A NEUROSURGICAL CHAIR*

W. JAMES GARDNER, M.D.

Department of Neurosurgery, The Cleveland Clinic Foundation, and The Frank E. Bunts
Educational Institute, Cleveland, Ohio

(Received for publication September 20, 1954)

Difficulties encountered during operations upon the head or upper spine are frequently caused by: (1) awkward positioning of the patient; (2) increased venous pressure; and (3) embarrassed respirations. In many neurosurgical procedures these factors can be minimized by placing the patient in a sitting or semireclining position in a suitable operating chair. In 1935 we described a neurosurgical chair and the advantages of the sitting position particularly for operations upon the cerebellum and cervical spine. Disadvantages of this position are the occasional occurrence of postural hypotension and the rare development of air embolus.

The basic requirements of a neurosurgical chair are as follows:

1. It should maintain the body in a position that will minimize the tendency to postural hypotension and air embolism.
2. Should hypotension develop, it must be possible to place the head lower than the feet.
3. The chair should hold the patient's body in position without the use of restraining straps.
4. Its shape should be such that it is impossible for the patient to slump or to struggle out of position during the course of the operation.
5. It should have a readily adjustable headrest which will hold the head firmly, will permit the surgeon easy access to any portion of the head and upper spine, and at the same time afford the anesthetist free access to the air passages.
6. It should be comfortable for the conscious patient.

The chair described below fulfills these requirements. The prototype of this chair originated 15 years ago and it has gradually evolved to its present form as the result of operating experience. Instead of the usual right-angled seat, this chair has a seat that is sharply flexed on the back rest, while the leg rest is extended. For the sake of stability, these angles are fixed. This shape prevents forward slumping and at the same time combats the tendency to venous pooling which contributes to postural hypotension and air embolism. To prevent sideways slumping, the back rest, seat, and leg rest are trough-shaped, which shape increases the area of contact with the patient's body and eliminates the need for padding. This in turn affords increased stability of the patient's body. Should the patient struggle at any time during operation, the force of gravity returns him to his original posture as soon as muscular contractions cease. During the 15 years that this type of chair has been used, with no padding other than a cotton blanket, no patient has had any pressure areas develop on the skin.

The important and basic feature of an operating chair is that it affords adequate

* Demonstrated at the meeting of the Harvey Cushing Society, Santa Fe, New Mexico, May 1954.

81
support to the skeleton. This structure is the same size in a fat as in a thin person. Chair manufacturers tend to build chairs wide and flat in order to accommodate all sizes of people, which means that they afford inadequate support. The wedging effect, which the contours of this chair furnish, permits the force of gravity to immobilize the skeletal framework without impeding respiration or circulation. With perhaps the addition of a folded blanket under the buttock or calves, a chair of this shape, though narrow, will accommodate a fat person as comfortably as a thin one and a tall person as readily as a short one. The contours of the chair enable the conscious patient to relax completely, because he feels secure and no muscular effort is required to maintain the position. This, together with the fact that the tendency to syncope is controlled, makes the chair satisfactory for use during operations on the conscious patient. The comfort of the position is attested to by the fact that during its manufacture, when the noon whistle blew, there ensued a contest among the workmen to determine who would sit in the wooden model during the lunch hour.

The chair can, of course, be raised or lowered by a foot pump, and also rotated about its vertical axis. By means of a crank, it can be tilted back like a rocking chair so that the feet are higher than the head. A slot in the back permits a lumbar puncture to be performed during operation, if indicated. Movable arm rests are provided. A small seat attaches to the back to accommodate a child.
Fig. 2. Patient in position for a cerebellar operation or cervical laminectomy, demonstrating the degree of backward tilting generally employed. The socket attached to the base of the chair is to receive the patient-lifter.

Fig. 3. The supine position for craniotomy. The table top fastens securely on the backward-tilted chair. The 3-point craniotomy headrest combines stability with ready adjustability.
The tic headrest fastens to the back of the chair. In principle, it is a three-point cushioned vise which, in the standard position, makes contact with the mastoid processes and forehead (Fig. 1). The bar to the forehead pad may be tilted to either side to afford access to a large area of the calvarium. After clamping in the tic headrest, the head may be tilted toward either shoulder if desired. When the head is placed in the clamp so that the face is toward one side, the Shelden position for approach to the optic chiasm may be simulated.

In all operations in the sitting position, the chair should be tilted backward as far as feasible without interfering with the convenience of the operator. This settles the patient more firmly in position, aids venous return from the lower extremities and decreases the vertical distance between the brain and the heart. Because of the vasodepression which occasionally results from the sympathectomy effect of bilateral cordotomy, we advocate the use of a G-suit (antigravity suit) when this procedure is carried out in the sitting position. In the Taarnhøj operation carried out in this chair, no additional precautions are ever taken to combat hypotension. A fall in blood pressure has never been observed and although the superior petrosal sinus has been opened repeatedly, aspiration of air has never happened.

The headrest pads employ a new and very effective principle. They consist of an inelastic but flexible plastic capsule, distended to the shape of a doughnut by the injection of a fluid under atmospheric pressure. This principle, by insuring an even distribution of pressure, permits a smaller sized pad to be employed and this renders a larger area of the skull accessible to the surgeon. These pads will withstand a pressure of 250 pounds without rupturing. If a pad is punctured, it may be readily replaced by a new one, although in 12 months of use this has not proved necessary. Since the contained fluid is noncompressible, it eliminates the movement inherent in

[Image of the prone position for posterior craniotomy or cervical laminectomy.]
Fig. 5. The position for lumbar or lower thoracic laminectomy.

Fig. 6. The patient has been raised by the lifter and the orderly is rotating the latter in its socket preparatory to lowering the patient into the bed alongside the chair.
any compressible type of padding. The cerebellar headrest is U-shaped and designed to support the head by contact with the forehead and malar prominences (Fig. 2). Movement of the lower jaw is unimpeded and ready access is afforded to the nose and mouth. Cushioning of this rest is provided also by a water-filled capsule molded to the shape of the metal portion. The rest is attached by a locking ball-and-socket joint to a rod which, in turn, fastens, by means of a 3-way adjustable clamp, to a horizontal bar in front of the patient.

The chair is converted into an operating table by simply laying a table top across it (Fig. 3). This table top is also trough-shaped and has a slot which permits spinal puncture with the patient in the supine position. A 3-point craniotomy headrest adjusts automatically to the contour of any portion of the calvarium with the patient in the supine or lateral position. The cerebellar headrest is as effective when the patient is in the prone position as it is when he is sitting (Fig. 4). A laminectomy frame, also cushioned by fluid-filled plastic pads, fits on the table. It flexes the lumbar spine while allowing the abdomen to hang free (Fig. 5). This reduces the tendency to venous bleeding.

The removal of a patient from an operating chair has always been an awkward procedure. To overcome this difficulty, a patient-lifter has been developed. It operates as follows: A canvas sling is placed on the seat of the chair before the patient is put into position. When the operation is completed, a hydraulic hoist is fastened by hooks to each of the four corners of the canvas sling. The patient is then simply raised from the chair by means of the hoist and deposited in his bed. The hoist consists of a vertical pole to the top of which is attached a boom that can be raised or lowered by a small manually operated hydraulic pump. The pole of the hoist fits in a socket fastened to the base of the chair. After the patient has been raised from the chair, the hoist is rotated in the socket until he is over the bed which has been placed beside the chair (Fig. 6). The boom is lowered by a small release valve. The patient-lifter is detached from the chair when not in use. It can, however, be used to apply skeletal traction during operations such as the open reduction of a fracture dislocation of the cervical spine.

The author wishes to express his grateful appreciation to Mr. Valentine Seitz,* and to Mr. Emil H. Buchning of the electromechanical shop of the Cleveland Clinic for their invaluable aid in devising the various headrests and clamps. To Mr. Elmer Ries of Cincinnati goes the credit for assembling the ideas and putting the chair on a production basis.† To the Stratton Equipment Co. of Cleveland, credit is due for the development of the patient-lifter. The fluid-filled plastic pads were developed through the cooperation of the Rand Development Corporation of Cleveland and Vin Tex Sealers of Chicago.

REFERENCES


* Now deceased.
† Ries Manufacturing Co., 717 Sycamore Street, Cincinnati 2, Ohio.