Scientific Research Publishing

Open Journal of Modern Neurosurgery, 2025, 15(2), 194-204
https://www.scirp.org/journal/ojmn
ISSN Online: 2163-0585
ISSN Print: 2163-0569

Surgery of Pituitary Adenomas by Trans Cranial Approach: Indications, Results, and Limits in the Senegalese Experience

Nicaise Akodjètin Mahougnon Sodjinou[1], Mualaba Celebre[2*], Nantenin Doumbia[2], Maguette Mbaye[2], Faye Mohameth[3], Mbaye Thioub[2], Alioune Badara Thiam[2], Ba Momar Code[2]

[1]Department of Neurosurgery, Hospital Center of Perpignan, Perpignan, France
[2]Department of Neurosurgery, Fann Teaching Hospital, Cheikh Anta Diop University, Dakar, Senegal
[3]Department of Neurosurgery, Idrissa Pouye General Hospital, Cheikh Anta Diop University, Dakar, Senegal
Email: *mualabcl@gmail.com

How to cite this paper: Sodjinou, N.A.M., Celebre, M., Doumbia, N., Mbaye, M., Mohameth, F., Thioub, M., Thiam, A.B. and Code, B.M. (2025) Surgery of Pituitary Adenomas by Trans Cranial Approach: Indications, Results, and Limits in the Senegalese Experience. *Open Journal of Modern Neurosurgery*, **15**, 194-204.
https://doi.org/10.4236/ojmn.2025.152020

Received: March 25, 2025
Accepted: April 26, 2025
Published: April 29, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
http://creativecommons.org/licenses/by/4.0/

Open Access

Abstract

Introduction: Intracranial surgery was the first procedure used historically to treat pituitary tumors. This study aims to report the indications of trans-cranial surgery of pituitary adenomas and specify its limits in our experience at the Neurosurgery Department of Fann Hospital. **Material and Methods:** This is a retrospective, descriptive and analytical study spread over a period of 4 years from January 1, 2016, to December 31, 2020 conducted at the Neurosurgery Department of the Fann University Hospital in Senegal, including all patients in whom the diagnosis of pituitary adenoma was evoked on clinical criteria, confirmed by data from computed tomography (CT), magnetic resonance imaging (MRI), and operated by trans-cranial approach. **Results:** According to our results, the trans-cranial approach using a pterional approach alone was the most common in our experience in 66.67% (n = 6 in this study). A combined endoscopic trans-sphenoidal approach first and then the secondary pterional approach was performed in 33.33% (n = 3) of our patients. Partial resection was performed in 06 patients (66.67%), and wide resection in 3 patients (33.33%). The evolution of the patients treated surgically by the high approach was marked by an improvement of the visual disorders in 22.22% of the cases, and an absence of recurrence in the whole series. A tumour residue was found in 33.33% of cases. **Conclusion:** Trans cranial approaches still have their place in the management of pituitary adenomas even if they are burdened with a very high mortality and morbidity rate in our series.

Keywords

Pituitary Adenoma, Transcranial Approach, Tumour Removal,

Limits in Senegal

1. Introduction

Pituitary adenomas are benign, well-differentiated, usually slow-growing tumors that develop at the expense of the pituitary gland and which, depending on their size and their functional character, secreting or not, are responsible for various clinical manifestations [1]. They represent 15% of intracranial tumors [1]. Their clinical expression is dominated by two syndromes, one endocrine syndrome resulting from hypersecretion or a pituitary hormonal deficit, the other tumour syndrome reflecting the lesional impact of the adenoma on neighboring structures (compression of the optic chiasma, invasion of the sphenoidal sinus, extension to the cavernous sinus) [2]. Their diagnosis has been greatly facilitated by the evolution of imaging methods, in particular the advent and development of magnetic resonance imaging (MRI). It allows the volume and extension of the adenoma to be determined, particularly in the cavernous sinus, and therefore the possibility of surgical removal to be assessed [3]. The treatment of these tumors requires close multidisciplinary collaboration between endocrinologists, neurosurgeons, and radiologists familiar with this pathology. Surgery performed by specialized neurosurgeons in referent centers is the basis of treatment of pituitary adenomas [1]. It has evolved over the years from the high intracranial approach to the low extracranial approach with the recent advent of the endonasal trans-sphenoidal approach under endoscopy [4]. The surgical management of pituitary adenomas is, as a rule, performed by trans-sphenoidal approach with the evolution of instruments and surgical techniques [5]. However, 3% to 7% of pituitary adenomas are usually larger than 4 cm and grow laterally outside the sellar limits exerting a mass effect on the optic tract and adjacent structures, such as the cavernous sinus, hypothalamus, and cerebrospinal fluid outflow tracts which contraindicates their removal by the lower approach. The trans-cranial approach in this case becomes one of the most complex neurosurgical challenges for the adequate management of these giant invasive pituitary adenomas due to their close relationship with the vascular-nervous structures of this region [6].

The objective of this work is to report the indications of the transcranial approach, but also to specify its limits in our experience.

2. Materials and Methods

This was a retrospective, descriptive and analytical study spread over a period of 5 years from 01 January 2016 to 31 December 2020 in the neurosurgery department of the FANN University Hospital in Dakar, Senegal.

It includes all the pituitary adenomas, managed in our structure during the study period (01 January 2016 to 31 December 2020). All patients admitted for pituitary adenomas and operated on trans-cranial, endonasal approach only or by

the combined approaches were included in this study and constituted our study's population.

Patient data were recruited through the emergency department and the neurosurgery outpatient clinic. They allowed us to study the epidemiological, clinical, paraclinical, therapeutic, evolutionary, and prognostic aspects.

The variables were analyzed descriptively. Quantitative variables are described in terms of numbers, several missing values, mean, standard deviation and extremes, and qualitative variables are described in terms of numbers, and percentage of data completed. Data analysis was done using Excel for graphs and figures and SPSS.

3. Results

3.1. Epidemiological Data

This series included 09 patients operated by the trans cranial approach out of a total of 107 pituitary adenomas managed in our department, *i.e.*, a frequency of 8.41%. The average age was 39.78 years with extremes ranging from 23 to 64 years. The age group over 45 years (>45 years) was the most frequent with 4 cases, followed by 30 - 45 years with 3 cases and under 30 years (<30 years) with 2 cases. In our series there were 4 males and 5 females, giving a sex ratio of 0.8. Only one patient had a history of ovarian tumor operated on in the gynecology department, 03 patients had been operated on previously by vaginal route for pituitary adenoma.

3.2. Clinical Data

Delay in diagnosis is very common. The delay between the onset of the signs and the consultation is between 1 month and 3 years in our series. Intracranial hypertension syndrome: headache (temporal, occipital or helmet) and/or vomiting were found in all the patients. Neurological examination revealed: 1 case of frontal syndrome, 2 cases of seizures and 2 patients presented with apoplexy.

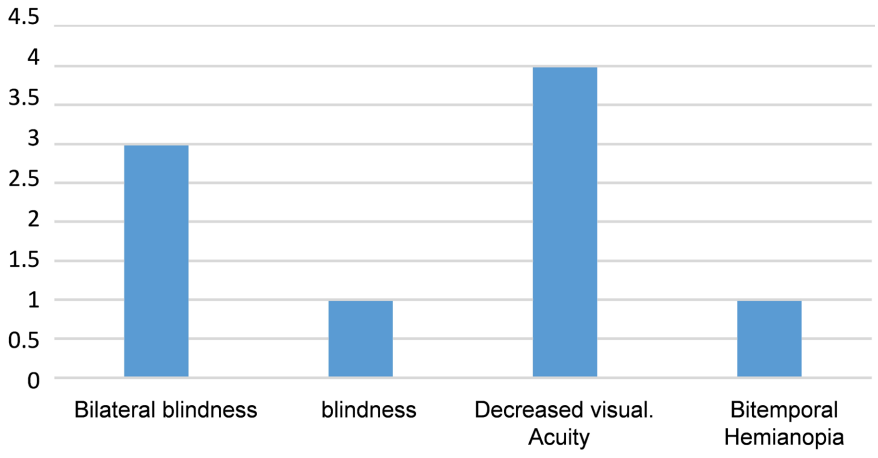

Figure 1. Distribution according to ophthalmological examinations.

Functional endocrine signs were found in 5 patients, the most frequently encountered being amenorrhea, associated or not with galactorrhea in 3 cases. The acromegalic dysmorphic appearance was found in 1 patient, and 1 case of faciotruncal obesity or the classic cushingoid appearance. All the patients had visual disorders, 03 patients had bilateral blindness, 01 patient had monocular blindness, 04 patients had bilateral decreased visual acuity, 01 patient had bitemporal hemianopia (Figure 1).

3.3. Paraclinical Data

All the patients had undergone a cerebral CT scan, *i.e.*, 100%, only 4 patients had undergone a cerebral MRI. These different examinations enabled us to make a topographical diagnosis. MRI spontaneously revealed a hyper signal image in 2 cases and in 1 patient a heterogeneous lesion containing areas of necrosis appeared in the hypo signal. In 1 case, we noted a T1 hyper signal before injection probably corresponding to a hemorrhagic area.

Most of the CT scans showed spontaneously hyper-dense lesions that were enhanced after injection of PDC. (Figure 2)

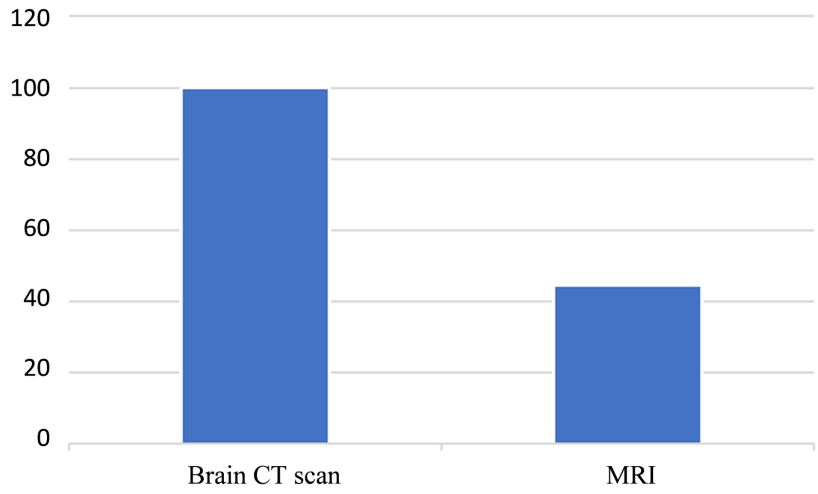

Figure 2. Distribution according to the imaging performed.

This study found mainly giant adenomas with a mean size of 62 × 50 mm (with extremes ranging from 44 to 98 mm).

Knosp grade 4 classification was found in all our patients (Figure 3). Hydrocephalus was reported in all our patients. No other morphological abnormalities of the parenchymal structures were reported.

Four patients had a non-functioning adenoma with a normal workup. The workup was disturbed in 5 patients: Hyperprolactinemia was reported in 3 cases of which 2 cases were due to disconnection. An elevated 8-hour cortisol level in 2 cases.

All (9) patients underwent surgery. The trans cranial peritoneal route alone was performed in 6 patients. The sub-frontal route was performed in one patient. A combined trans-sphenoidal endonasal route under primary and secondary high

pterional endoscopy was performed in 3 patients. (Figure 4)

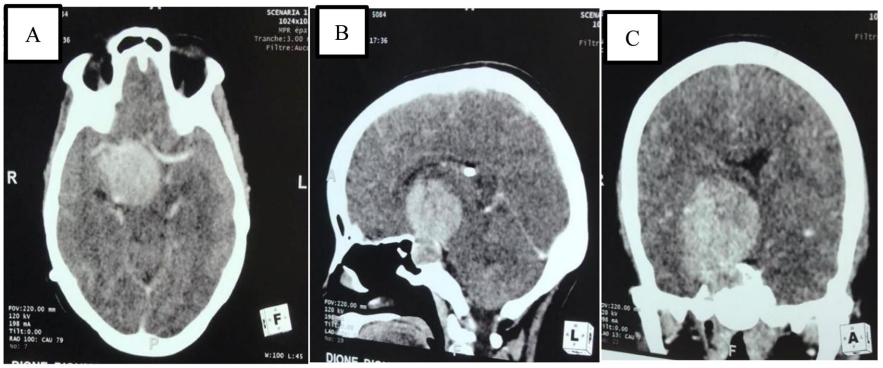

Figure 3. Cerebral CT in axial section (A), Sagittal reconstruction (B), and coronal reconstruction (C), showing a giant pituitary adenoma invading the carotid artery and the right Sylvian artery and compressing the ventricles, the optic chiasm, and the brainstem (Iconography Fann neurosurgery department).

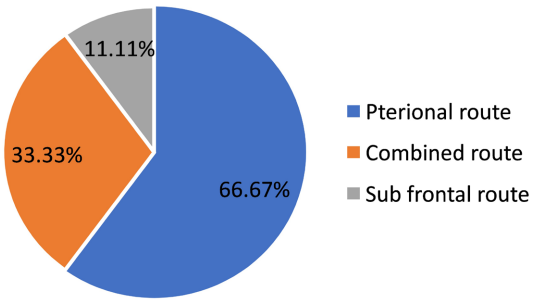

Figure 4. Distribution according to approach routes.

3.4. Treatment

Cabergoline (Dostinex*) was administered postoperatively in 3 patients. 2 patients underwent ventriculoperitoneal shunting (VPB) because of hydrocephalus. 1 patient underwent ventriculo-atrial shunting (VAS) because of a failure to resorb CSF at the abdominal level after his first VPB.

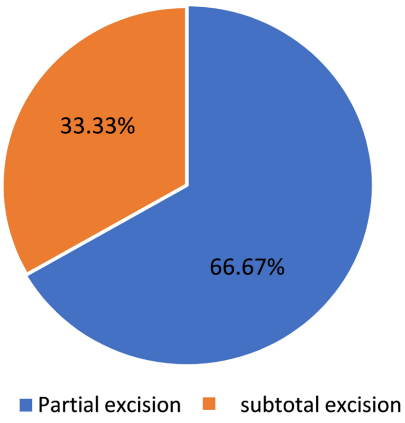

Figure 5. Distribution according to the quality of excision.

Partial excision was performed in our patients with 06 patients and subtotal in 3 patients (Figure 5).

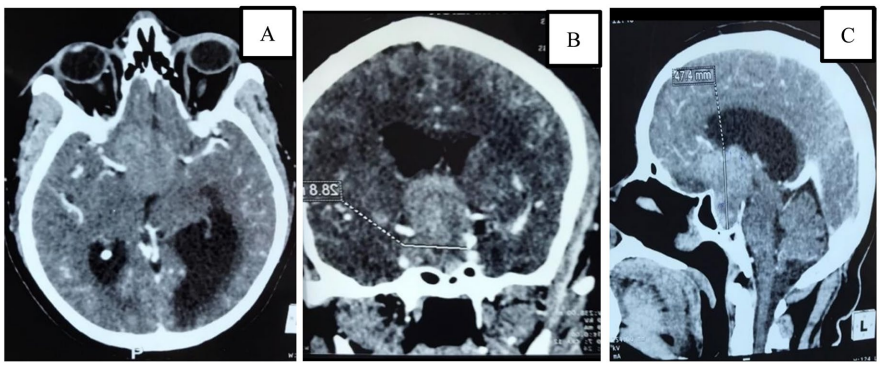

Figure 6. Cerebral CT scan with contrast injection in sagittal section (A), coronal and sagittal reconstruction (B) and (C), showing a slightly sellar and suprasellar lesion exerting a mass effect on the third ventricle, responsible for obstructive hydrocephalus and invading the right carotid artery.

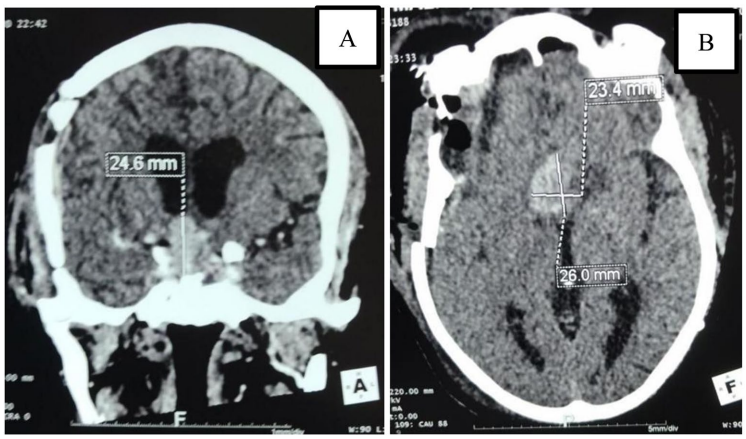

Figure 7. Coronal reconstruction brain CT (A) and axial section (B) M1 of recurrence, showing a slightly hyperdense sellar lesion predominantly on the right, slightly enhanced after injection of the contrast medium.

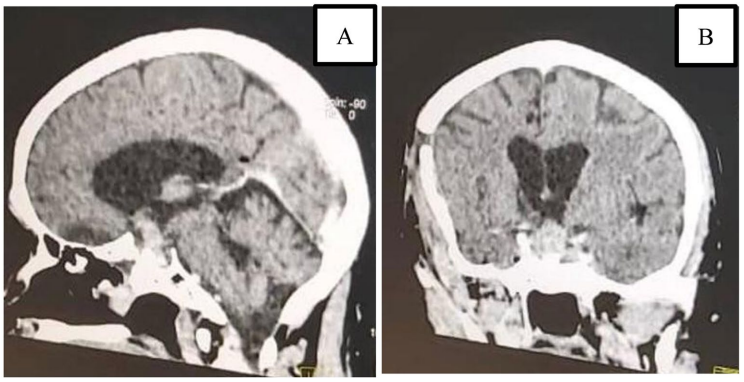

Figure 8. Preoperative and postoperative brain CT scan at M1 (A) and M6 (B) of a patient operated on for giant pituitary adenoma via the right pterional approach showing tumor residue and craniotomy stigmata.

Figure 6 illustrates a case of macroadenoma Knosp grade 4 operated by transcranially, with post operative imaging one month later (Figure 7) and six months later (Figure 8).

3.5. Post Operative Complications

The immediate postoperative complications found: Diabetes insipidus in 6 patients (66.7%) who progressed well on Desmopressin (minirin*), meningitis was reported in 2 cases which progressed well on antibiotic therapy, neurological deficit was noted in 03 patients secondary to cerebral ischaemia in 2 cases, 2 cases of postoperative haematoma of the surgical site after control. Two cases of deaths were reported, one due to injury to the carotid artery, and the other secondary to ischaemia in the sylvian territory. For the other patients.

3.6. Evolution

The evolution in short time reports favorable outcome with improvement of visual acuity in 2 patients. And the long-term evolution is difficult to assess in all our patients as some patients have been lost to follow-up. Radiological cure (absence of tumour residue on follow-up CT) was observed in 2 patients who had received medical treatment. Persistence of tumor residue in 3 patients with improved quality of life, but no improvement in vision.

4. Discussion

Although the trans-pituitary endoscopic approach is the preferred approach in the management of pituitary adenomas in general, surgery by the upper approach is particularly rare and represents 1% to 4% of indications according to different studies [7] [8].

In our study, they represent 8.41%. In our series, the average age of the patients operated on by the trans cranial approach was 39.78 years with extremes ranging from 23 to 64 years, in agreement with the data in the literature. Indeed, Shashidhar *et al.* in a 2020 study on trans cranial approaches for pituitary adenomas over two decades found an average age of 40.86 [9].

In this work, we note a predominance of surgery by the trans cranial route for the female sex by 55.56% of cases against 44.44% for the opposite sex, which is comparable with the data of a study carried out by Spallone *et al.* [6]. This predominance is mainly due to the general frequency of pituitary adenoma in the female population, especially prolactin, somatotropic and corticotropic [10]-[13].

Delayed diagnosis of adenomas operated on by the transcranial approach is very common. The delay between the onset of signs and the consultation is between 1 month and 3 years in our series, in agreement with the study by Han and colleagues. The main reasons for this delay are the slow evolution of pituitary adenomas and the lack of specificity in clinical symptomatology. This is all the truer as the tumor may be non-secreting [14]. The intracranial hypertension syndrome was found in all our patients and in the study of Azeroual *et al.* It represents 62.5%

of the reasons for consultation constituting the most frequent sign of appeal [14]. One case of the frontal syndrome (11.11%) was found in our study concordant with the study of Shashidhar *et al.* 11.7% [9], 2 cases of seizures as in the series of Bouaita [10], 2 patients presented apoplexy (22.22%) which is less than the 18 cases in the study of Shashidhar [9]. Several series in the indications of high surgery of pituitary adenomas report visual disturbances as the main mode of disclosure.

Thus, visual disorders were present in 88% and 90% of cases respectively in the series by Graillon, Bouaita *et al.* [8] [15].

The radiological exploration of the sellar and para-sellar regions is the witness of technological advances. Conventional radiology has been progressively replaced first by CT and then by MRI, the latter having become in a few years the method of choice in pituitary exploration, both for its sensitivity in detecting micro-adenomas and for its ability to establish the extension of macro-adenomas. However, the contribution of CT should not be neglected, as this method is still much more widespread than MRI [16] [17].

All our patients had a cerebral CT; only 4 patients had a cerebral MRI scan (44.44%). The same data was found in the series of Spallone *et al.*, however more MRIs were performed compared to our study (71.4%) [10].

The trans-cranial surgical approach was indicated for giant adenomas with supra- and later-sellar extension. These are defined as tumors with a maximum diameter > 4 cm [18] [19]. In our study, we found mainly giant adenomas with a mean size of 62 × 50 mm. In all the series studied, these adenomas were mostly approached via the upper approach in order to obtain a satisfactory surgical excision and a good decompression of the visual and CSF outflow tracts.

According to the extension of the tumor, the Knops grade 4 classification was found in all our patients as in the series of Nishioka *et al.* and most of the other series [20].

Hydrocephalus was reported in all our patients, only 14.6% in the Shashidhar series [9]. The hormonal workup allowed us to find mostly non-functional adenomas 44.44%, prolactinoma 33.33%, corticotropic adenomas 22.22% concordant with the results of the series of Sinha *et al.* [19]. The intracranial approach is rarely used, 1% to 4% in the literature, compared to 96% to 99% for trans-sphenoidal approaches [21]-[24]. At the CHNU Fann in Dakar, 65 patients were operated on by endoscopic trans-sphenoidal approach from 2014 to 2018. This procedure is delicate because the proximity of the optic pathways is fraught with significant postoperative complications [25]. The high periosteal approach alone was performed in 6 patients (66.67%), which corroborates the data in the literature [9] [10] [17]. A subfrontal approach was performed in only 1 patient. The combined endoscopic trans-sphenoidal first and then secondary high pterionic approach was performed in 33.33% of our patients. Surgery remains the method of choice because it is the only method that allows selective removal of the tumor, and therefore a definitive cure if the removal is total. The surgeon is asked, on the one hand,

to resolve the tumor problem of large adenomas compressing the opto-chiasmatic tracts and, on the other hand, to correct the manifestations due to hyper-hormonemia of hyper-secreting adenomas while respecting the pituitary gland and thus maintaining normal pituitary function [21]. No total exeresis was performed in our patients, it was partial in 06 patients (66.67%), large in 3 patients (33.33%) which has not been found in the literature dominated by subtotal exeresis in the series of Bouaita and Graillon [8] [15]. Our study shows that the evolution of patients treated surgically by the high approach was marked by an improvement in visual disorders in 22.22% of cases, and an absence of recurrence in the whole series. In addition, a tumour residue was found in 33.33% of cases. In his series, Graillon found 41% visual improvement, about 38.5% postoperative residues, and no recurrence. In comparison with the series by HAN where both trans-sphenoidal and trans-cranial routes were used, the former showed 81.4% visual improvement against 50% in the latter. Our study shows that 6 patients presented with diabetes insipidus (66.67%), 2 cases of meningitis, 03 patients presented with a neurological deficit (33.33%) secondary to cerebral ischemia in the sylvian territory, in the carotid territory and to a HED that was evacuated, 2 cases of post-operative hematoma. Nishioka in his series found 2 cases of diabetes insipidus, 2 cases of hemiparesis (secondary to ischemia and hematoma), and no meningitis. Our study shows 2 cases of death. This mortality concerned a vascular injury of the carotid artery in 1 case, and an ischaemia in the sylvian territory. In the SINHA series, 8 patients operated on via the trans-cranial route died, compared with 3 deaths in patients operated on via the trans-sphenoidal route.

5. Conclusion

The indications for Trans cranial surgery in adenomas are rare and very specific. The mortality rate is very high with this route, and its combination with the transsphenoidal route for large lesions extending into the supra-salar region can improve the patient's prognosis, as well as the objectives of the management. However, it remains the recourse for surgeons with technical and logistical limitations.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Jouanneau, E., Raverot, G., Trouillas, J. and Brassier, G. (2015) Adenomi Ipofisari. *EMC-Neurologia*, **15**, 1-10. https://doi.org/10.1016/s1634-7072(15)72180-x

[2] Masson, E. (2015) Pituitary adenoma, Mega Guid. STAGES IFSI, 510-514.

[3] Brassier, G. (2007) Les Adénomes Hypophysaires—Pituitary Adenomas. https://www.researchgate.net/publication/236159963_Les_adenomes_hypophysaires_mise_au_point

[4] Aniba, K., *et al.* (2018) The Endoscopic Treatment of Pituitary Adenomas. Elselvier, **64**, 233.

[5] Nishioka, H., Hara, T., Usui, M., Fukuhara, N. and Yamada, S. (2012) Simultaneous Combined Supra-Infrasellar Approach for Giant/Large Multilobulated Pituitary Adenomas. *World Neurosurgery*, **77**, 533-539. https://doi.org/10.1016/j.wneu.2011.07.013

[6] Spallone, A., Vidal, R. and Gonzales, J. (2010) Transcranial Approach to Pituitary Adenomas Invading the Cavernous Sinus: A Modification of the Classical Technique to Be Used in a Low-Technology Environment. *Surgical Neurology International*, **1**, 25.

[7] Youssef, A.S., Agazzi, S. and van Loveren, H.R. (2005) Transcranial Surgery for Pituitary Adenomas. *Operative Neurosurgery*, **57**, 168-175. https://doi.org/10.1227/01.neu.0000163602.05663.86

[8] Graillon, T., Fuentes, S., Metellus, P., Grans, R. and Dufour, H. (2012) Abord supratentoriel dans le cadre des adénomes hypophysaires : Indications, résultats, complications, intérêts et inconvénients. À propos d'une série rétrospective de 17 cas. *Neurochirurgie*, **58**, Article 414. https://doi.org/10.1016/j.neuchi.2012.10.018

[9] Shashidhar, A., Arimappamagan, A., Madhusudhan, N., Narasinga Rao, K.V.L., Bhat, D., Shukla, D., *et al.* (2021) Transcranial Approach for Pituitary Adenomas—An Evaluation of Surgical Approaches over Two Decades and Factors Influencing Peri-Operative Morbidity. *Clinical Neurology and Neurosurgery*, **200**, Article 106400. https://doi.org/10.1016/j.clineuro.2020.106400

[10] Mindermann, T. and Wilson, C.B. (1994) Age-Related and Gender-Related Occurrence of Pituitary Adenomas. *Clinical Endocrinology*, **41**, 359-364. https://doi.org/10.1111/j.1365-2265.1994.tb02557.x

[11] Kadiri, A., Hafidi, A., Chraibi, A. and Chennaoui, A. (1994) Corticotropic Pituitary Adenomas in Morocco: Analysis of 30 Cases. *Revue Francaise d'Endocrinologie Clinique*, **35**, 3.

[12] Kadiri, A., Hafidi, A. and Chraibi, A. (1994) Prolactin Adenomas in Morocco: Therapeutic Results in 48 Cases. *Revue Francaise d'Endocrinologie Clinique*, **35**, 3.

[13] Mayaudon, H., Bauduceau, B., Helie, C., Ducorps, M. and Sonnet, E. (1995) Prolactin Adenomas: Analysis of a Series of 50 Observations. *Revue Francaise d'Endocrinologie Clinique*, **36**, 3.

[14] Azeroual, M. (2012) Les aspects neurochirurgicaux des adénomes hypophysaires expérience du service de neurochirurgie du CHU Mohammed VI, thèse n°95, 2.

[15] Bouaita, K., Selmen, T., Belahrache, M. and Ioualalen, O. (2014) La place de la voie haute dans la chirurgie des adénomes hypophysaires. *Neurochirurgie*, **60**, Article 354. https://doi.org/10.1016/j.neuchi.2014.10.092

[16] Domengie, F., Petit-Lacour, M.C., Doyon, D. and Iffenecker, C. (2001) Radiological Exploration of the Pituitary Region. Encycl Méd Chir, Endocrinologie_Nutrition, 10-17-E-10, 17 p.

[17] Abecassis, J.P. and Bonnin, A. (1996) Imaging of Pituitary Adenomas. *Rev Prat* (*Paris*), **46**, 1504-1508.

[18] Sinha, S. and Sharma, B.S. (2010) Giant Pituitary Adenomas—An Enigma Revisited. Microsurgical Treatment Strategies and Outcome in a Series of 250 Patients. *British Journal of Neurosurgery*, **24**, 31-39. https://doi.org/10.3109/02688690903370305

[19] Mortini, P., Barzaghi, R., Losa, M., Boari, N. and Giovanelli, M. (2007) Surgical Treatment of Giant Pituitary Adenomas. *Neurosurgery*, **60**, 993-1004. https://doi.org/10.1227/01.neu.0000255459.14764.ba

[20] Nishioka, H., Hara, T., Usui, M., Fukuhara, N. and Yamada, S. (2012) Simultaneous

Combined Supra-Infrasellar Approach for Giant/Large Multilobulated Pituitary Adenomas. *World Neurosurgery*, **77**, 533-539. https://doi.org/10.1016/j.wneu.2011.07.013

[21] Derom, P.J., Visot, A., Derom, P.J. and Visot, A. (1996) Surgery for Pituitary Adenomas. *La Revue du praticien*, **46**, 1515-1519.

[22] Passagia, J., Gay, E., Reyt, E., Lebeau, J., Favre, J.P. and Chirossel, J.P. (1998) Les voies d'abord inhabituelles des adénomes hypophysaires. Masson, 316-326.

[23] Boute, D., Dewailly, D., Fossati, P., Boute, D., Dewailly, D. and Fossati, P. (1991) Pituitary Adenomas. Medical Encyclopedia, 25211-A-10, 8 P.

[24] Messerer, M. (2020) Indication of the Transcranial Route for Pituitary Adenomas. College of Neurosurgery, JNE.

[25] Benbow, S.J., Foy, P., Jones, B., Shaw, D. and MacFarlane, I.A. (1997) Pituitary Tumours Presenting in the Elderly: Management and Outcome. *Clinical Endocrinology*, **46**, 657-660. https://doi.org/10.1046/j.1365-2265.1997.1180933.x