USE OF POLYVINYL SPONGE IN NEUROSURGERY

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One of the primary problems facing a neurosurgeon in operative procedures necessitating sacrifice of the dura mater or requiring repair of cranial or spinal dural or bony defects is the assurance of watertight closure of the cerebral or spinal dural envelope. Polyvinyl plastic sponge has been used recently with success in various surgical procedures.1–3 It occurred to us that such material, namely, wettable plastic sponge with numerous interstices through which blood vessels and connective tissue can grow to form a neomembrane of connective tissue and sponge, might be useful in its application to some of the problems encountered in the practice of neurosurgery.† To this end a series of dogs was operated on in an attempt to elucidate the mechanism by which this material is incorporated into living tissue in and about the nervous system.

PRESENT STUDY

During the past 3 years, portions of spinal or cranial dura mater have been excised in 12 dogs. The portions excised were of various sizes and were situated over normal and also over traumatized cortex. Polyvinyl sponge was placed over normal and traumatized nervous tissues in the dural defects thus created in both the cranium and spinal cord. Observations were made at necropsy and at reoperation as to the microscopic and gross pathologic changes encountered during periods ranging from 6 months to 2 years (Figs. 1 and 2). It is our opinion that polyvinyl sponge is a useful and worthwhile substance for repair when it is properly used for correction of defects in the covering of the nervous system in animals. This type of sponge also has been placed in and about the nervous system in 27 patients during the past 2 years.

COMMENT

In the use of new synthetic materials in surgery, it is important to be cognizant of the disadvantages as well as the advantages of the material to

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† The polyvinyl sponges used in this study were kindly furnished by the manufacturer, Ivano, Inc., Chicago, and are available from Clay-Adams, Inc., New York City.
the patient and to the surgeon who uses it. Therefore, on the basis of our experience with polyvinyl sponge, we consider that this material is a useful substance when employed in certain situations. This sponge can be used as a watertight dural substitute when it is sewed in place in dural defects in the spinal cord and cranial cavity, provided edematous brain or spinal cord is not tightly approximated to the cut edges of the dural defect if the pia-arachnoid has been disrupted. It may be utilized satisfactorily in the repair of conditions producing cribiform rhinorrhea or cerebrospinal otorrhea. It may be used for the performance of orbitoplasty after transcranial removal of orbital tumors if the defect cannot be repaired satisfactorily by means of the usual stainless-steel or acrylic plates. It may be employed for reinforcement of walls of intracranial aneurysms or for closure in the management of certain meningoceles.

Effective and watertight closure after high cervical laminectomies, suboccipital craniectomies or combined cervico-occipital operations may be achieved by use of polyvinyl sponge in occasional difficult cases. The removal of malignant lesions in and about the nervous system may produce operative defects in which the plastic sponge is helpful for repair. We have noted that the involved area may leak cerebrospinal fluid for several days after repair of dural defects by use of these sponges. When invasion of the sponge by fibrous tissue takes place, the closure becomes satisfactorily watertight.

One of the most important contraindications to the use of polyvinyl sponge is the presence of considerable edema or trauma of the brain or spinal cord, with disruption of the pia-arachnoid. Gliosis through the lacerated pia mater into the sponge may take place more rapidly than does the desired
growth of connective tissue into the sponge from the edges of the cut dura mater. This leads to adhesions. The presence of contamination or infection is a contraindication to its use. Should the surgeon desire to use polyvinyl sponge in an area over traumatized nervous tissue, the injured nervous substance should be covered first with inert material, such as animal membrane. Peritoneum from sheep has been used for such a purpose. The sponge should perform efficiently in these instances if this precaution is used.

No reactions have followed placement of this material in the cranial or
spinal cavities, and to date we have had no incidence of infection. A few patients have displayed slight increases in temperature for several days during the immediate postoperative period. In no case has the sponge been extruded, and in no case in which we have employed the sponge and later had an opportunity to examine it have we encountered the foreign-body encystment so frequently seen with many substances placed in the body.

It is our practice, as is done when any foreign body is placed in or about the nervous system, to use penicillin prophylactically after the operation. At the time of incorporation of this sponge into the wound, an instillation of 20,000 units of aqueous penicillin is made into the wound and the entire length of the sponge is moistened with this solution. We have used sponge varying from 1 to 3 mm. in thickness and of the desired dimensions to fit the defect. However, the sponge may be cut to any size depending on the needs of the individual surgeon. The material was sterilized by boiling it in water.

SUMMARY

On the basis of both experimental and clinical experiences at the Mayo Clinic, polyvinyl sponge appears to have a place in neurosurgery in the replacement or reinforcement of the natural tissues covering the central nervous system. Polyvinyl sponge should not be placed over infected, edematous or traumatized nerve tissue. As in the use of other foreign materials in surgery, the indications and contraindications for the insertion of polyvinyl sponge must be well recognized.

REFERENCES