Posterior fossa decompression for Chiari malformation surgical technique

1. position: prone

2. equipment:

a) optional microscope

b) intra-op Doppler, if used (primarily in pediatrics)

3. consent:

a) procedure: surgery through the back of the neck to open the bone at the base of the skull and to insert a “patch” to make more room for the brainstem

b) alternatives: non-surgical management is usually not effective

c) complications: CSF leak, brainstem injury/stroke, apnea, failure to improve syrinx (if present)

General information

The most frequently performed operation is posterior fossa decompression of the cerebellar tonsils using a suboccipital craniectomy, with or without other procedures (usually combined with dural patch grafting and cervical laminectomy, which must be carried down to the bottom of the tonsillar tip, which usually includes C1, and sometimes C2 or C3). Options for grafts: same incision (pericranium), separate incision (e.g. fascia lata), and allograft (avoided by many authors because of dissatisfaction with ability to provide water-tight closure and because of infectious risks).

Goals of surgery: decompress the brainstem and reestablish normal flow of CSF at the craniocervical junction.

The patient is positioned prone on chest rolls with the head in a Mayfield head-holder or in a horseshoe headrest. Flex the neck to open the interspace between the occiput and posterior arch of C1. The shoulders is retracted inferiorly with adhesive tape. If a fascia lata graft is to be taken, elevate one thigh on a sandbag. A midline skin incision from inion to ≈ C2 spinous process is made. The removal of bone above the foramen magnum should be ≈ 3 cm high by ≈ 3 cm wide (keep the posterior fossa part of these operations small, the main thrust is to open the foramen magnum to decompress the tonsils and an upper cervical laminectomy; the compression is not in the posterior fossa). Excessive removal of occipital bone may allow the cerebellar hemispheres to herniate through the opening (“cerebellar ptosis”), and create additional problems. If a pericranial graft is to be taken, it should be harvested at this time to reduce the amount of blood entering the subsequent dural opening [1].

The pericranial graft can be procured without extending the incision about the inion using the technique of Dr. Robert Ojemann [2]. with subgaleal dissection and using a monopolar cautery with a

bent tip to incise the periosteum and then a Penfield Dissector #1 to free it from the bone surface.

Open the dura in a “Y” shaped incision, and excise the triangular top flap. CAUTION: the transverse sinuses are usually abnormally low in Chiari malformations. Suture the patch graft to provide more room for the contents (tonsils+medulla).

An option that is sometimes used in pediatrics is to not initially open the dura but to lyse constricting bands over the dura at the foramen magnum and then and use intraoperative ultrasound to determine if there is adequate room for CSF flow, the dura is then opened only if there is not.

Historical procedures that have been appended to the above: plugging the obex (with muscle or teflon), drainage of syrinx if present (fenestration, usually through dorsal root entry zone, with or without stent or shunt), 4th ventricular shunting, terminal ventriculostomy, and opening foramen of Magendie if obstructed.

Current recommendations are that these or other additional procedures beyond dural patch grafting are usually not warranted.

Some authors repeatedly admonish not to attempt to remove adhesions binding the tonsils together (to avoid injuring vital structures, including PICAs). Others recommend cautiously separating the tonsils and even shrinking them down with bipolar cautery.

In cases with ventral brainstem compression, some authors advocate performing a transoral clivus-odontoid resection as they feel these patients may potentially deteriorate with posterior fossa decompression alone [3]. Since this deterioration was reversible with odontoidectomy, it may be reasonable to perform this procedure on patients who show signs of deterioration or progression of basilar impression on serial MRIs after posterior fossa decompression.

[1] , [2]
Stevens EA, Powers AK, Sweasey TA, Tatter SB, Ojemann RG. Simplified harvest of autologous pericranium for duraplasty in Chiari malformation Type I. Technical note. J Neurosurg Spine. 2009; 11:80–83

[3]
Dyste GN, Menezes AH, VanGilder JC. Symptomatic Chiari Malformations: An Analysis of Presentation, Management, and Long-Term Outcome. J Neurosurg. 1989; 71:159–168