Epidemiology And Treatment Of Cerebral Aneurysms At An Australian Tertiary Level Hospital

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Abstract

Treatment of aneurysms has remained controversial in the last decade with protagonists for both coiling and clipping. This is a long-term retrospective audit of the management of aneurysms at an Australian tertiary level hospital. A novel method of retrospective analysis was undertaken, utilizing the radiological reporting system to identify patients presenting to the PAH with an aneurysm.

4762 reports were flagged and of these, 556 patients were identified and their treatment tabulated. The number of cases treated per year has remained stable; coiling has increased as clipping has decreased.

INTRODUCTION

The incidence of subarachnoid haemorrhage (SAH) from intra-cerebral aneurysm rupture is approximately 10 per 100,000 people per year1. The consequence of this is significant given the associated morbidity and mortality as well as its occurrence within a relatively young age group2. The ISAT in 2001 reported that patients with ruptured intracranial aneurysms showed a 1-year survival benefit with surgical coiling rather then endovascular clipping3. It focused on patients presenting with a low World Federation of Neurosurgical Societies (WFNS) clinical grade < 2 and with small (< 10mm) aneurysms arising from the anterior circulation3. ISAT famously foreshortened its trial due to safety issues when initial results indicated that coiled patients have better outcomes in terms of mortality and morbidity3,4. The 5-year data published in 2009 indicates that this primary end point is no longer significant3,4. Coiling was still however linked with a lower mortality3. Many places have altered their treatment protocols in response to this reported benefit. This paper has sought to ascertain the treatment trends at our institution. A subsequent paper will address outcomes.

METHODS

A retrospective analysis of patient records from a single hospital, The Princess Alexandra Hospital (PAH) in Brisbane Queensland, was conducted in order to identify appropriate patients for this study. The Princess Alexandra is one of three tertiary level hospitals servicing Queensland, Australia. Approximately 90,000 patients are seen each year, including referrals from regional and rural Queensland hospitals. All patients who have undergone a radiological procedure at the PAH from 2001 to December 31st 2011 were entered into a central database called 'SORTS'. Using this database as a starting point, the appropriate patients were identified using the words "+ cerebral + aneurysm" as a filter. This returned 4762 results. These results were for all computerized tomography (CT) head, CT neck, CT angiogram, digital subtraction angiogram (DSA), IA (Intracranial aneurysm) coiling and magnetic resonance imaging (MRI). This information was further filtered through a single-examiner viewing of all radiological reports. Patients for whom an aneurysm was identified and went onto definitive treatment were entered into the study. If a single aneurysm required multiple treatments it was counted as a single entry.

The exclusion criteria were patients where no aneurysm was identified, patients diagnosed with an aneurysm that was not for treatment and patients diagnosed with other cerebral or vascular pathology. After this criterion was executed 1462 patients remained.

The final result of 556 was achieved by removing all multiple entries as a result of follow up scans.

This resulted in a database of patients presenting with an aneurysm that lead to treatment. Once they were known, a chart and electronic discharge summary review was conducted to determine epidemiological information such as age, age at presentation, presenting complaint, WFNS grade,

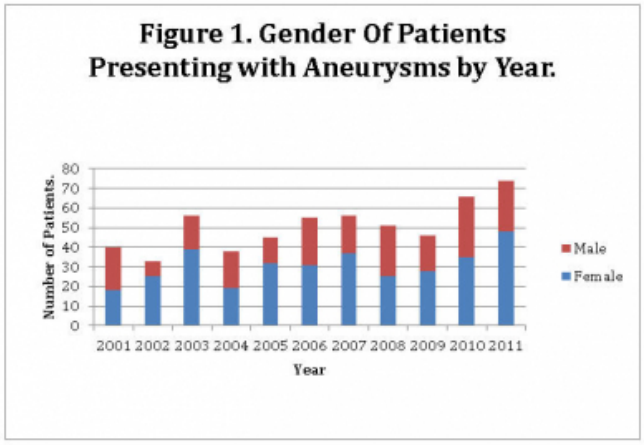
vessel location, vessel size and treatment.

RESULTS

Between January 1st 2001 and December 31st 2011, 556 patients presented for the first time to the PAH with an aneurysm that was treated. Three hundred and thirty five patients were female and 221 were male. Figure 1.

Figure 1

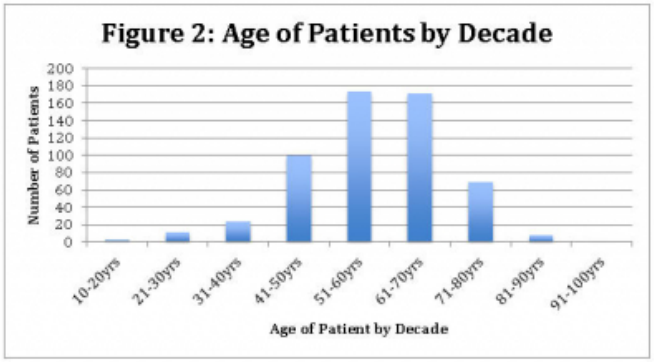
Gender of Patients Presenting with Aneurysms (by year).



The highest occurrence of SAH in both males and females was in the 5th and 6th decades of life. Figure 2. The mean age of aneurysm rupture was 50, which reflects the mean age of aneurysm rupture worldwide10,11.

Figure 2

Age Of Patients (By Decade).

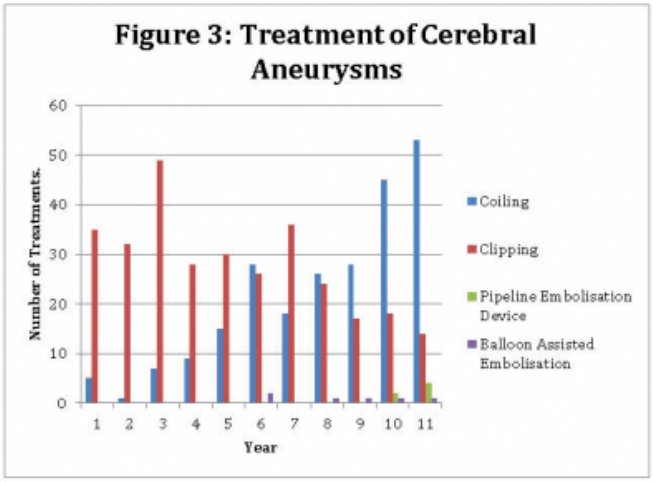


There are two treatment pathways available for aneurysm at the PAH. Neurosurgical clipping and endovascular embolisation, including balloon assisted stenting and pipeline embolisation devices. 309 patients had an aneurysm treated with clipping. 239 patients were treated with coil embolisation. 6 patients were treated with pipeline embolisation devices, 4 patients were treated with stent assisted coil embolisation and 2 patients with balloon-assisted embolisation.

The total number of treated patients per year has been steady, however changes in treatment pattern were significant with the rate of coiling increasing and the rate of clipping decreasing ($p < 0.001$) (chi square test for trend). Figure 3.

Figure 3

Treatment of Cerebral Aneurysms



A multivariate logistic regression analysis was used to adjust for confounding factors when comparing the upward trend of coiling vs. clipping.

Aneurysms arising from the anterior communicating artery were the most common, with 173 patients having an aneurysm in this location. 127 patients had an aneurysm from the middle cerebral artery, 88 had an aneurysm from the internal carotid artery and 35 from the anterior cerebral artery. From the posterior circulation, 74 had an aneurysm from the posterior communicating artery, 34 from the basilar, and 15 from the posterior inferior cerebellar arteries and 10 from the posterior cerebral artery.

The aneurysm sizing was split into three categories. 205 patients had a small aneurysm under 6mm. 208 patients had a medium sized aneurysm, which was determined as between 6-10mm. 134 patients had a large aneurysm, being over 10mm. 272 patients presented with WFNS grade 1 subarachnoid haemorrhage. The second highest presentation was of an incidental aneurysm, picked up through investigation for another complaint. 124 patients had this innocuous presentation. 56 patients had a WFNS grade 2, 25 had a WFNS grade 3, 19 had WFNS grade 4 and 52 patients had a WFNS grade 5.

DISCUSSION

Cerebral aneurysms occur in 2-5% adult population;

however, of these aneurysms, only small percentages go on to cause subarachnoid haemorrhage8. Non-traumatic subarachnoid haemorrhage is the cause of approximately 10% of strokes6. The Australian Bureau of statistics in 2008 named non-traumatic subarachnoid haemorrhage as the leading cause of death in 0.4% of the population13.

Larger proportions of aneurysms remain unruptured and have a benign outcome 3,10. The increase in radiological studies has increased the number of aneurysms detected and has concomitantly increased clinical uncertainty as to which category the aneurysm belongs3.

The treatment of aneurysms therefore has to reflect both the variable natural history as well as the severe consequences of rupture.

ISAT in 2001 heralded a large change in the processes behind determining treatment for aneurysms3. ISAT was a large multi-centre prospective study that randomized 2143 patients to compare the efficacy of endovascular treatment with neurosurgical clipping in patients whom either treatment was deemed suitable. At one year, unfavorable outcomes, defined as dependant or dead, were 30.9% for patients randomized for clipping, versus the significantly lower 23.5% for patients who underwent coil embolization3.

Some well-known criticisms of ISAT are based around the population subset that the investigators focused on. Of the 2143 patients whom were randomized, a much greater number, 9559 were excluded from the trial. The patient demographics were concentrated on older patients, with small anterior circulation aneurysms.

The 5-year follow up in 2009 reaffirmed the one-year survival benefit for coiling, however it also demonstrated an increased risk of late re-bleeding in this group. It also showed that when using a modified Rankin score for morbidity and disability the 5 year outcomes for patients who were still alive showed no significant difference between the two groups, suggesting that there is a decline in the outcomes of patients in the coiling group, as well as a improvement in the surgical patients4.

One of the prevailing concerns regarding ISAT is that whilst the data supported endovascular treatment for this particular population, its extrapolation to the wider community may be unfounded5.

The decision of which treatment pathway to offer a patient is difficult and there does not appear to be a consensus in the literature.

We have performed a long-term retrospective audit of management of aneurysms at the Princess Alexandra Hospital. This has shown a consistent number of aneurysms treated with a change in the treatment pattern, with increased usage of coiling versus clipping.

The typical patient at the PAH is female with a mean age of 50 presenting with WFNS low grade, small anterior circulation aneurysms. This is similar to the patient demographic studied in ISAT. With more patients being coiled it emphasizes that the focus on patients at the PAH should be on serial monitoring for recanalization or remnant formation as re-bleeding was a significant outcome shown in the long term follow up of patients in the ISAT trial.

One of the strengths of this audit is its reliance on a computerized reporting system. The initial data was mined from a central source using key words "cerebral + aneurysm" as a filter. It is improbable that any imaging that picked up an aneurysm was logged without using these two key words. A parallel analysis of the surgical database ORMIS was checked for all patients who underwent a clipping procedure. No extra patients were found from this search. Patients at the PAH who have a coiling procedure are followed up with yearly scans for 5 years. This increases the amount of times that they appear in the original database and therefore the potential catchment of patients. These factors combine to increase the strength of the audit and its validity in stating that all patients who presented to the PAH from 2001-2012 with an aneurysm that went onto treatment were included in the database.

One important group of patients in the study is those that had the same aneurysm treated multiple times. For the purposes of this study they were included in the treatment group of their original procedure. Future studies which focus on outcomes rather then treatment will likely to focus on this group and their morbidity and mortality.

It is accepted that the clinical outcome of patients presenting with an incidental or a ruptured aneurysm differs1,6. In this study, for the purposes of examining treatment, they were not differentiated. A separation of these two groups may be of subsequent interest to future studies.

The rising trend of coiling versus clipping has been demonstrated in the context of a stable rate of aneurysms requiring treatment. This had been attributed to the influence that ISAT had on worldwide treatment trends and protocols. It remains to be seen if this is valid response. The primary aim of this study was to demonstrate what the practices were at a single institution during the decade where change in treatment modalities was the norm within the neurosurgical community.

CONCLUSION

This eleven-year retrospective audit on the treatment

practices of cerebral aneurysms at an Australian tertiary level hospital has revealed that the number of cases treated per year has remained stable; coiling has increased as clipping has decreased. A subsequent study focusing on outcomes will evaluate the validity of this change.

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