Cranioplasty in a Craniopagus Twin

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The first successful separation of craniopagus twins with survival of both children was reported in 1957. This paper will describe the method used to repair the defect of the skull of one of these children. At the time the report of their separation was written the children were 2 years old. The larger, L, appeared to be a normal child and has continued to develop normally. At that time S, the smaller of the children, was retarded definitely with spastic left hemiparesis, a large right cerebral protrusion, and moderate torticollis with the head rotated to the left. She has remained in essentially the same state. A ventriculo-atrial shunt, using a Heyer valve, was successful from a mechanical standpoint for several months and the cerebral protrusion collapsed. Unfortunately, in this child a bacterial endocarditis developed which did not respond to therapy until the shunt was removed. As soon as the shunt was removed the cerebral protrusion recurred promptly. Since there had been no significant improvement in the neurological status of the child while the shunt was functioning, further surgical therapy was not attempted.

Since the time of separation of the children the desirability of repair of the defects of their skulls was apparent. However, in each child the cranial defect was covered in a large part only by the dura mater and overlying graft of skin. It was obvious this could not be reflected as a flap and remain viable, and it was even more obvious that insertion of any alloplastic material beneath the graft would result only in loss of the graft since its viability depended on vascularization from the underlying dura mater.

Case L. The child continued to do well and developed normally. When she was 4 years old it was decided to attempt to repair the defect of her skull using her own ribs as autogenous grafts and inserting them in multiple stages beneath the graft of skin overlaying most of her cranial defect. The first stage was not carried out until July 7, 1959. At that time the transverse diameter of the cranial defect was 10 cm. while the anteroposterior diameter was 9 cm. (Figs. 2 and 3). At this stage 12 cm. of the right 7th rib were removed. The small flap of scalp overlaying the right side of the cranial defect was elevated from the dura mater and after splitting the rib the two halves were fitted into the defect under the flap of scalp. The ribs were anchored by silk sutures passed through drill and punch holes in the ends of the ribs and edges of the skull. An additional suture anchored the middle of the lateral graft to the adjacent edge of the skull. The flap of scalp then was replaced and sutured to the edge of the graft.

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of skin. This initial stage did not differ in any essential way from the usual repair of a cranial defect using autogenous rib grafts.\textsuperscript{1,2}

The next stage was carried out on Aug. 6, 1959. A 15-cm. segment of the left 7th rib and a 9-cm. segment of the 6th rib were resected. The previous longitudinal incision on the right side along the medial margin of the flap of scalp was re-opened and the flap was re-elevated until the more medial of the previously placed grafts was exposed. The graft of skin was elevated medially for a few millimeters. The longer rib was split and the two halves were inserted side by side. The grafts were anchored again with silk sutures passed through drill and punch holes in the ends of the rib and the edges of the bone. The lateral margin of the flap of scalp was sutured again to the edge of the graft of skin. Then a longitudinal incision was made parallel to the left lateral margin of the defect of the skull and 5 mm. medial to it. The edges of the graft of skin were mobilized sufficiently to permit the insertion of the shorter graft of rib which was anchored in the usual way. The graft of skin then was resutured over the rib. At the close of this procedure we had a residual defect 10 cm. in its anteroposterior dimension and 5.5 cm. wide. The wounds initially healed well and the child left the hospital on Aug. 16, 1959.

We saw the patient at intervals. For a time the graft of skin broke down periodically over the graft of rib on the left. On one occasion an $8 \times 5$ mm. portion of this graft was removed so as to expose the underlying dura mater. The exposed dura mater then epithelialized promptly and no further difficulty was experienced. A roentgenogram of the skull in January 1960 showed the grafts to be intact with the exception of the small defect in the left graft produced by the procedure described above.

The next stage was carried out on Jan. 26, 1960. The previous incision in the right lateral wall of the chest was re-opened and extended anteriorly for 8 to 4 cm. The right 7th rib was mobilized and 14 cm. of it were removed. After the wound in the chest was closed the head was prepared surgically and draped and incisions were made on each side of the remaining defect parallel to the previously placed grafts and 12 to 15 mm. medial to them. After mobilization of the edges of these incisions a

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FIG. 1. Roentgenogram of skull of L at 9½ months of age. Lateral view.

FIG. 2

FIGS. 2 and 3. Roentgenograms of skull of L at 4 years and 9 months. (Left) lateral view; (right) anteroposterior view.
13-cm. segment of the split rib was placed on the right and a 10-cm. segment on the left. The incisions in the graft of skin then were closed. This left a longitudinal defect in the midline that was 3 to 4 cm. in width. The incisions healed satisfactorily and the child left the hospital 10 days after operation.

The final stage was carried out on July 7, 1960. At that operation the incision on the left side of the chest was re-opened. The 6th and 7th ribs were well regenerated but 10.5 cm. of the 5th rib were removed. A longitudinal incision was made in the graft of skin in the center of the remaining defect and this rib was inserted beneath the undermined edges of this incision. It was necessary to fracture the rib in two places in order to straighten it to conform to the contour of the head. It was some 5 mm. shorter than the anteroposterior diameter of the defect but a piece of this length was split from the larger end and used as a splice to completely span the defect. As usual the graft was anchored to the skull with silk sutures and an additional suture was used to anchor the two pieces of the graft together. The incision then was sutured. Initial healing again was satisfactory and the child left the hospital on the 10th postoperative day.

Later the graft of skin broke down over the middle portion of this last graft of rib. The exposed graft appeared dry and devitalized. On Sept. 24, 1960, the outer portion of the exposed rib was removed carefully with small rongeurs. This revealed raw bleeding bone indicating the deeper portion of the graft was revascularized satisfactorily. This was left intact and the exposed bone slowly epithelialized.

A wig now was made for this child and she discarded the plastic helmet she had worn previously for protection. Re-examination on May 5, 1962 revealed the graft to be solid everywhere except in the right anterior area where it could be slightly depressed. There was no visible pulsation anywhere. Roentgenograms of the skull (Fig. 4) showed the grafts to be viable with beginning ossification between them.

This report has been made primarily as a follow-up to the previously reported separation of these children. It also shows that cranioplasty can be carried out satisfactorily beneath a well established split-thickness graft of skin or epithelialized scar if one is willing to use autogenous bone or cartilage and a multiple-stage procedure. This should prove useful in certain cases of post-traumatic defects of the skull that are covered by scalp of poor viability, split-thickness grafts of skin, or epithelialized scars, and previously have been considered unsuitable for cranioplasty.

References