Rationale for Surgery in Growing Fractures of the Skull

B. Ramamurthi, M.D., and S. Kalyanaraman, M.D.
Department of Neurosurgery, Madras Medical College, and General Hospital, Madras, India

There have been a number of cases of growing fractures reported1-4 under various headings that include “leptomeningeal cyst” and “growing fractures.” Almost all the authors have advocated surgery. After discussing the clinical and radiological signs, the reports have proceeded to describe the pathogenesis of the condition and the operative findings in great detail. The need for surgery has not been questioned but has simply been assumed.

It is our purpose to present four cases which have not undergone surgery but which have done well, and to discuss the indications for surgical treatment in growing fractures of the skull. Our belief is that the usefulness of surgical therapy is limited to closure of skull and dural defects.

Case Reports

Case 1. A 3-year-old boy was admitted to our service a few hours after a fall from a height of 15 feet. He was reported to have been unconscious for 15 minutes, after which he regained consciousness, vomited, and was incontinent.

First examination. There was a small punctured scalp wound in the right frontoparietal region and a large right frontoparieto-occipital hematoma. He had a left hemiparesis involving the face, arm, and leg with an extensor plantar response. X-rays of the skull showed a right frontoparieto-occipital fracture with 4 mm maximum space between the fracture edges (Fig. 1 left). Altered blood was aspirated from the hematoma. At the time of discharge from the hospital 11 days after the injury his hemiparesis had partially disappeared.

Second examination. The patient was readmitted 2 months later for a palpable bony defect in the region of the fracture. He still had a left spastic hemiparesis, the arm being involved more than the face and the leg. Plantar responses were flexor. X-rays of the skull showed that the fracture had widened, the maximum space between the edges being now 10 mm (Fig. 1 right). The pneumoencephalogram showed the midline of the ventricular system shifted to the right. The

Fig. 1. Case 1. Left: Skull x-ray film a few hours after injury showing right frontoparieto-occipital fracture. Right: Skull x-ray film 2 months later showing fracture line had widened.
right ventricle was larger than the left and was pulled toward the site of the fracture.

*Third and fourth examinations.* The patient was reexamined after a further period of 2 and 6 months. The fracture had not widened further. The hemiparesis had improved with physiotherapy. It was decided not to undertake surgery in view of the lessening neurological deficit, and the stationary nature of the cranial defect.

*Case 2.* This 20-year-old man was referred to us for a longstanding complaint of progressive hemiparesis. He had received a blow on the head from a falling coconut 15 years earlier which had rendered him semi-conscious for a week following.

*Examination.* The patient had a spastic paraparesis with bilateral extensor plantar responses. There was a bony swelling in the left frontoparietal parasagittal region. X-rays of the skull showed a defect in the left frontoparietal parasagittal region with elevated edges (Fig. 2). The characteristic radiological appearance suggested a growing fracture with spontaneous arrest. The cerebrospinal fluid (CSF) protein content was 58 mg%. The electroencephalogram showed bilateral parasagittal slow waves. The left carotid angiogram was normal. The pneumoencephalogram showed the midline of the ventricular system to be shifted to the left. The left lateral ventricle was dilated and shifted upward.

Because 15 years had elapsed since the injury and the defect was closed by a thin bony shell, it was decided not to operate.

*Case 3.* This 2-month-old baby had received an injury to the head 3 weeks before admission to our service when an elder sibling had fallen on him. A swelling had developed in the occipital region and had gradually increased in size.

*Examination.* There was a parieto-occipital swelling with intact skin over it; it enlarged when the child cried. The fontanel was open and normal, and the head circumference was 15 inches. There was no neurological deficit. Skull x-rays showed a growing fracture of the left occipital region.

Surgery was advised but the child's mother was not willing for surgical treatment. There has been no increase in the size of the fracture during the last 6 months.

*Fig. 2.* Case 2. Skull x-ray film 15 years after injury showing defect in the left frontoparietal parasagittal region with elevated edges.

*Case 4.* This 6-month-old baby girl was admitted to our hospital with a history of a fall of 4 feet. She had been unconscious for an hour after the fall, and then had developed right focal fits.

*First examination.* The patient had a left temporoparietal hematoma with a palpable linear depression underneath. There was weakness of the right arm but gross movements were possible; skilled movements with the hand were defective. An electroencephalogram done in our service a few weeks after the injury was normal, and the skull x-ray film showed a linear crack fracture.

*Subsequent examinations.* Five months after the injury, x-rays of the skull showed a growing fracture. A year after the injury the fracture had grown further and was now a palpable linear defect in the left parieto-temporal region. The weakness of the right arm was persistent and had extended to the leg also. A ventriculogram showed the frontal horn and body of the lateral ventricle to be
Growing Skull Fractures

dilated and pulled toward the fracture site. The midline of the ventricular system was shifted to the left. A pneumoencephalogram confirmed these appearances and also showed a region of cortical atrophy beneath the site of the fracture, a feature not seen in the ventriculogram (Fig. 3).

It was decided to observe the case longer. The neurological deficit gradually became less. Follow-up after 5 years showed that the patient still had a mild right hemiparesis. The cranial defect had enlarged only slightly over 5 years. She was able to write with her left hand and was attending school. She was well above average in intelligence and stood first in her class.

Discussion

In the 5 years between 1964 and 1968, 3447 cases of head injuries were seen in our department, of which 620 patients had fractures of the skull. Only four among them showed this syndrome of growing fracture. The incidence is very low, in fact very few authors have had more than four cases in their series. The largest series in the English literature are those of Tavera and Ransohoff,4 who describe seven cases, and Banerji and Tandon,2 who report eight cases. The latter authors divided their cases into two groups: craniocerebral erosion and post-traumatic meningocele. Rao and Subrahmanyan3 reported a case of traumatic malacia of the skull following fracture. Lende and Erickson2 presented five cases and made a comprehensive survey of the world literature up to 1961.

These case reports suggest that this condition is not always progressive. If the patient is seen after infancy and the defect is not increasing, it is likely that the defect will not enlarge further. At this stage the patient comes either with a complaint of a skull defect or with hemiparesis or convulsions. If the defect is fairly small and not inconvenient to the patient, it is our contention that there is no need for surgical therapy. The convulsions can be treated with anticonvulsants. The hemiparesis cannot be improved by surgical methods like cranioplasty or duroplasty. In none of the surgical reports has there been a cure for the hemiparesis or for the smallness of the limbs.

In most of the case reports this hemiparesis was seen at the time of injury and persisted or slowly improved, indicating intrinsic injury to the brain. Air studies of these patients have shown an enlargement of the ventricular system on the side of the injury. This would indicate cerebral atrophy rather than a compression. Except in one case described by Lende and Erickson,2 where there was a non-communicating cyst containing fluid with increased proteins, the pneumoencephalogram has shown an enlarged ventricle on the affected side. This would indicate cerebral damage and atrophy, suggesting that the cause of the convulsion and the hemiparesis is the damage to the brain and not the cranial or dural defect. A study of the case reports also shows that hemiatrophy was not favorably influenced by surgical methods.

An analysis of the type of surgery undertaken and the results achieved shows that closure of the skull and dural defect has been the primary achievement. In a few cases the fits were better controlled and the
explanation offered was that the pressure by the loculated leptomeningeal cyst on the cortex had been removed. It is rather difficult to appreciate this argument when the pneumoencephalogram showed only an enlarged ventricle on the affected side, thus indicating lack of pressure on the cortex. Hence to blame pressure from a meningeal cyst for the epilepsy does not seem justified.

Epilepsy and hemiparesis in these cases could arise only from direct cortical injury, and the methods of surgery so far advocated do not deal with this problem directly. If hemiparesis cannot be improved and if the fits can be controlled by drugs, then the indication for surgical therapy becomes limited only to the cranial defect. Our experience indicates that the tendency for the defect to enlarge ceases after infancy and early childhood. Therefore, if there is no bulging in the scalp and no big cranial defect that is troublesome, surgery is unnecessary, especially if it would mean repeated procedures as has been seen in many reports.

Summary

Four cases of growing fracture of the skull not treated by surgery have been reported. In each case spontaneous stabilization occurred. The pathological basis and clinical features of this syndrome have been described. The limited indications for surgery have been discussed and the importance of follow-up in children with fracture of the skull emphasized.

References