The Occasional Burr Hole

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Introduction

Every now and again word comes of some doctor in the hinterland drilling a hole in a patient's skull to relieve an epidural bleed. One published account by an SRPC member in rural Alberta[1] described the evacuation of 400 mL of blood from the cranium of an 8-year-old child after the neurosurgeon in a tertiary centre faxed the instructions. The child had suffered a temporal bone fracture, lacerating the middle meningeal artery and was comatose, with a unilateral dilated pupil that "blew" at the time of admission to the emergency department. The child is now completely normal but would surely have died without the immediate intervention.

This report got me thinking about how lucky the child was that a neurosurgeon was not only located quickly but also could fax a set of instructions promptly. What would I have done in a similar situation if I had been unable to contact someone knowledgeable? Did our hospital have the proper equipment? If not, what could be found in hospital maintenance or at local hardware stores that could be used in a pinch? Here are the results. Post this in your emergency room. **If you are in a hurry just read the bold type.**

Equipment
10% povidone-iodine prep
Light, suction, and cautery
Dressing tray
Gelfoam
Penrose drain
3-0 silk suture
#10 scalpel blade and #3 handle
Small self-retractors or rakes
Drill and bit(s)

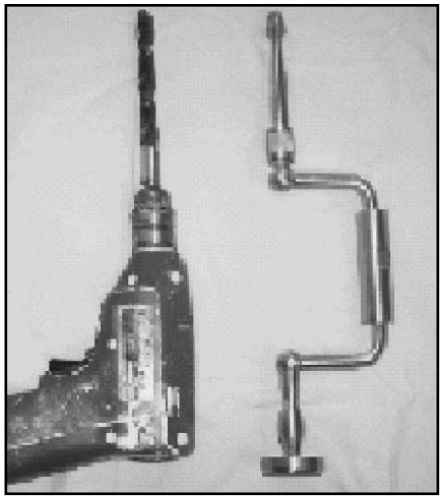

Fig. 1: Brace and bit

Drills and Bits

There are only 2 possibilities: either you have all the stuff or you don't (a tautology if you have time to appreciate it). Drilling a hole in the cranium is usually a 2- stage procedure. You use a sharp pointed drill (penetrator) to make a hole in the outer table of the cranium. Once the hole is large enough, you then switch to a blunt-ended burr hole bit to complete the drilling through the skull and minimize the chance of penetrating the dura. As it turns out our hospital had a burr hole bit and drill but no penetrator.

I went to the local hardware stores looking for a penetrator bit with as blunt an end as possible to drill the initial hole. The best I could find was a Canadian Tire 1/2 inch high-speed steel drill bit (part #54-3032-8, cost $10.49). When I compared this bit (now called an "instrument") with those at the Montreal Neurological Institute, the difference was minimal, except that their instruments were sterile and made of stainless steel.

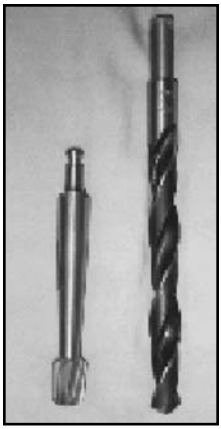

Fig. 2: Burr and "penetrator"

However, the new bit did not fit the brace supplied with the hospital's burr hole drill. A manual carpenter's brace (hard to find these days) or a regular carpenter's electric drill were needed. Illustrated in Fig. 1 are the electric drill and the penetrator and the burr hole bit and hand brace beside it. Detail of the 2 bits is shown on the right.

If you have them, use your hospital's properly sterilized penetrator and burr hole bits and braces for a formal 2-stage entry through the cranium. If these are not available, use a 1/2 inch steel drill bit for an adult (slightly smaller for a child) and sterilize it as well as possible.

If you do not have a burr hole bit then use the 1/2 inch penetrator or hardware store bit to drill carefully all the way through the cranium. You are, after all, presuming that there will be a large lake of blood in front of the dura, ensuring some leeway when you go through the cranium. Everything should be sterilized to the best of your abilities, but if you can't use sterilized instruments go ahead anyway and change gloves at each step.

Location

You want to avoid drilling into the orbit or into the temporal artery. One rule for an adult is to **drill 2 fingerbreadths above the top of the ear and 2 fingerbreadths anterior to the auditory canal** (Fig. 3). Some people will even go 3 fingerbreadths above the ear. Adjust the distances for children. You want to be **just above the roof of the zygoma.** Plain skull x-ray films in the setting of an epidural hematoma will often show a temporal bone fracture. If it is a depressed fracture, then care must be taken in putting pressure on the drill point.

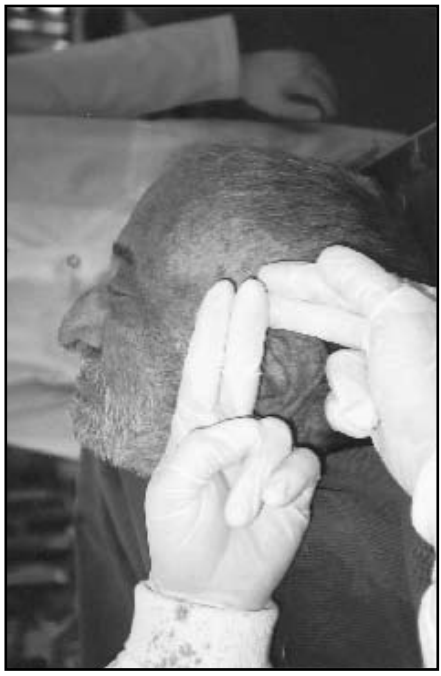

Fig. 3: Landmark above zygoma

Procedure

1. Shave and "prep" the side of the skull
2. Select your point of entry (see Fig. 2)
3. **Make a vertical incision approximately 3 cm long, centred over the entry point**
4. Carry the incision down to the temporalis muscle and divide the fibres of the muscle vertically. Cut the periosteum in the same manner

5) Use cautery to coagulate bleeders, although if the incision is done quickly and extended to the periosteum and the retractors or rakes are immediately placed under the periosteum with tension on the wound, cautery is usually unnecessary (Fig. 4)

Fig. 4: Retract to minimise bleeding

Fig. 5: Use penetrator for outer table

6. Drill the outer table of the skull with the penetrator (in the illustrated case, the carpenter's tools) (Fig. 5)

Fig. 6

7. **Follow with the burr hole bit and brace (Fig. 6). If this is not available, carry through with the penetrator,** taking it slowly to prevent abrupt inward movement of the bit after complete skull penetration. Change gloves if using contaminated equipment.

Fig. 7

8. **Evacuate the hematoma** (it can be surprisingly voluminous). Use a soft suction tip. Suture in a Penrose drain (Fig. 7).

If there continues to be excessive bleeding through the hole, try packing the wound with a hemostatic agent like Gelfoam. Muscle is a wonderful blood clotter and was used extensively in earlier neurosurgery. In a pinch, cut off a piece of temporalis muscle and stuff it into the hole. If all else fails and transport is delayed, use a bone rongeur and a good light to eat away at the bone until the bleeding branch of the meningeal artery can be found and cauterized. That is probably all the neurosurgeon would do anyway.

Reference

[1] Rottger J, Irving AM, Broere J, Tranmer B. Use of telecommunication in a rural emergency. Brain surgery by fax. J Telemed Telecare 1997;3:59-60.

Procedure Summary

- Select site
- Prepare scalp
- Incise scalp
- Drill the outer table
- Follow with bit and brace
- Evacuate the hematoma
- Suture in a Penrose drain