Neurosurgical Classic—V

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Of Harvey Cushing's many contributions to neurological surgery, perhaps the most important was his development and standardization of neurosurgical operating technique. Dr. Cushing himself summarized this succinctly when he was questioned about his contributions. His reply was, 'Tell them that I closed the galea.'

Aside from the development of many important surgical instruments, Dr. Cushing advanced neurosurgical operating technique by the introduction and adaptation of several basic principles. Foremost among these were the principles of careful hemostasis, gentle manipulation of tissues, and meticulous attention to details, which had been taught to Cushing by the man who was chiefly responsible for his surgical training, Dr. William S. Halsted.

In an address to the St. Louis Surgical Society on December 16, 1907, parts of which are reproduced below, Cushing outlined his procedure for performing osteoplastic resection of the skull. It is an unbroken tribute that most of the steps in this procedure are still followed today.


TECHNICAL METHODS OF PERFORMING CERTAIN CRANIAL OPERATIONS* 1

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... On this particular occasion ... I purpose to limit my remarks largely to a description of such technical methods as have come to be more or less habitual, in Dr. Halsted's clinic with which I am associated, in the routine performance of the simpler operations of craniotomy and craniectomy. ... From a purely technical point of view we are more indebted to the method of temporary osteoplastic resection, first attempted by Wagner in 1889, than to any other factor for the satisfactoriness of most of our present-day operations on the cerebral hemispheres. These trap-doors may be cut from the cranium with a variety of tools; the simplest armamentarium is a mallet and chisel, the most elaborate, a motor, with its trophines, burrs and saws, driven by electricity. ... Simplicity is a desirable quality in operative technique, but the blows of a mallet, even though transmitted in a glancing direction, are undesirable; and speed, the chief advantage of the motor-driven rotary tools, is invariably a source of danger, even in accustomed hands. It really matters little, except in saving time for the surgeon, whether an osteoplastic flap can be elevated by one method in seven minutes, or whether another requires twenty; and an operator who persists in taking dangerous corners at high speed will be the cause of a serious or fatal accident some day, whether he is driving an automobile or opening a skull. ... STEPS OF AN OSTEOPlastic RESECTION

Since this procedure may be taken as representative of any major operation on the skull, I shall, at the risk of being tedious, describe the general plan of preparation and performance to which I adhere. ...

General preparation. It is, I believe, a fairly universal custom to have the patient's head shaved and treated antiseptically in the ward on the day before the operation—some even advocate a double preparation of this kind. This I consider an unnecessary precaution, if not positively unwise; for the patient is apt to pass an un-

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1 Read before the St. Louis Surgical Society, December 16, 1907.
comfortable night and, even with the most expert shaving, the scalp is likely to be a little "sore" the morning of operation. In something over 350 craniotomies I have never seen an infection, even a superficial stitch abscess, and have ceased to regard the chance of sepsis as a possible complication of these operations.

It is our custom, without previous ward preparation, to have the hair clipped and shaved just before the operation. After a double shaving, once with and then against the direction of emergence of the hairs, there may be a preliminary cleansing of the scalp with green soap and a soft brush, the head then being wrapped in a towel wrung out of warm bichloride solution. The final preparation is deferred until after the anesthetic.

**Position on the table.** It is a great advantage, though it does not appear to be a common practice, to place the patient on the table in the position most favorable for the operation before administering the anesthetic.

Many operators have a particular form of head-rest for all cranial operations, table extensions for this purpose having been described by Horsley, Frazier, Morestin and others. For the usual operations on the vault, however, small, flat, solid pillows or sand-bags seem to be all that are necessary to turn and hold the head in the desired position: on the other hand, I regard a head-extension with shoulder supports as essential for occipital work, chiefly to insure free respiration. Thus do surgeons' views differ. Whatever form of table be used, however, it is desirable to have the head-end capable of being raised or lowered at will.

**The anesthetic.** Regardless of the drug to be employed, it is essential that it be administered by an expert—preferably by one who makes this his specialty. Cerebral surgery is no place for a "Guck in die Luft" anesthetist.

In all serious or questionable cases the patient's pulse and blood-pressure, their usual rate and level having been previously taken under normal ward conditions, should be followed throughout the entire procedure, and the observations recorded on a plotted chart. Only in this way can we gain any idea of physiological disturbances—whether given manipulations are leading to shock, whether there is a fall of blood-pressure from loss of blood, whether the slowed pulse is due to compression, and so on. A further safeguard is an artificial respiration apparatus, to be immediately put into use in case there is failure of an already burdened respiratory centre, either from the anesthetic, from loss of blood, or from additional medullary pressure due to cerebral manipulation.

In this country, where chloroform is doubtless ad-

1 We have, of late, in all of our cerebral operations followed the custom of having the etherizer constantly auscultate the heart. This is accomplished by strapping the transmitter of a phonendoscope to the precordium. From this a long tube passes to the aural receiver which is held against the auricle as is the receiver of a telephone operator. This is much more satisfactory than the usual supervision of cardiac action by the occasional palpation of the pulse for which a hand must be disengaged. It is surprising that the method has not come into general practice before this.

ministered less well than ether, the latter is the anesthetic of choice at most hands, the primary stage usually being induced with ethyl chloride. . . .

The question of the anesthetic in a two-stage operation is an especially serious one, and under these circumstances, the dangers from chloroform would possibly be less than those of a repeated etherization. Some years ago, however, having had a fatality from chloroform, I employ it far less frequently in cranial operations than ether, restricting its use largely to children.

Local anesthesia may at times suffice, especially for such simple measures as ventricular puncture, though infiltration of the scalp is difficult. I have learned, furthermore, that in favorable cases no anesthetic need be required in a second-stage operation limited to manipulations of dura and brain after re-reflecting an original bone-flap.

**Preparation of the operative field.** With the patient anesthetized and in proper position on the table the final cleansing is done; for this, alcohol and 1 to 1000 bichloride solution are sufficient.

It is my practice at this stage, before the landmarks are obscured by the covering of operative sheets and towels, to outline the proposed incision on the scalp by a superficial scratch with the scalpel.

An operating neurologist should acquire the power of visualizing the brain, its main fissures, the insula, the ventricles, etc., through the intact skull; and those who have, by long practice, familiarized themselves with the rules of crano-cerebral topography, learn to judge the position of the main fissures with no greater margin of error than when measurements are employed.

With the proposed flap thus outlined and the head raised by an attendant's hand placed under the back of the neck, a broad square of wet bichloride gauze is thrown over the entire head; over this, in turn, is placed a tourniquet.

For the control of hemorrhage from the scalp numerous forms of tourniquet have been advocated. Many use a simple rubber tube, or Esmark bandage, both of which are difficult to apply and to fasten without slips in the aseptic technique. Crite has employed a rubber dam which, being stretched over the entire scalp, renders it bloodless. I formerly used a pneumatic tourniquet, but have lately come to a form of rubber ring in which is inserted a buckle . . . so that the tube can be made into a ring of any size and can be easily removed at the end of the operation. Practice enables one, with a given quality of tubing, to estimate the size of the ring, necessary in a given case, to shut off arterial supply from the scalp without causing undue pressure. The ring, furthermore, is provided with a median tape . . . whose length—measured after the head is shaven—should equal the distance from glabella to inion, and the object of which is to prevent the ring from rolling over the orbits, as it is likely to do, especially if there is a prominent forehead. Having been boiled, the ring is applied by the operator and an assistant . . . being snapped over the head from occipital to frontal regions (Fig. 4).

In the majority of cases all bleeding from the scalp is thus controlled, though in certain patients with tumor, in whom there is marked intracranial stasis, some of the veins on the concave side of the incision which receive blood through emissary vessels from within the skull may have to be clamped.

Around and just above the tourniquet a small towel,