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Outcome At Discharge Among Surgically Managed Patients With Middle Cerebral Artery Aneurysms In A Tertiary Care Hospital

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Abstract

Middle cerebral artery (MCA) aneurysm is one of the most common cerebral aneurysms. The incidence of ruptured MCA aneurysm is about 21% (which is the third most common). The most common segment of MCA aneurysm is MCA bifurcation, and the incidence is 80-85%. MCA aneurysms occasionally arise at the origin of the anterior temporal branch or at the origin of the lenticulostriate arteries.Surgical clipping is preferable to coil embolization in treating MCA aneurysm even now. So, we neurosurgeons must learn harder about the feature, specificity, the method of simulation, intraoperative monitoring, and surgical technique of MCA aneurysm. Overall patient outcomes are mostly detennined by preoperative state, and the surgery related morbidity is actually low.

Objective

To study the outcome of operated cases of middle cerebral artery aneurysms

Methodology

Study design: Prospective Observationalstudy

Data Collection procedure

All consecutive cases who presented with symptomatic angiographically proven MCA aneurysm and then underwent surgical management in Department of Neurosurgery were taken for study.Patient history, comorbidities, examination findings, laboratory findings, surgical details was noted.Post operative follow-up done

After selecting patients satisfying the eligibility criteria, data collected through a semi-structured questionnaire in which the study variables that are being analysed was recorded.Data entered in Excelsheet and analysed by SPSS 26

Quantitative variables expressed in mean and standard deviation

Qualitative variables will be expressed in percentage Associations with categorical variables will be assessed bychisquare test.

Inclusion Criteria: Patients who presented with symptomatic angiographically proven MCA aneurysm and then underwent surgical management.

Exclusion Criteria:

Giant aneurysm;size>2.5cm

Patient lost to follow-up

Sample size - 25 patients who underwent clipping of MCA aneurysm from march 2022 to march 2023

Results

In this prospective study of 25 operated cases of MCA aneurysm over the one year study period, we found that the average age of sample is 56.5 years . This shows majority of patients are middle aged adults. About 45% of patients are hypertensive.In our study MRS score of I and 2 were considered as good outcome, whereas 3,4,5 were considered as bad outcome.In the age group of more than or equal to 60, there were 6 patients (n=6; 60%) with good outcome , whereas in the age group of less than 60, 9 patients had good outcome (MRS I and 2). However using fishers test when this was analysed the p value was 0.6. hence no significant statistical association between age and outcome could be established. Females are more affected as compared to males in our study. But there was nostatistically significant association between gender and outcome.

Post surgery hospital stay was in an average of 17 days.

In this study, side of aneurysm was an important predictive factor in tenns of outcome. Among right sided aneurysm patients, **11** of them had good outcome (n=**11,** 73.3% p value-0.04).

GCS at presentation was another factor which predicted the outcome. Patients with 14 and 15 GCS score at presentation had better outcome **(n=l4,** 66.7%) p value- 0.05 when compared to patients with low GCS at presentation.

Another factor which affected the outcome in our study was MFS score.

Patients with good MFS score (1-3) had better outcome **(n=l** 3, 72.2% pvalue 0.05)

Age, gender, WFNS score, Hunt and Hess score, rupture of aneurysm and intraventicular hemorrhage did not show any statitstically significant association with the outcome

Conclusion

MCA aneurysm managed by clipping had good outcome in our study. The factors which predicted the favourable outcome were right sided aneurysm, good GCS at presentation and MFS score at presentation.

Age, gender, WFNS score, Hunt and Hess score, rupture of aneurysm and intraventicular hemorrhage did not show any statitstically significant association with the outcome

Keywords: MCA ANEURYSM, CLIPPING, WFNS SCORE

Introduction

Middle cerebral artery (MCA) aneurysm is one of the most common cerebral aneurysms. The incidence of ruptured MCA aneurysm is about 21% (which is the third most common). The first being anterior communicating artery (AcomA) aneurysm about 40%, and the second internal carotid artery (ICA) aneurysm about 30%. The most common segment of MCA aneurysm is MCA bifurcation, and the incidence is 80-85%. MCA aneurysms occasionally arise at the origin of the anterior temporal branch or at the origin of the lenticulostriate arteries. In the rare event, MCA aneurysm can occur distally in the Sylvian fissure where it can become a giant, heavily thrombosed aneurysm, the so-called giant serpentine aneurysm. However, small aneurysm that arises far distally in the MCA is usually mycotic. MCA aneurysm can be bilateral and in a patient with mirror aneurysms is sometimes difficult to detern1ine which one has bled. MCA aneurysm is located relatively superficial in the sylvian fissure. It is relatively easy to find MCA aneurysm. However, the neck dome ratio is larger than other aneurysms. Branches of the MCA may emerge from the sac or neck of MCA aneurysms, making their treatment quite complicated. Therefore, surgical clipping is preferable to coil embolization in treating MCA aneurysm even now. So, we neurosurgeons must learn harder about the feature, specificity, the method of simulation, intraoperative monitoring, and surgical technique of MCA aneurysm. Overall patient outcomes are mostly detennined by preoperative state, and the surgery related morbidity is actually low. The preoperative poor Hunt-Hess grade is a strong indication for endovascular coiling, except if they have a big temporal hematoma that needs to be evacuated. Also, some patient may benefit from hemicraniectomy. Open surgery may provide the chance to do reconstruction clipping of the majority MCA aneurysms; additional to that at the same time, surgeon may be able to do thrombectomy, bypass, or even entrapment of the aneurysm On the other hand,

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about unruptured MCA aneurysm, the number of registered unruptured MCA aneurysm has the most number in record, and the rate is 36%; however, rupture rate is half of AcomA and ICA aneurysm according to UCAS Japan.

Primary Objective

To study the outcome of operated cases of middle cerebral artery aneurysms

Review Of Literature

The internal carotid artery (ICA) bifurcation is where the middle cerebral artery (MCA) originates. The MCA travels laterally through the sylvian cistern, receiving numerous branches along the way, and eventually terminates as a tiny cortical or deep lenticulostriate vessel.

In the plane of the Ml segment, 14% to 20% of all intracranial aneurysms start along the MCA, typically at the bifurcation of the first segment (MI)8"11.Before being

discovered, MCA aneurysms may reach relatively enormous diameters12. They are more prone to generate intraparenchymal haemorrhage than isolated subarachnoid haemorrhage (SAH) due to the fact that they project into the nearby parenchyma, and they are more likely to produce symptoms of mass effect than the majority of other intracranial aneurysms. They are not amenable to coiling due their architecture and their supply to eloquent areas.

The entryway to the mesial skull base and its associated structures is the sylvian fissure. A superficial and a deep compartment make up the fissure. The stem and many rami that stretch from the anterior clinoid process in a medial to lateral orientation between the frontal and temporal lobes make up the superficial compartment. The anterior or sphenoidal compartment, which houses the MI segment of the MCA, and the posterior or operculo insular compartment, which houses the M2 and M3 segments, are further divisions of the deep component 3 . This deep fissure is connected to the basilar cisterns and is also referred to as the sylvian cistern.

The MCA is the largest and most changeable of the intracranial arteries, and it is located within the sylvian fissure. Ml (sphenoidal), M2 (insular), M3 (opercular), and M4 (cortical) are its four segments. From the JCA's bifurcation, the Ml segment continues, coursing near the base of the Sylvian fissure. Although the Ml segment can be any length, it is often greater than 15 mm. Because aneurysms on such arteries are, by definition, further within the fissure than expected, short MI segments have surgical consequences. The genu of the MCA typically corresponds to the bifurcation (78%), trifurcation (I 2%), or numerous trunks that travel distally, and is frequently at or slightly distal to the Iimen insulae (a tiny gyrus at the anteroinferior comer of the insula).

M2 segmental arteries go through the fissure posterosuperiorly at varying depths, branch into M3 vessels near the insula's periphery, and come to an end at the cortical surface where M4 vessels are visible14.Angiographic and intraoperative orientation are made easier by the precise identification of patient-specific MCA branches. It may also dictate treatment paradigms and provide workable altematives and salvage procedures in complex instances. The numerous lenticulostriate arteries that emerge from the Ml segment are traditionally divided into two groups:

(I) medial lenticulostriate arteries that enter the anterior perforated substance superiorly and supply the lentiform nucleus, the caudate, and the internal capsule; and

(2) lateral lenticulostriate arteries that are more erratic in their location, traverse the basal ganglia, and supply the caudate nucleus. Morphology, location, aetiology, and size can all be used to categorise MCA aneurysms. It is not unusual for many aneurysms to fom1 throughout the MCA, and in patients who come with SAH, detem1ining the source of the SAH can be difficult. As a result, comprehensive techniques are needed to treat all potential sites of haemorrhage at the same intervention.

Saccular aneurysmal morphology is the most co1mnonly encountered morphology, distantly followed by fusiform manifestations. Blister aneurysms are less commonly described in the MCA distribution compared with the !CA. Extremely dysmorphic or distal aneurysms are often infectious and are classically identified on distal M4 branches.

Aneurysms of the Ml segment are second in frequency to bifurcation aneurysms and are composed of lenticulostriate or anterior tempora I artery saccular aneurysms. Proximal MI segment lesions represent 2% to 12% of all MCA aneurysms. 15•16Jn patients

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with multiple intracranial aneurysms the frequency of proximal MCA aneurysms tends to increase, and nearly three-fourths of patients with multiple intracranial aneurysms harbour an MCA aneurysm.

Rinne and colleagues examined 561 patients with MCA aneurysms and found that 39% harboured multiple intracranial aneurysms, significantly more than the 20% classically quoted for other segments of the intracranial circulation. Proximal MCA aneurysms can be further divided into superior and inferior wall types, depending on the specific anatomic presentation.17 Superior wall-type MI segment aneurysms arise at the origins of the lenticulostriate arteries and project into the frontal lobe postero superiorly. All efforts must be made to preserve such perforating vessels. Such aneurysms are also often small, making them hazardous for endovascular treatment. Inferior wall Ml aneurysms arise at the origin of the anterior temporal artery or the temporopolar artery and project toward the temporal lobe in an anterolateral projection. Bifurcation and trifurcation aneurysms represent up to 90% of all MCA aneurysms and are the lesions most co1mnonly referred for surgical consideration. As noted previously, the bifurcation (or trifurcation) can be highly variable, classically with one division supplying the frontal lobe and another supplying the temporal lobe. Large series of MCA aneurysms have shown wide variability in the directionality of aneurysmal projection.

Genetic predisposition to collagen deficiencies, abnormalities in proteoglycan structures, and other defects have been associated with saccular aneurysm formation and are most commonly found in familial clusters of intracranial aneurysms. These events, in combination with predisposing risk factors increasing tension in the vessel wall, are important contributors to saccular aneurysm formation. Fusiform lesions are most frequently seen in the posterior circulation and have far different management considerations than saccular aneurysms . Although rare, they represent a different disease process and in the MCA distribution can grow significantly and incorporate multiple branching vessels.Although MCA fusiform aneurysms can be found in all segments of the artery, they are most commonly found at the MCA bifurcation. Infectious Aneurysms Infectious or mycotic aneurysms are most commonly found along distal M3 or M4 branches. They are typically secondary to infectious emboli, which cause an inflammatory arteriopathy that results in aneurysm formation.

Dissecting MCA aneurysms are rare and may be associated with infection, connective tissue disorders such as Marfan syndrome, cystic medial degeneration, and fibromuscular dysplasia. In these patients, congenital weakness of the vessel wall with rupture of the elastic lamina is suspected, and dissection occurs between the internal elastic lamina and the tunica media, which differentiates intracranial dissection from aortic or peripheral arterial dissections. The intima, which is folded and displaced by the second lumen, causes the trne lumen to be narrowed or completely blocked. Angiographically, when flow is present the separated or folded intima results in asymmetrical narrowing or a rippled appearance. These pathologic changes limit treatment options, but if infarction has been avoided and patency has been preserved, trapping with bypass or endovascular stenting may be considered. Dissecting MCA aneurysms are more common in men (75%), and most patients present with ischemia; SAH is detected in only 43% of patients. Traumatic Aneurysms Major cranial trauma may be associated with intracranial arterial dissection. Traumatic aneurysms are uncommon and are most often associated with the anterior cerebral artery and its branches because of its proximity to both the skull base and the falx. Traumatic MCA aneurysms are unusual, are most classically associated with a skull fracture, and have a high rnpture rate. These lesions are most frequently distal on M3 and M4 segments, and patients often present with delayed rupture (average, 4.7 days) after the incitingtrauma. Classically, these aneurysms are managed with surgical trapping and excision with or without bypass.

The standard aneurysm size classification grouping lesions into small (<5 mm), medium (5-10 mm), large (11-25 mm), and giant (>25 mm) lesions has been used in most reported series of MCA aneurysms. Cerebral aneurysms that reach large (>15 mm) or giant (>25 mm) size are more frequently seen in the MCA distribution than in other arterial distributions and can represent up to 9% of MCA aneurysms6 .18 Similar to smaller aneurysms, they can manifest with saccular or fusiform morphology and frequently involve the origin of the M2 vessels, making clip reconstmction or endovascular stenting challenging. Although patients

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are often asymptomatic, they can present with symptoms associated with mass effect or with transient ischemic attacks (or stroke) owing to thrombus or flow reduction. About half of aneurysms have a neck that is amenable SAH and intracerebral hemorrhage (ICH) are the most common presentations of MCA aneurysms. Because of their propensity to become quite large before detection, aneurysms may occasionally become symptomatic without SAH. Giant aneurysms are reported to cause seizures more often than smaller ones, and this may be due to mass effect, ischemic changes, or repeated subclinical hemorrhages. Incidental detection of unruptured MCA aneurysms during evaluation for other conditions is increasing. Patients undergoing surgical treatment of an unruptured MCA aneurysm often undergo CTA alone as a preoperative study. Traditional angiography, however, remains the "gold standard" diagnostic modality and, in combination with three-dimensional reconstmction, provides accurate simulations of the microsurgical views, allowing for detailed preoperative planning. In symptomatic cases, computed tomography commonly reveals the presence of sub-arachnoid blood; however, absence of SAH on computed tomography in patients with high clinical suspicion should be followed by lumbar puncture to mle out a potential SAH. Approximately 1.6% of patients with mptured aneurysms can present with intraventricular or intraparenchymal hemorrhages without SAH, particularly when the hematoma involves the temporal lobe.20

As most MCA aneurysms are accessible surgically and can be treated durably with microsurgical clip reconstruction, MCA aneurysms are preferentially treated with microsurgery at many cerebrovascular centers.

The International Subarachnoid Aneurysm Trial (ISAT) has shown that small anterior circulation good-grade ruptured aneurysm patients have better I-year clinical outcomes after beingcoiled than clipped,23 but those results may not necessarily apply to patients with MCA aneurysms

Methodology

Study design: Prospective Observationalstudy

Study Setting: Department of Neurosurgery, Government Medical College, Thiruvananthapuram

Data collection Period :

1 year from the date of clearance of thesis from human ethics committee

Study Period:

I year from the date of clearance of thesis from human ethics committee

Sampling Technique:

All the cases who undergo surgical clipping for symptomatic angiographically proven Middle cerebral artery (MCA) aneurysm over a period of one year during the study will be analysed

Study Population:

All the cases who undergo surgical clipping for symptomatic angiographically proven Middle cerebral artery (MCA) aneurysm over a period of one year during the study will be analysed

Inclusion Criteria:

Patients who presented with symptomatic angiographically proven MCA aneurysm and then underwent surgical management.

Exclusion Criteria:

1. Giant aneurysm;size>2.5cm
2. Patient lost to follow-up

Sample Size

The outcome of surgically managed middle cerebral artery aneurysms is estimated to be 70% of the study population. The sample size calculated with this data using the formula 4pq/d2 is 48 for the current setting and time period. The study undertaken by Guang-xian Wang et al on " Risk factors for the rupture of MCA aneurysm using CT angio' has been taken as reference PLOS ONE 11 2016 Oct;

70(5); 369-372 ;d = absolute precision (10%). Based on the hospital statistics over the

last 2 years, the number of patients undergoing MCA aneurysm surgery is around 25. Thus, all the cases who undergo surgical clipping for symptomatic angiographically proven Middle cerebral artery (MCA) aneurysm over a period of one year during the study will be analysed.

Data Collection Procedure

All consecutive cases who presented with symptomatic angiographically proven MCA aneurysm

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and then underwent surgical management in Department of Neurosurgery will be taken for study.

1. Patient history, comorbidities, examination findings, laboratory findings, surgical details will be noted
2. Post operative follow-up will be done.
3. After selecting patients satisfying the eligibility criteria, data will be collected though a semi-structured questionnaire in which the study variables that are being analysed will be recorded
4. Data will be entered in Excel sheet and analysed by SPSS 26
5. Quantitative variables will be expressed in mean and standard deviation
6. Qualitative variables will be expressed in percentage Associations with categorical variables will be assessed by chisquare test. Univariate and multi variate analysis will be done Study Variables

The following factors were studied:

Preoperative Factors:

1. Age
2. Sex
3. Symptoms to surgery
4. Neurological deficits like hemiparesis or hemiplegia.
5. Radiological features like Fischer grading, presence of hydrocephalus, infarct, intraventricular blood, hematoma.
6. Aneurysmal factors like shape, number of lobes, direction offundus, size of aneurysm and neck.

Intra Operative Factors:

Lntraoperative Rupture

1. Temporary clipping
2. Duration of temporary clipping
3. Number of clips
4. Presence of atherosclerosis and calcification

Postoperative Factors:

1. Early and late infarct
2. Hematoma
3. Need for CSF diversion like VPshunt
4. Decompressive craniectomy
5. Tracheostomy
6. Duration on ventilator
7. Postoperative hospitalstay
8. GCS at day 5 and discharge
9. Rankin score at discharge
10. Deficit at discharge
11. Death

Data Analysis

1. Data will be entered in Excel sheet and analysed by SPSS 26.
2. Quantitative variables will be expressed in mean and standard deviation
3. Qualitative variables will be expressed in percentage
4. Associations with categorical variables will be assessed bychisquare test
5. Univariable and multi variable analysis will be done

Results

Total of 25 operated cases of MCA aneurysm clipped between 19/3/2022 to 19/3/2023 were analysed. All cases had underwent surgery at MCH, Trivandrum.

I.Age: The average age of presentation was 56.5 years

In the age group of more than or equal to 60, there were 6 patients (n=6; 60%) with good outcome , whereas in the age group of less than 60 9 patients had good outcome (MRS I and 2). However using fishers test when this was analysed the p value was 0.6. hence no significant statistical association between age and outcome could be established in this study

Sex

In this study of25 operated cases in the time period of one year, 15 were females and and IO were males.

In this study, out of 15 patients with good outcome, 8 (61.5%)were females and 7 (58.3%)were males. On statistical analysis, gender was not a predictive factor in patients outcome (p value-0.5).

Comorbidities

12 out of25 patients in the study population were hypertensive.

Laterality

15 among the operated cases had right sided aneurysm whereas left sided aneurysm was seen in the rest IOpatients

11 patients (73.3%) with good outcome had right sided aneurysm and 4 patients (40%) with left sided anerurysm had good outcome. This variable was found

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to have a p value of 0.04. Thus right sided aneurysm has statistically significant association with outcome of patients.

S.Presenting Symptoms

Among the study population, analysis was done regarding the presenting complaint and the symptom to surgery. Most common presenting symptom was headache .

GCS At Presentation

12 among the 25 patients presented to the hospital with 15/15 GCS.

Shape of aneurysm this study, the shape of aneurysm was also studied . 22 out of the 25 aneurysm were saccular in shape whereas, 3 out of25 were fusiform in morphology.

Postop Ventilation

Post operative ventilation was required for 9 patients. 16 patients were not ventilated in the post operative period.

Average days of hospitalstay was 17. Shortest number of days of hospital days was 6 days and longest hospitalstay was for 32 days.

There were no deaths among the operated 25 cases of MCA aneurysms during the study period of one year.

Discussion

Our study sample size was 25 . The average age of sample is 56.5 year . This shows majority of patients are middle aged adults.

Females are more affected as compared to males. Post surgery hospital stay was in an average 17 days. About 45% of patients are hypertensive.

21 Michael k morgan et al did a study from 1989 to 2009. In this study, 263 patients (339 aneurysms) underwent surgical clipping in 280 operations for unruptured middle cerebral artery aneurysms. Whereas our study included both ruptured and unruptured MCA aneurysm over one year study period which included 25 patients.

Multivariate logistic analysis ofrisk factors revealed in 21 Michael k n10rgan et al study that age and aneurysm size were independent predictors of surgical outcome. Patients < 60 years of age with an aneurysm ::: 12 mm constituted a low-risk group with a procedure-related combined mortality and morbidity of0.6% (95% CI, 0-3.8). Comparing this result with the results from our study, we couldnot find a significant association with age and outcome.

22Marcos Dellaretti et al did a study from 2008 to 2020. Evaluation of 146 patients evolution showed that 78 patients (69.0%) with a ruptured aneurysm had a good outcome, and among patients with unruptured aneurysms, 68 (88.3%) had a

good outcome at discharge (p = 0.005). In our study, n=9 64.3% patients with ruptured aneurysm had good outcome.However in our study, we couldn't establish an association between rupture of aneurysm and outcome.

22Marcos Dellaretti et al study patients with unruptured aneurysms, none of the factors analyzed had statistically significant differences in terms of outcome. Among patients with ruptured aneurysms, the Hunt and Hess score on admission, Fisher grade and presence of hematoma were significantly associated with clinical outcome. In this study only Fisher grade showed a statistical association with the outcome.

22Marcos Dellaretti et al study Multivariate analysis showed that only Hunt and Hess on admission was associated with prognosis. Postoperative arteriography demonstrated complete occlusion in 177 cases (83.1%). This study demonstrated that surgical treatment for middle cerebral artery aneurysms is safe and effective. In the overall analysis, ruptured aneurysms predicted poor outcome. None of the variables studied predicted poor outcome among patients with unruptured aneurysms However in our study, Hunt and Hess score did not show any association with outcome.

28Michael A. Mooney et al did a prospective randomised trial in which fifty patients underwent microsurgical clipping of a ruptured MCA aneurysm in the BRAT, including 21 who crossed over from the endovascular treatment arm. Four patients with nonsaccular (e.g., dissecting, fusiform, or blister) aneurysms were excluded, leaving 46 patients for analysis. Most (n = 32; 70%) patients presented with a Hunt

and Hess grade II or III subarachnoid hemorrhage, with a high prevalence of intraparenchymal blood (n =

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23; 50%), intraventricular blood (n = 21; 46%), or both. At the last follow-up (up to 6 years after treatment), clinical outcomes were good

(modified Rankin Scale score 0-2) in 70% (n = 19) of27 Hunt and Hess grades I-III patients and in 36% (n = 4) of 11 Hunt and Hess grade JV or V patients. There were no instances ofrebleeding after the surgical clipping of aneurysms in this series at the time of last clinical follow-up.

They concluded that microsurgical clipping of ruptured MCA aneurysms has several advantages over endovascular treatment, including durability over time. The authors report detailed outcome data of patients with ruptured MCA aneurysms who underwent microsurgical clipping as part of a prospective, randomized trial.

These results should be used for comparison with future endovascular and surgical series to ensure that the best results are being achieved for patients with ruptured MCA aneurysms.

Conclusion

In this prospective study of25 operated cases of MCA aneurysm over the one year study period, we found that the average age of sample is 56.5 year . This shows majority of patients are middle aged adults. About 45% of patients are hypertensive.

In our study MRS score of I and 2 were considered as good outcome, whereas 3,4,5 were considered as bad outcome.

In the age group of more than or equal to 60, there were 6 patients (n=6; 60%) with good outcome , whereas in the age group of less than 60, 9 patients had good outcome (MRS I and 2). However using fishers test when this was analysed the p value was 0.6. hence no significant statistical association between age and outcome could be established in this study.

Females are more affected as compared to males in our study. But there was nostatistically significant association between gender and outcome.

Post surgery hospital stay was in an average 17 days.

In this study, side of aneurysm was an important predictive factor in tenns of outcome.

Among right sided aneurysm patients, 11 of them had good outcome (n=l 1, 73.3% p value-0.04).

GCS at presentation was another factor which predicted the outcome. Patients with 14 and 15 GCS score at presentation had better outcome (n=l4, 66.7%) p value-0.05 when compared to patients with low GCS at presentation.

Another factor which affected the outcome in our study was MFS score.

Patients with gog MFS score (1-3) had better outcome (n=l3, 72.2% pvalue 0.05)

Age, gender, WFNS score, H and H score, rupture of aneurysm and intraventicular hemorrhage did not show any statitstically significant association with the outcome.

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Chart showing rupture of aneurysm and MRS at discharge

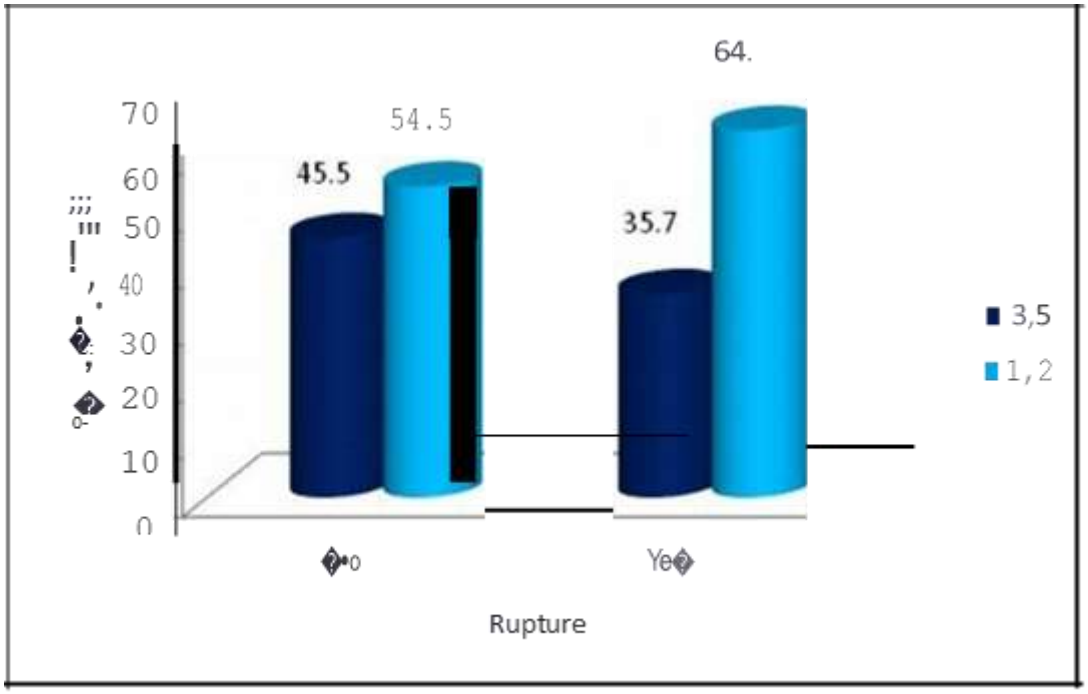

Table showing MRS and Age at discharge

		MRS at discharge		Total
		3-5	1-2	
Age	>=60	4 40.0%	6 60.0%	IO 100.0%
	<60	6 40.0%	9 60.0%	15 100.0%
Total		IO 40.0%	15 60.0%	25 100.0%

Table showing hunt and Hess score and MRS at discharge Fisher's exact test: p-value=.400

	MRS at discharge		Total
	3-5	1-2	

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HNH	4-5	I 100.0%	0 .0%	I 100.0%
	1-3	9 37.5%	15 62.5%	24 100.0%
Total		IO 40.0%	15 60.0%	25 100.0%

Table showing MFS Score and MRS at discharge

		MRS at discharge		Total
		3-5	1-2	
Modified Fischer Scale	**4**	5 71.4%	2 28.6%	7 100.0%
	1-3	5 27.8%	13 72.2%	18 100.0%
Total		10 40.0%	15 60.0%	25 100.0%

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