TIGHT DURAL CLOSURE WITH PEDICLED GRAFT IN WOUNDS OF THE BRAIN

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Although the importance of not opening the dura unnecessarily has been fully recognized both in regard to cerebral dura\textsuperscript{2,10} and spinal dura for some time, inadequate attention has been devoted to its repair in cases of penetrating wounds of the brain. The necessity for careful repair of the laceration of the dura in the region of the cribiform plate or one of the paranasal sinuses has long been known by neurologic surgeons.\textsuperscript{6} On the other hand, deliberate meticulous repair of a laceration of the dura under the vault of the skull has not generally been recognized in the literature,\textsuperscript{1,2,3,5,9} although Spurling, Senior Consultant in Neurosurgery in the European Theater of Operations,\textsuperscript{9} has recommended the use of grafts whenever it is impossible to close the dura with interrupted sutures. Usually dural patches have been free grafts of fascia lata, pericranium or temporal fascia. Pedicled grafts, having their own blood supply, would appear more likely to take, especially in the presence of bacteria. Insofar as the author is aware, the use of pedicled grafts for this purpose has not been previously reported.

THE NEED FOR WATERTIGHT CLOSURE OF THE DURA

Watertight closure of the dura is a barrier in two senses: it excludes blood and bacteria from the central nervous system, and it restrains cerebrospinal fluid and brain within their normal confines. In the past, closure of the galea aponeurotica has been emphasized to the neglect of the dura mater. From the surgical point of view, the dura is analogous to the serous membranes in other parts of the body. Naturally, closure of the scalp is important, but when the dura is properly closed, scalp closure regains its proper position of secondary importance. Careful restitution of the dura provides an effective barrier between the central nervous system and the somatic tissues. In the absence of a portion of the skull and scalp, as happens all too frequently in war wounds, the repaired dura alone may be the only effective barrier that excludes from the central nervous system both bacteria and blood. The former are the obvious source of intracranial infection: meningitis, brain abscess and encephalitis. The latter acts as nourishment for any organisms that may be present, and itself is organized into meningoencephaladhesions.

In the absence of scalp due to direct trauma, infection, or ischemic necrosis, the well-repaired dura provides a base for granulation tissue in the case of a small scalp defect, or a substratum for grafting of skin in the case of larger scalp defects. In the event that the brain has been inadequately

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Debrided at the time of the primary operation, it allows the infection to become localized as an abscess, which can be dealt with by block excision after the scalp has healed.

A properly closed dura contains the cerebrospinal fluid. The outpouring of this fluid tends to impair the healing of the scalp and keeps open the direct route to intracranial sepsis. The well-closed dura also prevents herniation of the brain, which is recognized to be due primarily to dural defect, and its more serious sequel, cerebral fungus. Naturally, a good scalp repair is an excellent support for dural closure.

**MATERIALS**

Inasmuch as the calvarium is almost a hemisphere, its coverings are ideally disposed for the rotation of pedicled grafts. Within each lateral semicircular aspect of the vault of the skull there is the smaller semicircle of the temporal fossa with its contained temporal muscle, and the latter's sheath, the temporal fascia. From the center of each of these semicircles, there radiate the temporal arteries. These well-known facts, utilized daily in making horse-shoe flaps of scalp or bone, are equally useful in the planning of pedicled dural grafts.

In cases of wounding of the brain, there will be an occasional linear laceration of the dura that can be tightly closed by simple suture. But in any appreciable defect of the dura, some strong fibrous layer is required to form a patch or graft. Excessive tension of the dura may give rise to epidural bleeding, especially when the fracture line extends from the bony defect across one of the larger dural sinuses. It is probably unwise to use the galea to repair the dura, because of its special relationship to both the mobility and the blood supply of the scalp.

The author has used the following tissues:

1. The loose connective tissue between the galea and the periosteum.
2. Pericranium, or periosteum of the skull.
3. Temporal fascia.
4. Falx.
5. Most commonly, combinations of the first three.

**METHODS**

1. **Planning.** Before the cranial operation is commenced, one plans not only the exposure and debridement of the brain and closure of scalp and skull, but also the dural repair. Frequently, it is best to hinge the galea and skin of the scalp in one direction and the subgaleal loose connective tissue with underlying periosteum and temporal fascia in another. A bone flap may be hinged in a third direction.

2. **Infiltration of fluid under the galea.** A considerable amount of saline solution or local anesthetic is injected under the galea in order to give thickness to the layer of underlying loose connective tissue. When the tip of the needle is below the galea, it takes relatively little pressure to inject the fluid, a large amount of which, often 50 cc., can be infiltrated without moving the needle. The fewer the insertions of the needle, the less likely is a tear in the periosteum to be used as a flap.

3. **The scalp incision** is made through the galea, but not through the underlying periosteum or temporal fascia.