

5.9. SITTING POSITION – APPROACH TO THE FOURTH VENTRICLE AND FORAMEN MAGNUM REGION

The other most common use for sitting position in Helsinki is to approach the posterior fossa lesions in the midline, usually located at the level of vermis, fourth ventricle and down to the foramen magnum. All the same rules for sitting position and risks apply as for the supracerebellar infratentorial approach (see section 5.8.). The anesthesiologic principles of the sitting position were reviewed in section 3.7.3. Compared to the supracerebellar infratentorial approach the greatest differences are: (a) no rotation of the head; (b) incision is exactly on the midline; (c) the incision starts lower and extends more caudally; (d) the transverse sinuses are not exposed, the craniotomy is placed below their level; and (e) the craniotomy extends to both sides of the midline.

5.9.1. Indications

This approach provides excellent visualization of all the midline structures of the posterior fossa. It allows access to the posterior aspect of the medulla oblongata and the brainstem through the fourth ventricle. With this approach it is possible to enter into the fourth ventricle from the caudal direction in between the cerebellar tonsils without dividing the vermis, and with sufficient forward tilt of the operating table, even the aqueduct can be visualized. Also, both distal PICAs can be accessed. We usually use this low posterior fossa midline approach to access midline tumors of the fourth ventricle, vermis and the cisterna magna region, such as medulloblastomas, pilocytic astrocytomas, ependymomas, or vascular lesions such as midline cavernomas of the fourth ventricle and posterior brainstem and distal PICA aneurysms. For lateral lesions in the posterior fossa we prefer the lateral park bench position. The advan-

tages of the sitting position compared to prone position are mainly related to a more advantageous viewing angle into the fourth ventricle, as the approach is oriented from a more caudal direction, and the possibility of adjusting the view by rotating the table forward even further. To obtain the same kind of approach angle in prone position requires placing the head well below the heart level, which worsens the venous outflow and increases bleeding.

5.9.2. Positioning

The positioning is almost identical to that of the supracerebellar infratentorial approach (see section 5.8.2.) (Figure 5-8a). As with the supracerebellar infratentorial approach, our sitting position is more like a forward somersault position with the head bent downwards. The only difference for the low midline approach is that the head is not rotated. The neck is only flexed forward leaving at least two fingers between the chin and the sternum. Again, there is no lateral tilt. All the steps of positioning are carried out in the same way as already described above (see section 5.8.2.).

5.9.3. Skin incision and craniotomy

The skin incision is placed exactly on the midline (Figure 5-8b). It starts just below the level of the external occipital protuberance and extends caudally all the way down to the C1–C2 level. Unless the incision is extended caudally enough, it will not be possible later to insert the craniotome in an appropriate angle to reach all the way down to the foramen magnum. It is important to remember that the posterior fossa drops steeply towards the foramen magnum,

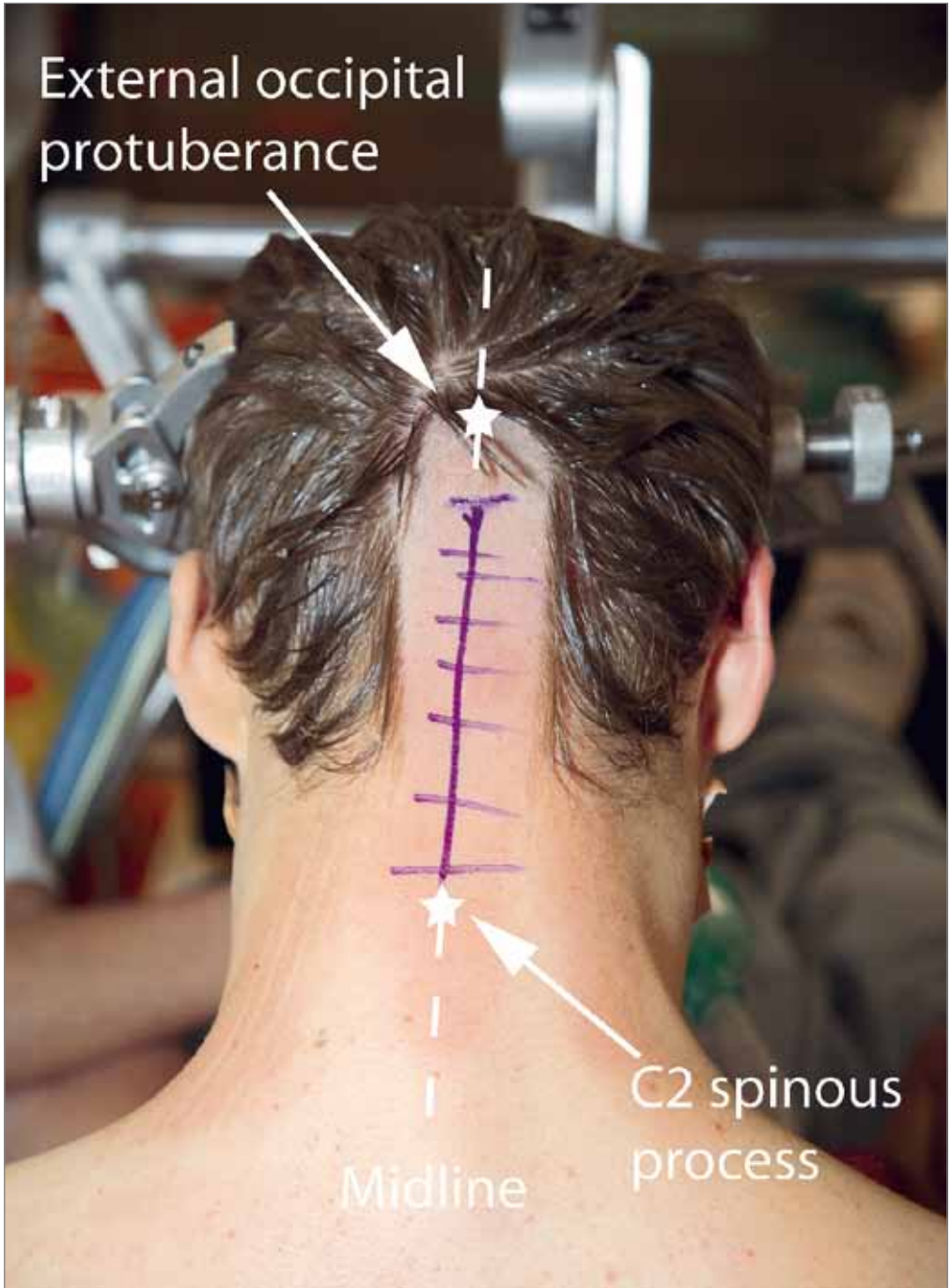


Figure 5-8 (b). Midline approach to fourth ventricle. See text for details.

which is almost horizontal. The muscles are split with diathermia all the way to the occipital bone (Figure 5-8c). One large curved retractor is placed from cranial and the other from caudal direction. The muscle insertions are cut and the occipital bone is exposed. Finger palpation is used to identify the level of the foramen magnum as well as the spinous process of the C1, which is partially exposed with blunt dissection using cottonoid balls. When releasing the muscles and exposing the bone close to the foramen magnum, care is needed not to accidentally cut into the vertebral artery. Up to 1–2 cm from the midline is safe. The other problem may be the large venous epidural sinuses at the foramen magnum. If the posterior atlanto-occipital ligament is cut accidentally, these veins may start to bleed heavily.

At this point the occipital bone should be exposed all the way down to the foramen magnum. One burr hole is placed about 1 cm paramedian to the midline, well below the level of the transverse sinus (Figure 5-8d). In older patients with densely attached dura another burr hole can be placed on the opposite side of the midline. The dura is carefully detached from the underlying bone first with a curved dissector and then with a flexible dissector. The dura should be released all the way towards the foramen magnum. A critical region to release the dura from is next to the burr hole towards and over the midline overlying the occipital sinus and the falx cerebelli. Two cuts are made with the craniotome (Figure 5-8e). The first one curving slightly lateral and down to the foramen magnum. The other cut starts first over the midline to the opposite side and then curves laterally and caudally to the foramen magnum. These two cuts are not joined and 10–20 mm of bone is left between them at the foramen magnum. The bone flap, held from its cranial edge with a large rongeur, is everted

downwards and cracked. The bone is thicker around the foramen magnum and it might be necessary to thin it further down along the craniotome cut before the bone flap can be lifted (Figure 5-8e). There are also dense attachments to the atlanto-occipital ligament, which often need to be cut with scissors. Damage to the epidural venous plexus is most likely to happen during this step, so extra caution is needed. With the bone removed we should be able to distinguish medial aspects of both cerebellar tonsils as well as the medulla oblongata, and the occipital sinus all covered with dura.

A high-speed diamond drill or a small rongeur is used if needed to remove bone in the lateral direction on both sides to expose the foramen magnum a little more. Few drill holes are prepared to be used with tack-up sutures during closure. We do not routinely remove the spinous process or the lamina of C1 vertebra. In our experience, the total removal of C1 arch does not provide any additional benefit regarding the exposure of the lower posterior fossa, but carries significant morbidity. It is performed only when truly necessary in lesions that extend well below the level of C1.

The dura is opened under the operating microscope in X-like fashion. The first reversed V-shaped dural leaf is cut from the midline below the occipital sinus, everted caudally and attached tightly to the muscles with a suture to prevent venous bleeding. Then two additional cuts are made in cranio-lateral direction on both sides over the cerebellar tonsils avoiding the occipital sinus in the midline. All the dural leaves are lifted up with sutures placed over the craniotomy dressings. Recently, we have often been satisfied with a single reversed V-shaped dural opening with the base towards the foramen magnum (Figure 5-8f). Arachnoid membrane of the cisterna magna is often still intact

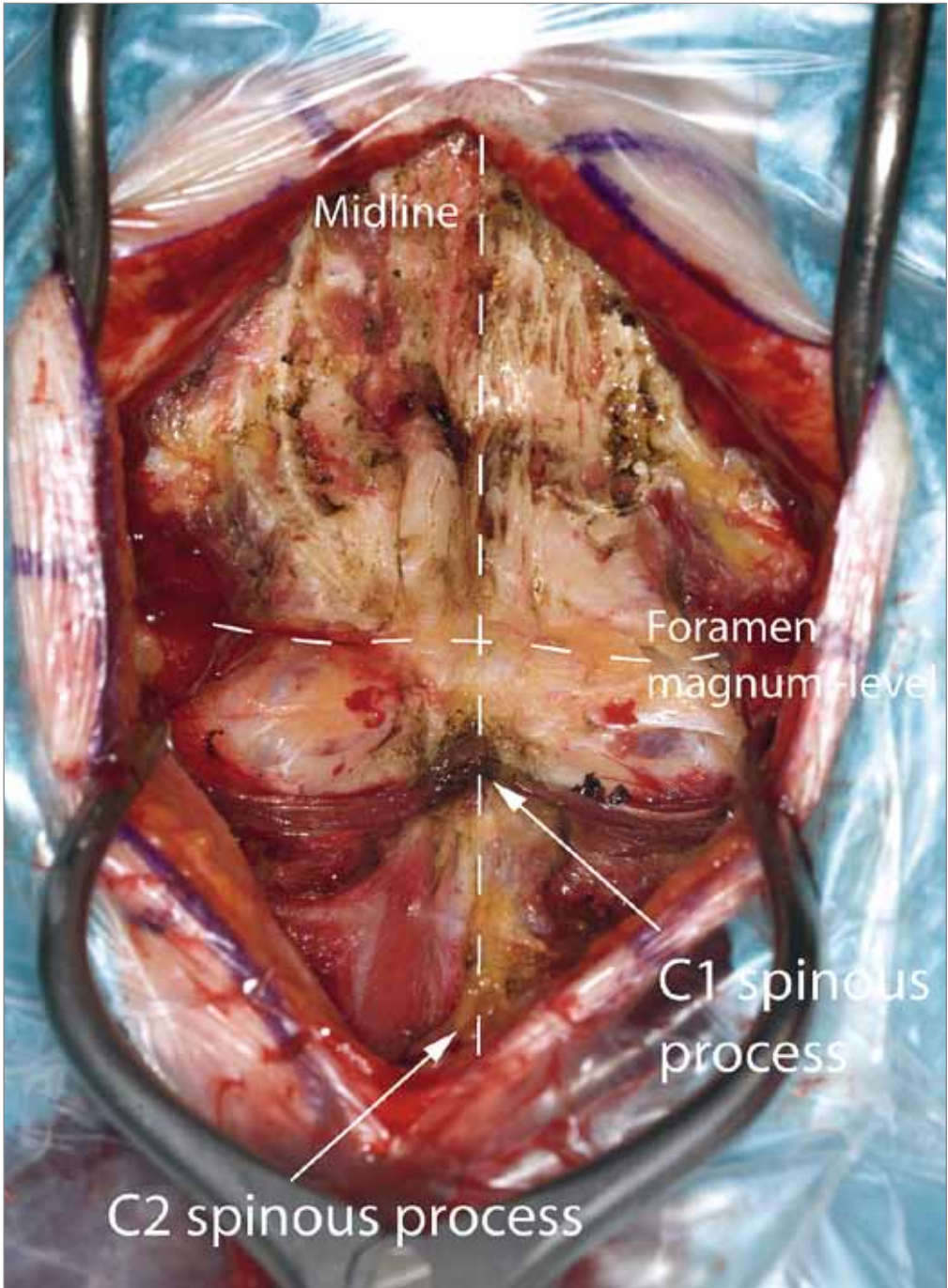


Figure 5-8 (c). Midline approach to fourth ventricle. See text for details.

at this point (Figure 5-8g). With the dura open, also the arachnoid membrane is opened as a flap with the base caudally and it is attached to the caudal dural leaf with a hemoclip(s) (Figure 5-8h). This is to prevent the arachnoid membrane from flapping inside the operation field during the whole procedure. Then, under high magnification of the microscope, the cerebellar tonsils are gently pushed apart and the caudal portion of the fourth ventricle can be entered. By tilting the table forward, good visualization of the upper parts of the fourth ventricle and even the aqueduct can be obtained.

T&T:

- *Neurosurgeon fixes the head clamp and is in charge of the positioning all the way*
- *The position should allow the neurosurgeon to rest his or her arms on patient's shoulders*
- *Neck is flexed forward, no rotation or lateral tilt*
- *Usually one burr hole is enough, dura carefully detached*
- *There are large venous plexus at the level of foramen magnum*
- *All the bleeding must be stopped even more carefully than in other positions*
- *Dura is better opened under the microscope*
- *Perfect hemostasis throughout the procedure, no oozing is allowed*
- *Tilting the table forward allows visualization of the cranial portion of the IV ventricle*

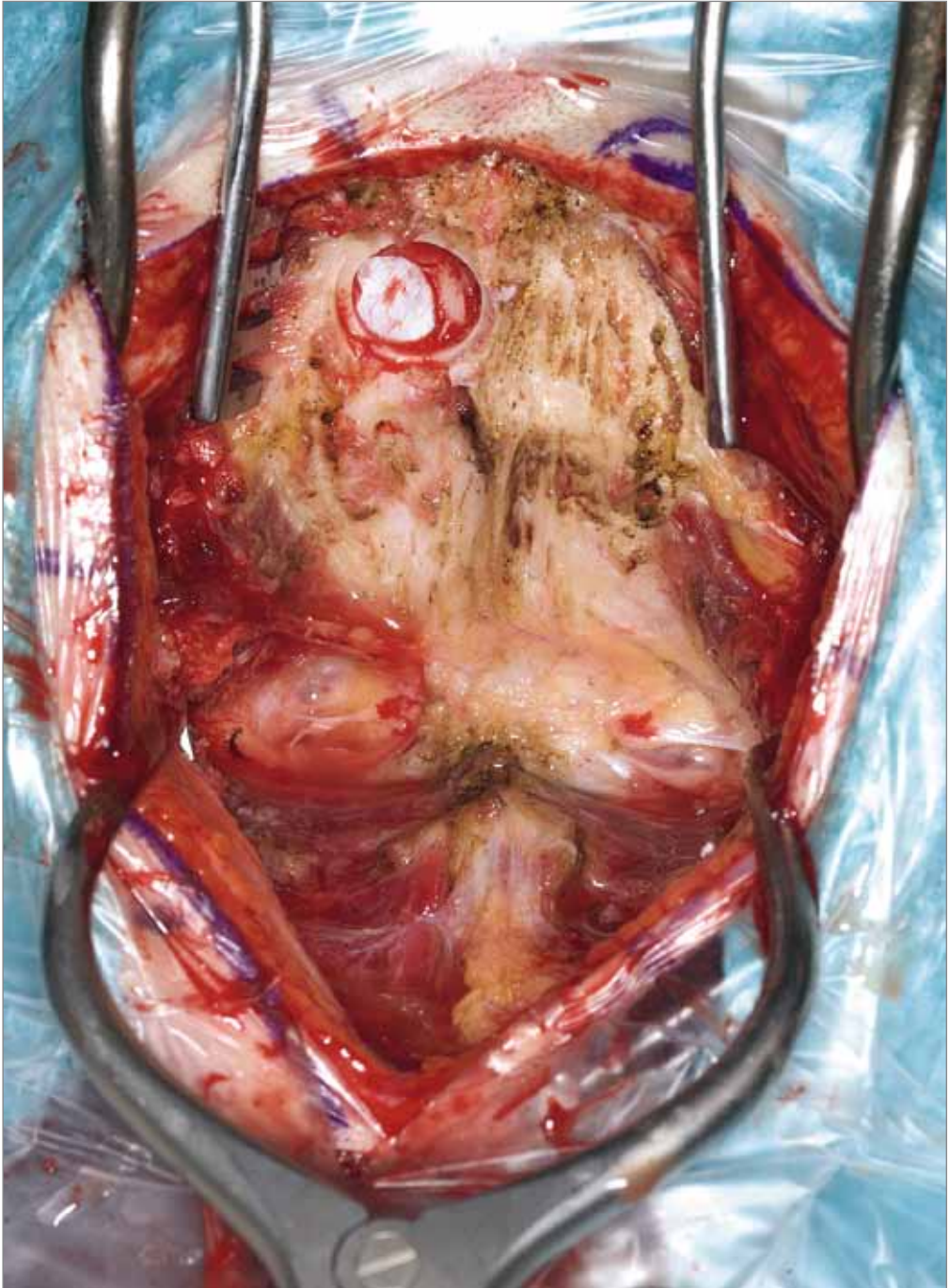


Figure 5-8 (d). Midline approach to fourth ventricle. See text for details.

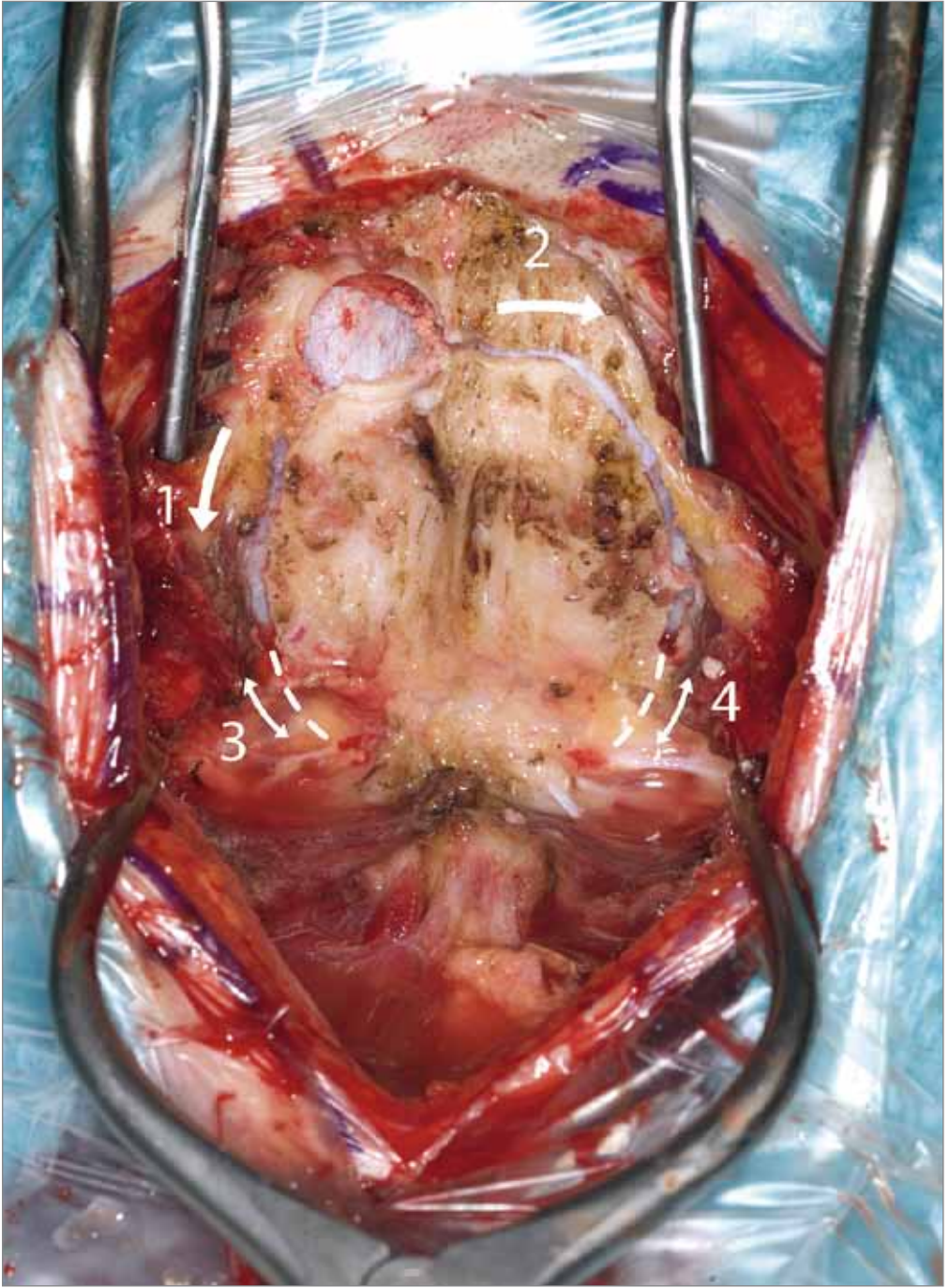


Figure 5-8 (e). Midline approach to fourth ventricle. See text for details.

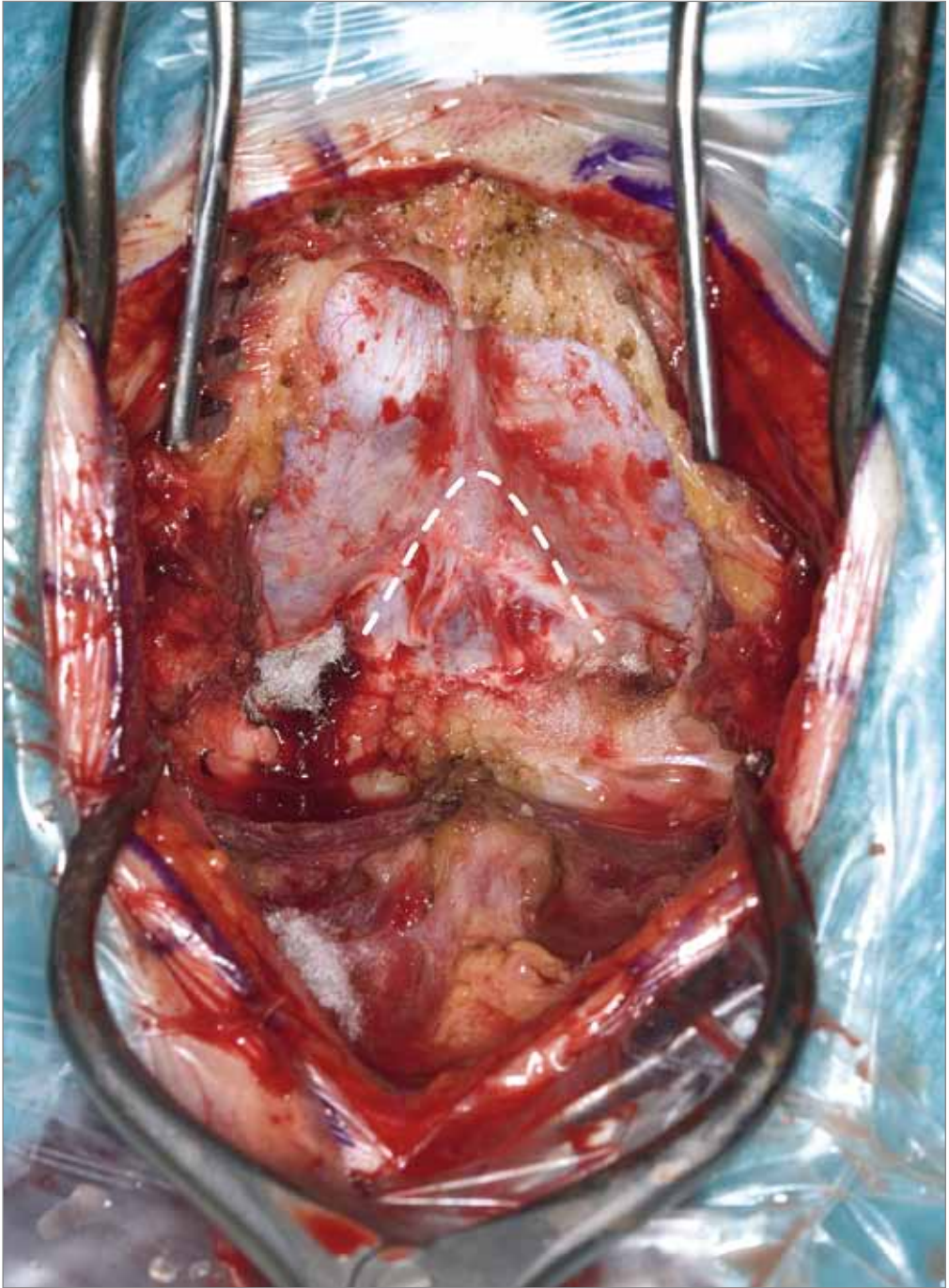


Figure 5-8 (f). Midline approach to fourth ventricle. See text for details.

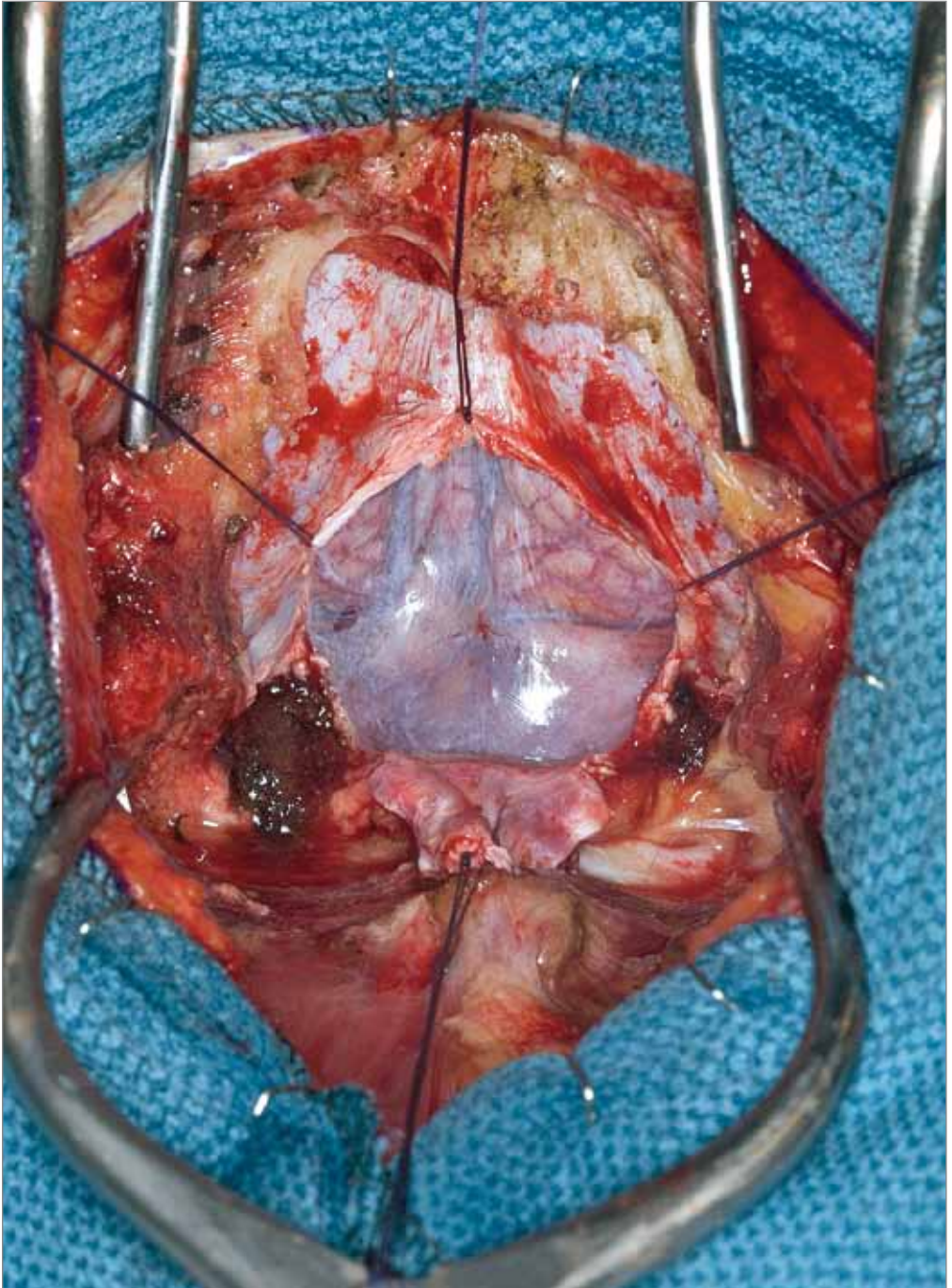


Figure 5-8 (g). Midline approach to fourth ventricle. See text for details.

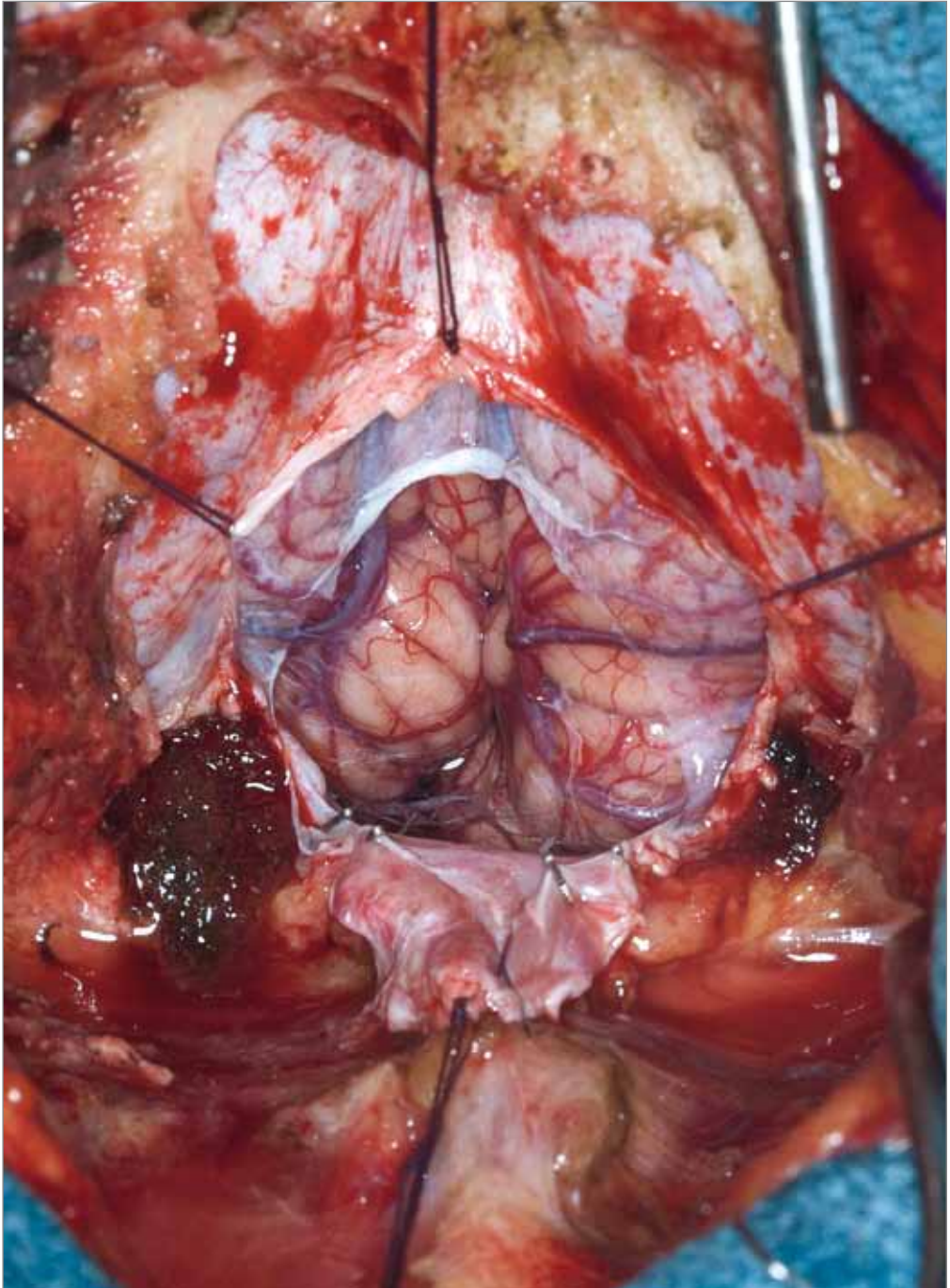


Figure 5-8 (h). Midline approach to fourth ventricle. See text for details.