THE FOUR-FLAP OPERATION
A NEW OPERATION FOR TREATMENT OF CRANIOSYNOSTOSIS

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Several operations have been described for the treatment of craniosynostosis.1, 2, 3, 5 Some of them proved to be unsuccessful, while others gave satisfactory results. The four-flap operation described herein consists of raising four cranial flaps, two frontal and two parietal. A ridge of bone in the midline covering the superior sagittal sinus is left behind. The periosteum is used as a barrier between the edges of the bone to delay union. This operation allows rapid substantial decompression of the brain.

DESCRIPTION OF OPERATION

The operation is done under general anesthesia. A bifrontal skin flap extending a little behind the site of the coronal suture is turned down. A right frontal bone flap is raised first (Fig. 1). The periosteum is divided anteriorly 1 cm. above the superior orbital margin, medially 1 cm. to the right of the midline, and posteriorly 1 cm. behind the ridge that is usually present corresponding to the site of the coronal suture. The periosteum is reflected for 1 cm. all around. A burr hole is made in any area denuded of periosteum. From this hole a strip of bone denuded from the periosteum is nibbled away to a width of 1 cm.—at least—all around in three directions. The flap is carefully lifted off the dura mater, and finally broken at its narrow base. Bone from the broken base is similarly nibbled away. Interrupted silk sutures are taken between the under surface of the temporalis muscle and the dura mater (Fig. 2). The flap is then replaced. The overhanging redundant periosteum is made to cover the edges of the flap. The periosteum is sutured to the dura mater using interrupted sutures at intervals of 1 cm. (Fig. 3). By this means the replaced flap is fixed securely to the dura mater anteriorly. The third stage comprises raising a left parietal flap. It may be done at the same sitting or later on.

CASE MATERIAL

This operation was performed in 6 cases of craniosynostosis. The patients were all over 2 years of age, which varied from 3 to 6 years. Four of the patients operated upon were followed up long enough to assess the result of the operation.

OPERATIVE FINDINGS

During the performance of these operations certain points were observed: (1) At the first stage the bone was found thinned out with notable convolutional markings. In 1 case parts of the bone opposite the convolutions were very thin—parchment-like—whereas the parts opposite the sulci were sharp and spiky. Some of the spikes were no less than 1 cm. long, being embedded in the depths of the dural invaginations. It was
remarkable that the spikes were longer than the expected normal thickness of the bone. The dura mater was also thin and showed corresponding markings. During performance of the later stages it was noticed that the thickness of the bone had increased. The convolutional markings were of lesser degree and the dura mater had become thicker.

(2) The average width of the gap made all around the flap by nibbling was 1 cm. But once the flap was raised and then replaced, the gap was noticed to be no less than 1½ cm. in width, indicating immediate expansion of the underlying brain.

OPERATIVE AND POSTOPERATIVE COMPLICATIONS

(1) Subarachnoid Hematoma. In suturing the periosteum to the dura mater utmost care was taken to avoid pricking the underlying cortical vessels with subsequent formation of an acute subarachnoid hematoma. However, this complication took place on 2 occasions during the 24 stages performed. The hematoma was detected immediately by the rapid bluish discoloration of the dura mater. When it occurred, the dura mater at the site of the prick was opened, the bleeding vessel was coagulated, the hematoma was evacuated and the dura mater was closed.

(2) Infection. Mild infection of the surface occurred at the corners of the parietal flap in I case, probably because of poor blood supply at the periphery of the flap.

(3) Anemia. Most of the patients were suffering from mild hypochronic anemia before any operation was done. Their hemoglobin varied between 75 and 80 per cent.