VINYON "N" AS A DURAL SUBSTITUTE
AN EXPERIMENTAL STUDY IN THE MONKEY*

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In the last six decades numerous materials have been used experimentally and clinically as dural substitutes. They include metallic materials such as gold, platinum, silver, aluminum, and nickel foils, and tantalum and stainless steel plate or screen. Biological tissues, including fascia, fat, periosteum, amniotic, human or animal allantoic, Cargile membranes, amnioplastin, gelfoam, and plasma fibrin films have all been used. Other substances such as rubber sheets, parchment, mica, cellophane, olive oil, polyvinyl alcohol plastic, and polythene sheets have also been employed.

The chief purpose of using a dural substitute in neurosurgery is to prevent adhesion between the exposed brain and the overlying soft tissues rather than to fill the defect in the severed dura mater. It is generally believed that the meningocerebral adhesions that follow injury or surgery are responsible for the post-traumatic or postoperative convulsive disorders.

The dural substitute must possess specific qualities, such as nontoxicity, inertness in tissue, nonabsorbability, resistance to disintegration, favorable tensile strength, soft consistency, easy maneuverability for wrapping over the surface of the brain, and ease in sterilization. None of the above-mentioned materials fulfills all these requirements. This probably accounts for the long and continuous search for suitable dural substitutes in neurosurgery.

This communication concerns a new synthetic material, Vinyon "N" cloth, which has been used experimentally as a dural substitute in the monkey.

MATERIAL AND METHOD

Vinyon "N" Cloth. Vinyon "N" is a synthetic fabric woven in cloth form with a construction of 144 warps and 90 filling yarns per square inch. The woven pattern, consistency and color are those of China silk. It is nontoxic, inert, and nonabsorbable when buried in animal tissue. It has a smooth surface. Its tensile strength is similar to that of silk. Furthermore, it can readily and repeatedly be sterilized in boiling water without any appreciable damage. Autoclaving stiffens it.

* The Vinyon "N" cloth used in this study was supplied by the Carbide and Carbon Chemicals Company, New York.

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Experimental Animals and Operative Technic Used. Two series of animals were studied. The first series consisted of 6 adult monkeys including 1 *Rhesus cynomologus* and 5 *Macaca mulatta*, weighing from 2.5 to 5.8 kg.

On each of these 6 monkeys a craniotomy was performed using sterile technic. A left frontoparietal bone flap was turned down under intravenous sodium nembutal anesthesia, 18 mg. per pound of body weight. In 4 of these 6 monkeys (Animals 1, 2, 3 and 4), the cerebral cortex was left intact, while in 2 (Animals 5 and 6) a piece of the cerebral cortex in or close to the motor area was excised. In each animal, a piece of dura mater measuring approximately 1 by $\frac{1}{2}$ inch was removed and replaced by a piece of Vinyon “N” cloth. The edges of the dural substitute and the dura

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**Fig. 1.** Diagram illustrating the result of three different methods of anastomosis of dura mater and Vinyon “N” dural substitute. (A) Edge-to-edge (end-to-end) anastomosis with the formation of meningo-cerebral cicatrix along the line of approximation (crosshatch). (B) Anastomosis by everted sutures. Meningocerebral adhesions were prevented. (C) Tuck-under method shows no meningo-cerebral adhesions.

- **Broken line** = Vinyon “N” dural substitute
- **S** = Suture
- **Crosshatch** = Adhesion formation
- **SA** = Subarachnoid space
- **DMA** = Dura mater and arachnoid
- **PC** = Pia and cortical surface
- **MC** = Meningocerebral cicatrix