

## Institutional Experience Of Intracranial Aneurysms And Its Surgical Outcome Analysis

Dr B. Hayagriva Rao<sup>Mch<sup>1</sup></sup>, Dr. M Premjit Ray<sup>Ms,Mch<sup>2</sup></sup>, Dr D Ravi<sup>Ms, Mch<sup>3</sup></sup>,  
Dr T Phaneeswar<sup>Ms, Mch<sup>4</sup></sup>, Dr Yeshwanth. V<sup>Ms<sup>5</sup></sup>, Dr Kn Somesh<sup>6</sup>

Professor, Department Of Neurosurgery,

King George Hospital, Andhra Medical College, Visakhapatnam, India.

Professor And Hod, Department Of Neurosurgery,

King George Hospital, Andhra Medical College, Visakhapatnam, India.

Assistant Professor, Department Of Neurosurgery,

King George Hospital, Andhra Medical College, Visakhapatnam, India. .

Assistant Professor, Department Of Neurosurgery,

King George Hospital, Andhra Medical College, Visakhapatnam, India.

Post Graduate, Department Of Neurosurgery,

King George Hospital, Andhra Medical College, Visakhapatnam, India.

---

### Abstract:

**Background:** Cerebral aneurysms could rupture causing stroke, or compress the nearby brain surface, the cranial nerves and blood vessels. Intracranial aneurysms, primarily of the saccular or berry type, significantly contribute to non-traumatic subarachnoid haemorrhages and demonstrate a rising incidence due to advances in imaging techniques. The CNS vascularization is an ascending process that accompanies the anatomical and functional maturations of its various territories. It starts at the myelencephalon and ascends sequentially through the metencephalon, mesencephalon, diencephalon, and finally the telencephalon. In our institute we go for micro vascular clipping of the aneurysm, and we present the various factors and our experience with these aneurysm surgeries.

**Materials and Methods:** in this Retrospective study, we have a total of 58 patients of intracranial aneurysms that were admitted and treated surgically by clipping of aneurysm under department of neurosurgery, King George Hospital. All patients were evaluated thoroughly by serial neurological examination and monitoring of vitals. Here we give the results of the 58 cases that have been operated and there clinical outcome.

**Results:** A total of 58 cases were operated, and we had 18 male and 40 females, while age wise most cases were present in the 6<sup>th</sup> decade of life. Headache with vomiting were the most common presenting symptoms, while most patients were in grade 2 hunt and hess, while in wfns they were predominantly in grade 1. Modified fishers had most in grade 1 and 3. Most common location was A Com A aneurysm followed by MCA.

**Conclusion:** there was a female preponderance of 2.3 to 1, while A Com A aneurysm was the most common, early treatment and prevention of intra operative rupture of aneurysm had good outcome compared to cases that had intra operative rupture.

**Keywords:** intra cranial aneurysm, rupture, SAH, Aneurysm Clipping, Vasospasm, Computed tomography Angiography, Risk Factors, Surgical Treatment, post op surgical complications, GOS, GCS.

---

Date of Submission: 26-12-2024

Date of Acceptance: 06-01-2025

---

### I. Introduction

An intracranial aneurysm, also known as a cerebral aneurysm, is a cerebrovascular disorder in which there is localised weakness in the wall of cerebral artery causing localised dilatation or ballooning of the blood vessel owing to the destruction of internal elastic lamina and tunica media. Intracranial aneurysms (IAs), specifically of the saccular or berry type, constitute acquired lesions and contribute to approximately 80% of non-traumatic subarachnoid haemorrhages (SAH)<sup>1</sup> and affects 5-10% of general population<sup>2</sup>. It is associated with significant morbidity and mortality. The outcome after subarachnoid haemorrhage due to aneurysmal rupture is still poor; mortality rates ranges from 40-50%, severe disability in 10-20% and only 40% reach independent status<sup>3,4</sup>. Contributing causes to mortality and morbidity is bleed, re-bleed, vasospasm and cerebral ischemia. The current study aims to review the epidemiology of the surgically clipped ruptured intra cranial aneurysms and to identify the predicting factors that influence the prognosis and surgical out come in these patients.

## II. Materials And Methods:

This is a retrospective analysis of the intra cranial aneurysm cases that were operated in the department of neurosurgery, King George Hospital, Andhra Medical College, Visakhapatnam, Andhra Pradesh. From October 2022- September 2024. A total of 58 cases were analysed, that were treated using microsurgical clipping. A comprehensive analysis was conducted using the data that was available, focusing on preoperative, intra operative and post-operative condition of the patient specifically on location of aneurysm, Hunt and Hess grade, WFNS grading and Fishers grade, side of approach, intra operative events, post-operative events and complications and the number of additional surgery needed were also considered. The research aligns with the main principles in the Declaration of Helsinki. Clinical data including risk factors, aneurysm characteristics, and surgical interventions, as well as follow-up details such as postoperative complications and mortality rate, were extracted from relevant files.

### Inclusion criteria:

- All age groups
- Sex: male and female
- All patients presenting with signs and symptoms of spontaneous SAH ruptured intracranial aneurysms
- Hunt and Hess grade 1,2,3 and 4 cases.

### Exclusion criteria:

- Patients with medical illness unfit for surgery.
- Patients not willing for surgical management
- Aneurysms other than saccular.
- Traumatic SAH other than aneurysmal rupture.
- Grade 5 of Hunt and Hess classification

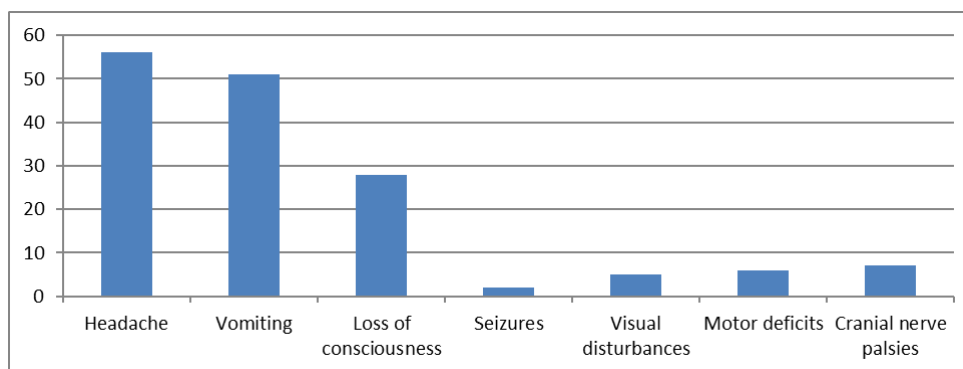
The data from each enrolled subject was entered, cleaned and coded using Microsoft Excel 2010. Data was checked for normality before performing statistical analysis. Descriptive and inferential statistical analysis was done using IBM SPSS version 27. Continuous variables were presented as mean + standard deviation (SD) whereas categorical variables were presented as absolute numbers and proportions.

## III. Results:

The study has a total of 58 cases that were operated for intra cranial aneurysms with primary focus being clipping of the aneurysm. we restricted only to clipping of aneurysm due to available facilities. We discuss only the intricacies of aneurysm management and its outcome analysis following clipping of aneurysm. In our study of 58 cases we had a total of 18 (31.03%) male and 40(68.97%) females. Showing female preponderance of 2.3:1 female to male ratio. While in age distribution we had the youngest patient with age of 26 yrs and oldest patient age was 78 yrs. Most of the cases were in 6<sup>th</sup> decade of life followed by 5<sup>th</sup> and 7<sup>th</sup> decade very closely.

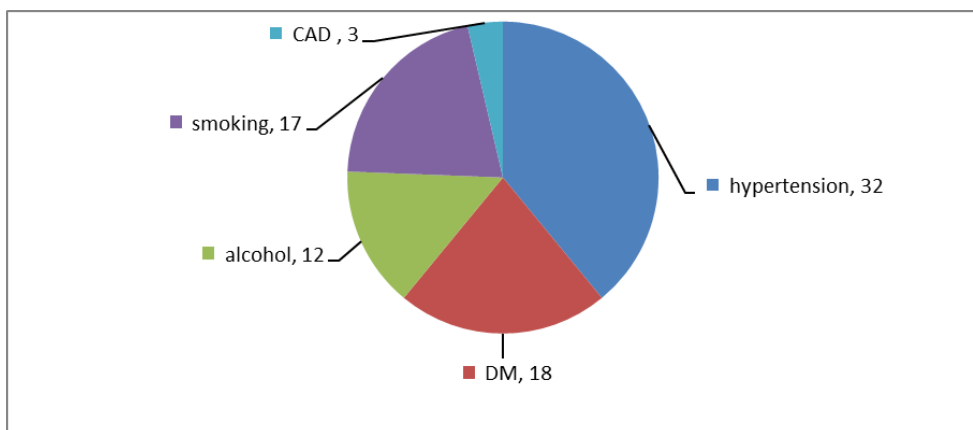
Age in years	Number	Percentage
<30	2	3.45
31-40	3	5.17
41-50	16	27.58
51-60	19	32.75
61-70	15	25.86
>71	3	5.17
Total	58	100.00

**Presentation:** Symptoms varied from head ache to motor deficits and comatose state. Most common presentation was headache in 56 patients described as worst headache by patients, followed by vomiting, loss of consciousness, seizures, visual disturbances, motor deficits, cranial nerve palsies. Cranial nerve deficits predominantly included 3<sup>rd</sup> and 6<sup>th</sup> cranial nerves. Which improved during follow up post operatively.



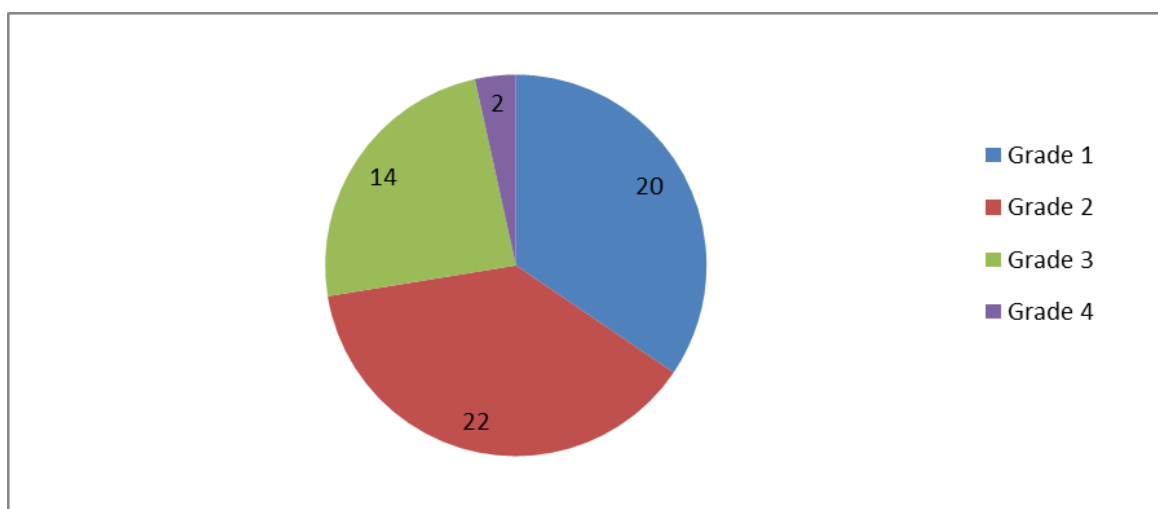
**Figure 1: Bar Graph Of Presenting Complaints Of Patients**

**Co morbidities in the presenting patients:** Most common risk factors associated are hypertension, diabetes mellitus, alcohol, smoking, trauma, CAD with blood thinners. Commonly found in patients above 50 yrs of age. Patients were on irregular medications for hypertension and diabetes mellitus. HTN was the most common comorbidity in aneurysmal SAH cases



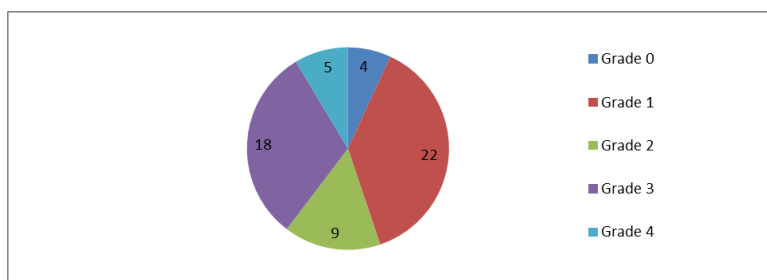
**Figure 2: Pie Chart Showing The Various Co Morbidities In Presenting Patients.**

**Hunt and Hess grading of patients:** Only those in Hunt and Hess grade 1,2 , 3 and 4 were included in study while grade 5 are excluded in view of their poor general condition. Most of the patients had been in group 1 and 2.



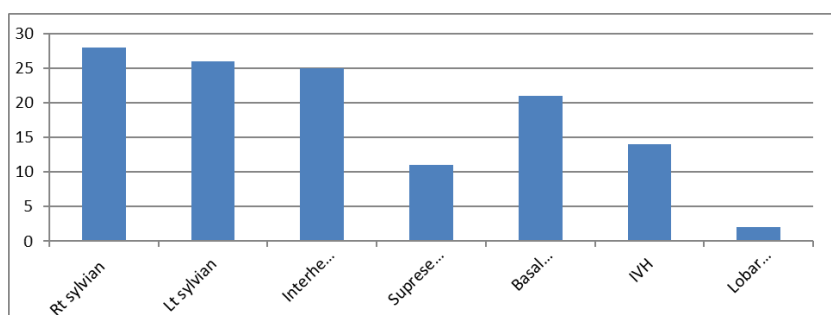
**Figure 3: Pie Chart Showing Number Of Patients In Various Grade Of Hunt And Hess Grade**

**Modified Fishers Grading:** Based on the Sub Arachnoid Haemorrhage in CT and MRI scans. All cases had some amount of SAH. Majority had been in Grade 1 followed by grade 3 which had thick haemorrhage.



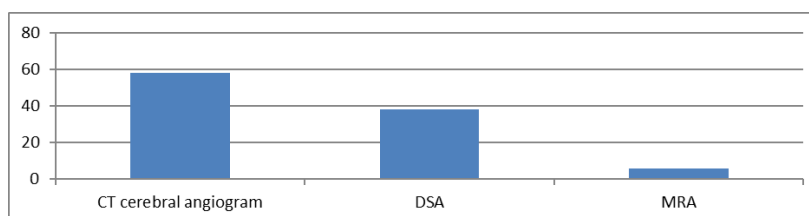
**Figure 4: Pie Chart Showing Various Grades Of Modified Fishers Score In The Study Group**

**Location of haemorrhage on CT scan:** All the patients were evaluated using ct scan at time of admission and the localisation of various bleeds was noted. Most common sites were right and left sylvian fissure followed by inter-hemispheric fissure and basal cisterns.



**Figure 5: Location Of Bleed In Various Cisterns Based On Ct Scan.**

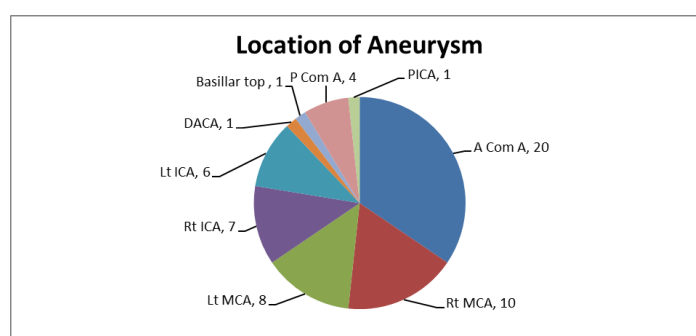
**Investigations:** All the patients were done with routine haematological work up and surgical profile. While specific investigations like CT cerebral angiogram was done in all 58 patients while DSA was done in 38 patients, those who were irritable and uncooperative were not subjected to DSA. 6 cases that were evaluated elsewhere and referred to us were done with MRA.



**Figure 6: Showing Specific Investigations That Were Done In Study Group.**

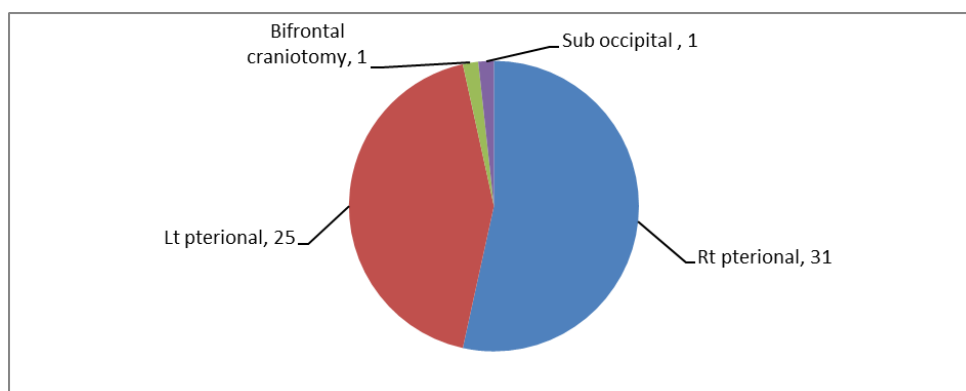
**Ct angiography localisation of aneurysm:** Patients after admission were evaluated with CT angiogram brain and 3D reconstruction of images.

Accordingly aneurysms were identified based on the locations. Most of the aneurysms were found to be A Com A location. Followed by Rt MCA and Lt MCA. We had 1 case each of DACA, Basilar Top, PICA aneurysm.



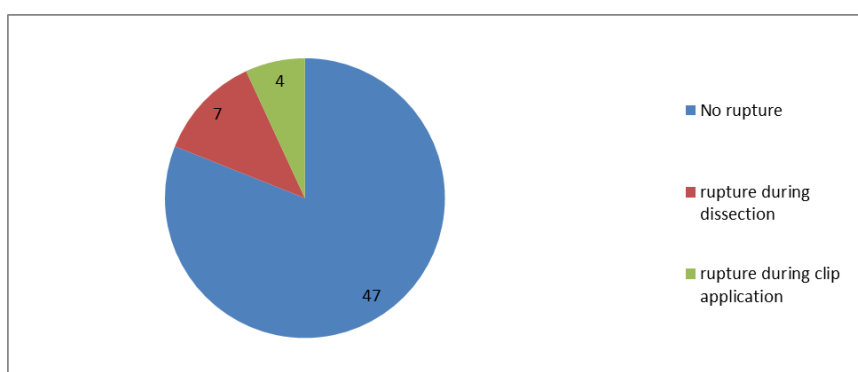
**Figure 7: Location Of Aneurysms Based On Ct Angiogram**

**Side of approach for surgery:** in our study group the side of surgical approach was based on the aneurysm localisation, direction and morphological attributes, primarily involved the utilisation of clipping. Craniotomies were executed predominantly through Pterional approach, while DACA aneurysm was clipped using bi-frontal craniotomy and inter-hemispheric approach, while PICA aneurysm was done with sub occipital craniotomy.



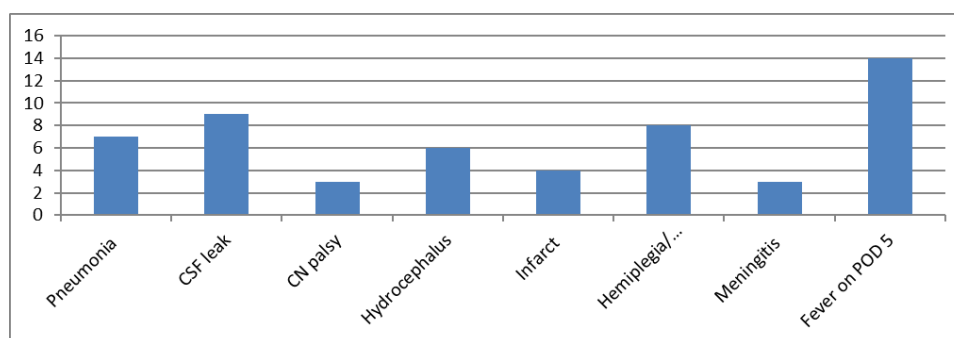
**Figure 8: Various Surgical Approaches To Aneurysm.**

**Intra operative event:** This was an intra operative finding. Cases in our study group had SAH in all the patients on ct brain. Intra operatively aneurysm was looked for presence of any bled like appearance on its surface after dissection which was most probable location of aneurysm rupture. We had presence of bleb in 45 cases while 13 cases we were not able to identify the bled due to various reasons. While a total of 47 cases were clipped successfully with rupture, there were 7 cases that had rupture during clipping and 4 cases in which rupture occurred during clip application on one side.



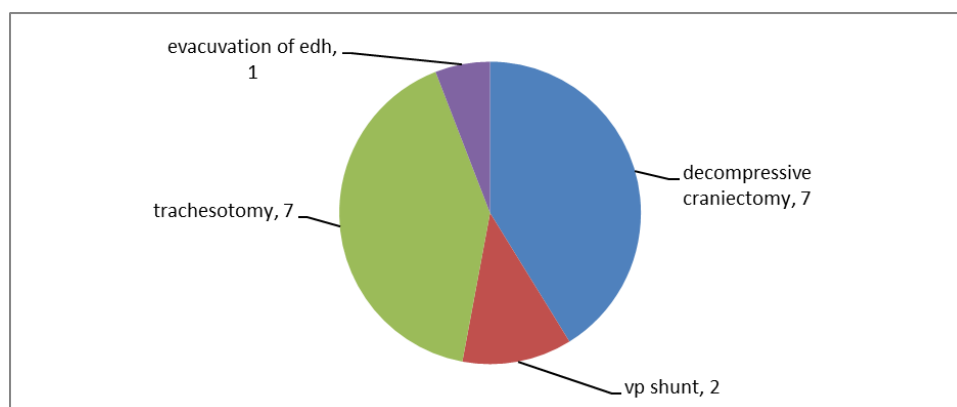
**Figure 9: Showing Number Of Cases That Had Rupture Or No Rupture During Clipping Of Aneurysm**

**Post op complications:** In our study group we considered the complications that patient developed post operatively. Both neurological and non neurological complications. Post operative day 5 fever was the most common complication which we encountered. Followed by pneumonia which was associated with cases that required prolonged ventilation. While neurological complications involved cranial nerve palsies, hydrocephalus. While CSF leak were managed conservatively with lumbar drain and repeated spinal tapping when-ever deemed necessary. Meningitis was treated accordingly with CSF culture sensitivity reports.



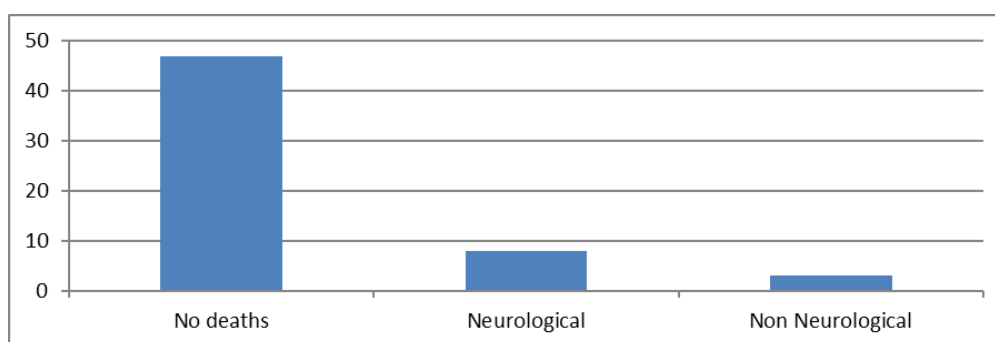
**Figure 10: Various Complications That Occured In The Post Operative Period.**

**Additional surgical procedures:** in our study group that developed complications post operatively which warranted further surgical intervention included infarct, hydrocephalus, prolonged ventilator support. Various procedures that were performed included conversion of Pterional craniotomy to decompressive craniectomy, VP shunt, tracheostomy, evacuation of EDH.



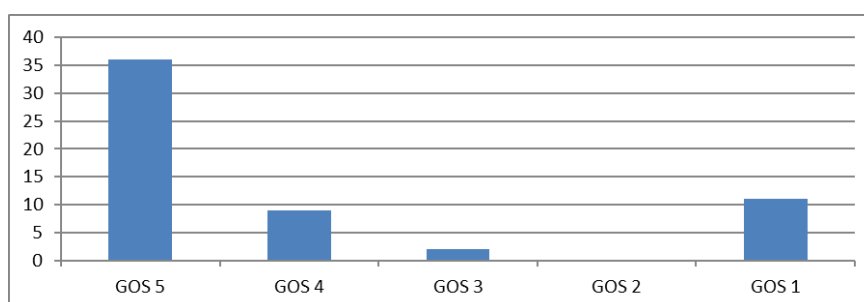
**Figure 11: Various Additional Procedures That Were Performed Postoperatively In The Study Group.**

**Post operative deaths:** of the 58 cases that were operated, we had a total of 11 deaths. While 47 cases were discharged. Of the 11 cases that expired 3 cases were non neurological 2 related to MI, and 1 case had aspiration pneumonia. While 8 cases were related to neurological problems.



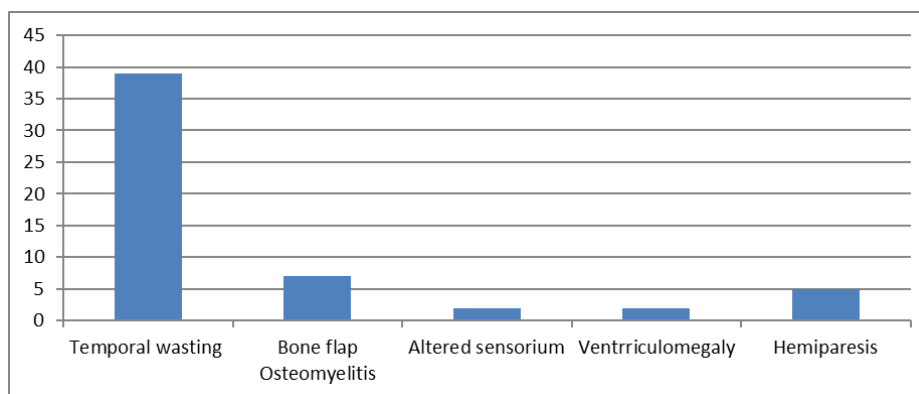
**Figure 12: Post Operative Causes Of Death For Patients In The Study Group.**

**GOS at discharge:** In the study group the GOS was employed for comprehensive evaluation of post-operative patient outcome. Most of the patients were in GOS 5, 36 patients. While 11 were in GOS1, GOS 4 and 3 had 9 and 2 patients respectively.



**Figure 13: Post Operative Results Of Patients Examined Using Gos.**

**Follow up period:** All the cases that were discharged were followed up post operatively after 2 weeks, 4 weeks and 2 month and monthly after that. Most of the patients developed temporal wasting during follow up period as a result of surgical procedure. While 7 cases developed bone flap osteomyelitis due to free bone flap placement. These warranted additional use of antibiotics according to culture and sensitivity. While 39 cases that were followed up had temporal wasting, while 5 cases had lesser degree of wasting as skin and muscle flap were elevated together rather than separate flaps. 5 cases had persistence of hemiparesis even after physiotherapy during follow up.



**Figure 14: Post Operative Complications During Follow Up Period.**

#### IV. Discussion

This study was conducted in department of Neurosurgery in King George Hospital, visakhapatnam. In our study of 58 patients, the majority were female 40 (68.97%), compared to 18 (31.03%) were males, reflecting a female predominance with a ratio of 2.22:1. Patients were categorized by age into decades of life, with most cases occurring in the 6<sup>th</sup> and 5<sup>th</sup> decades, accounting for approximately 60.34% of the total. A more detailed analysis suggests that the higher prevalence of cerebral aneurysms and subsequent subarachnoid hemorrhage (SAH) in females may peak during the post-menopausal period<sup>5</sup>, corresponding with a decline in estrogen levels. The fluctuation in oestrogen levels is posited to have consequential effects on vascular integrity, given its supportive role in the normal functioning of the vascular wall<sup>6</sup>.

Most common presenting symptom was headache in 56(96.56%) , followed by vomiting in 51(87.93%), loss of consciousness in 28(41.38%), seizures in 2 cases. Along with motor deficits and cranial nerve palsies. Hypertension was the most common co morbidity that was present in about 48.27% of patients followed by DM in 31.03% of cases and smoking in 29.31% of cases. . The inflammatory impact of smoking on arterial walls weakens the structural integrity, thereby predisposing the vessel to aneurysm formation<sup>7</sup>.

In Hunt and Hess grading most cases 22(37.93%)were in grade 2 followed by grade 1 20 (34.93%), 14(24.13%) cases cases in grade3 while only 2(3.45%) cases were in grade 4 and no cases from grade 5 were in the study. In WFNS classification Grade 1 had about 36 cases about 62.06% of total study population, while least were in grade 4, 2 cases. Modified Fishers Grading had about 21 cases in grade 1 while 18 un Grade 3 followed by grade 2,4 and 0 with 9,5 and 4 cases respectively in that order. in a study by Toader et al showed about 41% of cases were in grade 3<sup>8</sup>.

Symptomatic vasospasm constitutes a principal factor in delayed morbidity and mortality among individuals afflicted with aneurysmal SAH, as evidenced by existing research<sup>9</sup>. The severity of such vasospasm is correlated with both the quantity and the duration of exposure to SAH. Notably, approximately 40% to 70% of patients who endure the initial haemorrhagic episode following a cerebral aneurysm rupture experience arterial constriction, with 20%-30% demonstrating neurological deficits<sup>10,11</sup>. Strategies for the treatment of vasospasm are medical i.e. nimodipine which has a class I evidence and intervention i.e. angioplasty either chemical or balloon using Milrinone which has class II evidence<sup>12</sup>. In a study by Z.Q. Huang et al<sup>13</sup> 2361 patients with 2674 aneurysms were studied at 4 medical centres

On CT scan brain most common site of location was found to be right sylvian fissure along with left sylvian fissure followed by inter-hemispheric bleed which was most consistent with Anterior Communicating Artery Aneurysm. other locations included supra-sellar, basal cisterns and IVH. The most common aneurysm that we encountered was the A Com A 34.5%, followed by combined MCA about 31% of cases, ICA had about 22.35% of cases. Most common approach which was used was right pterional in 53.44% of cases followed by left pterional in 43.10% of cases. While 1 case each of DACA and PICA were approached with bi frontal craniotomy and sub occipital craniotomy. Intra operatively we were able to clip the aneurysm with out any rupture in 47(81.04%) cases, while 7(12.06%) cases had rupture during dissection, another 4(6.9%) cases had rupture during clip application.

Most common complication which we encountered in post operative period was fever followed by CSF leak, Pneumonia, hydrocephalus, hemiplegia/ hemiparesis. 7 cases needed the conversion of the craniotomy in to decompressive craniectomy for post operative infarcts and vp shunt placement and tracheostomy. We had a mortality of 11 cases of this 3 were non neurological while rest were neurological. Patient at time of discharge were assessed using GOS which was 5 in 36 patients, 1 in 11 cases, while 9 cases had GOS of 4 and 2 cases had GOS 3. Notably, the only significant prognostic factor was observed in patients

classified as Fisher grade II, all of whom had a favourable prognosis. This is consistent with findings from other studies examining prognostic factors after microsurgical clipping of cerebral aneurysms<sup>14</sup>.

## V. Conclusions

In our analysis of 58 intra cranial aneurysms we noticed that there was female preponderance compared to male. Age was predominantly common during 6<sup>th</sup> and 5<sup>th</sup> decade of life. While Hunt and Hess grade 1 and 2 were common. In modified fishers grade 3 cases were more common, followed by grade 2 and 1. Predominantly associated risk factors were hypertension, smoking and alcohol consumption.

NCCT showed SAH in all cases done within 24 hrs. of the incident. Ct angiography was used for reconstruction and was useful in localising the aneurysm and deciding the side of approach for clipping of aneurysms. Anterior communicating artery was most common location followed by the MCA aneurysms. Cases were clipped intra operatively and had increased risk of rupture if there were adhesions.

Post-operative evaluation gave a comprehensive view of outcomes and mortality rates, offering assessment of our surgical intervention. The use of Glasgow Outcome Scale highlighted favourable outcome in most of the cases. While operative intervention demonstrated good surgical outcomes, it was associated with significant mortality. Post-operative complications necessitated need for additional surgery including decompressive craniectomy and ventilator support. Follow-up period showed most patients had developed temporal wasting on the side of approach with bone flap osteomyelitis.

## References

- [1] Brown Rd: Unruptured Intracranial Aneurysms. *Semin Neurol.* 2010, 30:537-44. 10.1055/S-0030-1268858
- [2] Linn Fh, Rinkel Gj, Algra A, Van Gijn J: Incidence Of Subarachnoid Hemorrhage: Role Of Region, Year, And Rate Of Computed Tomography: A Meta-Analysis. *Stroke.* 1996, 27:625-9. 10.1161/01.Str.27.4.625
- [3] Seppjuvela, Kristina Poussa, Mattiporras: Factors Affecting Formation And Growth Of Intracranial Aneurysms, A Long Term Follow Up Study. *Stroke* 2001 Feb; 485-491.
- [4] Seppjuvela, Mattiporras, Kristinapoussa: Natural History Of Unruptured Intracranial Aneurysms: Probability Of Risk And Risk Factors For Aneurysm Rupture. *J Neurosurgery* 2000; 93:379-387.
- [5] Risk Factors For The Formation Of Multiple Intracranial Aneurysms Habib E. Ellamushi, Joan P. Grieve, H. Rolf Jägerand Neil D. Kitchen.
- [6] Jou Ld, Wong G, Dispensa B, Lawton Mt, Higashida Rt, Young Wl, Saloner D: Correlation Between Luminal Geometry Changes And Hemodynamics In Fusiform Intracranial Aneurysms. *Ajnr Am J Neuroradiol.* 2005, 26:2357-63.
- [7] Cebra Jr, Castro Ma, Burgess Je, Pergolizzi Rs, Sheridan Mj, Putman Cm: Characterization Of Cerebral Aneurysms For Assessing Risk Of Rupture By Using Patient-Specific Computational Hemodynamics Models. *Ajnr Am J Neuroradiol.* 2005, 26:2550-9.
- [8] Toader C, Kakucs C, Dobrin N, Et Al.: Cerebral Aneurysm Characteristics And Surgical Outcomes: An In-Depth Analysis Of 346 Cases Operated Using Microsurgical Clipping. *Cureus* 16(3): E56933. Doi 10.7759/Cureus.56933
- [9] Murayama Y, Malisch T, Guglielmi G, Et Al.: Incidence Of Cerebral Vasospasm After Endovascular Treatment Of Acutely Ruptured Aneurysms: Report On 69 Cases. *J Neurosurg.* 1997, 87:830-5.
- [10] Mahaney Kb, Todd Mm, Torner Jc: Variation Of Patient Characteristics, Management, And Outcome With Timing Of Surgery For Aneurysmal Subarachnoid Hemorrhage. *J Neurosurg.* 2011, 114:1045-53.
- [11] Yao Ps, Chen Gr, Zheng Sf, Kang Dz: Predictors Of Postoperative Cerebral Ischemia In Patients With Ruptured Anterior Communicating Artery Aneurysms. *World Neurosurg.* 2017, 103:241-7.
- [12] Treatment Of Intracranial Vasospasm Following Subarachnoid Hemorrhage Andrew M. Bauer\* And Petera. Rasmussen Cerebrovascular Center, Cleveland Clinic Foundation, Cleveland, Oh, Usa.
- [13] Geometric Parameter Analysis Of Ruptured And Unruptured Aneurysms In Patients With Symmetric Bilateral Intracranial Aneurysms: A Multicenter Ct Angiography Study. Z.Q. Huang, X Z.H. Meng, X Z.J. Hou, X S.Q. Huang, X J.N. Chen, X H. Yu, X L.J. Feng, X Q.J. Wang, X P.A. Li, And X Z.B. Wen
- [14] Orakdogan M, Emon St, Somay H, Engin T, Ates O, Berkman Mz: Prognostic Factors In Patients Who Underwent Aneurysmal Clipping Due To Spontaneous Subarachnoid Hemorrhage. *Turk Neurosurg.* 2016, 26:840-8.