Pterional Approach to the Orbits for Decompression or Tumor Removal*

W. B. Hamby, M.D.
The Cleveland Clinic Foundation, Cleveland, Ohio

The value of orbital decompression as a vision-preserving measure in malignant exophthalmos has been demonstrated well enough that it needs no defense here. Several methods of surgical decompression have been devised, the orbital walls being opened into the ethmoid sinuses, the maxillary antrum, the anterior fossa of the skull and laterally into the temporal fossa. My initial practice was to open the orbital roof by transfrontal craniotomy, as Naffziger advised. Gradually this operation was simplified until the transfrontal opening was reduced to a triangular craniotomy, 4 × 5 cm. in size, low in the frontotemporal area, similar to that described by Poppen. This made it possible to operate upon both orbits at one session almost routinely. Dr. Poppen and others have used the coronal scalp flap for this exposure; I used bilateral, small concealed, “Dandy”-type incisions.

In 1949, I saw the late Sir Hugh Cairns approach the orbit through a single pterional trephine opening, which he enlarged with rongeurs. The orbit was opened sufficiently to permit removal of an intra-orbital tumor. Sir Hugh similarly decompressed the orbits in cases of malignant exophthalmos. I adopted the method thereafter and have been impressed with its superiority over the transfrontal approach. Apparently Sir Hugh never wrote of the method. His successor, Mr. Joe Pennybacker, thinks that it simply “evolved” in their clinic. The operation was found to have been described in 1943 by Dr. Henri Welti1,2 of Paris. Apparently his is the honor of its invention. In 1946, Guyton,3 of Baltimore, described a somewhat similar approach to the orbit through its lateral wall.

He believed it to be safer than the Welti operation, since the cranial cavity was not entered.

The Operation

In the usual case of bilateral proptosis, bilateral operations are planned, unless surgical conditions make it necessary to stop after the completion of one side. To forestall panic on awakening, the patient is warned that his eyes will be bandaged shut.

General anesthesia with tracheal intubation is employed. The patient lies supine with the head supported to permit its deflection to either side.

The lids are closed with a simple double-fixation mattress suture, the horizontal external limbs of which pass over a short length of soft, quarter-inch rubber drainage tubing. This protects the corneas from trauma during the operation and the closed lids “splint” the anterior aperture of the orbit against the edema of its contents produced by the surgical manipulations.

A limited area is shaved in each anterior temporal region and the skin is prepared on both sides, including forehead and brows. The lids are covered with gauze pads moistened with Ringer’s solution.

The incisions are outlined with an alcoholic solution of dye (Fig. 1). This is a curved line, the anterior extremity starting in a natural fold of the skin about 2 cm. above the lateral rim of the orbit. It follows the fold backward to the hairline, then turns downward to the zygoma.

The head then is draped. The thin adhesive plastic drapes available now insure against moisture from the hair invading the field. Towels, moistened for ease of draping, are sutured to the skin, leaving exposed only the marked lines of incision, in such a manner that the head may be rotated to either side without disturbing asepsis. A loose, large-apertured sheet is draped over all. The head is turned to expose the operative field on the side chosen for the first decompression.

The incision in the skin is made and the antero-inferior flap is dissected forward moderately. The temporal fascia and muscle are incised to the bone. The bone of the temporal fossa then is bared with periosteal elevator, exposing the periorbit: the junction of sutures between the frontal and parietal...
tal bones, the temporal squama, and the greater wing of the sphenoid. This point may be quite apparent but it may be invisible when sutures are completely ossified.

A trephine opening (Fig. 2) is made at the pterion or at a point just behind the zygomatic process of the frontal bone, in case the pterion is not visible. Welti makes three trephine openings: one through the lowest part of the frontal bone, one into the temporal fossa and one antero-inferiorly into the lateral wall of the orbit. In either case, enlargement of the opening with rongeurs exposes the frontal and temporal dura mater and the orbital fascia, with the sphenoid ridge between them. With rongeurs the ridge is removed medially and the orbital roof and its lateral wall are removed forward and medially. If the dura mater is tight, the anesthetist may relax it with alternating-pressure hyperventilation, or by administering hypertonic solution of mannitol intravenously. We have seen no evidence of frontal-lobe damage from elevation as some writers have suggested. The dura mater and arachnoid over the sylvian fissure may be nicked to drain an amount of cerebrospinal fluid suitable for decompression. This small incision is sutured during closure of the wound to prevent possible cerebrospinal-fluid rhinorrhea in case a paranasal sinus also is opened.

The bony decompression then is continued with thin-bladed rongeurs to include the sphenoid ridge down to the superior orbital fissure, the lateral wall to the inferior orbital fissure, and the orbital roof almost to the midline. The lateral end of the lesser wing of the sphenoid is removed over the upper surface of the superior orbital fissure. It may be easy or difficult, depending upon the individual variations in thickness of bone, to remove the roof of the optic foramen; this rarely is indicated. The aperture at the surface is narrow, but there is plenty of room through which to work deliberately and precisely, with retractor, rongeurs and suction tip. Simple adjustable, overhead-beam illumination is adequate. The thin dura mater, adherent to the irregularities of the orbital roof, is dissected from the bone with cottonoid pledgets and is held with a thin retractor blade at each bite of the rongeur, to prevent its inadvertent cutting. As extensions of the frontal and ethmoid sinuses are approached, these may be opened. Attempts are made to avoid tearing the sinus mucosa. This membrane is pushed inward from the edge of the bone with cotton and the craniectomy is continued as far as is desired.

If the frontal dura mater and/or the sinus mucosa have been opened, the wound is irrigated with neomycin solution. An appropriate-sized piece of absorbable cellulose gauze is soaked in blood from some part of the surgical field and is packed firmly against the membranous rent. This maneuver has prevented the development of cerebrospinal-fluid rhinorrhea or of infection in any of our cases.

The orbital fascia is exposed almost to the midline, forward almost to the orbital rim and along its lateral and inferior surfaces (Fig. 3). The

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**Fig. 1.** Location of skin incision for pterional approach.

**Fig. 2.** Site of pterional approach for orbital decompression. The dotted circle indicates the primary trephine opening.
orbital fascia now is nicked and fat usually prolapses. The fascia is separated from the orbital contents with a suitable angled instrument, such as a dural separator or a grooved director, and the fascia is slit widely in all directions to permit free prolapse of its contents. An intraorbital tumor may be removed, if this is the indication for the operation.

Complete hemostasis is secured. Any dural rent is closed. If individual anatomical variants have required the removal of bone of the surface beyond the area covered by the temporal fascia, the defect may be covered with a small prosthesis. This may be made conveniently of stainless-steel wire mesh shaped properly with the fingers. The wound is closed carefully in layers with silk sutures, without drainage. The skin is closed with a layer of subcuticular silk sutures. In our hands this operation requires 35 to 60 minutes, only a little longer than for a temporal trigeminal rhizotomy.

If the patient’s condition permits, the head is turned to the opposite side and the other orbit is decompressed similarly.

The wounds are closed separately with gauze and adhesive plaster. Sterile glove-rubber is put over each orbit. These are covered with gauze padding above the level of the brows and an elastic bandage is applied around the head to exert mild pressure over the orbits. The orbits are inspected daily and compression is discontinued when recession of the globes is evident, usually within 2 or 3 days. When voluntary motion of the lids shows that the globes no longer are straining against the lids, the sutures in the lids are removed. This usually occurs within 3 to 5 days after operation.

Results

Approximately a third greater surface of orbit is exposed by this than by the Naffziger technique. Guyton was not impressed with the superiority of a larger decompression, but in our hands the results have been considerably better than with the smaller. Proptosis has receded quicker and corneal complications have been fewer. The cosmetic result is good; the fine scars located within skin-fold lines quickly become practically invisible.

In our 16 cases there have been no deaths, no infections and no rhinorrheas requiring repair. After paranasal sinuses have been opened, a little fluid may drain from the nose for 12 to 36 hours, but such discharge has always ceased spontaneously. This discharge apparently consists of irrigation fluid left in the wound at the time of closure.

Summary

The technique is described of decompressing the orbit by way of a single trephine approach through the pterion.

This approach permits a more extensive removal of roof and orbital wall than does the transfrontal operation.

The simplicity of the approach permits bilateral decompressions to be done at one session more easily than with frontal craniotomies.
The clinical and cosmetic results of this operation have in our hands been superior to those following transfrontal decompression.

References

Discussion
Dr. Robert C. Bassett: Our utilization of this technique, like Mr. Pennybacker’s, has been a technical evolution arising out of an “all-or-none” experience with a mixed tumor of the salivary gland invading the middle fossa and orbit in 1955. The middle fossa was approached through a “tic” subtemporal craniectomy. When the mass of tumor was well exteracted it was noted that the roof, the posterolateral wall of the orbit, was, in good portion, missing. This patient had a pronounced proptosis which subsided rapidly within 3 days.

Immediately thereafter this approach was instituted in the treatment of malignant exophthalmos refractory to other therapies. Eight unilateral and 2 bilateral cases of this affliction responded in most gratifying fashion without complications. Two cases of retro-orbital neurofibroma and 2 cases of chronic retro-orbital cellulitis have been handled expeditiously with this technique.

In slight contrast to Dr. Hamby’s approach we use a vertical hockeystick, temporalis muscle-splitting incision behind the hairline about 1 cm. anterior to the usual tic incision and still adequately posterior to the facial nerve supply to the levator palpebrae. This gives more room to assault the pteron with large forceps; the temporal and frontal dura mater are readily displaced atraumatically.

[Slide] This is a lateral view showing a little more bone resected posteriorly. As I said, this gives to me, at least, a better approach to the greater wing of the sphenoid with biting forceps.

[Slide] This is the internal view. Not all of the orbital roof has been removed. Much more, as well demonstrated by Dr. Hamby’s slides, can be removed, but the secret to this approach technically is the extensive lateral and posterolateral decompression with which the removal of the orbital roof can be supplemented.

[Slide] This, again, is the frontal repetition of what has gone before.

Dr. Hamby’s estimate of one-third greater decompression as compared to the Naffziger approach tends to the conservative since the entire orbital content comes readily to hand. His detailed presentation will surely popularize this procedure. Hence it must be remembered that a generous capsulotomy is the key here to a successful end.

Dr. W. B. Hamby: I don’t think this simple thing needs very much additional word, except to thank Bob for his discussion and to say that whenever you think you have discovered a new way of doing something, one of your friends has been doing it for a long time, and didn’t think it very important.