Temporal Meningocele*

I. Nagulich, M.D., G. Borne, M.D., and Z. Georgевич, M.D.
Neurosurgical University Hospital, Belgrade, Yugoslavia, and Neurosurgical Service, University Hospital Center, Oran, Algeria

Cranium bifidum is defined as a congenital gap in the skull usually at the site of a cranial suture line. During the first weeks of embryonic life, the nerve axis undergoes sequential transformations which if disturbed at any specific stage produce predictable malformations. Thus, we can distinguish defects ranging from a small loss of bone to a large opening that permits cerebral herniation and the passage of cerebrospinal fluid. The most common location is near the midline, including the nasal, nasopharyngeal, buccal, naso-orbital metopic, interparietal, occipital, and suboccipital areas.1,10 To our knowledge, no case of temporal meningocele has been reported. We are presenting eight cases of temporal meningocele; seven were operated on at the Neurosurgical University Hospital in Belgrade and one at the University Hospital Center in Oran.

Case Reports

Case 1. The patient, an 18-month-old girl, had a mass on the left temple; it was loosely covered with normal skin and was not affected by coughing. Pregnancy had proceeded normally to delivery at term.

Examination. The patient could not hold up her head, sit, or stand. She displayed bilateral choreothetoid movements when at rest. The left eyeball was abnormally small with a film on the cornea; fundus examination showed right optic atrophy. Myototic reflexes could not be elicited. Standard x-rays of the skull did not reveal any bone anomalies; left carotid angiograms were also normal. Pneumoencephalography showed dilated right lateral and third ventricles; the left lateral ventricle and meningocele did not show.

Operation. Surgical removal of the meningocele was performed. The cystic cavity, about 2 cm in diameter, was covered with dense fibrous tissue 1 cm thick. It contained cerebrospinal fluid and communicated with the subarachnoid space through a bony orifice 3 cm in diameter. The brain on this side appeared atrophied. The postoperative course was good.

Case 2. This 4-year-old girl had a left temporo-zygomatic mass covered with normal skin and hair (Fig. 1 A). Pregnancy and delivery had been normal.

Examination. General health and psychomotor development were normal, as was the neurological examination. Standard x-rays of the skull did not reveal any bone anomaly.

Operation. Surgical removal of the meningocele was carried out. The capsule, filled with cerebrospinal fluid, was joined to a dural pedicle at the level of the pterion, passing through a bony orifice 5 mm in diameter. There was congenital aplasia of the neighboring bones.

Case 3. This 8-month-old girl had a mass in the left lateral region of the head, which had progressively increased in size until it extended to the upper part of the cheek (Figs. 1 C and D). Pregnancy and delivery had been normal.

Examination. The patient’s general condition was good. She could hold up her head, sit, cry, and smile normally; there was a right hemiparesis. Standard x-rays of the skull showed a left temporal bony lump. Pneumoencephalography showed dilated right lateral and third ventricles; the left lateral ventricle and meningocele did not show.

Operation. A cavity, the size of an orange, was found to contain cerebrospinal fluid and to communicate with the endocranium through two juxtaposed bony holes, each 1 cm in diameter. The postoperative course was uneventful; 30 months later, plastic surgery was performed with satisfying results.

Received for publication December 14, 1966.
Case 4. A 23-day-old girl was born with a large pedicu lar mass in the left temporoparietal region (Fig. 2). Pregnancy and delivery had been normal.

Examination. The mass was covered with a finely-vascularized membrane; at the base, the skin appeared normal and was covered with hair. The circumference of the meningocele was 24 cm and that of the skull 34 cm. The mass became tense when the child cried. General health and psychomotor development were good; the neurological examination was normal. Standard x-rays of the skull showed no anomaly.

Operation. A cystic cavity 6 to 7 cm in diameter was found at the pteric fontanel; it contained cerebrospinal fluid and communicated with the endocranium through a bony orifice 1 cm in diameter. Four clips were placed to mark the limits of the bony defect (Fig. 3). Postoperative course was normal.

Case 5. A 6-month-old girl had a right temporal swelling covered with normal skin; it had progressively increased in size. Pregnancy had been normal, but delivery at term had been difficult.
**Temporal Meningocele**

**Examination.** The patient's general health and psychomotor development were normal, as was the neurological examination. Standard x-rays of the skull showed a right temporal swelling of soft tissue over abnormally thin bone. Pneumoencephalography showed a dilated right lateral ventricle; the left ventricle and meningocele did not show.

**Operation.** At operation a cystic mass with a cavity about 5 cm in diameter was found filled with cerebrospinal fluid and communicating with the endocranium by a bony orifice 4 cm in diameter. The adjacent brain was atrophied. The postoperative course was uneventful.

**Case 7.** A 10-month-old girl had a right hemicranial mass covered with thin, translucent, whitish skin. Pregnancy had passed without incident, except for premature delivery at 7 months.

**Examination.** General health was poor. The neurological examination seemed normal. Standard x-rays of the skull showed a

**Examination.** The patient's general health and psychomotor development were normal, as was the neurological examination. Standard x-rays of the skull showed a right temporal swelling of soft tissue over abnormally thin bone. Pneumoencephalography showed a dilated right lateral ventricle; the left ventricle and meningocele did not show.

**Operation.** At operation a cystic mass with a cavity about 5 cm in diameter was found filled with cerebrospinal fluid and communicating with the endocranium by a bony orifice 5 mm in diameter. Through this hole, atrophied brain could be seen at a distance from the bone. The postoperative course was normal.

**Case 6.** This 3-month-old girl had a mass covered with normal skin in the right temporal region; it became tense when she cried. The pregnancy and delivery had been normal.

**Examination.** A finger tip could be inserted into the lateral fontanel. The head was small, measuring 37.5 cm in circumference. General health was good, and the neurological examination was normal. Standard x-rays of the skull showed a right temporal bony defect. During pneumoencephalography, gas could be seen to penetrate the left ventricle only, where there was considerable dilatation. There was no filling of the right ventricle or the meningocele.

**Operation.** A cystic cavity 3 cm in diameter was found containing cerebrospinal fluid and communicating with the endocranium through a bony hole 5 mm in diameter. Through this hole, atrophied brain could be seen at a distance from the bone. The postoperative course was normal.

**Case 7.** A 10-month-old girl had a right hemicranial mass covered with thin, translucent, whitish skin. Pregnancy had passed without incident, except for premature delivery at 7 months.

**Examination.** General health was poor. The neurological examination seemed normal. Standard x-rays of the skull showed a
right temporal bony defect. During pneumoencephalography, gas filled the left subarachnoid space, but did not fill the right subarachnoid space, the ventricles, or the meningocele.

Operation. Two cystic cavities totalling 4 cm in diameter were found at operation (Fig. 4); they contained cerebrospinal fluid and communicated with the endocranium through a bony orifice 4 cm in diameter. Some atrophied cerebral tissue which seemed to be ectopic was removed from the meningocele. The follow-up period was good.

Case 8. A 4-year-old boy was admitted with a rounded right temporal mass which had increased progressively in size (Fig. 1 B). The child had had a normal birth at the end of an eventful pregnancy.

Examination. General health and psychomotor development were good; the neurological and x-ray examinations were normal. When the mass was pressed, the bony edges of a hole could be palpated. During pneumoencephalography, no gas entered the ventricles or the meningocele.

Operation. A cystic cavity 4 cm in diameter was surgically exposed; it contained cerebrospinal fluid and communicated with the arachnoid spaces by a bony hole 2 cm in diameter. Postoperative course was normal.

Discussion

Operative Method. All cases received the same type of neurosurgical treatment. The operation consisted in the removal of the meningocele and in the restoration of the tissue layer by layer, so as to close the hole completely and firmly. The covering of the bony collar was always spared, and bony or alloplastic cranioplasty was never done. In the same way, no by-pass of the cerebrospinal fluid was carried out as, for example, in the treatment of extracerebral cysts. Esthetic results were good on the whole, and the long-term functional prognosis seemed favorable in view of the absence of intracranial pressure. In one case (Case 3) a further operation was necessary.

A vertical incision 5 to 6 cm long was made in front of and above the ear; it was usually bow-shaped with anterior concavity but sometimes was rectilinear (Fig. 5 left). The skin was then dissected free. The problem of the pedicular meningocele was rather different. First, the mass had to be dissected free in such a way as to preserve a collar of skin sufficiently large to allow for a posterior flap so that the scar would be placed above the ear where it would be well hidden by hair. Otherwise the esthetic result would be unsatisfactory, as in Case 8 (Fig. 5 right), where an incision of such size was not absolutely necessary.

Clinical Examination. In all eight cases, this lateral cephalic mass was large. It sometimes had a pedicle (Case 4) and was covered with normal skin or finely vascularized membrane (Cases 4 and 7); this covering was either loose or so tightly stretched that the mass throbbed when the child cried (Cases 4 and 6). Seven of the eight patients were females. The distribution between sides was equal (Fig. 6). Some cases (Cases 3, 5, and 8) showed a progressive increase in size, but others stayed the same without increase in contents or pressure. We found no occurrence of increased intracranial pressure. In all cases, there was communication with the endocranium through a bony defect which could only be felt during clinical examination in two cases (Cases 6 and 8). Psychomotor development was abnormal in two cases (Cases 1 and 7). Neuro-
logical examination also showed abnormalities in two cases, including choreoathetoid movements, microphthalmus, and the absence of myotatic reflexes (Case 1) and hemiparesis (Case 3). This congenital malformation appeared isolated and unrelated to other embryonic or fetal developments.

X-ray Findings. The bony defect for passage of the meningocele was difficult to distinguish on standard x-rays; when it could be seen it was located at the pterion (Fig. 3). It is obvious that tomographic investigation would have been of great interest; unfortunately, it was not undertaken. Pneumoencephalography revealed the important fact that gas almost always entered the ventricle opposite the meningocele, which was dilated in three cases (Cases 1, 3, and 6, Fig. 7). Gas was not seen in the ventricle on the same side or in the meningocele itself, perhaps because of obstruction to the circulation of cerebrospinal fluid by arachnoidal compartments, or possibly due to atresia of the interventricular orifices or cisternae basalis, or atrophy of part of the cerebral mass. Gas did not enter the ventricular system at all in two cases (Cases 7 and 8), and pneumoencephalography was not done in two other cases (Cases 2 and 4). In none of the cases was cerebral aplasia apparent through the bony opening. In 50% of the cases there was cortical atrophy adjacent to the lesion (Cases 1, 5, 6, and 7).

Operative Findings. In each case, the bony orifice seen at operation was situated at the pterion; sometimes it encroached on the anterior part of the temporal shell (Fig. 6). Its size varied from 0.5 to 4 cm in diameter; generally, the hole was single but it could be double (Case 3). The dimensions of the cavity were generally smaller than the visible malformation because of frequent alterations to its wall by the dense and fibrous tissue, particularly at the level of the communicating orifice. The cavity contained cerebrospinal fluid and, in one case (Case 7), atrophied cerebral tissue, probably ectopic.

Except in Case 4, cerebral atrophy was confirmed on the side of the malformation; the brain was some distance from the inner wall of the skull from which it was separated by a layer of cerebrospinal fluid. This liquid compensation occurred without intracranial pressure; the fluid simply filled the empty space established by the cerebral atrophy.

There were no postoperative complications in our series. As none of our eight operations resulted in death, autopsy analysis of this cranio-encephalic malformation was impossible.
Fig. 6. Diagram of the variations in size of the bone defect in eight cases. Cases 1 through 8 are illustrated according to number. Note that the defect was always at the pterion, but varied from left to right side.
Temporal Meningocele

439

Cause. We will only consider the mechanism of development of the temporal malformation itself, knowing that the general problem of meningocele is far from being completely solved. The temporal meningocele is located at the level of the anterolateral fontanel, whose limits are the frontal, parietal, and temporal bones, and the great wing of the sphenoid, all bones of membranous origin. The development of these bones normally occurs at the same time as that of the brain and meninges. The different pieces of the vault are separated by sutural spaces and fontanellar islands, covered with membranous tissue. The bone continues to grow from the center towards the periphery as long as these membranous elements persist. Thus, the fontanels remain non-ossified until the middle of the first year of life, and are replaced by the sutures when ossification of the peripheral part of the neighboring bones is complete. The pteric fontanel is the first to close after birth, and the membranous spaces which closely surround the temporal shell close a little later. It is difficult to suppose that these spaces and the fontanel have a direct mechanical role in the elaboration of the anomaly, since the child has been born with the malformation already present.

The bony defect seems to be secondary; probably a deposit of meninges at the fetal stage later develops into a hernia filled with cerebrospinal fluid, protruding through the sutural spaces and more particularly through the pteric fontanellar island. Or, possibly, an anomaly in the development of the dura opposite the Sylvian fissure might cause embryological adaptation.

The essential fact remains that the temporal malformation is always found in the same place, far from the midline and that representing closure of the neural cleft which is the site of most cranio-rachidian dysraphiae. Thus, when we consider the embryogenesis of the latero-basal parts of the skull and their junction with the facial bones, we can draw attention to a possible relationship between the malformation and the development of the posterior part of the first brachial arch.

![Fig. 7. Pneumoencephalograms showing filling of the ventricle opposite the meningocele and failure to fill the meningocele or ipsilateral ventricle. Note cortical atrophy. A. Case 1. B. Case 3. C. Case 6.](image-url)
Summary

We have reported our experience with eight temporal meningoceles successfully treated by surgical excision. We have emphasized the significance of their consistent origin at the pterion, as well as the frequent failure of pneumoencephalography to fill either the meningocele or the ipsilateral ventricle.

References