In this retrospective study, Sanai and colleagues address the important issues of efficacy and durability of aneurysm obliteration after the treatment of pediatric intracranial aneurysms. The authors compare the results of microsurgery and endovascular therapy after the treatment of 43 aneurysms in 32 pediatric patients. The most significant findings of this study are as follows: 1) the reported superiority of microsurgery (rate of complete aneurysm obliteration, 94%) compared with endovascular treatment (rate of complete obliteration, 82%); and 2) the durability of treatment assessed in terms of aneurysm recurrence rate after microsurgery and endovascular treatment (0 and 14%, respectively).

Compared with the adult population, the incidence of aneurysms in the pediatric population is low; however, the unique morphological characteristics of these lesions and the delicate intracranial anatomy and physiology of children with small blood vessels, infants in particular, present a management challenge to the involved surgeons.

Unlike those in adults, aneurysms in children usually become symptomatic at the time of diagnosis. In terms of location, pediatric aneurysms have a predilection for the internal carotid bifurcation, the posterior circulation, and the distal anterior and distal middle cerebral arteries. Large aneurysms and giant aneurysms (> 25 mm in diameter) are more common in children than adults and tend to present as space-occupying lesions. Traumatic and infectious/mycotic aneurysms are more common in this age group as well.

Interestingly, in this series, one of the largest pediatric aneurysms series reported, the authors found no mycotic and only two traumatic aneurysms. Morphologically, 22 aneurysms (51%) were fusiform or dolichoecatic, and the remainder (49%) were saccular. The authors state that the aneurysms in both treatment groups were comparable in number, size, location, and severity. It remains unclear, however, whether fusiform and saccular aneurysms were equally distributed between the two groups. It is a well-known fact that the morphology of the aneurysm (fusiform compared with saccular) is an important determining factor regarding the degree of aneurysm obliteration and the recurrence rate in both treatment modalities. This particular issue was not addressed in the study. Assuming the aneurysm morphology selected for both treatment modalities was equally distributed, the conclusions of this study would raise concerns about the lifetime cumulative risk for recurrence after endovascular aneurysm treatment in children.

Additionally, the authors discuss the important issue of a multidisciplinary approach for the treatment of aneurysms in the pediatric population. To this end, there is no doubt that both the characteristics of the aneurysm and the clinical presentation of the patient can influence the treatment modality selected in children. For example, the most effective management strategy for a giant aneurysm in an infant presenting with mass effect will be surgery. A mycotic aneurysm, on the other hand, could be treated with intravenous antibiotic agents only, and a fusiform or ectatic aneurysm might require endovascular treatment.

Children are not small adults—their anatomical and physiological characteristics are too different. Open surgery in small children poses peculiar problems associated with small blood volumes and hypothermia, whereas pediatric endovascular treatment can become challenging because of the small size of the intracranial blood vessels. In this context, it would appear that the pediatric neurosurgeon and the pediatric endovascular specialist are those best suited for the care of these patients.

Contrary to the aforementioned perspective, the authors believe that the vascular neurosurgeon should manage the microsurgery aspects of the treatment of aneurysms in pediatric patients. Nevertheless, this concept is not supported by any scientific evidence or data in their study, most likely reflecting institutional practice policies. Because the incidence of intracranial aneurysms is lower
in the pediatric population, pediatric neurosurgeons have been erroneously considered less capable of treating them. Although this general notion may be acceptable in centers where neurosurgical practice is divided into subspecialties, with vascular specialists readily available, my personal experience in this area has been different. I believe that well-trained pediatric neurosurgeons must be familiar with microsurgical and vascular techniques. Hence, they should be able to manage the full spectrum of pediatric neurosurgical pathological entities; intracranial aneurysms should not be an exception.

At the beginning of my full-time pediatric neurosurgical practice in the 1970s, endovascular methods were not widespread and vascular neurosurgery was not a subspecialty. Consequently, pediatric neurosurgeons learned microsurgical techniques that enabled their treatment of both simple and complex intracranial vascular disease in children.

My personal 30-year experience in the surgical treatment of 21 pediatric patients with intracranial aneurysms involves a surgery-related mortality rate of 0% and overall satisfactory results. Twenty of these patients underwent craniotomy with clip placement/excision of the aneurysm and one patient (with a giant P1 segment aneurysm) was successfully treated with endovascular coil therapy. The durability of treatment has been consistently satisfactory in the long term. Only one de novo aneurysm was found. Although it may sound anecdotal, based on this modest personal experience, I have no regrets regarding my practice philosophy in this area of pediatric neurosurgery.

Considering the long life expectancy of children, the posttreatment recurrence of vascular lesions is of great concern for the treating physicians. The availability of minimally invasive endovascular techniques is very appealing to the parents of the affected child but not necessarily the best long-term solution for the child’s condition. Consequently, precise knowledge of the outcomes and treatment durability of the various therapeutic options available is invaluable to allow for accurate treatment planning and effective counseling of patients and families. The findings and conclusions reported by Sanai and colleagues are an essential contribution to this infrequent but intricate area of pediatric neurosurgery.

**References**


**RESPONSE**

We appreciate the editorial comments from Drs. Heros and Ventureyra, and we would like to address two important issues: selection bias and subspecialization within neurosurgery.

The selection of therapy for aneurysms in children is influenced by the anatomy of the aneurysm, clinician bias, and parental concerns. We acknowledge that our retrospective study was influenced by these factors. Our treatment recommendations for pediatric aneurysms were derived from clinical data and experience in adult patients, carefully applied on a case-by-case basis. Admittedly, the microsurgical and endovascular groups were not equal; however, the complexity of aneurysms in the two groups was at least equivalent, if not slightly more complex, in the surgical patients. For example, the aneurysm morphology was similar in both groups, with 10 fusiform aneurysms (59%) in the microsurgical group and 12 (52%) in the endovascular group. Randomization is the only method of eliminating or reducing selection biases, but the rarity of this lesion in children, not to mention the emotional nature of this treatment decision, makes randomization unrealistic. This paper was not intended to be a “clip versus coil” contest. We hypothesized that microsurgical aneurysm clip therapy would yield excellent patient outcomes, higher aneurysm obliteration rates, and greater durability than endovascular therapy, but that endovascular therapy would have greater parental appeal. Consequently, there is natural conflict between what might be best for the children and what is chosen by the parents. Our findings confirmed the advantages of microsurgical therapy.

The issue of what specialist is better suited to treat pediatric aneurysms is controversial, as demonstrated by the divergent opinions of Drs. Heros and Ventureyra. We agree with Dr. Ventureyra, however, that pediatric neurosurgeons should acquire and maintain vascular microsurgical skills, just as any neurosurgeon should, because these skills empower them to treat aneurysms and react to operative crises resulting in arterial injury and brisk bleeding. With these skills, it is possible for pediatric specialists to produce excellent results, even with small numbers of patients and limited experience. The relationship between surgical volume and patient outcomes, however, has been established not only with aneurysms but with many other procedures.