An evaluation of the surgical treatment of intracranial arachnoid cysts in children*,**, M. Marinov, S. Undjian, and P. Wetzka
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Abstract. In the period 1976–1987, the number of intracranial arachnoid cysts treated at our institute was 60: sylvian, 29; midline supratentorial, 13; subtentorial, 18. The diagnosis was mainly made by means of the results of a combination of CT, dynamic cisternography, and ventriculography. Based on an analysis of the preoperative investigations and operative results, an attempt was made to determine the appropriate treatment more precisely in cysts at different locations. The direct microsurgical approach with membrane excision was mainly used in combination with a preliminary VA shunt to treat hydrocephalus. The direct approach was supplemented with secondary cavity shunting in 5 cases. In more than half of the patients we used membrane excision alone (mainly children with sylvian cysts). In suprasellar cysts we consider the subfrontal approach to be more appropriate than the transventricular one. We restricted the use of primary cyst shunting as an alternative treatment to only 3 infants, with huge cysts. The follow-up reveals that 82.7% of the cases were favorably affected to varying degrees.

Key words: Primary intracranial arachnoid cysts – Children – CSF dynamics – Surgical indications – Operation – Results.

In 1958, Starkman et al. [17] demonstrated that intracranial arachnoid cysts (ICAC) are a separate nosological entity, postulating that they arise from a focal derangement of the leptomeninges. This has subsequently been confirmed by others [6, 12]. The advent of the CT scan in the past 15 years has increased the number of cases detected [3]. Despite the voluminous current literature regarding ICAC, many unsolved problems persist concerning their pathogenetic peculiarities and the proper surgical treatment. The surgical problems amount, in general, to a reasonable definition of the surgical indications and especially to the optimum surgical method. To date, the questions under discussion have evolved around the most reasonable approach – a craniotomy with membrane excision [1, 5, 10], primary cyst shunting [7, 16, 18], or a combination [14]. Some of the details about the surgical technique in different cyst locations and in accompanying hydrocephalus are still not clear. Some authors [8] recommend more flexibility in choosing the surgical tactics. Our department is the biggest pediatric neurosurgical referral center in the country. In the last decade we have had to deal with an increasing number of children with ICAC. In view of the controversies mentioned we tried to analyze our surgical experiences.

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Materials and methods
In the period 1976–1987 there were 60 cases with ICAC in the pediatric division of the Department of Neurosurgery, Medical Academy, Sofia. Besides the routine clinical investigations, the diagnostic workup included: pneumoencephalography (7 cases), angiography (45 cases), CT scan (53 cases), radionuclide (165Yb-DTPA or 111In-CaDTPA) cisternography (27 cases), metrizamide CT ventriculography (10 cases), and metrizamide CT cisternography (2 patients). Direct and indirect CT volume measurements [19] were performed in 10 patients with sylvian cysts.

Two patients died before the surgical treatment and the cysts were verified at necropsy. Of the remaining 58 patients, 32 underwent craniotomy alone, 16 had craniotomy and VA shunting, 5 craniotomy with additional shunting of the cavity (in 4 the shunt was placed during a second operation), 3 had primary cyst shunting, and another 3 had ventricular shunting alone (refused further treatment). Only true arachnoid cysts were considered in this series. The follow-up periods varied from 1 to 11 years (median follow-up was 3 years and 5 months).

Results of case analysis
Our ICAC cases amounted to 5.8% of all intracranial space-occupying lesions in the pediatric age group for the same
period. These cases occur 6.5 times less frequently than brain tumors, but in the age group under 3 this ratio tends to unity (1.2:1). The patients were between 40 days and 13 years old with a distinct predominance of males over females (2:1). More than 68% of the cases were diagnosed at or before 3 years of age. In two-thirds of the cases internal hydrocephalus was present. The location of 60 ICAC is shown in Table 1.

The cases with midline and subtentorial cysts were predominantly infants; all showed non-specific signs of progressive hydrocephalus syndrome and one-third were in poor preoperative condition (signs of herniation) (Table 2). The progression of the symptoms in sylvian cysts can be both sudden (in 7 patients with hemorrhagic complications after minor head trauma) or slow (in 15 patients). The remaining 7 patients demonstrated a non-progressive oligosymptomatic clinical course (chronic headaches and/or seizures); this group is worthy of mention with regard to the definition of surgical indications, especially in the case of a vague dislocation effect on CT and the suspicion of brain agenesis.

Following the van der Meche and Braakman technique [19], we calculated the cyst and brain hemisphere volumes in ten different types of sylvian cysts. Comparison of both hemispheres (Student's t-test for paired observations) showed an insignificant difference ($P>0.01$) between the two sides (mean value of the affected side 98.6% ± 4.45%). The results from the indirect measurements obtained by calculating the skull "radii" were similar. The "radius" on the cyst side was always greater and the difference between both radii was directly proportional to the cyst size, i.e., the increased hemicranium on the affected side is at the expense of the cyst volume. This strongly suggests that sylvian cysts have a primary space-occupying character and an absence of brain tissue deficiency in the affected hemisphere.

The insufficient diagnostic value of angiography and CT in suprasellar and subtentorial cysts prompted us to use metrizamide CT ventriculography. This was the diagnostic method of choice for differentiating between a suprasellar CSF cyst and an extremely dilated III ventricle (Fig. 1), and between a large retrocerebellar cyst and a Dandy-Walker cyst. The ventriculography demonstrated lack of communication with a blocked III ventricle in four suprasellar cysts; in six investigated subtentorial cysts, there were three isolated cysts with a blocked IV ventricle, two with cyst filling 1 h after contrast application, and one cyst communicated freely with the IV ventricle. The combination of CT ventriculography with dynamic cisternography allowed us to draw some conclusions about the site of CSF pathway occlusion and the relationship between the cyst and CSF spaces.

There were three types of pathological cisternographic findings (Table 3): (1) cysts with early entrance and delayed clearance (suprasellar and subtentorial); (2) cysts with late