Stainless Steel Mesh-Acrylic Cranioplasty

Technical Note

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The development of yet another method of cranioplasty was prompted in this department by the desirability of having available a relatively simple and inexpensive but cosmetically and functionally improved way to cover defects in the thin skulls of children. Previous materials used in our clinic have included autogenous bone, tantalum, acrylic, and steel mesh.

Autogenous bone is appropriate only for a limited number of small relatively flat defects and is often awkward to obtain in the young child. Tantalum cranioplasty has been used to good advantage in children since World War II, but has certain disadvantages: it is relatively expensive; insertion can be time-consuming if a perfectly fitting plate is fashioned at the operating table; a totally radiopaque area results, which may obviate satisfactory radiological contrast studies in later life. Both one-and two-stage plain acrylic plates have proved to be so thin and brittle that they often crack if subjected to the local trauma so frequent in the growing child. Stainless steel mesh alone is easily fashioned for small defects but does not give adequate protection if the area covered is relatively large or involves multiple curved surfaces.

We have developed a combination of the latter two methods which resolves at least some of the problems posed by the procedures outlined above. Stainless steel wire mesh is molded by hand at the operating table to reconstruct the contours of the skull accurately. This is then covered with freshly prepared acrylic from commercially available prepackaged material to form a thin (1 mm) plate of almost any desired shape or size. The resultant plate is light, inert, of uniform thickness, and extremely tough, so that it cannot be deformed by attempts at bending or by local blows or pressure.

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Materials and Method

We use specially woven stainless steel mesh (0.028-inch wire, 16 wires per inch);* the size represents a compromise between strength and ease of manipulation. A shallow ledge 3 to 5 mm wide is first made around the margins of the skull defect; this is expedited by the use of a high-speed air drill. A pattern of the defect is traced and cut out of moist cottonoid and placed on a piece of the steel mesh. The mesh is then cut with sterile heavy metal shears to form a piece slightly larger than the pattern. The steel mesh is then shaped by hand to conform perfectly to the skull contours and the edges trimmed so that the plate fits accurately in the ledge surrounding the defect. Multiple drainage holes are made through the plate by enlarging a number of properly separated spaces with a small hemostat. It is important

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to have the plate fit the contours perfectly before the acrylic coating is applied (Fig. 1).
Solvent is then added to the sterile acrylic powder and mixed thoroughly in a glass until polymerization has proceeded to a "pea-soup" consistency. The plastic is then poured over the mesh, which must be clean and dry (Fig. 2). The excess is allowed to drip off. Just before the plastic is completely hardened (5 to 10 minutes, usually) the acrylic is perforated at the sites of the drainage holes and at several additional points around the periphery of the plate for placement of anchoring wires (Fig. 3). Any rough edges of the plastic coating are removed with air drill. The plate is then fastened in place with stainless steel wires passed through drill or punch holes in the ledge bordering the defect. Another advantage of this method is the fact that heat engendered during polymerization is never in contact with the brain. In the thinner skulls of young children, where only a very shallow ledge can be made, the plastic can be removed from the under-

Fig. 2. Acrylic poured over mesh. Note enlarged holes for drainage.

Fig. 3. Completed plate wired in place.

Fig. 4. X-rays illustrating bilateral stainless steel mesh-acrylic plates covering decompressive craniectomies carried out in an adult to control increased intracranial pressure secondary to herpes simplex encephalitis.