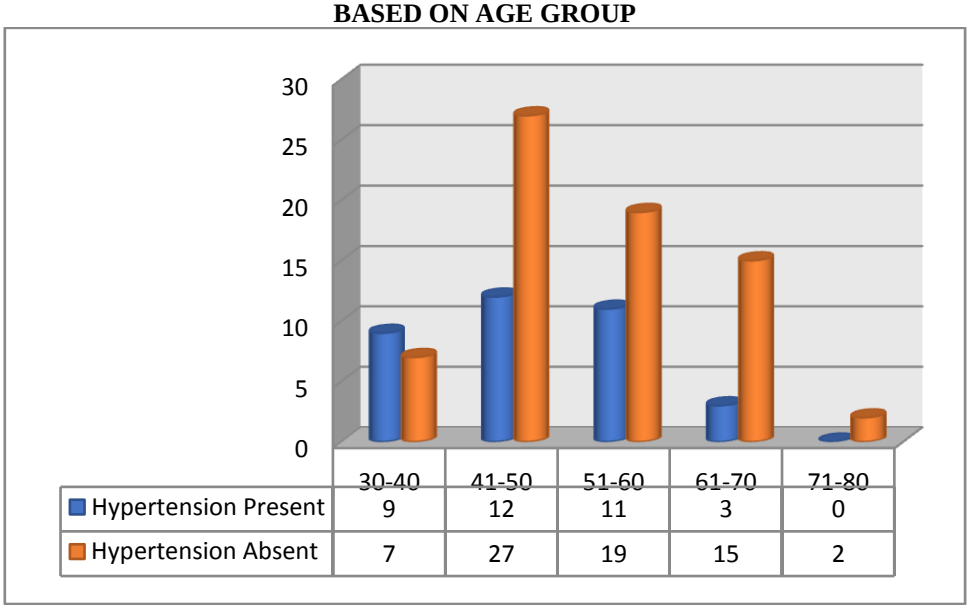
**TABLE3: DIAGNOSED HYPERTENSION CASES**

| Hypertension | Number | Percentage |
|---|---|---|
| Present | 35 | 33% |
| Absent | 72 | 67% |
| Total | 105 | 100% |

**GRAPH 3 (A) : DIAGNOSED HYPERTENSION CASES**




**GRAPH3 (B) : DIAGNOSED HYPERTENSION CASES BASED ON AGE GROUP**

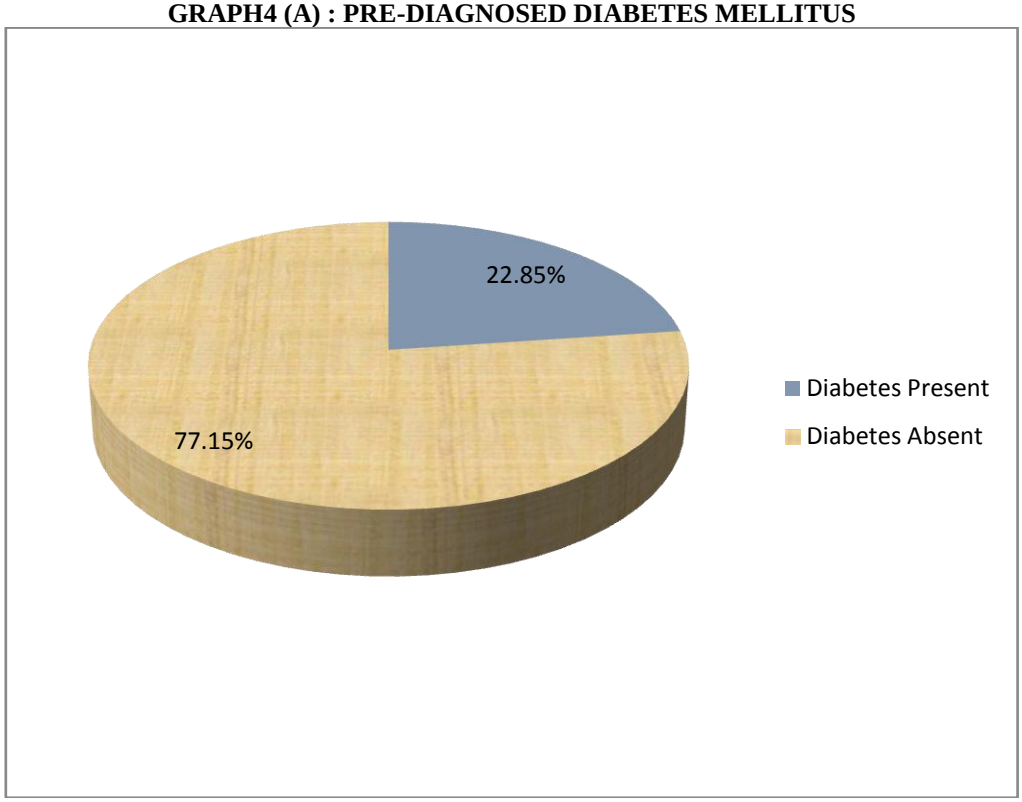



Out of 105 patients, 35 patients (33%) had hypertension and 72 patients (67%) didn't have pre-diagnosed hypertension. Of all the age groups, only 17.6% of patients with age >60 had pre-diagnosed hypertension, while 56% patients with age<40 had pre- diagnosed hypertension.

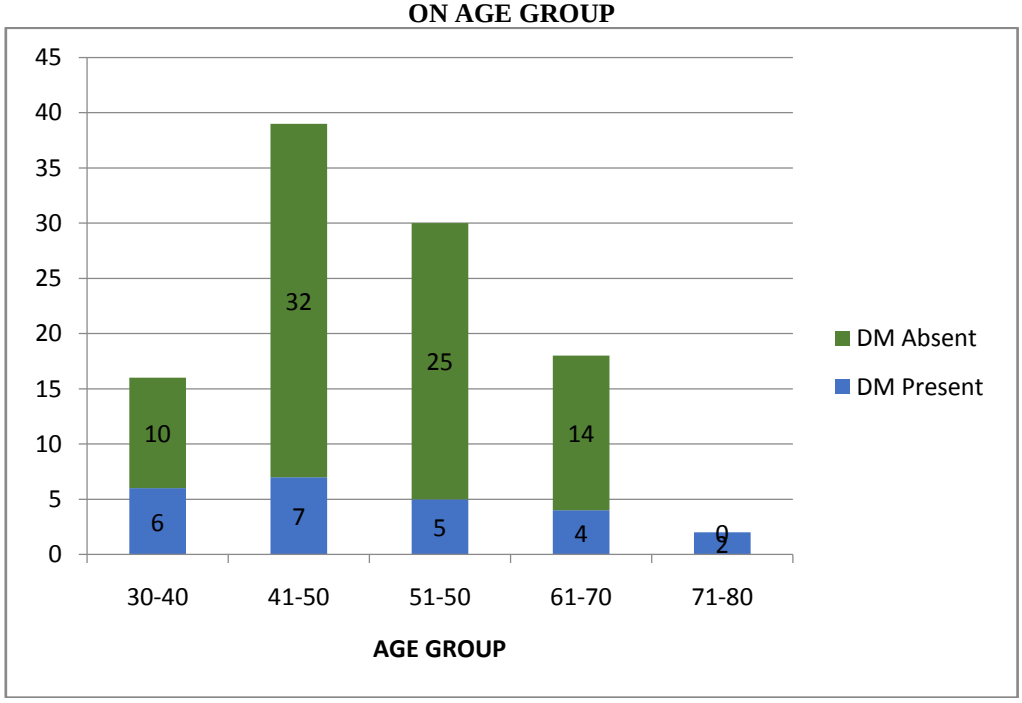
**TABLE4: PRE-DIAGNOSED DIABETES MELLITUS**

| Diabetes | Number | Percentage |
|---|---|---|
| Present | 24 | 22.85% |
| Absent | 81 | 77.15% |
| Total | 105 | 100% |

**GRAPH4 (A) : PRE-DIAGNOSED DIABETES MELLITUS**




**GRAPH4 (B) : DIAGNOSED CASES OF DIABETES BASED ON AGE GROUP**

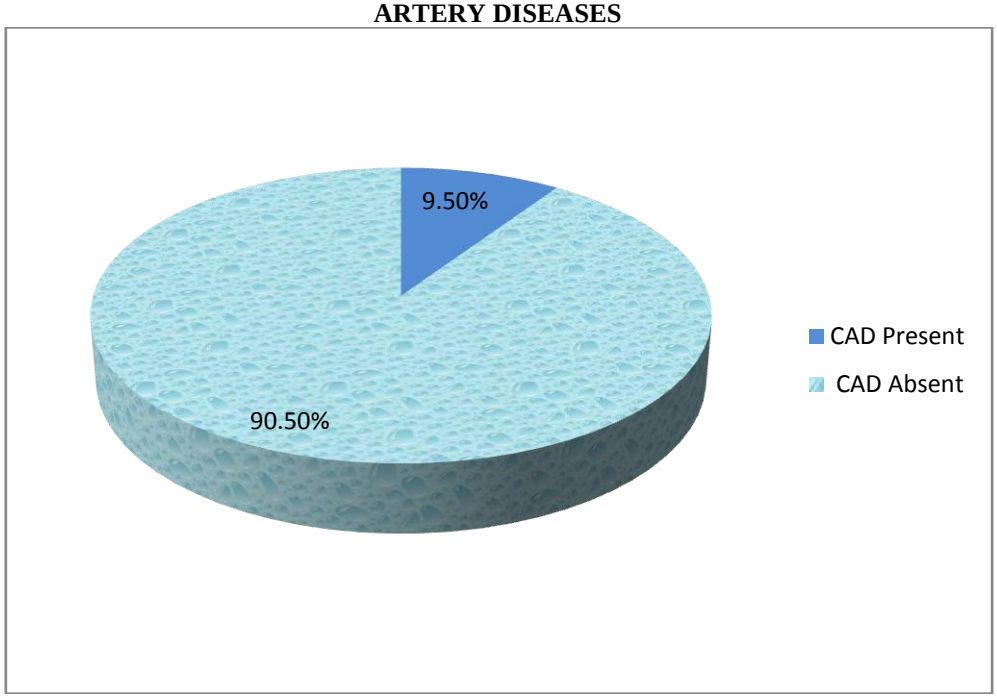



Out of 105 patients, 24(22.85%) had a diagnosis of diabetes made prior to the IC bleed episode. Out of all the age groups, the extremes of age group had more percentage of diabetes( 37.5% of patients with age <40 and 100% patients with age >70 had a diagnosis of diabetes mellitus.

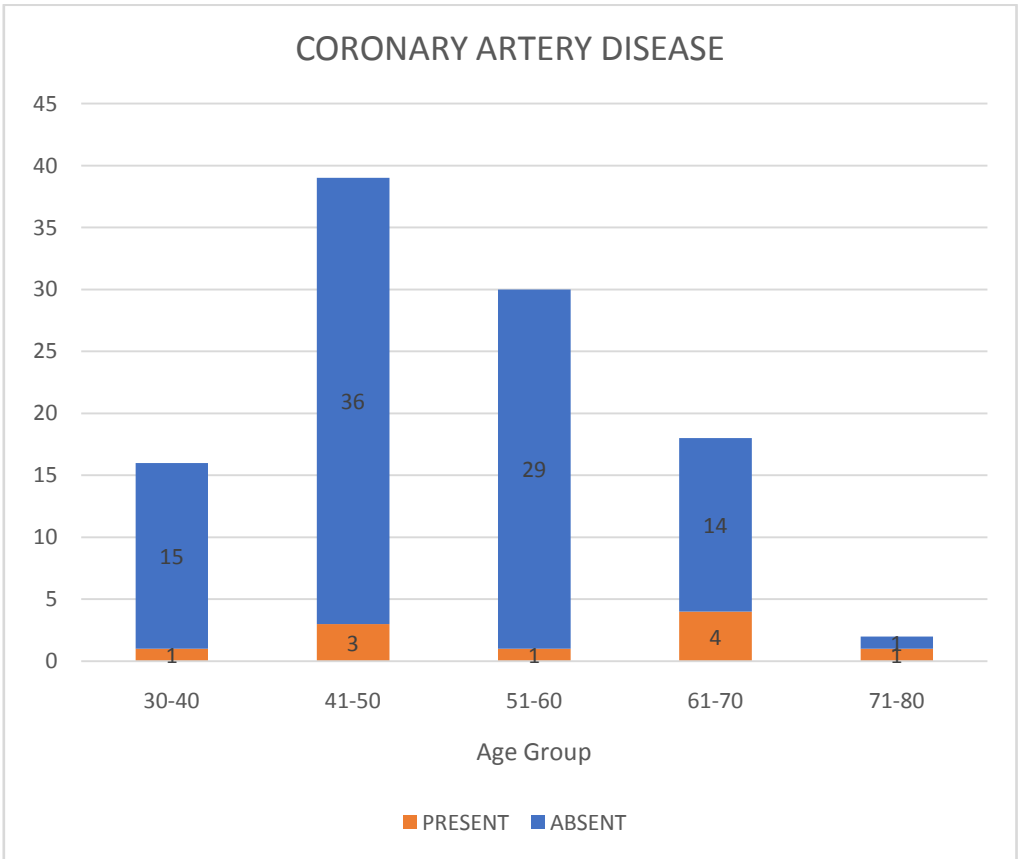
**TABLE5: PRIOR HISTORY OF CORONARY ARTERY DISEASES**

| CAD | Number | Percentage |
|---|---|---|
| Present | 10 | 9.5% |
| Absent | 95 | 90.5% |
| Total | 105 | 100% |

**GRAPH5 (A): PRIOR HISTORY OF CORONARY ARTERY DISEASES**




**GRAPH5 (B) : DIAGNOSED CASES OF CAD BASED ON AGE GROUP**

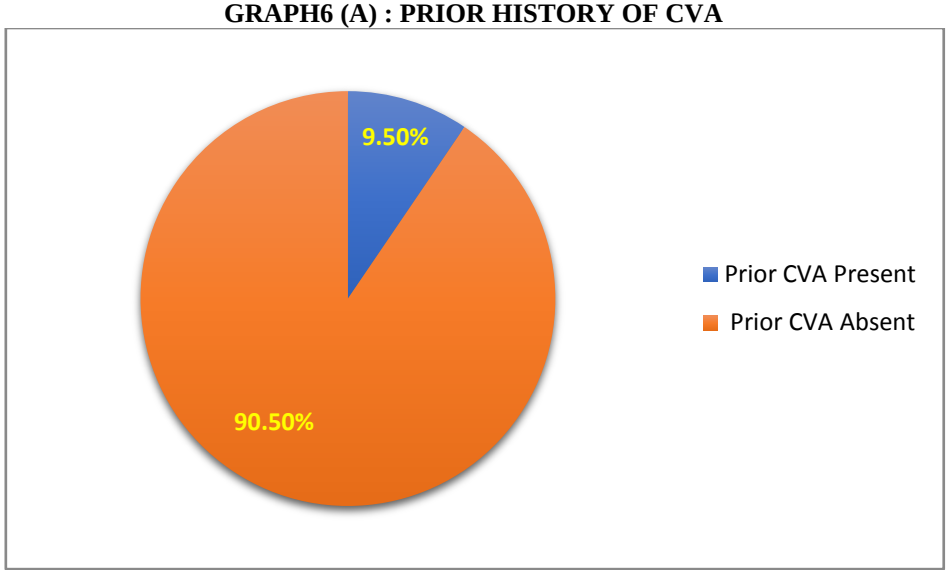


Out of 105 patients, only 10 (9.5%) had a past history of coronary artery disease. Of the age groups, 25% patients of age >60 had a history of CAD prior to this IC bleed episode.

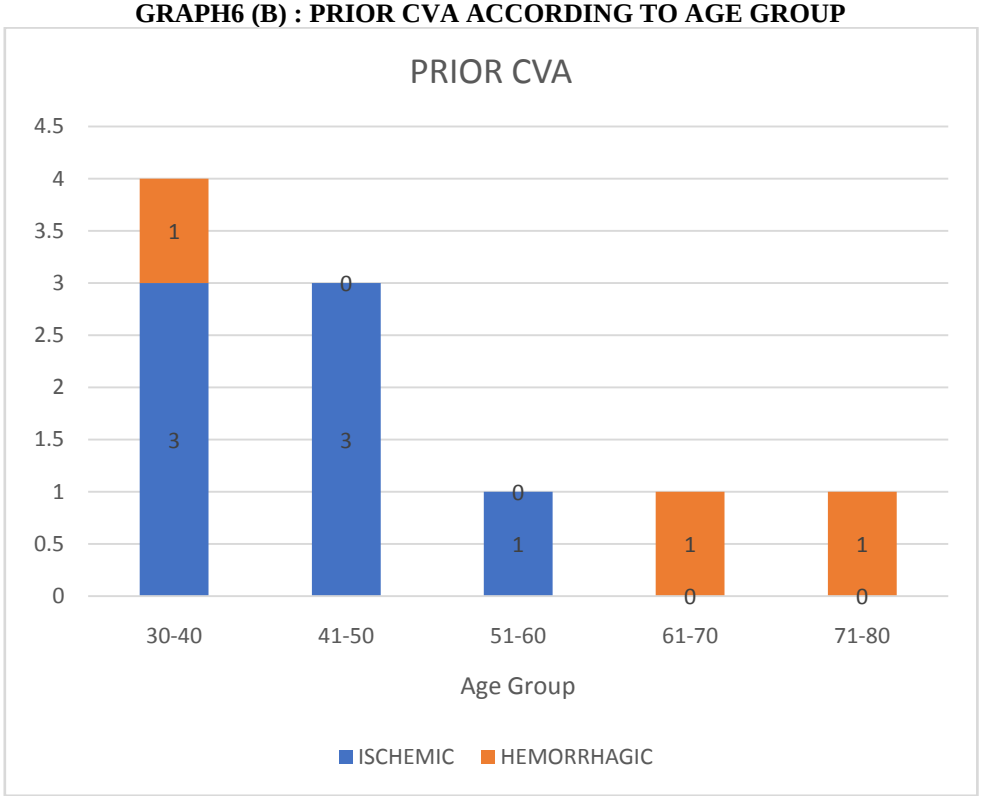
**TABLE6: PRIOR HISTORY OF CVA**

| Age Group | CVA-Present | | Absent | Total | Chi-Square |
|---|---|---|---|---|---|
| | Ischemic | Hemorrhagic | | | |
| 30-40 | 3 | 1 | 12 | 16 | 10.065<br>P = 0.393 |
| 41-50 | 3 | 0 | 36 | 39 | |
| 51-60 | 1 | 0 | 29 | 30 | |
| 61-70 | 0 | 1 | 17 | 18 | |
| >70 | 0 | 1 | 1 | 2 | |

**GRAPH6 (A) : PRIOR HISTORY OF CVA**




**GRAPH6 (B) : PRIOR CVA ACCORDING TO AGE GROUP**

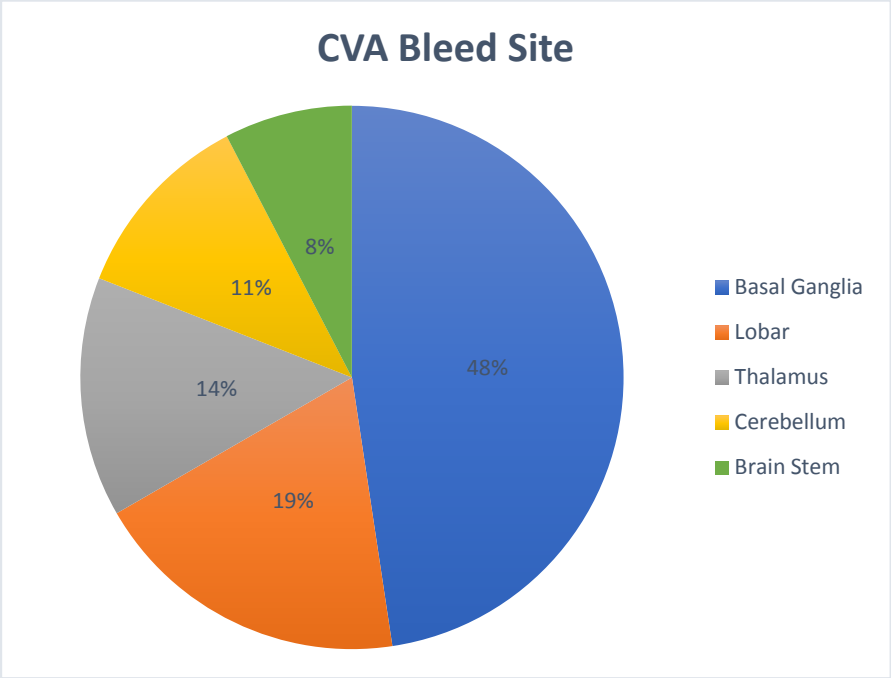



Out of 105 patients, 10(9.5%) had a prior history of CVA. Out of these 10 patients, 3(30%) had hemorrhagic CVA in the past. 25% patients in age group <40 had a prior history of CVA, which was statistically significant.

**TABLE 7: INTRA CEREBRAL BLEED SITE**

| Site | Number | Percentage |
|---|---|---|
| Basal Ganglia | 50 | 48% |
| Lobar | 20 | 19% |
| Thalamus | 15 | 14% |
| Cerebellum | 12 | 11% |
| Brain Stem | 8 | 8% |
| Total | 105 | 100% |

**GRAPH7 : INTRA CEREBRAL BLEED SITE**

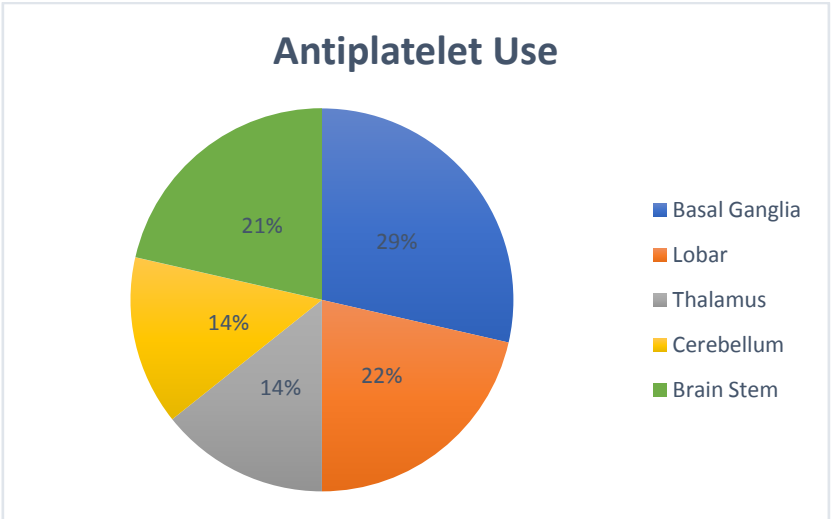



Out of 105 patients, 48% had bleeding in the basal ganglia, 19% had bleeding in the lobar area, 14% had bleeding in the thalamus, 11% had bleeding in the cerebellum and 8% had bleeding in the brain stem.

**TABLE8: ANTI-PLATELET USE AND BLEEDING SITE**

| Site | Number | % of patients | P value |
|---|---|---|---|
| Basal Ganglia | 4 | 8% | 0.245 |
| Lobar | 3 | 15% | |
| Thalamus | 2 | 13.33% | |
| Cerebellum | 2 | 16.67% | |
| Brain Stem | 3 | 37.5% | |
| Total | 14 | | |

**GRAPH8: ANTI-PLATELET USE AND BLEEDING SITE**

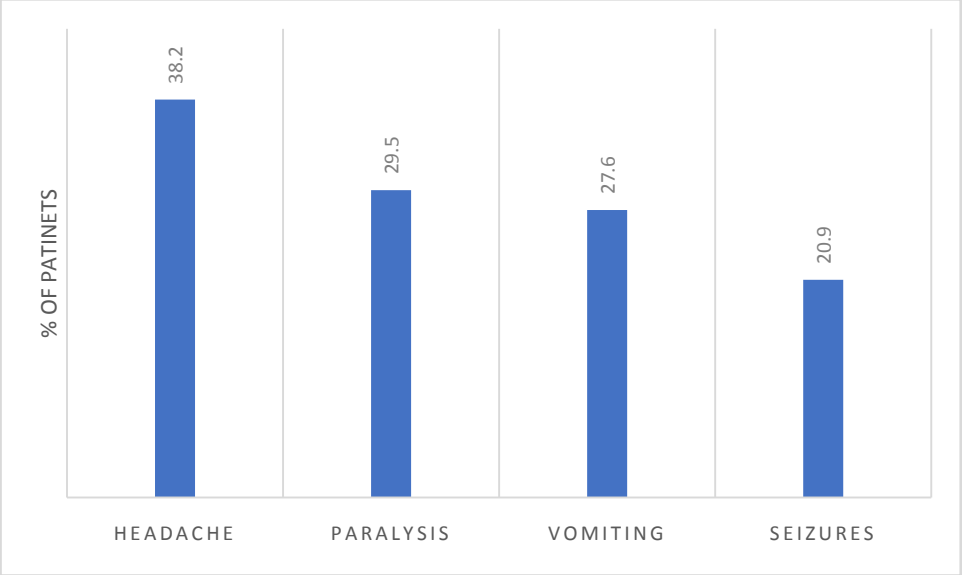


Out of 105 patients, 14 patients were using antiplatelets. 3 out of 8 patients (37.5%) who had brain stem bleed were using anti-platelets when compared to only 4 out of 50 patients (8%) with basal ganglia bleed, but this was statistically insignificant(p=0.245).

**TABLE 9: PRESENTING COMPLAINTS**

| Presenting Complaints | Number | Percentage |
|---|---|---|
| Headache | 40 | 38.2% |
| Paralysis | 31 | 29.5% |
| Vomiting | 29 | 27.6% |
| Seizures | 22 | 20.9% |

**GRAPH 9: PRESENTING COMPLAINTS**

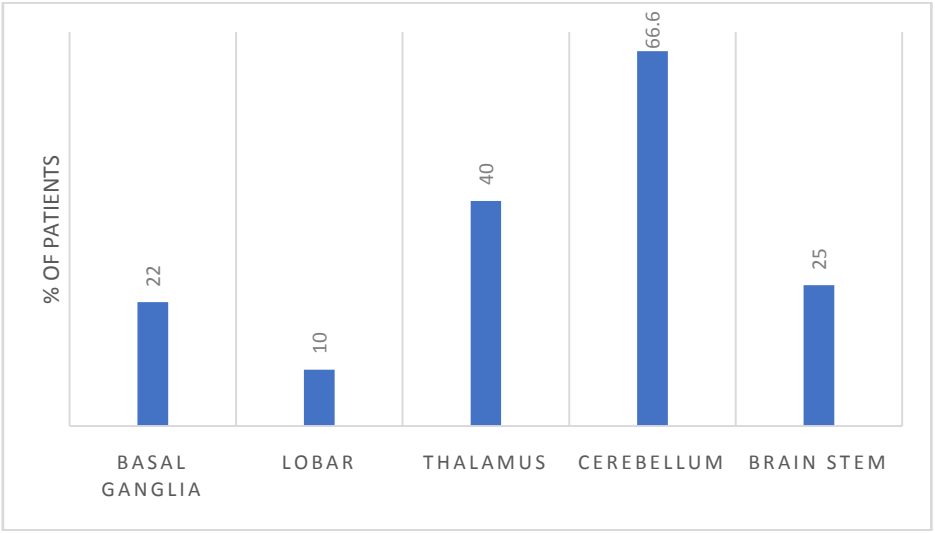



Out of 105 patients with IC bleed, headache was the most common symptom, present in 38.2% of patients followed by paralysis, vomiting and seizures in 29.5%, 27.6% and 20.9% respectively.

**TABLE10 : PAST HISTORY OF RECURRENT HEADACHE**

| Site | Number | Percentage | P value |
|---|---|---|---|
| Basal Ganglia | 11 | 22% | 0.006 |
| Lobar | 2 | 10% | |
| Thalamus | 6 | 40% | |
| Cerebellum | 8 | 66.6% | |
| Brain Stem | 2 | 25% | |

**GRAPH10 : PAST HISTORY OF RECURRENT HEADACHE**

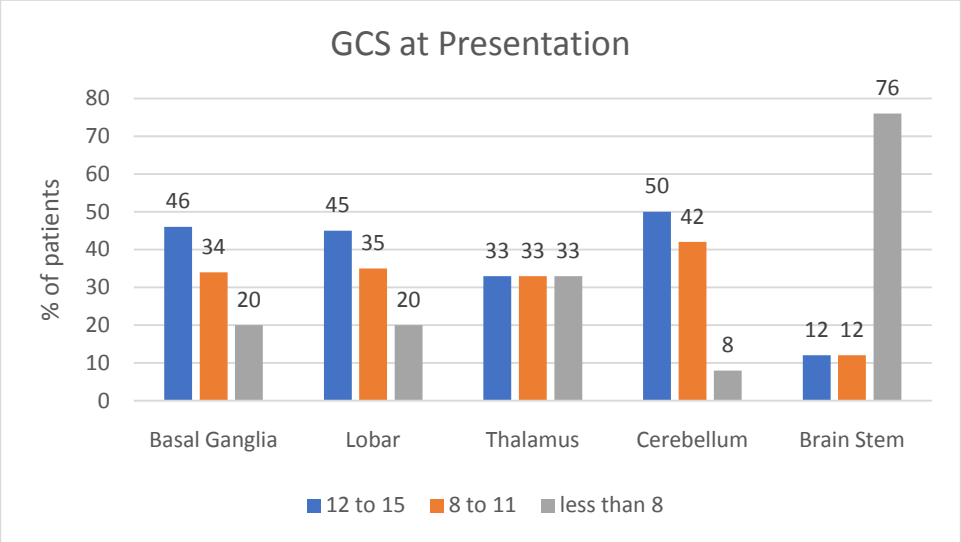


Out of 105 patients with IC bleed, 66.67% of cerebellar bleeds had history of persistent headaches while only 10% of lobar hemorrhage had the same history which was statistically significant.

**TABLE 11: GCS AT PRESENTATION**

| Site | 15-12 | 11-8 | <8 | P value |
|---|---|---|---|---|
| Basal Ganglia | 46% | 34% | 20% | 0.76 |
| Lobar | 45% | 35% | 20% | |
| Thalamus | 33% | 33% | 33% | |
| Cerebellum | 50% | 42% | 8% | |
| Brain Stem | 12% | 12% | 76% | |

**GRAPH 11: GCS AT PRESENTATION**

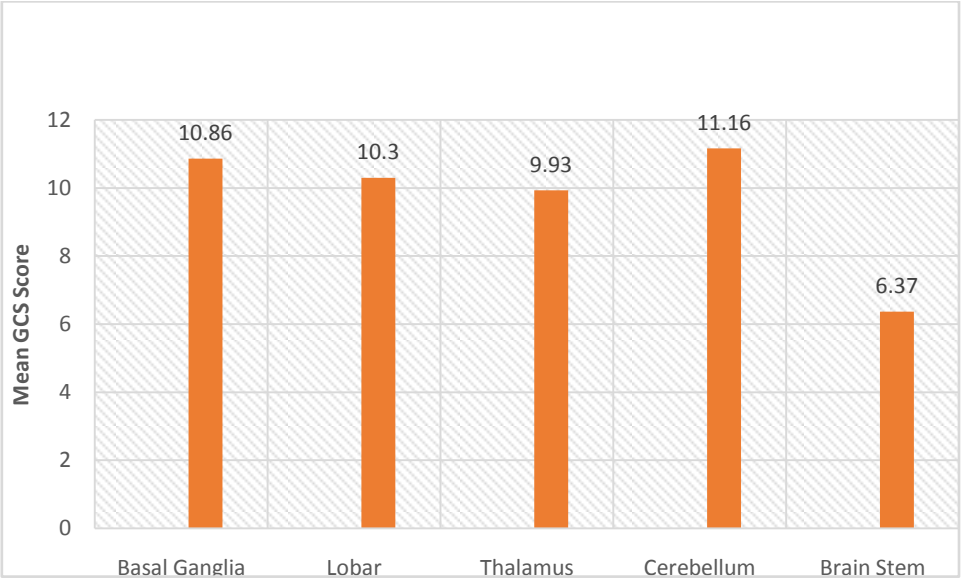



Out of 105 patients with IC bleed, 76% of patients with brain stem bleed had a GCS <8, when compared to only 8% of patients with cerebellar bleeds, but this was not statistically significant.

**TABLE 12: MEAN GCS AT PRESENTATION**

| Site | Mean GCS | P value |
|---|---|---|
| Basal Ganglia | 10.86 | 0.09 |
| Lobar | 10.3 | |
| Thalamus | 9.93 | |
| Cerebellum | 11.16 | |
| Brain Stem | 6.37 | |

**GRAPH 12: MEAN GCS AT PRESENTATION**

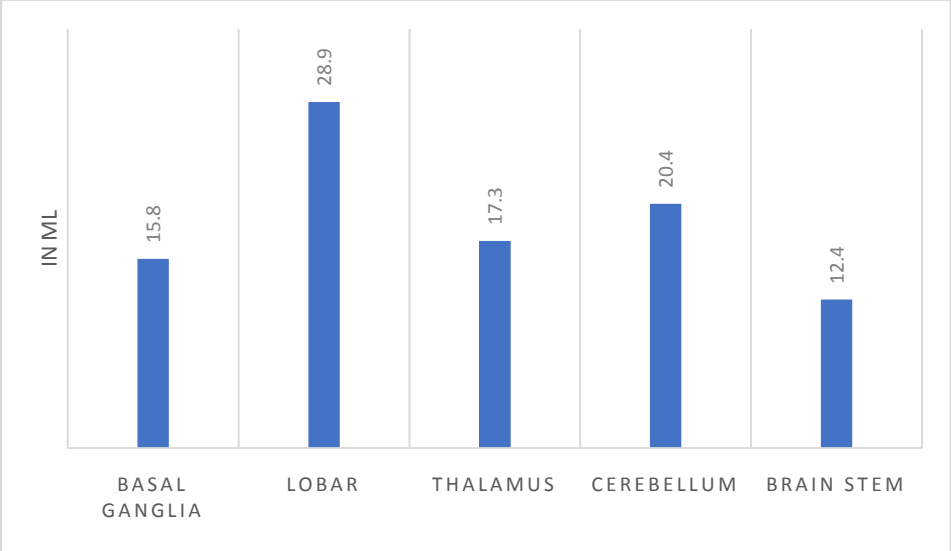


Out of 105 patients, mean GCS was 6.37 for patients who had a brain stem bleed whereas it was 11.16 for those with cerebellar bleed and all other sites with values in between. The result was statistically significant.

**TABLE13 : MEAN HEMATOMA SIZE**

| Site | Mean Hematoma Size in ml | P value |
|---|---|---|
| Basal Ganglia | 15.8 | <0.0001 |
| Lobar | 28.9 | |
| Thalamus | 17.3 | |
| Cerebellum | 20.4 | |
| Brain Stem | 12.4 | |

**GRAPH13: MEAN HEMATOMA SIZE**

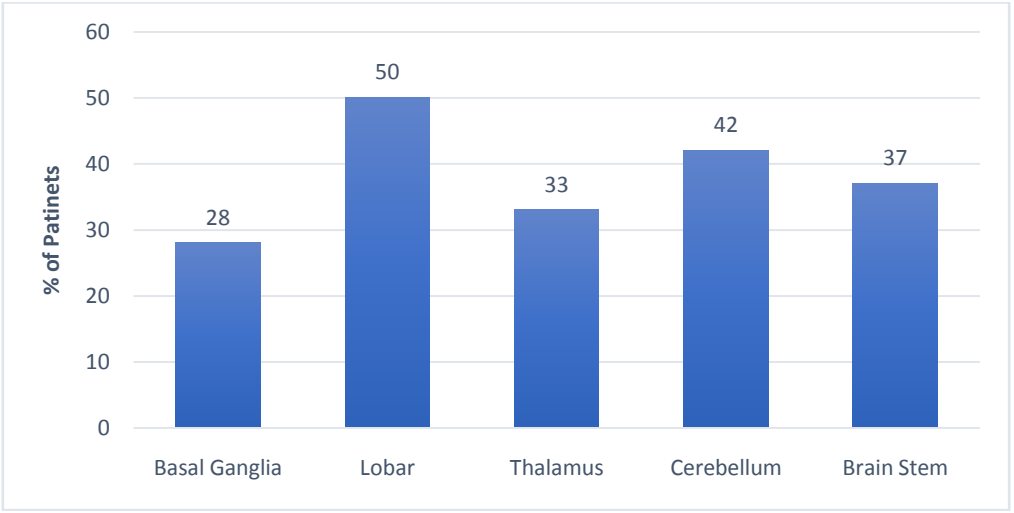



Out of 105 patients with IC bleed, there was statistically significant difference in the mean volume of hematoma in the different sites. The maximum mean of hematoma size was in the lobar (28.9ml) with least in the brain stem (12.4ml).

**TABLE 14 : INTRAVENTRICULAR EXTENSION**

| Site | Intraventricular Extension % | P value |
|---|---|---|
| Basal Ganglia | 28 | 0.506 |
| Lobar | 50 | |
| Thalamus | 33 | |
| Cerebellum | 42 | |
| Brain Stem | 37 | |

**GRAPH14: INTRAVENTRICULAR EXTENSION**

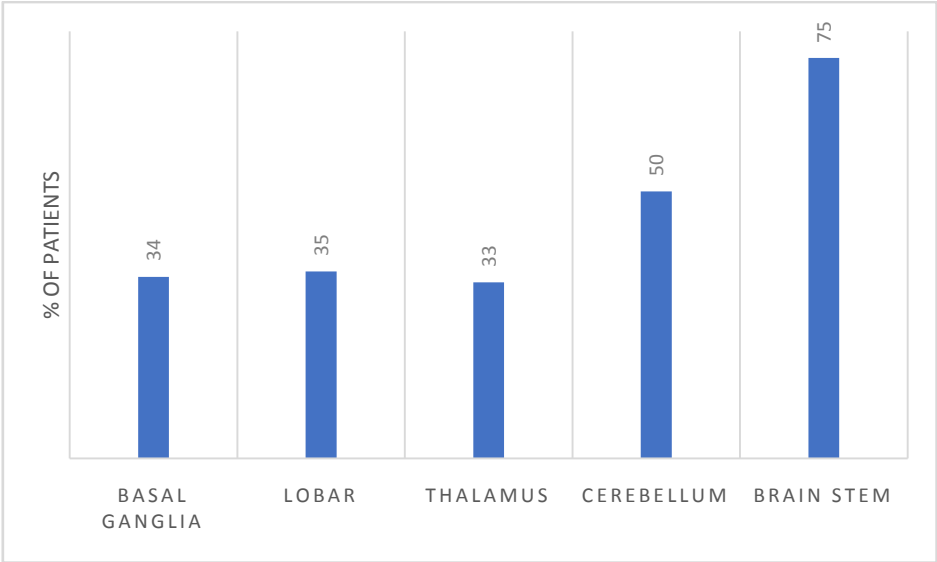


Out of 105 patients with IC bleed, 37 patients (35.2%) had intraventricular extension. 50% of lobar bleed patients had IV extension, while only 28% of basal ganglia bleed had it. This difference was not statistically significant.

**TABLE 15 : MORTALITY RATE**

| Site | Mortality Rate in % | P value |
|---|---|---|
| Basal Ganglia | 34 | 0.212 |
| Lobar | 35 | |
| Thalamus | 33 | |
| Cerebellum | 50 | |
| Brain Stem | 75 | |
| Total | 41 | |

**GRAPH 15: MORTALITY RATE**

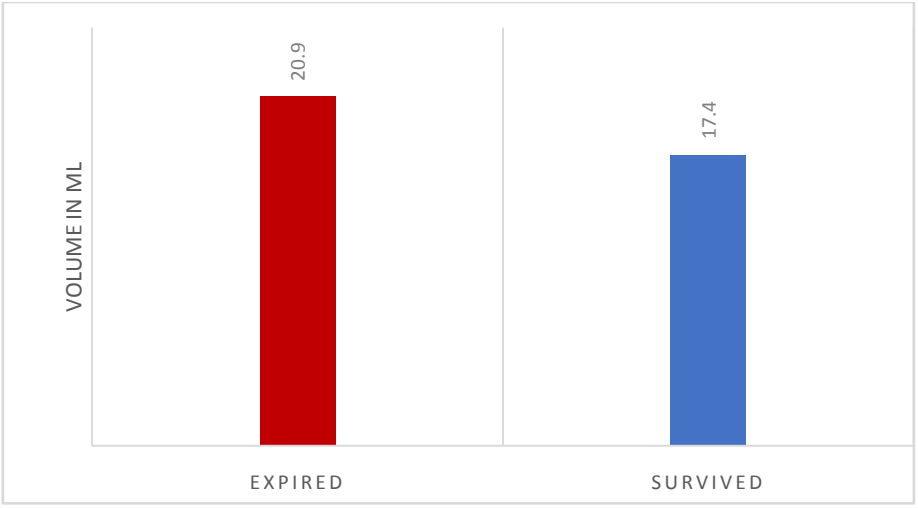



Out of 105 patients, 41 patients (39%) expired in the first 4 weeks. The maximum mortality rate was for brain stem bleed (75%) followed by cerebellar bleed (50%), lobar bleed (35%), basal ganglia bleed (34%) and thalamic bleed (33%). The difference in mortality rates between all the sites were not statistically significant.

**TABLE16 : MEAN HEMATOMA SIZE OF SURVIVED VS EXPIRED**

| | Mean Hematoma Size in ml | P value |
|---|---|---|
| Expired | 20.9 | 0.047 |
| Survived | 17.4 | |

**FIGURE 16 : MEAN HEMATOMA SIZE OF SURVIVED VS EXPIRED**



The mean hematoma size of the patients who expired was statistically significantly higher (by 3.5ml) than those patients who survived.

## IV. Discussion

**Epidemiology**

105 cases of intracerebral bleed admitted in our hospital from November 2017 to October 2019 was evaluated for this present study. There were 64 males (61%) and 41 females (39%). This discrepancy in sex ratio is also seen in other studies from India, which may be explained by the cultural practice in India, mainly a patriarchal society. The mean age of population was 51.28 years. So intracerebral bleed is basically a disease of middle aged and elderly population. The youngest patient was 34-year-old while the oldest patient was 75-year-old. When age groups were taken into consideration, most of the patients were in the 41-50 age group (37.14%) followed by 51-60 age group (28.57%) and only 1.9% patients were older than 70. This distribution was slightly younger when compared to most of the studies. In the study by Narayan et al form JIPMER, most of the patients were in the 60-80 age group [14]. In another study by Baidya et al from KGMU, most of the patients were in the 50-60 age group[15]. This difference may be attributed to the low educational status of the present study population, in which chronological age is not properly monitored.

**Topography**

Most of the bleeding was in the basal ganglia (49%) followed by lobar (19%), thalamus (14%), cerebellum (11%) and brain stem (8%). This was similar to most of the studies published in literature. In the study by Suthar et al from Ahmedabad [16], 49% of the IC bleed case was in basal ganglia with 21% in the cerebral lobes and 9% in the brain stem. The study by Narayan et al [14] from JIPMER also had 45% of bleeds in the basal ganglia, while a study by Ojha et al [17] had 60% of the bleed from basal ganglia.

**Risk Factors**

**1. Hypertension**

Hypertension was the most common risk factor being present in 33% of the population. It was present in 40% of cases of basal ganglia bleed, 25% of cases of lobar bleed, 40% of cases of thalamic bleed,41% of cases of cerebellar bleed and 37% of cases of brain stem bleed. This difference was not statistically significant (P=.809). This data was similar to those published by Ojha et al [17]in which 29.5% had pre-existing hypertension. But some other studies had published much higher rates of hypertension in patients who presented with IC bleed. The study byDaniel Woo et al [18]found out that 63% of patients with intracranial bleed had hypertension. In another study from Chennai by Gobindram[19], hypertension was present in 73% of cases. But in our present study the prevalence of hypertension was lower, which again may be due toin many of the prior studies hypertension was said to be present when the BP at presentation was high andother reason may be the presence of undiagnosed hypertension in this community in which contact with a healthcare worker is at a premium.

**2. Diabetes**

Diabetes was present in 22.8% of the population.The study by Baidya et al[15]had a prevalence of diabetes in 17% in the intracerebral population. Siddique et al [20]in their study reported that 15% of acute hemorrhagic patients were diabetic. Daniel Woo et al [18]also reported 20% prevalence of diabetes among Intracerebral Hemorrhage patients. The high rate of diabetes in this study population may be due to the site being located in one of the diabetic hot beds.

**3. Prior CVA**

In this study 9.5% of the patients who presented with intracerebral hemorrhage had prior history of CVA. Out of this 70% were ischemic CVA and 30% hemorrhagic. This is similar to the reported 1.5%-2% risk of recurrence for intracerebral hemorrhage[21].

**4. Anti-platelet Usage**

Out of 105 patients with IC bleed, 14 patients (13.3%) had history of intake of anti-platelets. 37.5% of patients with brain stem bleed had history of intake of anti-platelets as compared to only 8% of patients with basal ganglia bleed. But this difference was not statistically significant (p= 0.245). The use of anti-platelet was also not associated with increased mortality (p=0.75).

**5. Past History of Headache**

66.67% of patients with cerebellar bleed had history of persistent headache while only 10% of patients with lobar bleed had the same history, which was statistically significant (p=0.006). This difference may be also due to some bias as the mean GCS of those patients presenting with cerebellar bleed was significantly higher than those with lobar bleed (11.16 vs 10.3), which may lead to absence of history in the case of lobar bleed.

**Clinical Presentation**

**Symptoms**

Headache was the most common presenting symptom, present in 38.2% of patients followed by paralysis in 29.5%, vomiting in 27.6% and seizures in 20.9% of cases. This was similar to the study published by Suthar et al [16] in which headache was present in 41%, vomiting in 39% and seizures in 17% of the cases. The study by Ojha et al[17]also had 42% of patients having vomiting, 23% having headache and seizure in 21% of cases.

**GCS at presentation**

The mean GCS at presentation was 10.31. When the mean GCS at presentation was sub classified based on the site of bleed, brain stem bleed had a mean GCS of 6.37 while cerebellar bleed had a mean GCS of 11.16. This difference was statistically significant (p=0.009). 76% of patients with brain stem bleed had a GCS <8 at presentation while only 8% of patients with cerebellar bleed had a GCS <8 at presentation. The mean GCS of patients who expired was 8.8 when compared to 11.28 of those patients who survived (p=0.00009).

**Mean Hematoma Size**

The mean hematoma size of 105 patients with IC bleed was 18.8ml. When the mean hematoma size was sub classified depending on the site of bleed, lobar hemorrhage was associated with a mean hematoma size of 28.9ml whereas brain stem hematomas were only about 12.4ml in average (p=<0.0001). The mean hematoma size of patients who expired was 20.98 while the mean of those who survived was 17.41. This difference in mean hematoma size was also statistically significant (p=0.047).

**Intraventricular Extension**

IVC extension was present in 35.2% of patients. The presence of IVC was associated with mortality (p=0.006).

**Mortality**

The overall mortality rate was 39%. This was similar to the mortality rates reported in studies by Gobindram[19] and Daniel Woo [18]. The maximum mortality rate was for brain stem bleed with 75% and least was for thalamic bleed with 33%, but this difference was not statistically not significant (p=0.212).

## V. Conclusion

Cerebrovascular accidents are one of the leading cause of mortality and morbidity in developed as well as developing countries with intracerebral haemorrhage causing the highest overall mortality.

In my study,105 patients of intracerebral haemorrhage were prospectively studied from 2017 to 2019,of which 64 (61%) were males and 41(39%) were females.

The average age of study group was 51.28 years.Most cases were included in the 41-50 age group (37.14%) indicating it as a disease of middle age.

Among cases,35 patients (33%) had hypertension and 72 patients (67%) didn't have pre-diagnosed hypertension. Of all the age groups, only 17.6% of patients with age more than 60 had pre-diagnosed hypertension, while 56% patients with age less than 40 had pre-diagnosed hypertension.

Out of 150 patients,24(22.85%) had a diagnosis of diabetes made prior to the IC bleed episode. Out of all the age groups, the extremes of age group had more percentage of diabetes( 37.5% of patients with age <40 and 100% patients with age >70 had a diagnosis of diabetes mellitus.Along with diabetes,10 patients (9.5%) also had a past history of coronary artery disease. While considering age,25% patients of age >60 had a history of CAD prior to this IC bleed episode.

Restroke was detected in 10 patients (9.5%). Out of these 10 patients, 3(30%) had hemorrhagic CVA in the past indicating lack of proper follow up and risk factor management leading to increased rate of restroke.Of which, 25% patients in age group <40 had a prior history of CVA, which was statistically significant.

The most common site of bleeding was found to be basal ganglia(48%) with 19% had lobar bleed, 14% had bleeding in the thalamus, 11% had bleeding in the cerebellum and 8% had bleeding in the brain stem.

In patients with antiplatelet associated intracranial haemorrhage most common site was found to be basal ganglia.But3 out of 8 patients (37.5%) who had brain stem bleed were using anti-platelets when compared to only 4 out of 50 patients (8%) with basal ganglia bleed, but this was statistically insignificant(p=0.245).

Headache was found to be the most common symptom, present in 38.2% of patients followed by paralysis, vomiting and seizures in 29.5%, 27.6% and 20.9% respectively.In patients of cerebellar haemorrhage,66.67% had history of persistent headaches while only 10% of lobar hemorrhage had the same history which was statistically significant.

When compared GCS,it is found that mean GCS was 6.37 for patients who had a brain stem bleed whereas it was 11.16 for those with cerebellar bleed and all other sites with values in between,which shows poor prognosis of among brainstem bleed patients.Also76% of patients with brain stem bleed had a GCS <8, when compared to only 8% of patients with cerebellar bleeds.

In patients with IC bleed, there was statistically significant difference in the mean volume of hematoma in the different sites. The maximum mean of hematoma size was in the lobar (28.9ml) with least in the brain

stem (12.4).The mean hematoma size of the patients who expired was statistically significantly higher (by 3.5ml) than those patients who survived.

Among the study group, 37 patients (35.2%) had intraventricular extension. Of which 50% of patients had lobar bleed patients had IV extension, while only 28% of basal ganglia bleed had it. This difference was not statistically significant.

When compared mortality during hospital admission,out of 105 patients, 41 patients (39%) expired in the first 4 weeks. The maximum mortality rate was for brain stem bleed (75%) followed by cerebellar bleed (50%), lobar bleed (35%), basal ganglia bleed (34%) and thalamic bleed (33%) respectively.

From this study it was found that brainstem bleed was associated with low GCS at presentation and have high mortality and morbidity while comparing with other sites.Hematoma size had a prognostic role as patient who had a higher volume by 3.5ml were expired compared with those who survived.Seizure was associated with 20.9% cases of intracerebral haemorrhage as clinical presentation.Early management of intracranial hypertension and other complications prolonged survival.

Further studies are required to delineate various aetiologies like cerebral amyloid angiopathy and imaging modalities like CT angiography,MR angiography to find out the exact vessel involvement.Also for determining optimal treatment strategies so that it will help in reduction of morbidity and mortality.

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