Middle frontal gyrus approach

J.Sales-Llopis

Neurosurgery Department, University General Hospital of Alicante, Foundation for the Promotion of Health and Biomedical Research in the Valencian Region (FISABIO), Alicante, Spain

The operative approaches to the third ventricle are divided on the basis of whether they are suitable for reaching the anterior or posterior part of the 3rd ventricle. The approaches suitable for lesions within or compressing the anterior portion of the 3rd ventricle are the transsphenoidal approach, subfrontal approach, frontotemporal approach, subtemporal approach, anterior transcallosal approach, and anterior transventricular. The approaches suitable for reaching the posterior portion of the 3rd ventricle are the posterior transcallosal, posterior transventricular, occipital transtentorial approach, and infratentorial supracerebellar approach [1].

The transcortical middle frontal gyrus approach is an excellent route for the excision of tumors in the ipsilateral frontal horn of the lateral ventricle (LV), the anterior body of the lateral ventricle, and the anterior or superior third ventricle.

This is the approach most frequently used to excise tumors of the frontal horn. That most neurosurgeons are comfortable with passing a ventricular catheter into the frontal horn of the lateral ventricle probably accounts for the relative ease of this approach; it is simply an extension of that common neurosurgical maneuver. Tumors that extend inferiorly from the lateral ventricle into the third ventricle and require subchoroidal exposure for removal are better visualized when using a transcortical than a transcallosal approach [2].

The middle frontal gyrus is usually found 3.5 cm from the midline and 1 cm in front of the coronal suture. Its location can be confirmed with aid of image guidance. Image guidance can be helpful at this point for planning frontal transcortical access to the anterior third ventricle (foraminal entry).

A right-sided approach (nondominant hemisphere) is preferred unless the tumor’s position in the lateral ventricle dictates otherwise. A rectangular flap of approximately 6 x 4 cm, starting 2 cm behind the coronal suture and centered on the middle of the middle frontal gyrus, is made. Its medial limit is about 1 cm off the midline. Image guidance helps in planning the craniotomy

In the middle frontal gyrus approach, a 4 cm incision is made paralell to the axis of the middle frontal gyrus above and anterior to Broca's area, and anterior to the motor strip [3]. ; about the same point as used for frontal ventriculostomy. see Kocher's point.

In cases of small ventricles or large tumors, a longer cortical incision prevents brain injury.

The approach is directed from the middle frontal gyrus toward the contralateral inner canthus in a plane extending from the coronal suture to the external auditory meatus. The dissection is done with blunt instruments. The lateral ventricle is usually entered near the foramen of Monro (FM).

A study compared the damage of main neural bundles between virtualtrans-F1 and trans-F2 corridors by means of diffusion tensor imaging tractography method (DTT) in 11 magnetic resonance imaging (MRI) exams from clinical series (22 hemispheres, regardless of dominance). Corpus callosum, cingulum, subdivisions I and II of superior longitudinal fasciculus (SLF I and SLF II), corticoreticular as well as pyramidal tracts crossing both approaches were subjected to surgical violation. Both approaches served a similar total number of fibres (0.94 to 1.78 [× 103]).Trans-F1 route caused significantly greater damage of total white matter volume(F1: 8.26 vs. F2: 7.16 mL), percentage of SLF I fibres (F1: 78.6% vs. F2: 28.6%)and cingulum (F1: 49.4% vs. F2: 10.6%), whereas trans-F2 route interrupted morecorticoreticular fibres (F1: 4.5% vs. F2: 30.7%). Pyramidal tract (F1: 0.6% vs. F2:1.3%) and SLF II (F1: 15.9% vs. F2: 26.2%) were marginally more vulnerable incase of the access via middle frontal gyrus. Both approaches destroyed 7% of callosal fibres. Summarising the above DTT findings, trans-F2 route disrupted a greater number of fibres from eloquent neural bundles (SLF II, pyramidal and corticoreticular tracts), therefore is regarded as inferior to trans-F1 one. Due to lack of up-to-date guidelines with recommendations of the approaches to LV or FM, an individual preoperative planning based on DTT should precede a surgery [4].

[1] [3]
Rhoton AL Jr, Yamamoto I, Peace DA. Microsurgery of the third ventricle: Part 2. Operative approaches. Neurosurgery. 1981 Mar;8(3):357-73. PubMed PMID: 7242884.

[2]
Rhoton AL Jr, Fujii K, Fradd B: Microsurgical anatomy of the anterior choroidal artery. Surg Neurol 12:171-187, 1979

[4]
Szmuda T, Słoniewski P, Szmuda M, Waszak PM, Starzyńska A. Quantification of white matter fibre pathways disruption in frontal transcortical approach to the lateral ventricle or the interventricular foramen in diffusion tensor tractography. Folia Morphol (Warsz). 2014 May;73(2):129-38. doi: 10.5603/FM.2013.0063. PubMed PMID: 24902089.