A rapid and modifiable technique for regional exposure in cerebral surgery

Technical note

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The authors describe a technique by which a properly demarcated regional cerebral exposure may be performed rapidly and safely. The method involves a linear scalp incision of varying length and orientation and a circumferential craniotomy of variable size and shape centered about a single burr hole. While providing for rapid exposure with reduced blood loss, the vascular integrity of the wound is also better preserved, allowing for rapid healing of the scalp. This technique provides satisfactory unilateral exposures of most cerebral sites not located in the vicinity of the frontal sinus or the sphenoid wing.

KEY WORDS: craniotomy, operative procedure

A variety of regional craniotomies have been described in the classical works of Asenjo, Gurdjian and Thomas, Odom and Woodhall, and Rowe. These authors generally described the use of a wide-based skin flap and multiple burr holes, which results in a “standard” craniotomy exposure. While this method is desirable for certain conditions, in many instances a trephine craniotomy has been most suitable for limited exposures in cerebral surgery. This procedure has been used for tumor biopsy or excision, abscess drainage, evacuation of intracranial clots, and even clipping of aneurysms. This technique utilizes a linear scalp incision with significant reduction in blood loss and better preservation of the scalp vasculature, which improves wound healing. In particular, the time required for exposure is considerably reduced. With the availability of high-speed drills, further modifications on the theme of limited regional cerebral exposures are possible.

We describe a method for exposure of the cerebral convexity using a linear scalp incision that maintains vascular pedicles and a craniotomy of variable dimensions centered about a single burr hole.

Technique

The incision is oriented so that it provides maximum access to the widest extent of the intracranial lesion according to transposed radiographic markings on the scalp surface; it is also positioned between vascular territories supplied by frontal, temporal, and occipital vascular pedicles. The latter aspect allows for effective wound healing and minimal blood loss. Linear incisions measuring 10 to 15 cm are used for the cranial exposure. Further hemostasis is secured either by application of local clips to the skin edges or, more simply, by tamponade with one or two self-retaining retractors. Most incisions in the parieto-occipital area extend from a point on the midline laterally between the territories of the posterior auricular and occipital arteries. Temporal and parietal incisions may be oriented vertically between the pedicles of the posterior auricular, superficial temporal, and zygomaticotemporal arteries. In addition, longitudinally oriented parasagittal scalp incisions separating the vascular territories of the supraorbital and superficial temporal arteries may be used to expose intracranial hematomas or tumors of the convexity (Fig. 1).

A burr hole is then made in the center of the intended craniotomy, and a Penfield dissector is used to separate the inner surface of the bone from the dura for variable distances in all directions, according to the dimensions of the intracranial lesion to be exposed. Allowance is made for the size of the bone flap to exceed these dimensions, minimizing subsequent cerebral retraction.
Rapid regional craniotomy

Fig. 1. Schematic illustration indicating linear incisions used to expose lesions in the high convexity area (1), posterior frontal area (2), sensorimotor area (3), parietal area (4), and the occipital area (5). Dotted line indicates the midline. Arterial distributions indicated are supraorbital (SO), zygomaticotemporal (ZT), superficial temporal (ST), posterior auricular (PA), and occipital (O).

and edema. We have found this to be safe over radii of as much as 4 to 5 cm, even in older patients with adherent dura. With a pneumatic drill, a single cut is made along the radius from the burr hole to the periphery of the intended craniotomy; subsequently, the border of the bone flap is cut in a circumferential fashion according to the expected dimensions of the underlying lesion. Small drill holes are placed about the circumference of the bone flap for dural suturing and replacement of the bone flap using wire or sutures. Tenting sutures through the bone flap may also be used by making a small drill hole in the wall of the central burr hole to reduce the danger of postoperative extracerebral hematoma.

Illustrative Case Reports

Two cases are summarized to illustrate the value of this technique. In both cases, the time needed to expose the dura was less than 15 minutes. There was minimal blood loss and sufficient exposure to safely perform the intracranial procedure.

Case 1

This 60-year-old man presented with left-sided weakness 8 months after resection of laryngeal carcinoma. A computerized tomography (CT) scan with contrast infusion demonstrated a ring-like enhancing lesion within the posterior parietal lobe measuring 6 × 5 × 4 cm. After transposition of radiographic markings onto the scalp surface, a 12-cm linear incision was made centered over the intended craniotomy. A burr hole was placed in the center of the exposed calvaria, and an area of dura was separated from the inner table of the skull over the required surface. A pneumatic drill was then used to fashion a bone flap with the required diameter to achieve adequate exposure of a metastatic neoplasm (Fig. 2). Complete removal was performed.

Case 2

This 68-year-old woman presented with obtundation and marked left-sided weakness. A CT scan demonstrated an acute and chronic subdural hematoma of the right convexity. An anteroposterior incision, measuring 12 cm, was made over the right hemicranium. A longitudinally oriented bone flap with a 10-cm anteroposterior diameter was then fashioned to expose the subdural collection (Fig. 3). The hematoma was then evacuated with excision of the membranes.

Discussion

Limited cerebral exposures with craniotomies and craniectomies performed through multiple burr holes or a trephine have become popular since the development of the operating microscope and microsurgical techniques. Methods to expedite the opening and closing of operative exposures have been further facilitated by the introduction of air-driven high-speed drills. A method is described for the swift, simple, and safe exposure of the cerebral surface. In performing any craniotomy, the most important aspect of the procedure is the accurate placement of the bone flap to expose the intracranial lesion while avoiding injury to the adjacent brain. Numerous external and radiographic landmarks can be used to place the bone flap over the intended site with relatively little margin for error. The technique described is not applicable to exposures near the
pterion or frontal sinus as both of these areas require special technical considerations.²⁴¹⁰

The facility to modify the shape of the bone flap to accommodate any exposure of the cerebral convexity from a single burr hole represents an advantage of our technique unavailable with the use of a trephine. In addition, the size of the craniotomy, with a maximum transverse diameter of 10 cm, allows for ample surgical exposure.

With proper localization and placement of the bone flap, the central burr hole can be repeatedly used for percutaneous aspiration since it will be directly over the center of the lesion. Ultrasound evaluation can also be more accurately performed through a central burr hole than one that is at the periphery of the lesion, which is the case in most conventional craniotomies utilizing multiple burr holes.

This technique can also be used in exposures of the posterior fossa if one avoids the transverse and occipital sinuses. Replacement of the bone flap in the posterior fossa contributes to a good cosmetic result, with better acceptance by the patient. The single burr hole may be occluded with bone chips, acrylic, or plastic buttons as the surgeon prefers. In summary, this technique provides a rapid access into the cranial vault without compromising the surgical principles of safety; it offers adequate exposure and effective wound healing.

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References


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