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Olfactory groove meningiomas Complications avoidance strategy in 47 patients Serie with review of the literature

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Abstract:
Aim: in this retrospective descriptive study we are reviewing the main clinical and radiological features of our 47 patients Serieof olfactory groove meningiomas operated on in our department as well as their surgical results and outcome while focusing on the complication strategy avoidance with nuances in the surgical management in the light of up to date management criteria. Patients and methods: 47 patients were operated on in the department of neurosurgery at the neurosurgical specialized hospital in Cherchell and Ali Ait Idir specialized hospital in Algiers in the period between January 2010 and December 2019. All our cases were reviewed from their clinical manifestation to the radiological findings and the surgical approach adopted for each case. Complications were listed and looked up for any associated variable according to the clinical features associated with them and the surgical approach adopted. Results:83% of our patients presented with anosmia at the time of diagnosis, while cognitive deterioration was found in 37 cases (78.7%) rangingfrom memory loss to severe dementia with urinary incontinence. Visual deterioration was seen in 22 cases with unilateral acuity loss in 10 cases. Seizures were seen in 8 cases only preoperatively. On Imaging, OGM in our Serie tend to appear unilateral in 15 % of cases (7 cases) with size less than 3 cm in 4 cases, between 3 and 6 cm in 11 cases, and 32 were found to exceed 6 cm in diameter. Frontal edema was found in 17 cases ranging from mild to severe as it was observed on MRI. The Bifrontal sub frontal approach was the most used in our Serie with 55.3% followed by the Pterional approach in 9 cases, the unilateral sub frontal approach was adopted in 8 cases. Finally, the extended endoscopic endonasal transcribriform approachwas used in 4 cases. Gross total resection was achieved in 92% of cases while subtotal resection and near total resection involved equally 2 cases. No mortality was recorded in our Serie. Frontal oedema on the other hand with deterioration of the frontal syndrome was observed in 6 cases (12.7%) and involved particularly preexisting frontal edema associated with large OGM. CSF leak involved 3 cases with two of them were noticed early after EEEA transcribriform approach. Conclusion: Surgical experience in anterior skull base approaches with tailored strategy for each patient by choosing a convenient and individualized approach planning are mandatory for achieving best results of OGM surgery.

Keywords*: Olfactory groove meningioma, olfactory preservation, bifrontal subfrontal approach,transcribriform approach, Anosmia, Optic Nerve*

Abbreviations*: OGM: Olfactory groove meningioma, ACA: anterior cerebral artery, AcoA: anterior communicating artery, ON: optic nerve, OC: optic canal, Ch: chiasm, EEEA: extended endoscopic endonasal approach, CSF: cerebrospinal fluid, CT: computed tomography, MRI: magnetic resonance imaging, SSS: superior sagittal sinus, ICA: internal carotid artery, A2: second segment of anterior cerebral artery*

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I. Introduction:

Olfactory grove meningioma (OGM) is a particular location among other intracranial classical locations of meningiomas that was the subject of study by many pioneer neurosurgeons. The successful management with good results of that type of tumour nowadays is the result of an accumulative knowledge of many surgeons and scientist since the mid nineteenth century [1].

Jean Cruveilhier was the first to illustrate the OGM and related them with symptomsin 1835 [1,2]. That description allowed diagnosis of that type of tumour only by neurological examination. The successful removal of the first OGM was recorded in 1885 by Francesco Durante when he operated on 35-year-old women with anosmia and mood changes. The lady underwent the second operation after 11 years and lived 20 years after the first operation. The successful removal of that location of meningiomas opened the door for further removals and successful management by the following surgeons. In 1906 Victor Horsley stated that "*all tumours which growing from the meninges penetrate the brain or which are encapsulated ... can be excised with a good*

permanent result». Therefore, He introduced the bone wax for bone haemostasis. Early neurosurgeons faced many hurdles when managing OGM among other types of intracranial meningiomas. Those struggles were mainly the successful diagnosis, appropriate surgical exposure, haemostasis and blood loss, inadequate anaesthesia. Harvey Cushing implemented the modern rules of intracranial meningiomas surgery that are still in use today such as the need for removal of the bony hyperostosis, debulking first, pushing the nest of meningioma while preserving the surrounding frontal lobe in the case of OGM. After the introduction of the electrocautery by Bovis in 1926, Cushing stated that it was of great help in dealing with haemostasis and reduced the blood loss making the management of cranial meningiomas possible. Later in 1950's Simpson reported that the complete removal of meningiomas was directly found to be related to a low rate of recurrence. The development of X-Rays since the beginning of the twentieth century helped the diagnosis of intracranial meningiomas in general which improved since the introduction of angiography by Moniz in 1927and popularized later by List in 1945, followed by the breakthrough invention of CT-scan in 1970 and MRI in 1980's. technological improvement in the purpose of a safer management of intracranial meningiomas are still evolving today with Ultrasonic aspiration and Laser Applications.

There was a significant low rate in morbidity reported by recent series while raising concern to achieving long term symptoms-free patients with low recurrence rate [2].

Advances in several microsurgical approach'stechniques for OGM are pushing the goal of OGM surgery to a new level such as the attempt to preserve olfaction with the minimum of cosmetic prejudice. Therefore, some authors are advocating the extended endoscopic endonasal transcribriform approach as an alternative to classical cranial routes for small to medium sized OGM [2], while others used an endoscopic assisted minimally invasive transcranial techniques for the same category of meningiomas [2].

Olfactory groove meningiomas arise from the meningothelial cap cells over the cribriforme plate and the fronto sphenoidal suture and account for 10% of all intra cranial meningiomas [1,2]. Although The tumour is located in the midline of the anterior skull base it can extend predominantly to one side especially for small to medium sized OGM which implies clinical, surgical and even post-operative considerations[2,3].OGM's are vascularised by the anterior and posterior ethmoidal arteries which are found to be typicallyenlarged[1,2,8].The ACA contribute to thePial Blood supply of large Meningiomas in this location [1,3,8]. The location of Tuberculum sellae meningiomas are particularly close that can be differentiated from OGM by their relatively small size and visual impairment first in the opposite of OGM which have a more insidious onset of symptoms with anosmia and progressive declining cognitive function. There are some similarities between tuberculum sellae meningiomas and posteriorly extending OGM. However, the optic nerves and chiasm are located inferolateral to OGM and superolateral to tuberculum sellae meningiomas as it might also be seen on visual field cut with inferior quadranopsia in OGM and bi temporal hemianopsia in TSM [1,3,8].

In this paper we are summarizing the main clinical features with our surgical approach selection of a 47 patients retrospective Serie over ten years period while focusing on complications avoidance strategy as well as a review of recent series with patient's outcome discussion.

II. Patients And Methods

We report a retrospective descriptive Serie of 47 patients operated on OGM in two centres over ten years period from January 2010 to December 2019 (25 patients were operated on at Ali Ait Idir specialized hospital in Algiers, and 22 patients in the department of neurosurgery at Cherchell's specialized neurosurgical hospital in Tipaza Province). We

collected clinical data, radiological findings prior to surgery as well as the surgical approach adopted for every case with the outcome of all OGM patients while discussing the operative technique used.

Surgery is usually required as soon as the diagnosis was made due to the large sized OGM with mass effect typically found on Imaging of this location of the tumour [9]. The widespread use of use of imaging in the few last decades allowed incidental OGM findings. Therefore, OGM tend to appear to present relatively smaller sizes. On the other hand, care should be taken into account to the silent progress of the tumourwith insidiouscognitive symptoms which are responsible for the classical large size of these tumours [1,4,9]. Regular observation helped with radiosurgery seem to be an option for patients presenting with incidental or small sized OGM according to patient's life expectancy.

III. Approach Selection And Planning

The bifrontal Sub frontal approach is the most adopted approach for large OGM that was tailored by many neurosurgeons [1,9,10]. This approach offers an early access to the ethmoidal arteries, branches of middle meningeal artery and the ophthalmic artery. This approach is particularly preferred by many authors with variety of refinement for large OGM. the bifrontalsubfrontalapproachoffers a short distance to the OGM, the anterior skull base and the posterior pole of the tumour bilaterally allowing a convenient dissection of the optic apparatus and ACA with its branches. preservation of ACA branches should be always attempted. however, some authors

reported that the fronto polar artery as well as small branches of the ACA toward the meningiomacan be sacrificed without consequences [10] while others advocate that injury to the hypothalamic perforators can lead to dramatic worsening of the patients [9]. A convenient positioning of the head allows a significant reduction of the frontal lobe retraction [1,9,10].

The frontal sinus is nearly always encountered in the bifrontal sub frontal approach and require a particular attention. The anterior limit of craniotomy is performed at the levelof 1 cm below the line above the orbital rims. The frontal sinus is first breaches by the opening of the outer bony table first before the inner table is then removed using forceps. Mucosae is then removed from the bone flap before the latter will be soaked in saline solution with iodine. The frontal sinus is then cranialized with the exenteration of mucosae first followed by the obstruction of the frontal ducts using bone wax and Iodine. Care should be taken to avoid any additional bony defect of the anterior skull base to avoid postoperative mucoceles and infection. The pericranium is then sutured tight over the opened frontal sinus. the dura is opened horizontally at the more anterior and inferior aspect of the falx with ligation of the sagittal sinus and falx cutting at this level.

Pterional approach was first reported in a Serie of 11 cases of OGM operated by Hassler and Zentner in 1989. It offers many advantages as it spares the SSS, cortical veins, avoids frontal lobes compression and frontal sinus opening while allowing the surgeon to visualize the anterior circulation, the basal feeders, ON and CH. However, this approach does not allow the preservation of the contralateral olfactory nerve and might need excessive brain retraction to reach the contralateral olfactory nerve especially for smaller sized OGM. This approach is found to be difficult to be used to address the tumour in the frontoethmoidal sinuses implying a challenging reconstruction of the anterior skull base defects. Afterall, the Pterional approach might be adequate for large lateralised OGM with less involvement of the anterior skull base.

The Subfrontal approach seems to be adequate for Almost every OGM according to Knospas it offers a simple route with less complications while providing same surgical results [9]. This approach avoids the opening of the frontal sinus making it a simple and fast when addressing the removal of OGM. Also, this approach allows control of the ethmoidal arteries with opening of the sylvian fissure with early identification and dissection of the ipsilateral ON, ICA. Accordingly, the devascularisation become more effective and less dangerous. In the final stage, dissection of the tumour from ACA, AcoA with its perforators as well as A2 and frontopolar arteries is carried out of both sides. Orbital osteotomies can be added to this approach to limit brain retraction.

The lateral supra orbital approach put the sylvian fissure in the border of craniotomy and can be opened when necessary. It provides advantages of the pterional approach but it is less traumatic, faster (158minutes in the average skin to skin), economic benefit, slight blood loss <250ml in large OGM, good visualization of feeders from anterior circulation that can be responsible of an important bleeding particularly in large OGM [8].

Extended endoscopic endonasalTranscribriformapproach (EEEA) allowed resection of OGM due to the advancement in endoscopic optics and instrumentation [2,9]. This route allows early devascularization of the tumour with early blood supply control. On the other hand, this approach is limited by the lateral extension of the tumour and the significant risk of post-operative CSF leak. The high rate of post-operativeanosmia due to the difficulty dissecting the olfactory nerves and the major concern of skull base reconstruction dictates that this approach should be taken with caution [2,8,9]. The role of EEA remains limited to small OGM with no vascular encasement, no lateral dural attachment, without intact olfaction. In our serieThis approach was chosen for 4 casesresenting with anosmia due to small OGM extending significantly through the cribriform plate.

IV. Results

4.1 Clinical features

Anosmia was a near constant clinical feature representing 39 cases of our serie regardless of the size of the OGM. thus 8 casesmeasuring 3 to 6 cm in diameter show a preserved olfaction and were particularly associated with a unilateral extension.Large and Giant OGM with diameter exceeding 6cm were the main subgroup in our seriepresenting 68% of all cases and show a variety of symptoms ranging from a slight memory loss to dramatic dementia with important visual loss. The rest of clinical features are summarized in table 1

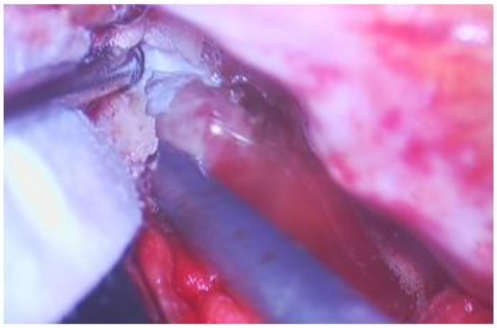

Figure 1: *Bifrontal subfrontal approach to a giant OGM. debulking using CUSA*

Figure 2: *superiorArachnoid plan dissection of a giant OGM under high magnification*

Table 1:

Size OGM	**<3cm**	**3-6cm**	**>6cm**
Mentotal 18	0	4	14
Women total 29	4	7	18
Sexeratio: 1.6(F/M)			
Mean age (yo)	45	54	58
Anosmia	4	3	32
Headaches	2	4	7
Short term memory loss	-	5	4
Flat affect & dementia	-	-	28
Urinary incontinence	-	-	5
Visual disturbances			
Visual acuity loss		1	9
Visual field cuts		1	14
Forster Kennedy syndrome	-	-	1
Seizures	-	-	8

4.2RADIOLOGICAL FINDINGS

CT without contrast shows a slightly hyperdense mass with important enhancement after injecting the contrast agent. CT scan shows not only the typical bony hyperostosis in the skull base but also, it might show a thinning and local bony defect leading the tumour to invade sinuses and orbits with a lesser degree that can be identified on coronal views. 4 cases in our Serie were particularly found to develop through the cribriform plate and were operated via EEEA transcribriformapproach. Typical dural tail can be seen on T1 weighted imaging on MRI after contrast agent administration. The lack of this typical feature on MRI lead to suspect the exceptional schwannoma of the Olfactory nerve sheets [9]. Frontal oedema is particularly observed in 10 large OGM in our Serieand was evaluated on T2 Weighted images as it is particularly found in large to giant OGM while it is considered as an important factor influencing the approach selection, operative strategy and even post-operative cognitive worsening which is responsible of some cases of mortality [2,8,9,10]. As for small to medium sized OGM, care should be taken into the possible lateral extension of OGM especially for patients presenting with a preserved olfaction and that surgery should focus on the olfactory preservation. The posterior pole of the tumour should be assessed on T2 Weighted imaging in the purpose to evaluate the dissection plan with the possibility of ACA encasement. The relationship of the tumour toward the optic apparatus and the optic canal should be evaluated for any OC invasion, local mass effect on the ON and CH which are found to be related to large and giant OGM.

4.3 SURGICAL RESULTS AND OUTCOME

The Goal of surgery consists of the total removal of the tumour with the involved dura and the hyperostotic invaded bone, Gross total resection (Simpson 1) was achieved in 92%.The GTR was particularly achieved in all cases presenting with less than 3cm in diameter and operated via EEEA approach. Whereas the subtotal resection was performed in 2 cases presenting an important encasement of the ACA with a small residuethat was left in place. Also, for 2other cases presented with a large invasion of the ethmoid and planum sphenoidale as well as an important optic canal invasion bilaterally, a near total resection was then achieved in these two cases.

Early follow up strategy consists of early clinical and radiographical follow up with CT performed usually in the first hour postoperatively to rule out hematomas,pneumocephaly or frontal oedema. The extent of resection is estimated by the surgeon after the surgery and assessed with an MRI in the first week post operatively. Long term follow-up focuses on any residual tumor growth detection on MRI performed yearly.

Table 2:

Features	Number(percentage)
Surgical approaches	
Bifrontal subfrontal	26(55.31%)
Pterional	9(19.14%)
Subfrontal Unilateral	8 (17.02%)
EEEA trans cribriforme	4 (8.51%)
Optic canal involvement	
Unilateral	10 (21.2%)
ACA encasement	7 (14.8%)
Extent of resection	
GTR	43 (92%)
NTR	2 (4.2%)
STR	2 (4.2%)

Functional mental status is the most improved clinical featurein 80% of cases that was reported to be related to frontal oedemaregression [8].

Visual improvement was reported in 72% of patients assessed with preoperative objective examination and it was found that the extent of visual improvement is related to the duration of visual disturbances since the onset of symptoms. The microsurgical techniques helped to achieve a better dissection of the optic nerves with a significant decrease risk of visual loss. Aggressive resection should be avoided in favour to a subtotal resection when the capsule is adherent to the optic nerve.The lateral based approaches (Pterional, fronto-lateral) were found to be adequate for better dissection and preservation of the optic pathways.

The adequate management of visual loss due to ischemia consist of the use of calcium channels blockers with adequate blood pressure to prevent visual deterioration. Patients were seizure free in 60% of cases(5 cases).

Anosmia persist postoperatively despite the constatnt attempt to the anatomic preservation ofthe olfactory tracts. The olfactory function loss is constant in the transcribriform approach due to the impossibility to dissect the olfactory nerves. olfactory preservation was seen in 4 cases operated by unilateral subfrontal approach. While the anatomic preservation was achieved in 10 cases

4.4SURGICAL COMPLICATIONS:

CSF leakwas found in 2 cases operated via EEEA transcribriform approach that was successfully managed with lumbar CSF drainage. As for transcranial approaches used in our Serie, the CSF leak was not observed.Careful Drilling of hyperostosis with reconstruction of the anterior skull base with pericranium sutured in place in a water tight closure with dural patching is the main procedure to avoid such complication. No infections or meningitisrelated to post-operative CSF leak was seen. During the reconstruction ofthe dura we tend to leave a sufficient ridge over the inferior limit of the bone flap to avoid necrosis and oedema of the pericranial flap which can help a better reconstruction of the anterior skull base.

Increased post-operative Frontal oedemais admitted to be related to cognitive worsening but that was not addressed widely in the previous series [8]. Frontal oedema can be avoided with less retraction of the frontal lobe particularly in the bifrontal subfrontal approaches when associated with the sacrifice of the anterior sagittal sinus.However, further comparison between different approaches should be performed to determine a possible additional frontal oedema risk specific to a particular approach [8]. Frontal lobe syndrome may result from ischemia or significant parenchymal oedema which was seen in 12 cases of our Serie and managed successfully after 1 week.

Good Cosmetic outcome is dealt with fixation of the bone flap to avoid it sinking

Postoperative haemorrhagewas found in the surgical nest of 4 cases of large OGM which did not require reoperation.

Intracranial haemorrhage, obliteration of hypothalamic feeders and an oedema are particularly found to be associated with mortalities reported in the literature [8]. Care should be taken to dissect the ACA, fronto-polar arteries as it is usually possible in the majority of cases.02 cases of our serie presented with an important encasement of ACA leading to a subtotal resection. Other complications (sepsis, pulmonary embolismwere found to be responsible formortality cases in recent series [8]. Overall, the 30-day mortality rate is found to be up to 4.4% in the literature. No mortality was recorded in our serie.

Overall, complications seem to not be related to the approach used. Skull base approaches were particularly suspected to betheoretically responsible for a higher rate of CSF leak and infection but that was not observed in the majority of serieswhich have shown that these complications can be avoided with adequate reconstruction of the skull base in addition to a convenient management of a breached frontal sinus [1,4,8]

V. Discussion

The outcome of the olfactory function is related to the adopted surgical route as the transcribriform EEN approach is responsible of anosmia in all cases operated according to several series regardless the size of the operated OGM via this route [2,8].whereas the transcranial approaches seem to be adequate for the anatomical preservation of the olfactory tract displaced classically outward by the tumour. The vulnerable olfactory tract should be dissected proximally to the olfactory bulb. That does not guarantee the preservation of olfactory function despite of its anatomical preservation. The olfactory tract is particularly weak due to an ischemia caused by bipolar coagulation and even the slightest manipulation can abolish its function. Many authors advocate that the olfactory function preservation should always be attempted even if it is considered to be impossible for large OGM [10].JuhaHernesniemi succeeded to preserve particularlythe contralateral olfactory function in only small and medium sized OGMs while 88% of patients with larger OGM presenting with anosmia showed no improvement[8]. Transcranial approaches tend to be more favourable to olfaction preservation even for small OGM as it was achieved around 67.7% [8,10,11].

Embolization was not performed in our serie as the blood loss was successfully managed in all our cases despite many findings showing a significant decrease in blood loss following Embolization in many studies. Embolization is not without risks as Rosen et al reported two cases of monocular blindness with 1.8% of visual field cut following supraselective angiography for Embolization [1,10].

There are multiple approaches reported in the surgery of OGM. The frontolateral approach which similar to the LSO approach was found to be superior than the bifrontal Approach but from the post-operative frontaloedema point of view [8]. Authors then concluded that the SSS should be preserved during surgery of OGMs. There is a raising concern to compare the different approaches for OGM surgery. A recent anatomic study concluded that the mini supra orbital approach with the removal of the orbital rim provides similar surgical view of the pterional and the orbitozygomatic approaches. But J Hernesniemi stated that orbital osteotomy is not necessary in the OGM as he operated on 66 patients with small to medium and even large OGM with very good results [8].

The Adequate approach adopted for OGM should ideally combine an early devascularisation of the blood supply of the tumour, visualisation of the anterior skull base with less retraction of the frontal lobe. Accordingly, a better control of the posterior pole of the tumour dictates a good identification of the optic nerve, chiasm and the anterior cerebral artery with the frontopolar artery to achieve a complete removal of the tumour, reconstruction of anterior skull base with an accepted cosmetic result.

Despite the Multitude of approaches reported in the literature of the OGM's surgery, there is a lack of consensus among neurosurgeons to identify the superiority of an approach over the others [1,3,8]. That can be explained by the considerable difference in size of the OGM, relatively similar good results by recognised authors who used different approaches [1,4,8], the difficulty to control every surgical requirement with one specific approach regardless of the size of the OGM. Few series tend to adopt a more customized approaches taking into account the tumour size, the laterality of the tumour and the involvement of paranasal sinuses. It is widely admitted that the Bifrontal subfrontal approach is convenient for large OGM as it offers less retraction of the frontal lobes. The pterional and unilateral subfrontal approach are commonly used in smaller tumours [9,10]. The pterional approach is preffered by some authors as it offers a better control of the optic nerve and the vascular structures. Orbital osteotomies can be added to shorten the distance to the tumour and to avoid additional retraction. Unilateral approaches are preferred to avoid cognitive deterioration.Subcranial approaches are advocated for an important involvement of the para nasal sinuses

The complete resection rate was reported to vary between 50% to 90 % since 1990 [8,9]. It was widely admitted that the extent of the surgical resection can be achieved independently from the chosen surgical route [9]. However, in a recent review by Shetty at al who compared the transcranial approaches versus the

Endoscopic endonasal approaches have found that the GTR was achieved in 90.9% in transcranial approaches and 70.2% after an EEA. CSF leakage rate was around four folds in EEA approach with 25.7% and only 6.3% in transcranial approaches in addition to 100% olfaction loss was reported in EEA and 61% after transcranial approaches. [8,9,10,11]. It is admitted that OGM greater than 4cm tend to extend laterally, present a poor cortical cuff and adherence to optic nerve as well as vascular structures. We need to take into account that the proper and careful patient selection with tailored surgical approaches allows 100% GTR via EEA versus 80% of transcranial approaches, whereas 62.5% was found in the combined group [11].

The combined transcranial-EEA approach (endoscopic assisted transcranial or cranionasal approach) was reported to be particularly useful in recurrent OGM with significant involvement of paranasal sinuses with a high rate of lateral extension with tumour adherence to neurovascular structures as the EEA offers an additional reconstruction solution with the nasoseptal flap since patients present with a prior craniotomy with pericranial Flap used in the first surgery [11]. Two stages approach with EEA followed by fronto lateral craniotomy for giant OGM exceeding 6cm in large diameter were reported by Cappabianca [2].

The attitude of surgeons toward the management of the invaded dura and the bony hyperostosis diverge between those who advocate the removal of the superficial hyperostosis with coagulation of the dura to prevent the post-operative CSF leak, and those who suggest an aggressive approach by the removal of all the invaded bone and duraon the account of an increased risk of CSF leak. However, the assessment of these two different surgicalattitudes was found to be difficult to ascertain particularly toward the risk of long-term recurrence [1,8,9]

Recurrence rate in our Serie was observed in 10 cases after a median follow up of 48.5 months. It was particularly seen in the NTR groupand STR group due to an important dural attachmentposterolaterally in contact with the optic nerve in 2 cases and important encasement of A2 in the supero-posterior pole of the tumour in 2 other cases. All patients have been followed with periodical clinical and radiological assessment.Recurrences were reported to appear in the first 5 years after surgery and it has been related to a less addressed total removal of the tumour in the first time since the description of Simpson in 1957. as it was mentioned in our Serie recurrence rate seems to reflect the important size of the tumour at the time of diagnosis. We have found that 9 out of 10 recurrences involved large to giant OGMs with diameter exceeding 6 cm. Therefore, the fear of neurological worsening related to frontal oedema, encasement of large blood vessels such as ACA, ACoA and Also the Optic nerve make the procedure safer to be stopped leaving a small residue of the tumour behind. But with the cost of potential further high recurrence rate in the following 5 years or more. The discussion of the extent of tumour removal in comparison with recurrence rate should take into account the quality of life of patients during the following years after surgery of large to giant OGM [1,3]. The difficulty of the anterior skull base reconstruction seems to be another factor of a subtotal resection and recurrence of OGM due to an important bony hyperostosis and large dural attachment. The analysis of these attributes dictates that the surgeon should emphasize the removal of the bony hyperostosis with the dural attachment in addition to a complete water tight reconstruction of the anterior skull base in contrast with the perseverance of freeing the tumour capsule from important neurovascular structures that should be addressed wisely as it risks major or vital consequences on the patient. Risk factors of recurrence were coagulation of the dura without removal of the dural insertion, bone invasion, ethmoid sinus infiltration and also the soft consistency of the tumour according to J. Hernesniemi[8]. The recurrence rate seems to be influenced when only the intra cranial tumour is advocated for removal in the elderly in the opposite of young patients with anosmia where radical removal of the tumour is planned with ethmoid bone drilling aiming for a longer recurrence free follow-up.

Recurrence rates varies between 0 to 41 % in the literature and it depends mainly on the resection rate, follow up duration and the degree of orbital and paranasal sinuses [1,8,10]. The mean follow-up in many series is around 10 years. The initial resection of the invaded bony hyperostosisseems to be an independent factor of recurrences at 15 yearslength follow-up. The MIB-1 index might be added toaffect the incidence of recurrence as that lack further detailed data from recent series.

Recurrences are discovered in the regular post-operative imaging follow-up as they tend to develop many years after the initial resection. Surgery is rarely required, but when needed it must address the invaded dura and the bony hyperostosis. In the other cases, Radiosurgery remains an adequate alternative option in the management of recurrences for patients who are not prone to undergo the second radical surgery and especially for the few cases of residual adherent capsule to important neuro vascular structures. Recurrent tumour control was achieved in 93% with a significant volume reduction of 10% [1,10].

VI. Conclusion

Surgical experience in anterior skull base approaches with tailored strategy for each patient by choosing a convenient and individualized approach planning are mandatory for achieving best results in OGM surgery.

Bibliography

[1]. Michael E. Sughrue, Nader Sanai, and Michael W. McDermott, Al Mefty's meningiomas Franco DeMonte, Michael W.McDermott, Ossama Al-Mefty second edition 2011

[2]. Paolo Cappabianca, Luigi M. Cavallo, Michael W. McDermott, Tuberculum sellae meningiomas: grading scale to assess surgical outcomes using the transcranial versus transsphenoidal approach, Neurosurgical focus vol 44 (4):E9,2018

[3]. STEPHEN J. HENTSCHEL, M.D., F.R.C.S, AND FRANCO DEMONTE, M.D., F.R.C.S, Olfactory groove meningiomas, Neurosurg Focus 14 (6):Article 4, 2003

[4]. Michael Saleman, MD, Roberto C.Heros MD, Edward R. Laws, Jr MD, Volker K.H Sonnetag, MD, Kemp's Opertavive Neurosurgery , Vol 1, Springer

[5]. Saul F. Morales-Valero, MD, and Giuseppe Lanzino, MD, Olfactory groove Meningiomas. Contemporary Neurosurgery Volume 36. Number 18. September 2014.

[6]. E. Sander Connolly, Jr., MD, Guy M. McKhann, II, MDJudy Huang, MDTanvir F. Choudhri, MD Ricardo J. Komotar, MDJ Mocco, MD, MS. Fundamentals of Operative Techniques in NeurosurgeryThiemeSecond Edition

[7]. Rossana Romani, M.D.Martin Lehecka, M.D., Ph.D.Emilia Gaal, M.D.Stefano Toninelli, M.D.ÖzgürÇelik, M.D.Mika Niemelä, M.D., Ph.D.Matti Porras, M.D., Ph.D.JuhaJääskeläinen, M.D., Ph.D.JuhaHernesniemi, M.D., Ph.D.LATERAL SUPRAORBITAL APPROACH APPLIEDTO OLFACTORY GROOVE MENINGIOMASm Neurosurgery Volu;e 65m Num 1

[8]. M. Necmettin Pamir, MDPeter M. Black, MD, PhD, FACSRudolf Fahlbusch, MD, PhDMeningiomas:A Comprehensive Text Saunders Elsevier 2010

[9]. Joung H. Lee, Meningiomas Diagnosis, Treatment, and Outcome, Springer 2008

[10]. James K. Liu,MD, Commentary: Results of Transcranial Resection ofOlfactory Groove Meningiomas in Relation toImaging-Based Case Selection Criteria for theEndoscopic Approach. Operative neurosurgery

[11]. Hooman Azmi-Ghadimia,Alexander Jacobs, *Charles Cathcart*, Michael Schulder . Preservation of Olfaction inOlfactory Groove Meningiomas with Stereotactic Radiosurgery

[12]. Daniel Monleon, MENINGIOMAS – MANAGEMENT ANDSURGERY, InTech February 2012

[13]. Professor Dr. med. MADJID SAMII, MARIO AMMIRATI, M.D. Professor Dr. med. Dr. phil. GERHARD F. WALTERSurgeryof Skull BaseMeningiomas. Springer

[14]. Meningiomas :Ossama Al Mefty, Saleem Abdulrauf, Georges F.Haddad . Elsevier 2011.

T,SELMANE, et. al. " Olfactory Groove Meningiomas Complications Avoidance Strategy in 47 Patients Seriewith Review Of the Literature." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 19(12), 2020, pp. 11-18.