

# SURGICAL APPROACHES OF PITUITARY ADENOMAS

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**Abstract:** This paper tries to systematize the surgical indications for pituitary adenomas surgery. We have reviewed the surgical approaches in order to ensure the optimal way of resection and the reduction of the intra-surgical accidents and the post-surgical complications at minimum. Each surgical approach is dictated by localization, size, suprasellar extension or by the invasion of the neighbouring neural elements. According to these anatomical data, there is a very well established surgical approach, which is also decided by the practical experience of the operating surgeon.

**Keywords:** pituitary adenomas, surgical approaches

**Rezumat:** Acest articol încearcă să sistematizeze indicațiile chirurgicale în terapia tumorilor hipofizare. Se face o trecere în revista a posibilităților de abord chirurgical care să asigure calea optimă pentru rezecția completă a acestora și reducerea la maxim a incidentelor și accidentelor intraoperatorii și complicațiilor postoperatorii. Fiecare cale de abord chirurgical are indicații legate de localizare, dimensiuni, extensie supraselară sau invazia elementelor nervoase de vecinătate. În funcție de aceste date anatomice există o cuantificare bine stabilită a căii de abord chirurgical, care este hotărâta și de experiență practică a celui care operează.

**Cuvinte cheie:** tumori hipofizare, cale de abord

## Pre-surgical preparation

Irrespective of the chosen surgical approach, the intervention will be preceded by a preanaesthetic consultation, a certain obligation, which is indispensable for the old patients or for those suffering from pituitary insufficiency, as well as for the people with acromegaly, where the difficulties of incubation are predictable, usually requiring the orthotracheal intubation under fibroscopy. It is also preceded by drug treatment, which makes the object of a consensus between the medico-surgical team and the anaesthetist.

- for the pituitary adenomas, except for the Cushing disease or the Nelson syndrome, it consists of:
  - 50mg. of hydrocortisone hemi-succinate associated to pre-medication, then 25 mg. i.m. or i.v. every 6 hours;

18 hours after pre-medication – prednisone 20 mg;

- 24-hour antibiotherapy: lincocin 10mg/kg. (maximum dose in adults - 600 mg), gentamicin: 1 mg/kg. These two antibiotics will be administered in association with premedication; then, twice every 8 hours, for the pituitary adenomas within the Cushing disease or the Nelson syndrome;
- enoxaparin 20 mg. s.c. 2 hours before the intervention, regarding the patients above 20 years old.
- substitutive treatment: in Cushing disease with evolutive hypercorticism - 50 mg. hydrocortisone hemi-succinate i.m., then 25 mg. every 6 hours; if the Cushing disease was under treatment - 75 mg every 6 hours i.v. plus the supervision of the blood pressure; syncortyl 5 up to 10 mg i.m. every 12 hours if necessary; the same 24-hour antibiotic protocol.

## Surgical approaches

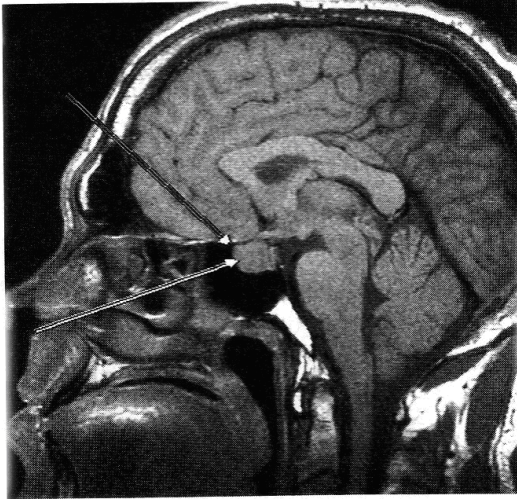
The two most used surgical approaches in the surgery of pituitary fossa are: the intracranial (subfrontal and pterional) approach and the transsphenoidal rhinoseptal approach. (1,2,3.) The latter approach is by far the most used in the surgery of pituitary adenomas. The cranial surgical approach (4) is reserved for the tumoral expansions, cases in which the rhinoseptal approach is not allowed, or in the absence of an efficient antitumoral treatment. In return, regarding the craniopharyngiomas surgery, the cranial approach is the most indicated. (5)

### Transsphenoidal rhinoseptal approach (2,3)

It is perfectly encrypted, its methods being well known. Under general anaesthesia, the patient is placed in a semiseated position, his head straight, orthogonally to the operating room. A small sterile separated field is systematically prepared at the level of the right thigh, allowing if necessary to take a sample of fascia lata and muscle in case of LCR fistula. (7%) The intervention has been performed by the neurosurgeon himself, for a long time. The intervention is accomplished under an operating microscope and under the permanent control of the position of the instruments with Rontgen equipment.

Regarding the majority of the pituitary adenomas operated this way, a surgical plane divides the area of the tumour from the normal compressed structures, so that a complete and selective exeresis should be allowed. A macroadenoma usually moves the intact dural wall of a cavernous sinus, without invading it. (6) (Picture no.1)

Picture no. 1. Surgical approaches for the pituitary region surgery



In case of adenomas within the Cushing disease, the surgical exploration is extremely thorough. Within this context, the adenoma is white-grey, soft and semiliquid. Its diameter may be sometimes of only few millimetres, sometimes even less than 2 millimetres, inciting to a real inventory of the pituitary gland, including that of the posterior lobe. With the patient's consent, a negative exploration may lead to a hemi-hypophysectomy or even to hypophysectomy. This difficult surgery may be performed only by a very experienced team.

Other routine possible but unused techniques:

- Pre-surgical fibroscopy: it allows checking the quality of exeresis in the areas where the direct view under the microscope is difficult: cavernous sinus and the upper extension.
- Pre-surgical echography: this technique may be a promising contribution, especially in the Cushing disease with normal MRI;
- Computer-assisted surgery (neuronavigation): in certain cases, it may represent an extra contribution if certain difficulties are predictable regarding the surgical approach. It does not seem to offer a long term guarantee or a better safety.

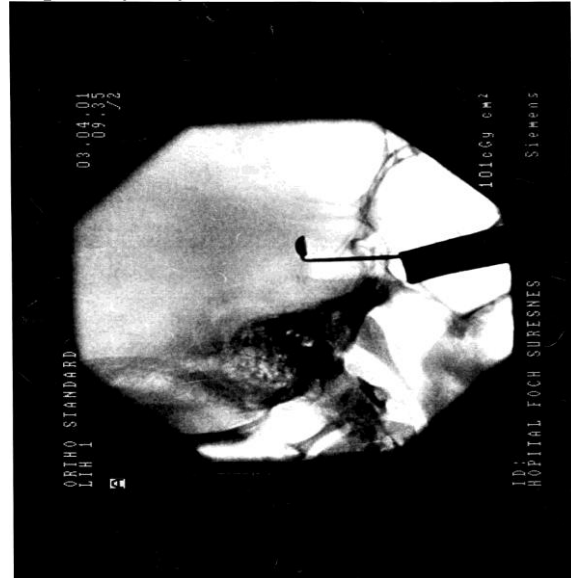
Rhinoseptal intervention lasts for one hour on average, or even less. Hospitalization length is of 5 days.

Transsphenoidal rhinoseptal approach is preferred to the nostril approach, so that to avoid a distension in force, a fracture of the concha, of the ethmoid riddled lamina or of the internal wall of the orbits.

The absence of the sphenoidal sinus does not contradict the transsphenoidal approach; in this case, the pituitary fossa is approached through milling under permanent radiological supervision. In certain exceptional case of pituitary adenomas, in the patients with Albright syndrome and with extensive fibrous dysplasia of the sphenoid, the pituitary fossa could not be approached.

In the below radiography, one can see the intra-surgical aspect of a pituitary tumour with suprasellar extension – see the curette above the sellar diaphragm. (picture no. 2)

Picture no. 2. Intra-surgical radioscopic image after transsphenoidal pituitary adenoma resection. Aerial transparency may be observed in the resection cavity.



#### Post-surgical immediate supervision

Besides antibiotherapy and substitutive treatment, the post-surgical immediate supervision is put into practice in the post-operative recovery room and comprises an input-output hydric examination, measurement of the urinary volume, hourly urine density, urine density every three hours and natremia supervision. If the criteria are met, the diabetes insipidus protocol is established - Minerin. Usually, when the patients leave the hospital (the fifth day after the surgery), they are under hydrocortisone treatment, with the recommendation of natremia, if they go home.

Long and medium term post-surgical follow up comprises: natremia – seventh day after the surgery, hormonal examination and MRI on the third month after the surgery, annual imagistic and hormonal follow-up.

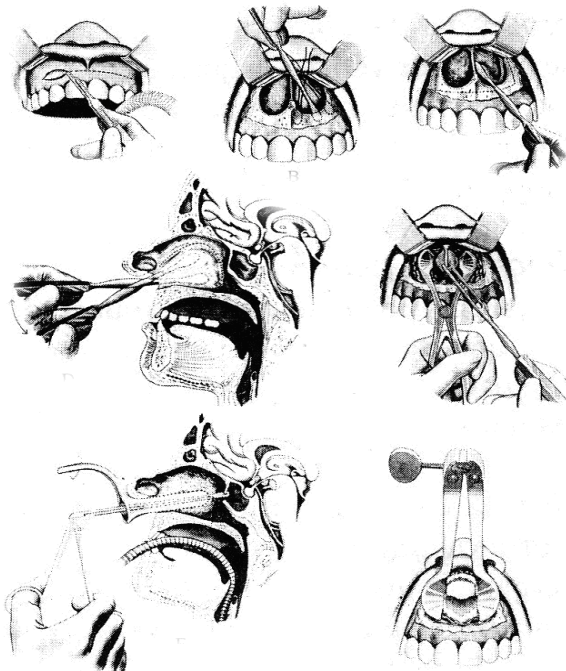
#### Transsphenoidal approach in two times

It is a very interesting approach used in certain cases. The strategy is the following: during a first transsphenoidal approach, the superior pole of the adenoma does not descend in the pituitary fossa, despite the successive manoeuvres of jugular compression. The superior part of the adenoma is left there after a detailed haemostasis. After this incomplete surgery, a visual improvement is usually noticed. MRI check up made 2-3 months after the surgery may show the spontaneous decrease of the suprasellar expansion into the pituitary fossa, expansion that becomes accessible to a new transsphenoidal approach, with a view to accomplish a complete exeresis, to preserve the pituitary healthy tissue and to avoid radiotherapy. This strategy is successfully used for a large number of non-functional adenomas. (4)

The indications of cranial approach, regarding the surgery of the pituitary adenomas are rare (2,3 % in the neurosurgery setting of Foch hospital). The cranial approach is indicated only in the relatively young patients, having visual signs with no improvement under the medical treatment and where adenoma cannot be operated

transphenoidally (some of them have already been submitted to the transsphenoidal surgery). (see picture no. 3)

**Picture no. 3. Stages of the transsphenoidal approach**



Generally, it is about non-functional macroadenomas or gonadotropes with multidirectional intracranial expansions, which communicate with the intrasellar contents through a narrow groove.

Choosing the cranial approach is dictated by the direction of the tumoral expansion: craniotomy, bifrontal, median, pterional sub-fronto-temporal approach or subtemporal approach.

In this case, the situation will not be approached from the endocrine point of view, but from the tumoral compression point of view. Surgery is often incomplete, long and complex (4) especially due to the difficulties related to the dissection of the arteries of Willis' polygon, of the optic tract, of the oculomotor nerves of the brain stem. The second indication of the cranial approach is given by the rare existence of a functional adenoma, placed above the diaphragm.

Regarding craniopharyngiomas, the problems are different, depending on the intrasellar and extrasellar expansion of the tumour. The chosen surgical approaches, sometimes combined (transsphenoidal, subfrontal, bilateral, subtemporal, transfrontal, intraventricular) translate the difficulty of the treatment of these benign lesions, whose extension might sometimes be significant. The choice of the surgical approach is also made according to the cystic or flesh-like aspect of the tumour. This tumour continues to be a veritable attempt for the neurosurgeon, to the extent in which the complete exeresis is often impossible without major risks. It is estimated at 55% transphenoidally, with a recurrence risk of 22-36% .

For other rare lesions, the choice of the surgical approach is dictated by the anatomic conditions and any time it is possible, the transsphenoidal approach is preferred.

### Surgery of the pituitary adenomas recurrences

It is about a difficult problem that arises in this moment, after knowing the undesirable effects of radiography, especially the endocrine ones. (7) In practice, re-intervention may be taken into consideration if radiotherapy is counter-indicated, if there is no possibility for a medical treatment, if imagery is conclusive and if a new intervention may lead to a new "healing". Visual threat, the absence of the hypersecretion control through medical treatment, the invasive character and the location of the recurrence are some of the elements that must be taken into consideration in case of re-intervention.

In case of a visual threat, re-intervention is especially recommended when there is a non-secretory adenoma (9 % LCR fistula) (8) especially in case of previous radiotherapy, which increases the fibrous character of the adenoma. Regarding the secretory adenomas, the results of the transsphenoidal surgery are successful in 50% of the cases, but with an important risk (70%) of pituitary insufficiency. (9)

The problem of recurrence or of the incomplete resection of a craniopharyngioma is a very complex problem. Craniopharyngioma, a benign tumour, usually proves to be impossible to be excised without assuming major risks. Recurrences are numerous, despite the tentative of total exeresis. In children, surgery is indicated, especially due to the negative effects of radiography. Even under the pretext of a large exeresis, the neurosurgeon is obliged to deliberately leave a part of the capsule adherent to vascular structures and/or to the vital hypothalamic structures. The message is clear, in a child with growth disorders and reduced school performances, MRI is compulsorily suggested. Only this way, it will be possible to early diagnose and operate the small-sized craniopharyngiomas, before the occurrence of the vital and endocrine complications, still too frequent.

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## CLINICAL ASPECTS

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