5. COMMON APPROACHES

Each of the described approaches is also demonstrated on supplementary videos, please see Appendix 2.

5.1. LATERAL SUPRAORBITAL APPROACH

The most common craniotomy approach used in Helsinki by Prof. Hernesniemi is certainly the lateral supraorbital (LSO) craniotomy. The LSO has been used in more than 4,000 operations to access vascular pathologies of the anterior circle of Willis as well as extrinsic and intrinsic tumors of the anterior fossa and basal regions of the frontal lobes. The LSO approach is a more subfrontal, less invasive, simpler and faster modification of the classical pterional approach by Yaşargil. The LSO utilizes smaller incision, it dispenses with the laborious subfacial dissection and involves taking a smaller free bone flap which has less temporal extension than the pterional bone flap.

In the LSO approach the skin-muscle flap is opened as a one layer block and only the anterior portion of the temporal muscle is split open. The partial split of the temporalis muscle has ensured very little risk of problems with the temporomandibular joint, mastication and mouth opening, and late disfiguring muscle atrophy. The facial branch to the frontalis muscle is not damaged as it is not exposed, dissected or cut during the craniotomy. Due to relatively short skin incision and a small bone flap the closure is also simpler. The Finnish people have generally thin and light eyebrows. This precludes the possibility of using an eye-brow incision.

5.1.1. Indications

The LSO approach can be used to access all aneurysms of the anterior circulation, except those of the distal anterior cerebral artery. The LSO approach can be used also for high positioned basilar bifurcation or even basilar-SCA aneurysms. In addition to aneurysms, LSO approach can be used for most pathologies involving the sellar and suprasellar region, and tumors of the anterior cranial fossa and sphenoid ridge. The LSO approach is our preferred route to enter the Sylvian fissure and the pathologies that can be accessed through there. It gives excellent access to the anterior portion of the Sylvian fissure and by extending the craniotomy more in the posterior and temporal direction also the distal part of the Sylvian fissure can be visualized. By adjusting the exact location of the LSO craniotomy, one can achieve either a more frontal or a more temporal exposure. This combined with well-planned head positioning provides usually an excellent accesses to nearly all of the above mentioned pathologies with ease.

5.1.2. Positioning

The patient is positioned supine with shoulders and head elevated above the cardiac level. The head, fixed with 3 or 4 pins to the head frame is: (a) elevated clearly above the cardiac level; (b) rotated 15 to 30 degrees toward the opposite side; (c) tilted somewhat laterally; and (d) extended or minimally flexed (Figure 5-1a,b). We prefer to use a Sugita head frame with 4-point fixation. Besides providing good retraction force by its spring hooks, it allows the surgeon to rotate the head during microsurgery. If this feature is not available, the table can be rotated as needed. The head orientation is to allow for a comfortable working angle, downward and somewhat forward. Nevertheless, the position of the head and body is subject to frequent changes as necessary during the whole operation. The exact positioning of the head depends on the pathology being approached and is adjusted on case-by-case basis. One has to imagine the exact location and orientation of the lesion in 3D space to plan the optimal head position. In general, the head is rotated less to the opposite side than in standard pterional approach. If the head is rotated too much, the temporal lobe obstructs easy access into the Sylvian fissure. The extension of the head depends on the cranio-caudal distance of the pathology from the base of the anterior cranial fossa. The higher the lesion is, the more the head needs to be extended. The upper limit of the access is 15 mm from the anterior skull base in the chiasmatic region. On the other hand, for lesions near the skull base little flexion might be needed. Lateral tilt is used to orientate the proximal part of the Sylvian fissure almost vertical, which helps in exposing the proximal middle cerebral artery and the internal carotid artery.

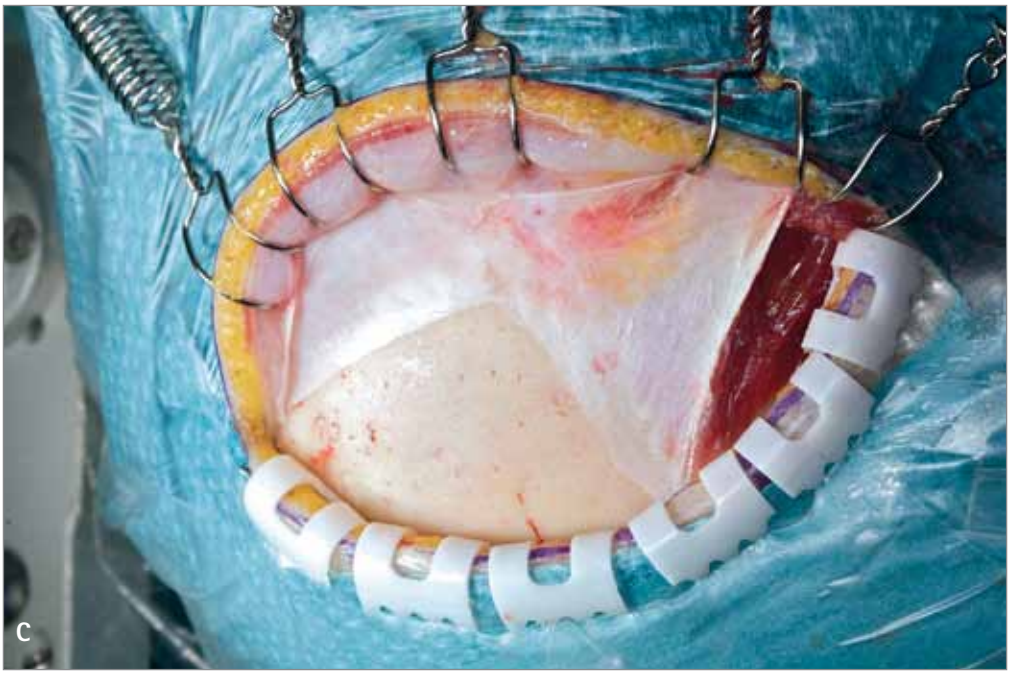
Figure 5-1 (a). Lateral supraorbital approach. See text for details

5.1.3. Incision and craniotomy

The shaved area is minimal. An oblique frontotemporal skin incision is made behind the hairline (Figure 5-1a,b). The incision stops 2 to 3 cm above the zygoma and is partially opened by frontal spring hooks. Raney clips are placed on the posterior margin of the incision (Figure 5-1c). The temporal muscle is split vertically by a short incision, and one spring hook is placed in the incision to retract the muscle towards the zygomatic arch. The one-layer skin-muscle flap is retracted frontally by spring hooks until the superior orbital rim and the anterior zygomatic arch are exposed (arrow; Figure 5-1d). The extent of the craniotomy depends on the surgeon's experience and preferences. Usually a small LSO craniotomy is enough (the keyhole principle).

A single burr hole is placed just under the temporal line in the bone, the superior insertion of the temporal muscle (Figure 5-1e). The dura is detached from the bone with a curved dissector "Jone" (Figure 4-11a - page 92). Each side of the instrument has a stout, curved, blunt end that makes it an ideal instrument for this function. The bone flap of 5 x 3 cm is detached mostly by the side-cutting drill. First a curved cut is made from the burr hole towards the region of the zygomatic process of the frontal bone. Then an almost straight second cut is made from the burr hole towards the temporal bone. The sphenoid ridge is left in between these two cuts (Figure 5-1f). Finally, the two cuts are joined by thinning the bone along a straight line with the craniotome blade without the footplate. The bone is then cracked along this line by using a stout dissector and leverage from the burr hole region and the bone flap is lifted (Figure 5-1g). Before cracking the bone, a few drill holes are made

Figure 5-1 (b). Lateral supraorbital approach. See text fordetails



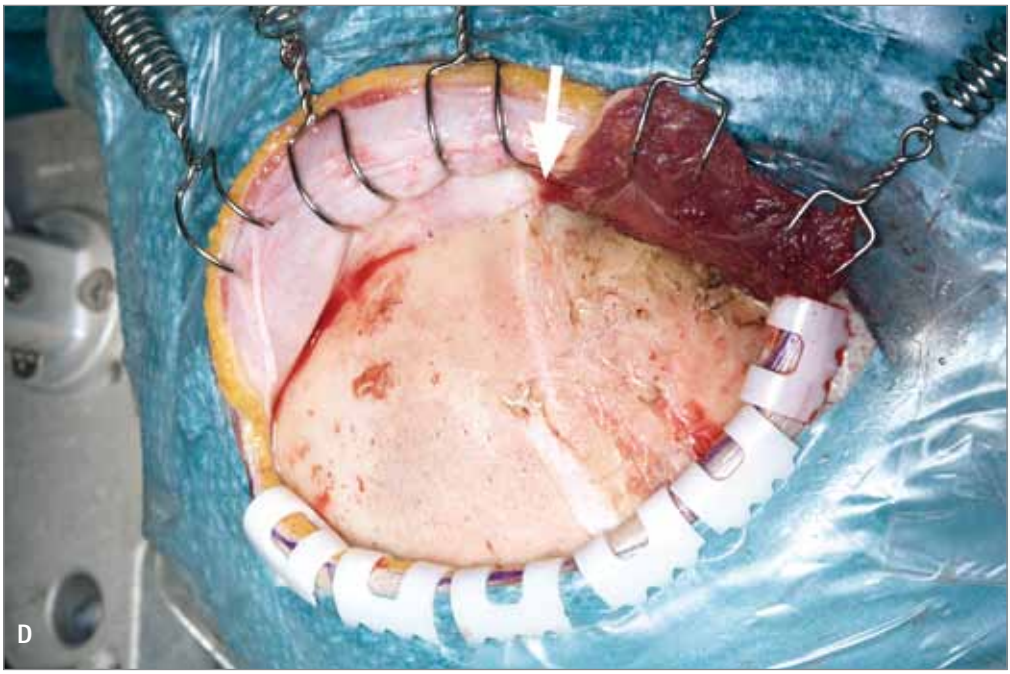


Figure 5-1 (c - d). Lateral supraorbital approach. See text for details

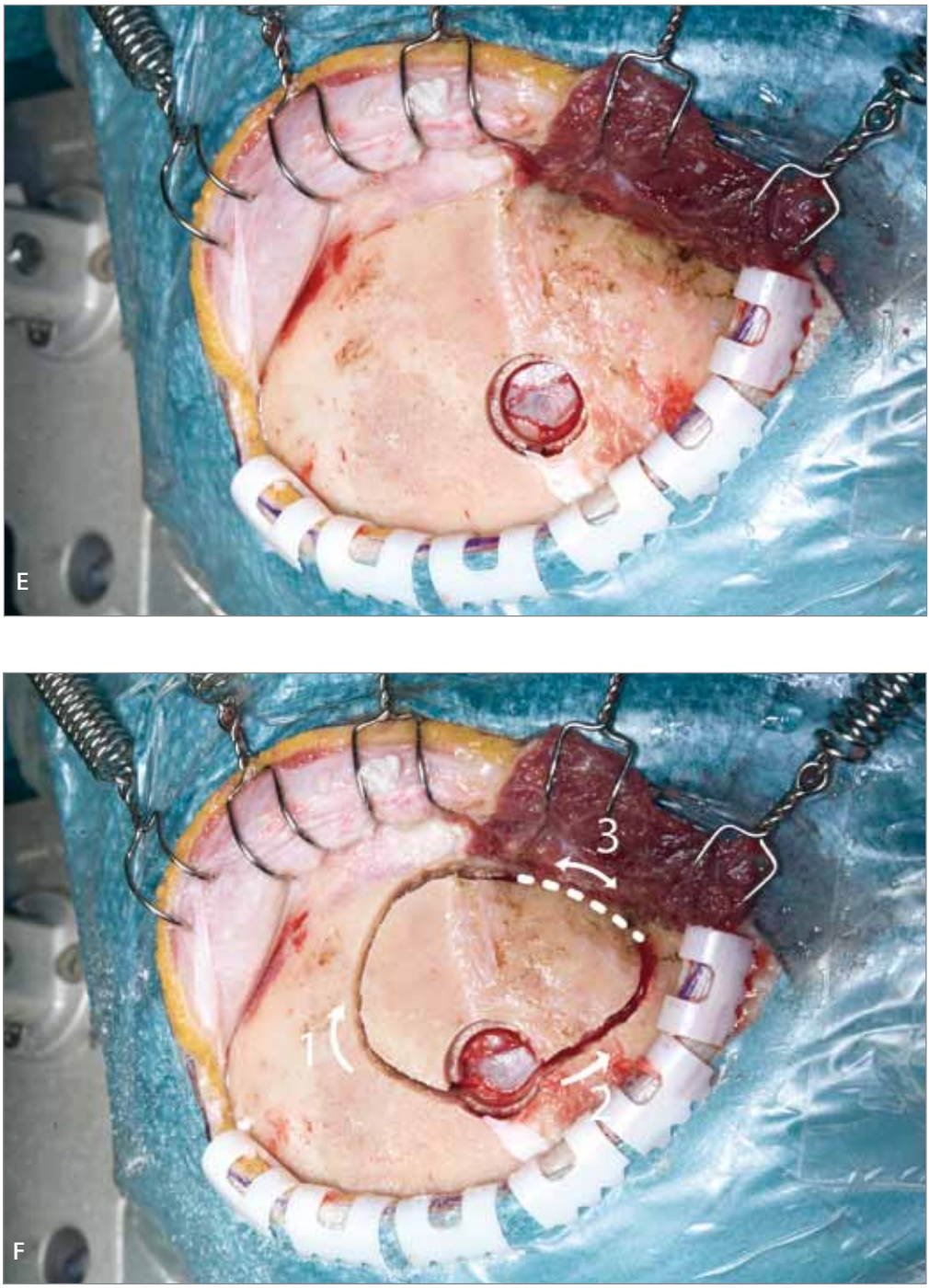
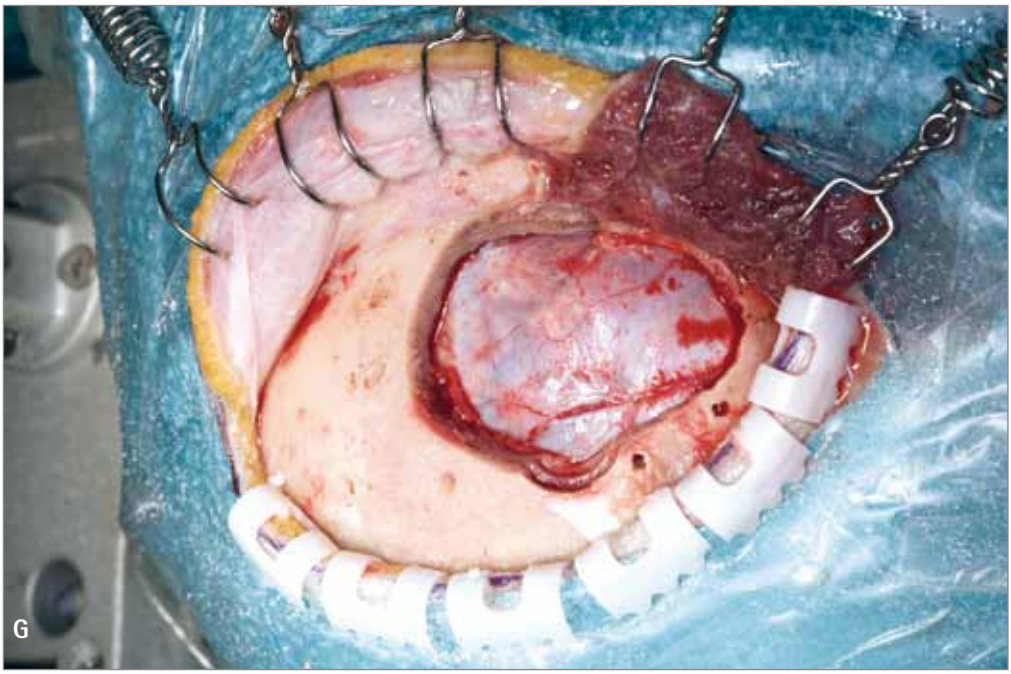


Figure 5-1 (e - f). Lateral supraorbital approach. See text for details



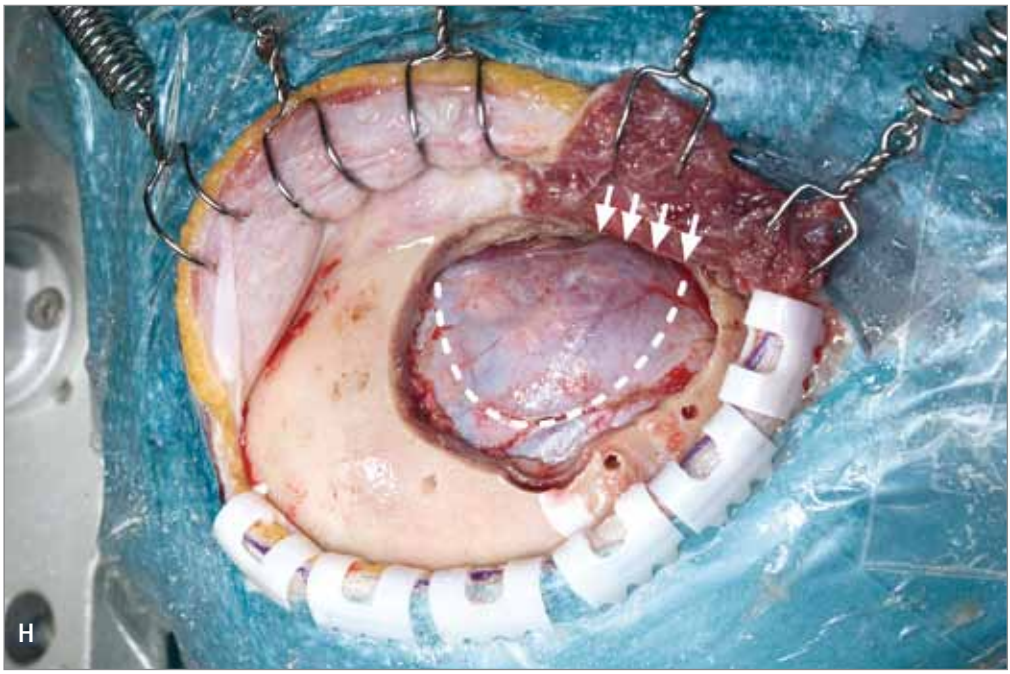
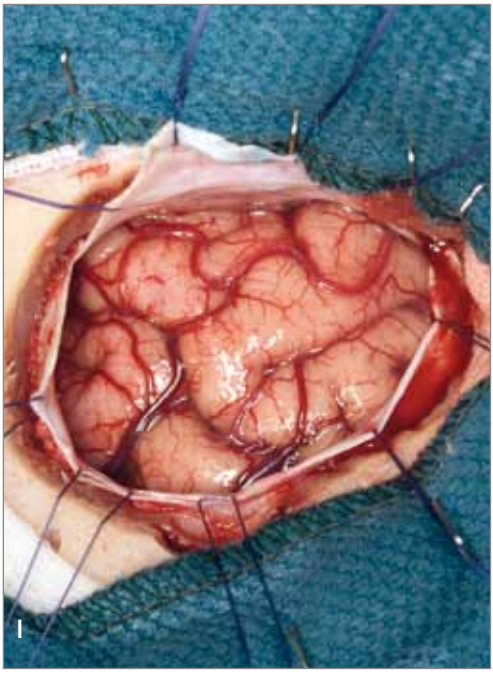


Figure 5-1 (g - h). Lateral supraorbital approach. See text for details

for tack-up sutures. The lateral sphenoid ridge is then drilled off allowing access to the skull base (arrows; Figure 5-1h). The drilling starts with a high-speed drill and continues with a diamond drill. Oozing of blood from the bone is finally controlled by "hot drilling", i.e. using a diamond tipped drill without irrigation heating the bone and sealing the bleedings. The wound is irrigated, and hemostasis is achieved using bipolar, Surgicel and cottonoids.

The dura is opened using a curvilinear incision pointing anterolaterally (dotted line; Figure 5-1h), the dural edges are elevated by multiple stitches, extended over craniotomy dressings (Figure 5-1i). This prevents oozing from the epidural space. From this point on, all surgery is performed under the operating microscope, including the skin closure.

The first goal during intradural dissection is usually to reach basal cisterns for CSF release and brain relaxation. The dissection starts along the frontobasal surface of the frontal lobe slightly medially from the proximal Sylvian fissure. The first aim is to reach the optic nerve and its entrance into the optic canal. The arachnoid membranes limiting the optic cistern are opened and CSF is released. For further CSF release also the carotid cistern on the lateral side of the optic nerve is entered. With the brain relaxed the dissection continues according to the pathology. In situations with very tight brain and little CSF in the basal cisterns, as e.g. in acute SAH, we try to remove more CSF by opening the lamina terminalis. To reach the lamina terminalis, we continue with the dissection subfrontally, along the ipsilateral optic nerve towards the optic chiasm. This dissection step is often complicated by lack of space and requires high magnification. The frontal lobe can be gently retracted by tandem work of bipolar forceps and suction to reach the grayish membrane of the lamina terminalis just posterior to the optic chiasm. The translucent membrane is punctured with sharp bipolar forceps or closed microscissors and further CSF is released directly from the third ventricle. The dissection then continues as planned.



T&T:

- *Accurate head positioning, imagine in 3D how the lesion is situated inside the head*
- *Short incision centered on the orbitocranial joint*
- *One layer skin-muscle flap, one hook retracts incised muscle downward*
- *One burr hole at the temporal line*
- *Bone removed basally to minimize retraction, diamond drill stops bleeding from bone*
- *Brain is relaxed by releasing CSF from basal cisterns and further through lamina terminalis*

Figure 5-1 (i). Lateral supraorbital approach. See text for details