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TO STUDY THE SURGICAL OUTCOMES IN PATIENTS WITH HYPERTENSIVE SUPRATENTORIAL INTRACEREBRAL HEMORRHAGE

Neurosurgery

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ABSTRACT

Background: Intracerebral Haemorrhage (ICH) is a deadly illness that has a high death rate and morbidity. ICH ranks second among pathologies underlying stroke. Incidence is 10-40 per year per lakh population. Arterial hypertension is reported as the main cause of ICH. Age, level of consciousness, volume of hematoma and presence of intraventricular blood are independent predictors of recovery. **Aim:** To Study the Outcomes of Surgical Interventions in Patients with Hypertensive Supratentorial Intracerebral Haemorrhage. **Materials And Methods:** This follow-up study included 50 patients of either sex with diagnosis of hypertensive supratentorial ICH and operated for the same by different surgical interventions over period of 1 year. GCS, GOS, mRS at discharge and at 2 months were noted to analyze the clinical outcome. **Results:** The average age was 53.58 years. Male to female ratio of 5.25:1. Hypertension was present in 76% patients. There was statistically strong correlation between GCS at admission, at discharge and on follow up at 2 months. Mid-line shift and operative techniques has statistically strong correlation with clinical outcome and mortality. **Conclusion:** An elderly male with associated comorbidities mainly Hypertension, Diabetes mellitus and Chronic alcoholic patients are at more risk to develop ICH. Patients with low GCS, Neurological deficit have poor clinical outcome. The most common location for ICH is Gangliocapsular region. Maximum patients have hematoma volume less than 30 ml. ICH volume and midline shift and operative techniques plays a key role in clinical outcome and mortality of the patient.

KEYWORDS

Intracerebral haemorrhage (ICH), Supratentorial, GCS, GOS, mRS

INTRODUCTION-

Intracerebral Haemorrhage (ICH) is a deadly illness that has a high death rate and morbidity. ICH ranks second among pathologies underlying stroke.[1] The Incidence is 10-40 per year per lakh population.[2] Primary ICH incidence rates were twice as high in low and middle-income nations as they were in high-income nations.[3] The incidence in Asian communities is almost twice that of white Western populations.[4] As age increases, the incidence of ICH rises. Arterial hypertension is reported as the main cause of ICH – 57% in meta-analysis.[5] The outcome of this common and distinct entity of Hypertensive ICH is determined mainly by severity of bleeding.[6] Previous multivariate studies principally investigated short term outcome 30-day mortality [7] after ICH and showed that age, level of consciousness, volume of hematoma and presence of intraventricular blood are independent predictors of recovery.[8] Its unclear whether alcohol consumption, smoking, use of NSAIDs or clinical parameters like level of blood pressure, target organ damages like hypertensive changes in optic fundus and left ventricular hypertrophy would influence the outcome. These factors might also impair the outcome by making patients prone to severe initial bleeding, to enlargement by hematoma or to cerebral ischemia. Further, prognostic significance of signs of tentorial herniation, midline shift and interference of the hematoma with the CSF circulation has to be evaluated. The impact of surgical evacuation of hematoma on the prognosis, selection criteria and timing of evacuation has to be assessed.[9]

Conventional medical therapy of haemorrhagic stroke is principally focused on adjunctive measures to minimize injury and to stabilize individuals. General measures to maintain airway and hydration, control blood pressure, reduce ICP, prevent seizures and maintain systemic health are important in preventing progression of the hemorrhage, edema and brain ischemia. [10] The goals of surgical evacuation of hematoma are: 1. To reduce the mass effect. 2. Block the release of neuropathic products from the hematoma. 3. Prevent prolonged interaction between the hematoma and the normal tissue which can initiate pathologic process.

Some patients have a penumbra of potentially viable but functionally impaired tissue around the ICH. Surgical evacuation of clot may improve the function and recovery in this penumbra. Surgical interventions in SICH include: Craniotomy and hematoma evacuation. Decompressive craniectomy and hematoma evacuation. [11] Minimally invasive techniques such as endoscopic hematoma evacuation and stereotactic hematoma evacuation. [12] Burr hole and EVD of acute hydrocephalus, fibrinolysis of IVH using „Recombinant tissue plasminogen activator" (rtPA), or streptokinase are other indications for surgery, especially in IVH.

The goal of "The International Surgical Trial in Intracerebral Haemorrhage" (STICH) was to determine whether conservative medical care or early hematoma evacuation (in less than 24 hours of 4 randomization) was superior. A total of 1,033 patients were randomly assigned to either the early surgery (n = 503) or initial conservative treatment (n = 530) groups after being recruited from 83 centres across 27 nations. Although there was no overall statistically significant difference in mortality or functional result between the early surgery and initial conservative therapy groups, the research did suggest that early surgery may be helpful in some patients with superficial lobar hemorrhage. The results of "The STICH II trial" (2013) show that early surgery doesn't raise the risk of death or impairment at six months, and that patients who have spontaneous superficial intracerebral hemorrhage without intraventricular hemorrhage may have a slight but meaningful survival advantage. Hematoma evacuation may be deemed a life-saving intervention for individuals exhibiting neurological decline due to supratentorial ICH. This study was done to learn about the outcomes of surgical interventions in management of supratentorial hypertensive intracerebral haemorrhage for better management and thus improving the outcome of these patients.

MATERIALS AND METHODS-

Study Design And Settings

This was an observational study conducted between period of November 2022 to December 2023 for a period of 1 year. In this study, patients diagnosed with Hypertensive Supratentorial Intracerebral Haemorrhage and got operated was taken into study group.

Selection Of Patients

The study included all patients above 18 years of age with supratentorial hypertensive intracerebral haemorrhage who underwent surgical intervention. While exclusion criteria were patients having intracerebral haemorrhage due to Head trauma, Intracranial neoplasm, Aneurysm, AVM, Bleeding diathesis, Infratentorial haemorrhage and also patients who were not willing for surgery.

Sample size
This was time-based study for period of 1 year. So, we had taken total 50 patients in this study.

Data Collection
All the patients more than 18 years was evaluated neurologically and radiologically with non-contrast CT of head. Detailed clinical and neurological examinations was performed in all patients. All relevant information like Demographic (Age, Sex, Address), Family history, Personal History Co-morbidity etc. was collected. Patients was managed according to the clinical and radiological findings and appropriate surgical procedure was chosen.

Outcome And Follow Up:
Patients were followed up in outpatient department. Outcome was assessed by using GOS (Glasgow outcome scale), GCS (Glasgow coma scale) and mRS (Modified Rankin scale) at the time of discharge and on follow up at 2 months.

Surgical Procedures
Surgical procedures used in this study depending was Craniotomy and hematoma evacuation, Decompressive Craniectomy and hematoma evacuation, EVD insertion with ICH evacuation, EVD insertion. Appropriate surgical procedure was used depending upon the clinical and radiological findings and also depending on the various indications for the surgical intervention such as, patients with Supratentorial ICH of size ≥ 2 cm of diameter and with GCS of ≥ 5. [13], Spontaneous Lobar ICH on CT scan (≤ 1cm from the cortical surface of the brain) [14], Temporal Hematoma as small as 30ml [15], Hematoma occupying 4-8% of intracranial space with clinical status of the patient. [15], Hematoma occupying 8-12% of intracranial space [15] and Hematoma volume of 50-100ml with evidence of raised ICP (Pupillary asymmetry, and drop in GCS)

Statistical Analysis:
Data was described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

RESULTS: -
The total number of cases included were 50. Maximum patients (38) having age between 40 to 70 years. The youngest patient in the study was of 30 years and the oldest patient was of 87 years old. The average age was 53.58 years (median 52.0 years) with standard deviation (SD) was 12.92 years.

Out of 50 cases, 42 (84.0%) were male and 8 cases (16.0%) were female. Gender distribution showed male predominance in the study.

Distribution of co-morbidity among the cases were studied. There were 38 cases (76.0%) who were hypertensive, 8 cases (16.0%) had diabetes mellitus, 3 cases (6.0%) had CAD, 4 cases (8.0%) had CKD, 4 cases (8.0%) had hypothyroidism. (Fig 1)

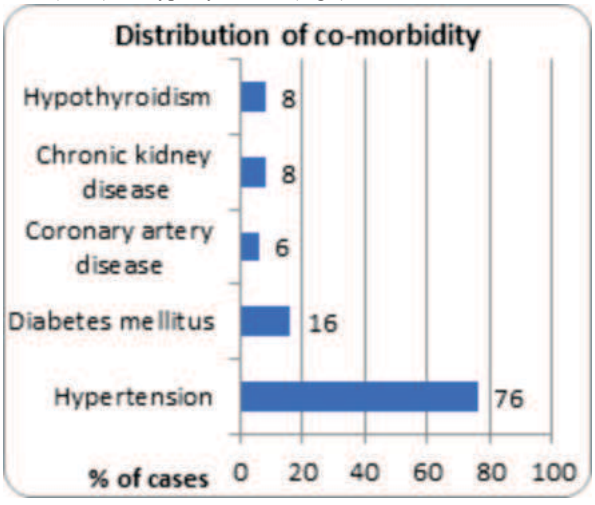

Fig.1 Distribution of Co-morbidity

Among the cases studied, altered sensorium was the most common presenting symptom which was present in 47 cases (94.0%), hemiparesis was the second most common symptom which was present in 42 cases (84.0%), the third most common symptom was vomiting which was seen in 11 cases (22.0%), Headache was present in 8 cases (16.0%), 9 cases (18.0%) had loss of consciousness, 7 cases (14.0%) had aphasia, 3 cases (6.0%) had seizures and only 1 case (2.0%) had blurring of vision.

Right gangliocapsular region was the most common location of haemorrhage presented with 17 cases (34.0%), 15 cases (30.0%) Left gangliocapsular region involved, 10 cases (20.0%) had left thalamic region, 1 case (2.0%) had left parietal, 1 case (2.0%) had left temporoparietal region and 5 cases (10.0%) had right thalamic region involved in the study group.

Out of 50 cases, 18 cases (36.0%) had volume of bleed below 30 ml, 16 cases (32.0%) had volume of bleed between 30 – 50 ml, 13 cases (26.0%) had volume between 51 – 80 ml and 3 cases (6.0%) had volume of bleed above 80 ml in the study. On studying GCS score on discharge, 17 cases (34%) had GCS between 9 – 11; 14 cases (28.0%) had GCS between 12 – 14 on discharge, 9 cases (18.0%) had GCS between 6 – 8, 3 cases (6 %) had GCS between 3 – 8 and 5 cases (10%) had GCS 15 on discharge while 2 cases had death in the study group. Similarly, on studying GCS score after 2 months, 17 cases (34%) had GCS 15, 12 cases (24%) had GCS 12-14, 14 cases (28%) had GCS 9-11 and 4 (8%). On calculation of GOS on discharge, 40 cases (80%) had GOS 3(Severe disability), 6 cases (12%) had GOS 2 (Vegetative state) and 2 cases (4%) GOS 4 (Moderate disability) while 2 cases had GOS 1 (Dead). Similarly, on studying GOS score after 2 months majority of cases (31 cases, 62.0%) had GOS 3, 14 cases (28.0%) had GOS 4, case had GOS 5 and GOS 2 each. Lastly on studying mRS score on discharge out of 50 cases, majority of cases (37 cases, 74%) had mRS score 4 (moderately severe disability) on discharge; the second largest group i.e. 8 cases (16.0%) had mRS score 5 (Severe disability and requiring constant nursing care and attention), 2 cases (4%) had mRS score 2 and 1 case (2%) had mRS score 1 while 2 cases had death in the study group. Similarly, on studying mRS score after 2 months majority of cases (24 cases, 48%) had mRS score 4, 13 cases (26.0%) had mRS score 3, 6 cases (12%) had mRS 2 and 4 cases (8%) had mRS 5 score while 3 cases had death in the study group.

The correlation analysis between volume of bleed with GCS on admission, on discharge and after 2-month follow-up, GOS and mRS on discharge and after 2-month follow-up was studied. (Table 1) Volume of bleed showed statistically significant negative correlation with GCS on admission, GCS on discharge and GCS after 2-month follow-up in the study group (P-value<0.05 for all). Volume of bleed showed statistically significant negative correlation with GOS on discharge and GOS after 2-month follow-up in the study group (P-value<0.05 for all) and it showed statistically significant positive correlation with mRS on discharge and mRS after 2-month follow-up in the study group (P-value<0.05 for all).

Table 1. The Correlation Analysis Between Volume Of Bleed With GCS On Admission, On Discharge And After 2-month Follow-up, GOS And mRS On Discharge And After 2-month Follow-up

Correlation between	r-value	P-value
Volume of bleed With GCS on admission	-0.311	0.028*
Volume of bleed With GCS on discharge	-0.498	0.001***
Volume of bleed With GCS after 2 months	-0.509	0.001***
Volume of bleed With GOS on discharge	-0.290	0.045*
Volume of bleed With GOS after 2 months	-0.365	0.012*
Volume of bleed with mRS on discharge	0.381	0.008**
Volume of bleed with mRS after 2 months	0.504	0.001***
Correlation analysis using Spearman's method. P-value<0.05 is considered to be statistically significant. *P-value<0.05, **P-value<0.01, ***P-value<0.001.		

Out of 50 cases, 4 cases (16.0%) had mid-line shift below 5 mm, 34 cases (68.0%) had mid-line shift between 5 – 10 mm and 12 cases (24.0%) had mid-line shift above 10 mm. The distribution of mean GCS on admission did not differ significantly between group of cases with various levels of mid-line shift in the study group (P-value>0.05 for both) but, distribution of mean GCS on discharge and mean GCS after 2-month follow-up differs significantly across group of cases with different levels of mid-line shift in the study group. (P-value<0.05 for both). Mid-line shift seems to have no statistically significant impact

on GOS and mRS on discharge and after 2-month follow-up. (Fig 2)

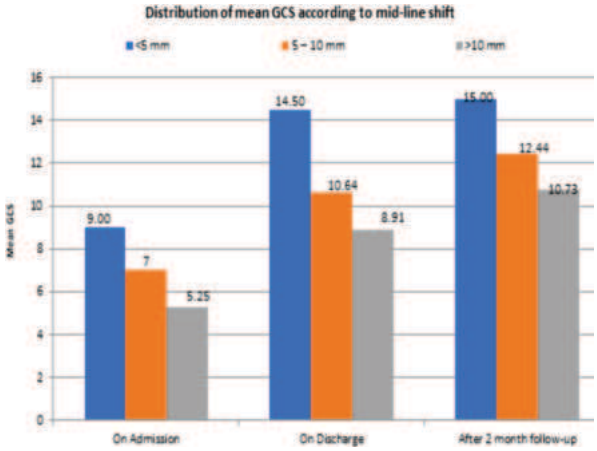

Fig.2 Distribution Of Mean GCS According To Mid-line Shift

Out of 50 cases, 3 cases (6.0%) had Craniotomy and hematoma evacuation, 28 cases (56.0%) had Decompressive craniotomy (DC) and hematoma evacuation and 16 cases (32.0%) had EVD insertion and 3 cases (6.0%) had EVD insertion with hematoma evacuation in the study group. The distribution of mean GCS on admission and mean GCS on discharge did not differ significantly between group of cases with various operative techniques used in the study group (P-value>0.05 for both) while Distribution of mean GCS after 2-month follow-up differs significantly across group of cases with different operative techniques used in the study group (P-value<0.05). Similarly, the distribution of mean GOS and mRS after 2-month follow-up differs significantly between group of cases with various operative techniques used in the study group (P-value<0.05) but not at the discharge. (Fig.3)

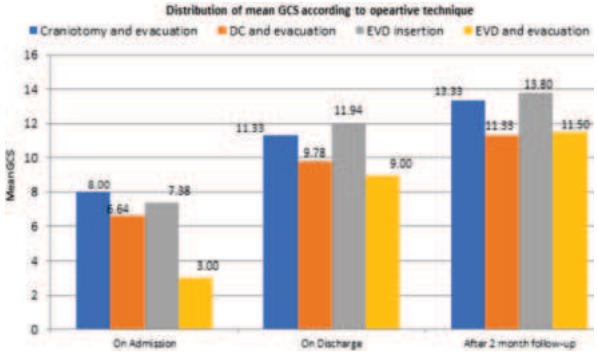

Fig.3 Distribution of mean GCS according to operative technique.

DISCUSSION: -

In this study, we wanted to assess the ICH in a wide spectrum, including risk factors, various surgical interventions and factors affecting the outcome of the patients. In addition, the study provides data to compare with studies conducted in other populations employing similar criteria and methodology.

Age: Previous study by Muller and Radu (1981) [16] showed 2 peaks for hypertensive ICH; 51-55 years and 71.75 years and that the age was increasing now probably due to improved antihypertensive treatment. This is similar to the findings in the study conducted by Obiako et al. in Ibadan, where patients aged 40-59 years constituted 73% of the patients with acute stroke. [17] Caucasian studies show that ICH tends to occur in older and elderly population, with lower frequencies in younger age group. Although age is non-modifiable; this is useful prognostic indicator for patients and health care providers. On analysing the age group of patients, it is seen that the incidence after 80 years is only about 1% which probably shows the lower life expectancy of people. These factors are similar with the previous observation that advancing age increases the risk of ICH. Our study shows, there is no significant correlation between Age of patients and Mortality/GCS/GOS/mRS at admission, at discharge, at 1 month and at 2 months follow up.

Gender: This study found male preponderance which followed a similar trend to previously reported studies by Osuntokun et al. Desalu et al. and Sanya et al. [18-20] This male preponderance may represent a truly higher incidence of ICH in men as has been repeatedly reported worldwide. Similarly, in the study of brain herniation in ICH, conducted at SGPGIMS. Lucknow, out of 24 Patients 18 (75%) were men and only 6 (25%) were women, indicating a similar male preponderance.[21]

Comorbidities: Results from the "INTERSTROKE study", which identified self-reported history of Hypertension as a strongest risk factor for stroke overall. Most importantly the study found that this association was even more pronounced for intracerebral haemorrhagic stroke than for ischemic stroke. [22] Hypertension is highly prevalent in India, and is consistently reported as a risk factor for all stroke types. Blood pressure control rates remain suboptimal, varying from 42 to 45% in patients receiving care in tertiary institutions, and non-compliance to treatment has been cited as a major reason for this trend. [23] Also, from among other risk factors like Coronary heart disease, Diabetes mellitus, chronic kidney disease. Diabetes Mellitus was second common risk factor in ICH patients.

Location of Hematoma: Castellanos et al. observed that the cortical location of the bleeding was an independent predictor of a good short-term ICH outcome. [24] In another study, the patients with a basal ganglia hematoma had mortality rates at 3 months (78.8%) compared to patients with a lobar hematoma (67.8%). [25] In our study clinical outcome in the form of Mortality, GCS, GOS and mRS, was best in Lobar Hematoma patients and worst in Gangliocapsular hematoma. However, the results are not statistically significant.

ICH Volume and Outcome: Larsen et al. observed that the acute mortality of ICH was 27%, and determinant for the immediate prognosis was consciousness level and the hematoma volume.[26] According to Mukesh K Bhaskar et al. study the mortality rate at 3 months was found to be directly proportional to the hematoma volume (P = 0.039) with 100% mortality for patients with a volume >90 ml. The mortality was 56.4% in patients with volume in the range of 31-60 ml whereas it was 81% in patients with the volume in the range of 61-90 ml. The mortality rate in the group of 31-60 ml volume was significantly lower in the surgical group (35.7%) than in the conservative group (77.8%) (P = 0.016). [25] A substantial number of the patients (34.7%) and mostly those with basal ganglia hematoma also had intraventricular extension of the ICH. This is expected due to the anatomically contiguous location of the basal ganglia to the ventricles. IVE is associated with increased mortality and morbidity.

Mid Line Shift: Nag et al. found that the midline shift is prognostically poor only when 0coexisting with other factors causing a mass effect such as ventricular compression by the hematoma.[27] In another study, the death rate at 3 months was higher with an increase in the midline shift irrespective of the group; however, the death rate was significantly higher in the conservative group (90.9%) with a midline shift of more than 5 mm compared with the surgical group (63.3%), which was statistically significant (P = 0.023). In our study Mid-line shift has statistically strong correlation with clinical outcome (GOS, mRS) and mortality.

Operative Techniques: In previous studies, 'Decompressive craniectomy' (DC) with evacuation of hematoma was compared with evacuation of hematoma by craniotomy. "Hayes et al." in a retrospective study compared hematoma evacuation ± decompressive craniectomy. In patients with Putaminal hemorrhage, 10 patients underwent evacuation of hematoma with DC and were compared with 16 patients who underwent evacuation of hematoma by craniotomy. DC group had lower preoperative GCS (GCS <8, p=0.019). Decompressive Craniectomy in Putaminal hemorrhages shown significant improvement in midline shift and a trend toward better outcome. In patients with lobar lCH, eight patients underwent evacuation of hematoma + decompressive craniectomy and 17 patients underwent only hematoma evacuation by craniotomy. Decompressive craniectomy group had larger midline shift (p=0.022), and were right-sided hemorrhage (p=0.011). No benefit of decompressive craniectomy was found in patients with lobar hemorrhages. [28] In this study, maximum patients underwent DC and Evacuation of hematoma. The major goal of surgical treatment in patients with an ICH is safe and thorough clot evacuation with maximal preservation of neurological function. Operative techniques used in our study have strong

correlation with clinical outcome and mortality and among those EVD technique has more favourable clinical outcomes.

CONCLUSION: -

In conclusion, an elderly male with associated comorbidities mainly Hypertension, Diabetes mellitus and Chronic alcoholic patients are at more risk to develop ICH. Clinical presentations including low GCS, Neurological deficit, Headache and Loss of consciousness have poor clinical outcome. The most common location for ICH is Gangliocapsular region followed by Thalamic region; however, the specific location of the hematoma doesn't influence overall clinical outcome or mortality rate. Maximum patients have hematoma volume less than 30 ml in the study and ICH volume plays a key role in clinical outcome of the patient. Midline shift has impact on clinical outcome and mortality i.e. patients with more midline shift has poor clinical outcome. Various operative techniques employed in managing ICH have shown significant effects on clinical outcome and mortality.

REFERENCES: -

1. Mendelow A, ICH. Editorial. J Neurol Neurosurg Psychiatry. 1991;54:193-5.
2. Dauber RD. The Framingham Study: The epidemiology of atherosclerotic disease. Massachusetts: Harvard University Press; 1980.
3. Toyoda K. Epidemiology and registry studies of stroke in Japan. J Stroke. 2013;15:21-6.
4. Sun W, Pan W, Kranz PG, Hailey CE, Williamson RA, Sun W, et al. Predictors of late neurological deterioration after spontaneous intracerebral hemorrhage. Neurocrit Care. 2013;19:299-305.
5. Weisberg LA. Subcortical lobar ICH: Clinical-CT correlation. J Neurol Neurosurg Psychiatry. 1985;48:1078-84.
6. Fujitsu K, Muramoto M, Ikeda Y, Inada Y, Kim J, Kwabava T. Indications for surgical treatment of putaminal hemorrhage: comparative study based on serial CT and time course analysis. J Neurosurg. 1990;73:518-25.
7. Franke CL, Van Smieten JC, Algra A, Van Gija. Prognostic factors in patients with ICH. J Neurol Neurosurg Psychiatry. 1992;55:653-7.
8. Borderick JP, Brott T, Tamsick T, Huster G, Miller R. The risk of subarachnoid hemorrhage and intracerebral hemorrhage in blacks as compared to whites. N Engl J Med. 1992;326:733-6.
9. Muller HR, Radu EW. Intracerebral hematoma. Neurology. 1981;13:320-51.
10. Takeuchi S, Wada K, Nagatani K, Otani N, Mori K. Decompressive intracerebral hemorrhage for spontaneous hemicraniectomy. Neurosurg Focus. 2013;34:E5.
11. Zhou X, Chen J, Li Q, Ren G, Yao G, Liu M, et al. Minimally invasive surgery for spontaneous supratentorial intracerebral hemorrhage: a meta-analysis of randomized controlled trials. Stroke. 2012;43:2923-30.
12. Mendelow AD, Gregson BA, Fernandes HM, Murray GD, Teasdale GM, Hope DT, et al. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomised trial. Lancet 2005;365:387-97.
13. Mendelow AD, Gregson BA, Fernandes HM, Murray GD, Teasdale GM, Hope DT, et al.; STICH Investigators. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial intracerebral haematomas in the International Surgical Trial in Intracerebral Haemorrhage (STICH): a randomised trial. Lancet. 2005; 365:387-97.
14. Mendelow AD, Gregson BA, Rowan EN, Murray GD, Gholkar A, Mitchell PM; STICH II Investigators. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial lobar intracerebral haematomas (STICH II): a randomised trial. Lancet. 2013;382:397-408.
15. Kaufman HH. Spontaneous intraparenchymal brain hemorrhage. Neurosurgery. 1996; 2:2567-85.
16. H.R.Muller, EW Radu. Intracerebral hematoma. Neurology. 1981;13:320-51.
17. Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors JJ, Culebras A et al. An Updated Definition of Stroke for the 21st Century: A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association Stroke. 2013;44:2064-89
18. Desalu OO, Wahab KW, Fawale B, Olarenwaju TO, Busari OA, Adekoya AO et al. A review of stroke admissions at a tertiary hospital in rural South western Nigeria. Ann Afr Med.2011;10:80- 5
19. Sanya EO, Desalu OO, Adepoju F, Aderibigbe SA, Shittu A, Olaosebikan O. Prevalence of stroke in three semi-urban communities in middle-belt region of Nigeria: a door-to-door Survey.Pan Afr Med J. 2015; 20:33.
20. Ashley WW Jr, Charbel FT, Amin-Hanjani S. Surgical management of acute intracranial hemorrhage, surgical aneurysmal and arteriovenous malformation ablation, and other surgical principles. Neurol Clin. 2008;26:987-1005.
21. Kalita J, Misra UK, Vajpayee A, Phadke RV, Brain herniations inpatients with ICH; ActaNeurolScand 2009:119:254-60.
22. O'Donnell M, Xavier D, Diener C, Sacco R, Lisheng L, Zhang H et al. Rationale and design of INTERSTROKE: a global casecontrol study of risk factors for stroke. Neuroepidemiology. 2010; 35:36-44.
23. Akinkugbe OO. Current epidemiology of hypertension in Nigeria. Arch.Ibadan Med. 2003;1:3-5
24. Castellanos M, Leira R, Tejada J, Gil-Peralta A, Dávalos A, Castilo l. Predictors of good outcome in medium to large 137 spontaneous supratentorial intracerebral haemorrhages. JNNP 2005;76:691-5.
25. Bhaskar MK, Kumar R, Ojha B, Singh SK, Verma N, Verma R. et al. A randomized controlled study of operative versus nonoperative treatment for large spontaneous supratentorial hemorrhage. Neurol India [serial online] 2017 [cited 2021 Jan 26]; 65:752-8. Available from: https://www.neurologyindia.com/text.asp?2017/65/4/752/209497
26. Larsen SH, Sommer W, Strange P, Lester J, Boysen G. Prognosis for patients treated conservatively for spontaneous intracerebral hematomas. Stroke 1984; 15:1045-8.
27. Nag C, Das K, Ghosh M, Khandakar MR. prediction of clinical outcome in acute hemorrhagic stroke from a single CT scan on admission. N Am J Med Sci 2012;4:463-7.
28. Hayes SB, Benveniste RJ, Morcos JJ, Aziz-Sultan MA, Elhammady MS. Retrospective comparison of craniotomy and decompressive craniectomy for surgical evacuation of nontraumatic, supratentorial intracerebral hemorrhage. Neurosurg Focus. 2013;34: E3.