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An Overview on Burr Hole Craniostomy

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Abstract

Burr holes are small holes that a neurosurgeon makes in the skull. Burr holes are used to help relieve pressure on the brain when fluid, such as blood, builds up and starts to compress brain tissue. A layer of thin tissues called meninges surround and help protect the brain. These meninges contain blood vessels that carry blood to and from the brain. The dura is the outermost of these meninges. A head injury can cause one or more of these blood vessels to tear and bleed. A sudden tear might cause blood to build up very suddenly. With a small tear, the blood might build up more slowly. Blood might start to build up just below the dura mater. This causes something called a subdural hematoma. Tears in different blood vessels may cause blood to build up just above the dura layer, causing an epidural hematoma. A hematoma is when blood collects in an area and causes swelling. This buildup of blood is dangerous. As the blood builds, it pushes up against the skull and has nowhere to go. If the blood starts to compress the brain, it can lead to symptoms or even death if not treated. One of the most common reasons burr holes are needed is for a subdural hematoma. This is when blood slowly builds up under the dura layer after a mild head injury. The veins here are fragile and easy to break, especially in older adults. This can lead to symptoms like headache, changes in behavior, seizures, and one-sided muscle weakness. If the blood continues to build, it may cause coma and brain damage.

Keywords: Burr Hole, Craniostomy, Hematoma.

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1. Introduction

In general, there is a consensus that patients with symptoms that can be attributed to a radiologically confirmed CSDH should be treated surgically. Surgical treatment of symptomatic CSDH results in a rapid improvement of patient symptoms and a favorable outcome in over 80% of patients. Coupled with relatively low surgical risk, surgical evacuation is currently the mainstay of management for symptomatic patients [1].

Three primary surgical techniques are used:

i. bur-hole craniostomy (BHC), involving openings of 10 to 30 mm;
ii. twist-drill craniostomy (TDC), involving small openings (<10 mm) made using a twist drill; and
iii. Craniotomy, involving larger openings [2].

Within each of these three broad categories, a number of specific techniques have been described and are used by the individual surgeons. Usually, one or two techniques are used by a surgeon or the institution to treat most cases of presenting CSDHs. Although it is likely that certain techniques are more suitable for certain subtypes of the CSDHs, this has not been shown in the published literature, and the choice of the technique is probably determined by the institutional tradition more than any other factors [3].

2. Bur-Hole Craniostomy

BHC is by far the most common technique performed for CSDH unless there are multiple membranes or a significant acute component to the hematoma, in which case mini-craniotomy would be used [4]. BHC is usually performed under general anesthesia but may be performed under local anesthesia. The patient is placed supine on a horseshoe headrest and the head and shoulders are tilted to the contralateral side, ideally with the frontal bur hole being placed at the highest point of the head. This may be difficult to achieve in an elderly patient with a stiff neck, in which case operating table tilt may be useful. Two bur holes are placed over the maximum width of the hematoma, roughly 7 cm apart [5]. Usually, there is one frontal and one parietal bur hole, both of which are just superior to the superior temporal line; a common mistake is to place the bur holes too medially. The dura and outer membrane of the CSDH are incised, releasing hematoma fluid, which is classically described as engine-oil‖ colored but may resemble blood, serum, or cerebrospinal fluid.

The subdural collection cavity is then irrigated liberally with saline until the effluent runs clear; a soft, flexible catheter may be used to augment thorough irrigation in areas remote from the bur holes, although it does carry risks associated with blind insertion of the tubing into subdural space. First, the parietal wound is closed: the bur hole is plugged with a thick wafer of absorbable sponge (e.g., gelatin sponge) to aid hemostasis and improve the seal. Next, the scalp is closed in two layers, galeal and cutaneous. A soft silicone drain is then inserted into the subdural space via the frontal bur hole. The cavity and drainage tubing are filled with saline prior to closure to aid brain reexpansion through the combination of brain pulsation and the siphoning effect of the drain. It is therefore important that the drain tubing is at least 50 cm long and the drainage bag is positioned below the level of the patient's head. Air trapped in the subdural space and tube may dampen the efficacy of the drain, and hence brain reexpansion, and so may increase recurrence. The drain is removed after approximately 48 hours.

This is an arbitrary period, thought to be a good compromise between the time given to the brain to expand and the risk of infection related to the presence of the drain, and may be shortened if there is no drainage or lengthened if there is ongoing drainage. If a blood clot blocks the drain, it may be possible to dislodge it by wrapping the drain's soft tubing around a pen several times. There may be instances in which rapid brain reexpansion prevents safe insertion of the subdural drain; in these instances, a drain is not inserted [6]. The series reported by Markwalder and associates in 1981 brought BHC into prominence as a first-line alternative to craniotomy for the treatment of CSDH, and surveys in the United Kingdom, Canada, and the Netherlands suggest that this is the most popular technique currently in use. It seems to provide the best balance between maximal efficacy and minimal invasiveness. A randomized controlled trial confirmed that the use of a subdural drain in a closed drainage system for approximately 48 hours decreased recurrence from 24.3% to 9.3% ($p = 0.003$) and 6-month mortality from 18.1% to 9.6% ($p = 0.042$) [7]. However, uncertainties remain about a number of aspects of the technique:

- *A number of bur holes:* Although systematic reviews have found no difference in outcome between one and two bur holes,[7] we tend to create two bur holes under general anesthesia because this provides better exposure while being less invasive than a full craniotomy. One bur hole may be considered if the CSDH is more localized or the procedure is performed under local anesthesia, for example.
- *Use of intraoperative irrigation:* There is evidence suggesting that irrigating the hematoma cavity leads to better outcomes despite the potential risks associated with introducing air and infection. Although saline is currently used, there is preliminary evidence of reduced recurrence with both thrombin and tissue plasminogen activator as irrigation fluid. These clearly have opposite purposes, and further evidence is thus required [8].
- *Use of drains:* Although there is high-quality evidence that the use of subdural drains reduces recurrence, preliminary evidence suggests that subgaleal and sub periosteal drains may be equally effective [9-11] but further evaluation is required.

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