Analysis of Correlation Between Direction of Dome of Aneurysm and Patient Outcome Following Surgery for Ruptured Anterior Communicating Artery Aneurysms

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Abstract

Background: Anterior communicating (Acom) artery aneurysm is the most common type of intra-cranial aneurysms. Despite the enormous advancements in the field of endovascular surgery for intracranial aneurysms, open surgical clipping of aneurysm still remains the gold standard management of Acom aneurysms. There have been various studies based on the clinico-radiological profile and outcome of open clipping for intracranial aneurysms, but the correlation of direction of dome of aneurysm with surgical outcome, however, remains incompletely defined.

Aim: Analysis of correlation between direction of dome of aneurysm and patient outcome following surgery for ruptured anterior communicating artery aneurysms.

Methods and materials: CT angiography brain was done in all patients pre-operatively which is part of the standard treatment protocol. Retrospective data was collected from a well maintained inter-departmental computerised database which include patient’s details, history, investigations, course in the hospital from admission to discharge and operative note by the surgeon. Prospective data was collected from patients of ruptured Acom artery aneurysms. We analysed the relationship of direction of dome of Acom aneurysm with preoperative, intraoperative and post operative variables.

Results: Among total 48 ruptured Acom-aneurysms cases posted for surgery, 34 (70.8%) were female patients and 14 (29.2%) were male patients. 11 cases (40.7%) out of 27 cases had post operative complications for anterior direction of dome of aneurysm. Two cases (40%) out of 5 posterior directions of dome of aneurysms had some sort of postoperative complications. One-third cases of 6 inferior direction of dome and 10% of 10 superior direction of dome of aneurysm also found to have postoperative complications. However, the association between the occurrence of post-operative complications and direction of dome of aneurysm were found to be statistically non-significant (p value-0.93) by applying chi-square test.

Conclusion: Our study showed that superiorly directed dome of aneurysm has the lowest risk of intraoperative aneurysm rupture. However the 3 month patient outcome was not affected by direction of dome of aneurysm. Our study showed that superiorly directed dome of aneurysm has the lowest risk of intraoperative aneurysm rupture.

Introduction

An abnormal outpouching of the tunica intima layer of blood vessel as well as tunica adventitia layer of blood vessel caused by a tear in the inner elastic lamina as well as tunica media of an artery is known as an aneurysm [1-3]. Inherited factors or acquired factors (turbulent blood flow, hypertension or atherosclerotic plaques in the wall) may be to blame for the compromised structural strength of the layers of vessel wall [4-7]. The branch points of significant arteries near the Circle of Willis are where intracranial aneurysms typically develop. Both torn and un torn intracranial aneurysms are possible presentations [8-11].

Big intracranial aneurysms that are not ruptured cause a widespread effect. They caused subarachnoid haemorrhage when they burst. Patients with subarachnoid haemorrhage manifest with varied degrees of impaired sensorium, unexpectedly appearance of serious headaches, vomiting, and stiffness in the neck [12-15]. Nearly 30,000 Americans experience SAH as a result of aneurysms each year. Death rates with SAH range from 25% to 50%. Nearly half of survivors experience permanent handicap, meaning that only one-third of patients experience a favourable prognosis [16]. Initial descriptions of exposure of aneurysm were
only made accidentally while treating other intracranial illnesses with surgery. One of the first people who commented on these results was Victor Horsley (1857-1916) [17,18].

The four most common forms of cerebral aneurysms are the mycotic, fusiform, saccular, and dissecting varieties. 90% of them are the saccular variety. The artery networks of the Willis circle are the origin of 85% of saccular aneurysms [19,20]. Aneurysms occur in the anterior communicating artery in 35% of instances, the internal carotid artery in 30% of cases (comprising the ophthalmalic artery, the posterior communicating artery and the carotid artery itself), the middle cerebral artery in 22% of cases, and the posterior circulatory system sites in the remaining cases. 30 percent of cases have multiple aneurysms [21,22]. The most frequent type of intracranial aneurysm is an anterior communicating (Acom) artery aneurysm, which accounts for up to 34% of all intracranial aneurysms [18,23]. Although the use of endovascular surgery regarding treating intracranial aneurysms has made great strides, open mode of clipping surgically of aneurysms is still the most commonly performed treatment for Acom aneurysms [24,25]. Due to their intimate connection to the optic system and the very varied morphology of the Acom artery, anterior cerebral artery, and its perforators, perforated Acom aneurysms are exceptionally challenging to perform surgical procedures on. In comparison to aneurysms in other locations, this makes surgical intervention of Acom aneurysms extremely difficult and more prone to intraoperative along with postoperative problems [26,27].

Moreover, compared to aneurysms in other places, Acom aneurysms appear more likely to rupture during surgery. Even at diameters that are deemed adequate for prudent treatment for aneurysms in other places, Acom aneurysms are nonetheless more likely to rupture [19,28]. There have been several research relying upon the clinico-radiological characteristics and results of open surgical clipping for cerebral aneurysms, but the relationship between the aneurysm’s dome’s direction and the surgical result is still not fully understood [16,21]. The available literature provides some insight into how the direction of the dome affects choosing the approach side, the probability of perforator injury, and the Glasgow outcome rating [29,30]. However, additional factors like the impact of the aneurysm’s direction on intraoperative blood loss, the length of the procedure, the length of the hospital stay, and postoperative problems have not been fully investigated [31]. We try to close this information gap with this study. The results of this study will probably affect how decisions are made and what treatments are available for bursting Acom aneurysms. On this subject, relatively few research have been conducted in India, and none have come from the east. This study examined the relationship between the aneurysm’s dome’s orientation and the postoperative course of patients who underwent surgery to treat burst Acom Aneurysm.

Materials And Methods

The study was carried out in the Department of Neurosurgery AIIMS Bhubaneswar over a period of 1 ½ years. It was a retrospective and prospective observational study. All patients meeting the inclusion criteria and who have undergone surgery in the Department of Neurosurgery AIIMS Bhubaneswar from August 2017 to January 2022 were included in this study.

Inclusion criteria include patients with ruptured Acom artery aneurysm who have undergone surgery in our institute from August 2017 till January 2022.

Exclusion criteria has patients all aneurysms other than Acom aneurysm, multiple aneurysms, should not be in a patient suffering from any connective tissue disorder or any other systemic disease e.g. Polycystic kidney disease which is associated with a high number of concomitant intracranial aneurysms.

Data collection tools

CT angiography brain was done in all patients pre-operatively which is part of the standard treatment protocol. Retrospective data was collected from a well maintained interdepartmental computerised database which include patient’s details, history, investigations, course in the hospital from admission to discharge and operative note by the surgeon. Prospective data was collected from patients of ruptured Acom artery aneurysms presenting to AIIMS Bhubaneswar. Computerized as well as offline data patient’s history, radiological imaging, pre-operative workup, intra-operative course and postoperative course was maintained. Data thus collected was analysed statistically. Confidentiality with regards to patient data was maintained in both retrospective and prospective samples. This is an observational study. There were no complications or untoward events to the patient because of the study. Complications which were a part of natural history of disease was managed by the neurosurgical team of AIIMS Bhubaneswar as per the standard treatment protocol.

The study followed ICMR and GCP guidelines and commenced only after clearance from IEC (Institutional ethics committee) with IRB number IEC/AIIMS BBSR/PG Thesis/2020-21/09.

We analysed the relationship of direction of dome of Acom aneurysm with the following at presentation for WFNS grade

Intra-operative outcome checking duration of surgery, intraoperative rupture, blood loss, surgeons comfort
Post-operative outcome checked Glasgow outcome score at discharge, modified Rank in score at discharge, Glasgow outcome score at 3 months follow up after discharge (only for prospective samples), new onset neurological deficit, duration of stay in hospital, duration of stay in ICU, duration of stay on ventilator, need for second surgery.

Post-operative complications checked were seizures, vasospasm, hydrocephalus, meningitis. The angle of dome of aneurysm is Aneurysm dome projection was noted intraoperatively and reconfirmed from pre-operative CT angiography 3D reconstruction. The plane of the planum sphenoidale is taken as the horizontal plane or zero-degree plane. Four quadrants were defined in relation to this plane: anterior (+45° to -45°), posterior (135° to -135°[or 225°]), superior (+45° to +135°), and inferior(-135°to -45°).

Any new onset motor weakness, worsening of pre-existing weakness, development of aphasia, falling GCS were considered as new onset neurological deficit. The standard surgical steps we follow in our institute for clipping of Acom Aneurysm is as follows. We have used the pterional approach in all cases. We have used the pterional approach in all cases. A semicoronal cut is created from the upper zygomatic edge to the medial aspect of the forehead, commencing 5mm forward to the tragus.

On the face of the frontal region of the sylvian veins, the sylvian fissure is divided. The spatula is introduced to grasp the frontal lobe once the sylvian fissure has been opened, and it is then gradually pulled back towards the chiasma. The ICA is stabilised before the membrane of the arachnoid is cut, exposing the opposing optic nerve. The optic chiasma’s anterior portion is then separated. Beyond the AcomA’s lower terrain, opposite side A1 is fixed. The procedure for getting to the aneurysmal peduncle comes next. Before neck clipping of the aneurysm, five blood arteries, including the symmetrical A1, A2 including the AcomA, needs to be established.

We developed a ‘surgeon comfort’ score, a straightforward, objective scoring system that enables us to compare and evaluate surgical procedures’ ease and difficulty from an objective standpoint. The data were analysed through computer software tool SPSS21.0 after thorough data cleaning. Categorical variables were expressed in terms of proportion/ percentage. Chi-square test was applied to find out if any association between these variables. Continuous variables were presented in terms of mean ± Standard deviation. One-way ANOVA test was applied to find out any significant difference between means of these variables.

Results

Among total 48 ruptured Acom-aneurysms cases posted for surgery, 34 (70.8%) were female patients and 14 (29.2%) were male patients. Among total 48 ruptured Acom-aneurysms cases posted for surgery; maximum 20 patients (41.7%) belong to 51-60 years age-group. 13 patients (27.1%) belong to 61-70 years of age group. Only 1 patient (2%) belongs to the < 30 years age group. Among total 48 ruptured Acom-aneurysms; maximum 27 patients (56.3%) had anterior direction of dome. 10 patients (20.8%) had superior direction of dome. Only 6 (12.5%) and 5 (10.4%) patients had inferior and posterior directions of dome respectively.

Table-1; describes the quantity of blood loss during surgery according to of dome of ruptured Acom aneurysms.

<table>
<thead>
<tr>
<th>Directions of Aneurysm</th>
<th>Minimum Blood loss in ml</th>
<th>Maximum Blood loss in ml</th>
<th>Mean blood loss in ml</th>
<th>Standard deviation</th>
<th>One-way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>100</td>
<td>800</td>
<td>455.56</td>
<td>159.5</td>
<td></td>
</tr>
<tr>
<td>Posterior</td>
<td>200</td>
<td>600</td>
<td>370</td>
<td>156.5</td>
<td>F=1.069, p=0.37 Brown-Forsythe =0.96 P=0.43</td>
</tr>
<tr>
<td>Superior</td>
<td>200</td>
<td>1200</td>
<td>525</td>
<td>292.7</td>
<td></td>
</tr>
<tr>
<td>Inferior</td>
<td>150</td>
<td>600</td>
<td>375</td>
<td>175.3</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1: Blood loss with respect to direction of dome of Acom Aneurysm**

There was a maximum mean blood loss of 525 ml in the superior direction and a minimum mean blood loss of 370 ml in the posterior direction. Anterior direction had a mean blood loss of 455.5 ml. The inferior direction had a similar mean blood loss (375ml) to that of posterior direction. However, the difference between these means as well as their variations were found to be statistically non-significant by applying one way ANOVA test.
Table-2; describes the duration of surgery according to dome of ruptured Acom aneurysms.

<table>
<thead>
<tr>
<th>Directions of Aneurysm</th>
<th>Minimum Surgery duration in minutes</th>
<th>Maximum Surgery duration in minutes</th>
<th>Mean Duration of Surgery in minutes</th>
<th>Standard deviation</th>
<th>Oneway ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>120</td>
<td>300</td>
<td>207.78</td>
<td>48.4</td>
<td>F=0.313p=0.816</td>
</tr>
<tr>
<td>Posterior</td>
<td>150</td>
<td>360</td>
<td>222</td>
<td>83.7</td>
<td>Brown-Forsythe=0.239 P=0.867</td>
</tr>
<tr>
<td>Superior</td>
<td>150</td>
<td>240</td>
<td>198</td>
<td>32.2</td>
<td></td>
</tr>
<tr>
<td>Inferior</td>
<td>180</td>
<td>270</td>
<td>215</td>
<td>39.8</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2: Duration of surgery with respect to direction of dome of Acom aneurysm**

Maximum 222 minutes were consumed by the surgeon for the posterior direction. The inferior direction consumed a similar mean figure of 215 minutes. The surgeon needed comparatively lesser mean duration of surgery for anterior (207.78 minutes) and superior (198 minutes) directions respectively. However, the difference between these means as well as their variations were found to be statistically non-significant by applying one way ANOVA test. Intra-operative ruptures were reported in 5 cases each from inferior (83.3%) and 2 cases from posterior (40%) direction of aneurysms. Only one case of intra operative rupture (3.7%) was reported for anterior direction. There was no case of intra-operative rupture reported in superior direction. The association between these intraoperative ruptures and direction of dome of aneurysm were found to be statistically highly-significant (p value<0.01) by applying chi-square test.

Table-3 describes the surgeon comfort rating according to dome of ruptured Acom aneurysms.

<table>
<thead>
<tr>
<th>Directions of Aneurysm</th>
<th>Mode of Surgeon comfort</th>
<th>Mean Surgeon comfort</th>
<th>Standard deviation</th>
<th>Oneway ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>1</td>
<td>1.63</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Posterior</td>
<td>1</td>
<td>1.0</td>
<td>0.0</td>
<td>F=1.07p=0.39</td>
</tr>
<tr>
<td>Superior</td>
<td>1</td>
<td>2.0</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Inferior</td>
<td>2</td>
<td>2.33</td>
<td>0.33</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3: Surgeon Comfort rating with respect to direction of dome of Acom Aneurysm**

This is to be noted that only those cases who have been posted for surgery (18 cases) during the study period, could provide this data. Clinical records of old cases (30 cases) could not provide the data for surgeon comfort level. Mean surgeon comfort level is highest (2.33) in case of inferior direction of dome and lowest (1.0) in case of posterior direction of dome. However, this analysis of variance was found to be statistically non-significant by applying oneway ANOVA test.

Table-4; depicts the Glasgow outcome scores (GOS) at discharge and GOS at 3 months after discharge w.r.t dome of ruptured Acom aneurysms.
TABLE 4: Glasgow Outcome Score comparison with respect to direction of dome

<table>
<thead>
<tr>
<th>Direction of Aneurysm</th>
<th>Mean GOS at discharge (n=48)</th>
<th>SD</th>
<th>One way ANOVA</th>
<th>Mean GOS after 3 months of Discharge (n=18)</th>
<th>SD</th>
<th>One way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>4.2</td>
<td>1.4</td>
<td></td>
<td>3.38</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Posterior</td>
<td>1.6</td>
<td>0.9</td>
<td></td>
<td>1.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Superior</td>
<td>4.4</td>
<td>1.0</td>
<td></td>
<td>4.33</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Inferior</td>
<td>3.8</td>
<td>1.6</td>
<td></td>
<td>4.33</td>
<td>1.1</td>
<td></td>
</tr>
</tbody>
</table>

This is to be noted that only those cases who have been posted for surgery (18 cases) during the study period, could provide the data for GOS after 3 months of discharge. Clinical records of old cases (30 cases) could not provide the data for same. Mean GOS at discharge are higher in case of superior (4.4) and anterior (4.2) directions of dome and lowest (1.6) in case of posterior direction of dome. The analysis of variance was found to be statistically high-significant by applying one way ANOVA test. Mean GOS after 3 months of discharge is highest (4.33) in case of both superior and inferior directions of dome and lowest (1.0) in case of posterior direction of dome. However, this analysis of variance was found to be statistically non-significant by applying one way ANOVA test.

Table-5; depicts the Modified ranking score (MRS) at discharge and MRS at 3 months after discharge w.r.t dome of ruptured Acom aneurysms.

TABLE 5: Modified ranking Scale comparison w.r.t. Direction of dome

<table>
<thead>
<tr>
<th>Directions of Aneurysm</th>
<th>Mean MRS at the time of discharge (n=48)</th>
<th>SD</th>
<th>One way ANOVA</th>
<th>Mean MRS after 3 months of discharge (n=18)</th>
<th>SD</th>
<th>One way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>2.75</td>
<td>2.2</td>
<td></td>
<td>2.78</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Posterior</td>
<td>6.0</td>
<td>0.0</td>
<td>F=1.2 p=0.35</td>
<td>2.8</td>
<td>2.5</td>
<td>F=0.29 p=0.82</td>
</tr>
<tr>
<td>Superior</td>
<td>2.0</td>
<td>1.5</td>
<td></td>
<td>2.1</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Inferior</td>
<td>2.67</td>
<td>2.1</td>
<td></td>
<td>2.8</td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

This is to be noted that only those cases who have been posted for surgery (18 cases) during the study period, could provide the data for MRS after 3 months of discharge. Clinical records of old cases (30 cases) could not provide the data for same. Mean MRS at discharge is highest (6.0) in case of posterior direction of dome and lowest (2.0) in case of superior direction of dome. Mean MRS after 3 months of discharge is almost similar (~score of 2.8) in case of anterior, posterior and inferior directions of dome and lowest (2.1) in case of superior direction of dome. However, this analysis of variance was found to be statistically non-significant in both the cases by applying one way ANOVA test.

Table-6; describes the duration hospital stay, ICU stay and on-ventilator duration w.r.t dome of ruptured Acom aneurysms.
Mean duration of hospital stay is highest (17.7 days) in case of anterior direction of dome and lowest (11.8 days) in case of inferior direction of dome. Mean duration of ICU stay is highest (10.6 days) in case of posterior direction of dome and lowest (5.7 days) in case of inferior direction of dome. The need of ventilator was found to be of longest duration (mean of 6.04 days) in case of anterior direction of dome and was of shortest duration (mean of 3.0 days) for inferior direction of dome. However, the analysis of variance between these directions were found to be statistically non-significant in all 3 cases, by applying one way ANOVA test (p=0.79). 12 cases (44.4%) out of 27 cases needed second surgery for anterior direction of dome of aneurysm. Two cases (40%) out of 5 posterior direction of dome of aneurysm needed a second surgery. One third cases of 6 inferior direction of dome and 10% of 10 superior direction of dome of aneurysm did not need second surgery. However, the association between need of second surgery and direction of dome of aneurysm were found to be statistically non-significant (p value-0.86) by applying chi-square test.

Table-7 describes the WFNS (world federation of neurological societies) grading in relation to direction of dome of Acom aneurysms.

The mean WFNS score is highest (score of 4) with posterior direction of dome and lowest (score of 2.17) with inferior direction. The analysis of variance was found to be statistically significant (p value-0.019) by applying one way ANOVA test.
patients and 14 (29.2%) were male patients. Patient demographics of 300 Acom aneurysm patients by Bohnstedt BN et al. [19] had similar gender distribution with higher incidence of Acom aneurysms in females compared to males. The Acom series by Ivan et al also had a majority of females (64%) in their study [21].

Among total 48 ruptured Acom aneurysms cases posted for surgery, maximum 20 patients (41.7%) belong to 51–60 years age group. This finding is consistent with the demographic findings in the study of Acom aneurysms by Bohnstedt BN et al. [19] In the study by Ivan M et al the average age of the study population was 56 years [21]. Age of the patient has implication on patient outcome. It is a well known from previous studies that as age of the patient increases, chances of good surgical outcome decreases.

On analysing the percentage distribution of each of the four directions in the study population it was noted that maximum 27 patients (56.3%) had anterior direction of dome. 10 patients (20.8%) had superior direction of dome. Only 6 (12.5%) and 5 (10.4%) patients had inferior and posterior directions of dome respectively. These finding are consistent with previous studies. Study by Bohnstedt et al [19] also showed that anteriorly directed dome is the most common direction of dome of aneurysm. The percentage distribution of various directions in their study is as follows: 48% anterior, 29% inferior, 17% superior, 19% posterior [21].

Operative blood loss is vital intra op parameter which has a bearing on patients post operative outcome. In our study there was a maximum mean blood loss of 525ml in the superior direction and a minimum mean blood loss of 370 ml in the posterior direction. Anterior direction had a mean blood loss of 455 ml. The inferior direction had a mean blood loss (375 ml) similar to that of posterior direction. However, the difference between these means as well as their variations were found to be statistically non-significant. On most occasions intra operative rupture of aneurism or injury to perforator vessels is the major source of bleeding. We have seen that in our study population superior direction is clinically significant for decreased risk intra op aneurysm rupture. But superior direction of dome does not have least blood loss. In our study sample superiorly directed dome has a relatively higher intraoperative blood loss compared to other directions. The higher blood loss in superiorly directed dome is probably because of the more extensive dissection of dome done in these cases. Posterior and inferior directions have a lower mean blood loss due as less dissection of dome is required in these cases. There are other studies available in medical literature which have analysed the relation of intraoperative blood loss and direction of dome of aneurysm.

When we analysed the relationship of intra operative rupture of aneurysm with direction of dome of aneurysm, it was found that only one case of intra operative rupture (3.7%) was reported for anterior direction. There was no case of intra-operative rupture reported w.r.t superior direction. Superior directed dome had a significantly lesser risk of intra operative rupture compared to other directions. These findings are contrary to the findings in the study by Ivan M et al [21], where they found that Quadrant dome projections did not enhance the probability of intraoperative rupture. Acom aneurysm perforators are endangered by posteriorly projecting aneurysms during permanent clipping. These perforators are forced inferiorly into the triangle's lower corner by the aneurysm dome. Although it is simpler to visualise this corner than the upper corner, it is more dangerous when attempting to separate these perforators because of their tiny size and potential for dense adhesion to the aneurysm.

In their investigation, Sandalciglu IE et al. [29] discovered that intraoperative aneurysm burst (IOR) has no bearing on the result. The death frequency after IOR rose, and the prognosis for IOR insurmountables was validated by Bederson JB et al [30]. We designed an objective scoring system to grade to technical ease/comfort level of the surgeon during the entire surgical procedure and tried to analyse its relation with the direction of dome of aneurysm. Mean surgeon comfort level is highest (2.35) in case of inferior direction of dome and lowest (1.0) in case of posterior direction of dome. However, the role of direction of dome of aneurysm was insignificant in making the surgical procedure easy or difficult for the surgeon. Ivan M et al [21] in their research article on Acom aneurysms discovered that anterior as well as inferior extending aneurysms that only affect the pre-communicating triangle, which is simpler for cutting microsurgically, and had better results. Acom aneurysms are more tough to visualise, necessitate accessing the junctional triangle, and present surgical challenges due to superior as well as posterior dome extensions. The dome obscure the contralateral A2 section, making superiorly extending Acom aneurysms the most difficult to detect.

When we evaluated the relation of Glasgow Outcome score with direction of dome of aneurysm mean GOS at discharge are higher in case of superior (4.4) and anterior (4.2) directions of dome and lowest (1.6) in case of posterior direction of dome. The analysis of variance was found to be statistically significant. This is consistent with previous studies. The study by Ivan M et al [21] also had a similar outcome. In their study they state that aneurysms directed superiorly and posteriorly have poor outcome. The probable explanation for the worse outcome is that posteriorly projecting aneurysms hide Acom artery perforators. These perforators are forced downward into the lower corner of the communicating triangle by the aneurysm dome. Because of their tiny size and potential for extensive adhesion to the aneurysm, these perforators are more dangerous to securely dissect. To maintain the blood flow through the hypothalamus as well as columns located in the fornix, which have an impact on endocrine as well as mental performance, respectively, perforator conservation is required [21].
Additionally, Debono et al. [23] discovered that individuals with anteriorly extending Acom aneurysms had higher GOS scores. In the research conducted by Bohnstedt BN et al. [19], the mean GOS remained 4.6 at discharge and 4.8 at six months and twelve months follow up, respectively, among patients having unruptured aneurysms. 92% of patients had a good prognosis (GOS of 4 or 5), whereas only 8% had an unfavourable result (GOS of 3). The average GOS score among individuals with ruptured aneurysms was 3.8 at discharge, 6.0 months later, and 4 month, 12 months afterwards. In their study, 67.5% of the individuals who had microsurgical clip constriction after experiencing a subarachnoid haemorrhage from an Acom aneurysm had a favourable result (GOS of 4 or 5) [19]. This is in line with findings from previous International Trial, which showed that 69.4% of all individuals with subarachnoid haemorrhage who had microsurgical clipping at one year after therapy had a successful outcome [12].

We analysed the relation of post-operative complications with direction of dome. 11 cases (40.7%) out of 27 cases had post-operative complications for anterior direction of dome of aneurysm. Two cases (40%) out of 5 posterior directions of dome of aneurysms had some sort of post-operative complications. One third cases of 6 inferior direction of dome and 10% of 10 superior direction of dome of aneurysm also found to have post-operative complications. However, the association between the occurrence of post-operative complications and direction of dome of aneurysm were found to be statistically non-significant. Our findings were consistent with the study findings by Bohnstedt BN et al. [19] in which analysing the extensions of the Acom aneurysm dome, there were no statistically significant changes in results or comorbidities. Salary M. et al. [32] investigated the effects of abrupt hydrocephalus in SAH patients and the results following shunting. They concluded that there was no meaningful advantage to shunting and that since shunted patients generally had worse conditions than non-operated patients, it was reasonable to assume that their outcomes would be poorer as well.

We analysed the relation of WFNS scores at presentation with direction of dome of Acom aneurysm. The mean WFNS score is highest (score of 4) with posterior direction of dome and lowest (score of 2.17) with inferior direction which was found to be statistically significant. The probable explanation for our findings is that posterior directed domes at presentation donot present with a very thick SAH at presentation owing to its anatomical relation to the cisterns. Hence, they do not become symptomatic early and probably result in a delayed presentation. This delayed presentation may cause the may of a worse WFNS score observed in posteriorly directed dome of aneurysm. Hunt and Hess score, Modified Fischer score and WFNS score and three widely used clinical scoring systems of ruptured intra-cranial aneurysms.

Limitations

There are several restrictions on this study. The study’s reduced sample size is the first drawback. Additionally, because the study was conducted in one location, its relevance to a wider range of people is constrained. Our study was 18 prospective samples and 30 retrospective samples. Surgeons comfort and 3 months follow up, GOS/MRS could not be obtained for the retrospective samples. We have conducted 3 months follow up of the prospective samples. However, a longer follow up would be necessary to understand the implication of direction of dome of aneurysm with long term patient outcome. Taking all these limitations into consideration a large prospective clinical study with long term follow up may be warranted to better understand the role of direction of dome of Acom aneurysm on patient outcome.

Conclusions

The results of our study show that patients with posteriorly directed dome of aneurysm tend to have lower WFNS score at the time of presentation, have the lowest GOS at the time of discharge. Our study showed that superiorly directed dome of aneurysm has the lowest risk of intraoperative aneurysm rupture. However the 3 month patient outcome was not affected by direction of dome of aneurysm. Our study showed that superiorly directed dome of aneurysm has the lowest risk of intraoperative aneurysm rupture. According to the study results direction of dome of aneurysm does not affect intraoperative blood loss, duration of surgery, duration of hospital stay /ICU stay /duration of stay on ventilator, need for second surgery, new onset neurological deficit and postoperative complications. This study also explored the relation of direction of dome with common post operative complications like seizures, hydrocephalus, IVH, meningitis and vasospasm.

This study threw some light on the role of direction of dome of aneurysm on various preop, intra op and postoperative patient parameters. A larger prospective study with long term follow up is required to better understand the influence of direction of dome of Acom aneurysm and patient outcome.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. All India Institute of Medical Sciences issued approval IEC/AIIMS/BBSR/PG Thesis/2020-21/09. Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services.

References


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**References**
