Olfactory groove meningioma case series

see also Anterior skull base meningioma case series.

2022

Seventy-seven consecutive patients who underwent operations at Rigshospitalet, Denmark, between 2008 and 2017 were retrospectively analyzed. Patients were prospectively invited to respond to the Functional Assessment of Cancer Therapy-General, Functional Assessment of Cancer Therapy-Brain, and Hospital Anxiety and Depression Scale. Information regarding preoperative, perioperative, and postoperative factors was collected from the patient's medical records and scans.

Patients with subfrontal meningiomas exhibited better HRQOL and lower levels of anxiety and depression than general populations and other meningioma and glioblastoma cohorts. The only statistically significant prognostic factors for long-term HRQOL were the number of symptoms at diagnosis and whether patients were discharged home or to a local hospital postoperatively. Tumor and peritumoral brain edema volumes were not prognostic factors.

Patients with subfrontal meningiomas exhibited better long-term postoperative HRQOL and were less likely to have anxiety or depression than the reference populations. This information on long-term prognosis is very valuable for patients, next of kin, and neurosurgeons and has not been previously studied in detail [1].

The clinical and surgical data of patients who had been operated on for large (4-6 cm) or giant (>6cm) OGM via a UFTA between 2011 and 2018 were retrospectively collected.

In all, 18 patients were included. All tumors were compatible with a diagnosis of OGM in the light of peri-operative examinations. 11 cases (61%) were large and 7 (39%) giant OGM; mean diameter was 6.1cm (range, 4-10cm). Resection extent was Simpson grade II in 14 cases (78%), grade III in 1 (5%), and grade IV in 3 (17%). Sixteen cases (89%) had no peri-operative complications, while 2 patients (11%) showed cerebrospinal fluid leakage and hemorrhagic deposition in the surgical area. There were no new neurological deficits nor deaths.

The UFTA for OGM is a relatively safe and effective approach, ensuring a high total removal rate with low mortality and morbidity. This study, with a reasonable number of patients, is one of the few in the literature on the outcome of this approach [2].

2021

A two-step staged resection procedure was carried out in a consecutive series of 19 patients harboring giant OGMs. As the first step, a bifrontal craniectomy was performed followed by a right-sided interhemispherical approach. About 80% of the tumor mass was resected leaving behind a shell-shaped tumor remnant. In the second step, carried out after the patient's recovery from the first

surgery and decline of edema, the remaining part of the tumor was removed completely followed by duro- and cranioplasty.

Ten patients recovered quickly from the first surgery and the second operation was performed after a mean of 12.4 days. In eight patients, the second operation was carried out later between days 25 and 68 due to surgery-related complications, development of trigeminal zoster, or persisting frontal brain edema. The mean follow-up was 49.3 months and all but one patient had a good outcome regardless of surgery-related complications.

The results suggest that a two-step staged resection of giant OGMs minimizes the increase of postoperative brain edema as far as possible and translates into lower morbidity and mortality [3)]

2019

Ung TH, Yang A, Aref M, Folzenlogen Z, Ramakrishnan V, Youssef AS. Preservation of olfaction in anterior midline skull base meningiomas: a comprehensive approach. Acta Neurochir (Wien). 2019 Apr;161(4):729-735. doi: 10.1007/s00701-019-03821-8. Epub 2019 Feb 4. Erratum in: Acta Neurochir (Wien). 2019 Feb 26;: PMID: 30715605; PMCID: PMC6503964.

2018

A retrospective study covering a 17-year period examined a total of 78 patients (31 males and 47 females) diagnosed with OGM, and surgically managed in the two participating institutions (Greece and Romania). The patients' charts as well as their imaging studies (head CT, brain MRI/1HMRS, brain MRA/MRV, cerebral DSA), and their operative reports were carefully reviewed. All participants underwent pre- and post-operative neurocognitive evaluation with the Mini Mental Status Examination (MMSE), and the Frontal Assessment Battery (FAB). Microsurgical resection was performed by employing a bilateral subfrontal, a unilateral subfrontal, or a pterional approach. The Simpson scale was utilized for assessing the extent of resection. The histological type of the resected meningioma was identified. The follow up period ranged from 2 to 15 years (mean: 5.6).

Results: Non-specific headache was the most common presenting symptom, followed by personality changes in our series. Grade 1 Simpson resection was accomplished in 19.2%, grade 2 in 46.2%, grade 3 in 17.9%, and grade 4 in 16.7%. The most common postoperative complication was anosmia (89.7%), followed by CSF leakage (21.8%). The observed 5-year recurrence rate was 11.8%. Analysis of our data demonstrated that patients with larger tumors presented with poorer neurocognitive status, and had also lower, compared with patients with smaller meningioma, postoperative neurocognitive outcome. Meningioma's histological type had no correlation with complication occurrence or tumor recurrence. Surgical resection significantly improved the preoperative MMSE scores of our patients, while the observed postoperative improvement of the FAB scores was not statistically significant. The bilateral subfrontal approach demonstrated higher complication rate than the other two approaches, in our series. Interestingly, bifrontal approach was associated with higher tumor recurrence rate. Tumor size, patient's age, and ethmoid bone infiltration seem to be predisposing factors for complication occurrence and tumor recurrence.

Individualized surgical strategy is necessary for mitigating the postoperative complication rate, and

the possibility of recurrence in the management of OGMs. The exact role of less invasive, endoscopic approaches in the management of these patients remains to be defined [4].

2016

Fifty-seven patients with olfactory groove meningiomas, who underwent 62 microsurgical resection procedures in 1990-2014 were included in the study (74% were more than 5 cm at presentation). Pterional and bifrontal craniotomies were the most commonly used approaches. At follow-up, the volume of the porencephalic cave after the lateral approach was significantly less in the side contralateral to craniotomy irrespective of tumor size. The difference between the ratio of the volume of the porencephalic cave and the initial tumor was significantly less after lateral approaches when compared to anterior approaches.

Conclusions: Lateral approaches (pterional/frontolateral) resulted in less frontal lobe change and better olfactory preservation in comparison to anterior approaches in the present series [5].

Nineteen cases were reviewed and divided according to operative technique into 3 different groups: purely endonasal (6 cases); supraorbital eyebrow (microscopic with endoscopic assistance; 7 cases); and combined endonasal endoscopic with either the bicoronal or eyebrow microscopic approach (6 cases). Resection was judged on postoperative MRI using volumetric analysis. Tumors were assessed based on the Mohr radiological classification and the presence of the lion's mane sign.

Results: The mean age at surgery was 61.4 years. The mean tumor volume was 19.6 cm(3) in the endonasal group, 33.5 cm(3) in the supraorbital group, and 37.8 cm(3) in the combined group. Significant frontal lobe edema was identified in 10 cases (52.6%). The majority of tumors were either Mohr Grade II (moderate) (42.1%) or Grade III (large) (47.4%). Gross-total resection was achieved in 50% of the endonasal cases, 100% of the supraorbital eyebrow cases with endoscopic assistance, and 66.7% of the combined cases. The extent of resection was 87.8% for the endonasal cases, 100% for the supraorbital eyebrow cases, and 98.9% for the combined cases. Postoperative anosmia occurred in 100% of the endonasal and combined cases and only 57.1% of the supraorbital eyebrow cases. Excluding anosmia, permanent complications occurred in 83.3% of the cases in the endoscopic group, 0% of the cases in the supraorbital eyebrow group, and 16.7% of cases in the combined group ($p = 0.017$). There were 3 tumor recurrences: 2 in the endonasal group and 1 in the combined group.

The supraorbital eyebrow approach, with endoscopic assistance, leads to a higher extent of resection and lower rate of complications than the purely endonasal endoscopic approach. The endonasal endoscopic approach by itself may be suitable for a small percentage of cases. The combined above-and-below approaches are useful for large tumors with invasion of the ethmoid sinuses [6].

2015

Ninety-nine patients who underwent 113 craniotomies at the Institute of Neurosurgery, Università Cattolica del Sacro Cuore, Rome, Italy between 1984 and 2010 were entered this study. The relationship between surgical approach (bifrontal, fronto-orbito-basal, and pterional) and either tumor diameter, extent of tumor resection, complication rate, need of reoperation, and Karnofsky Performance Status (KPS) was analyzed. The impact of age (≤ 70 vs. > 70 years), sex, tumor

diameter (< 6 vs. ≥ 6 cm), pre- and postoperative KPS (< 80 vs. ≥ 80), Simpson grade (I-II vs. III-IV), and World Health Organization (WHO) histologic grade (I vs. II-III) on survival was assessed. Kaplan-Meier survival curves were plotted and differences in survival between groups of patients were compared. A multivariate analysis adjusted for age, pre- and postoperative KPS, Simpson grade, tumor diameter, and WHO histologic grade also was performed.

The fronto-orbito-basal approach (n = 22) allowed a significantly greater percentage of Simpson I-II removals than the bifrontal (n = 70) and pterional approach (n = 21) (P = 0.0354 and P = 0.0485, respectively). The risk of life-threatening complications trended to be lower in patients operated upon either via the fronto-orbito-basal and via the pterional approach than in those treated via the bifrontal approach. Retraction-related brain swelling did not occur in any case after the fronto-orbito-basal approach (P = 0.0384); however, this approach was associated with a greater rate of cerebrospinal fluid leak (P = 0.0011). Among prognostic factors, age ≤ 70 years (P = 0.0044), tumor diameter <6 cm (P = 0.0455), pre- and postoperative KPS ≥ 80 (both P < 0.0001), Simpson grade I-II (P = 0.0096), and WHO histologic grade I (P = 0.0112) were significantly associated with longer overall survival. Age (P = 0.0393) and WHO histologic grade (P = 0.0418) emerged as independent prognostic factors for overall survival on multivariate analysis.

In the largest series of OGMs published to date, the bifrontal approach was associated with a greater risk of life-threatening complications compared with the lateral pterional and fronto-orbito-basal approaches. The fronto-orbito-basal approach provided greater chances of total tumor removal than the bifrontal and pterional approaches. Two independent factors for overall survival of patients with OGM were identified, namely age and WHO grade [7].

A retrospective review was performed on 34 consecutive patients who underwent primary OGM resection at a single London institution between March 2008 and February 2013. Collected data included patient comorbidities, pre-operative corticosteroid use, tumor characteristics, imaging features, operative details, the extent of resection, histology, use of elective post-operative ventilation, complications, recurrence, and mortality.

The complication rate was 39%. 58% of complications required intensive care or re-operation. Higher complication rates occurred with OGM > 40 mm diameter versus ≤ 40 mm (53 vs. 28%; p = 0.16); OGM with versus without severe perilesional edema (59 vs. 19%; p = 0.26), more evident when corrected for tumor size; and patients receiving 1-2 days versus 3-5 days of pre-operative dexamethasone (75 vs. 19%; p = 0.016). Patients who were electively ventilated post-operatively versus those who were not had higher risk tumors but a lower complication rate (17 vs. 44%; p = 0.36) and a higher proportion making a good recovery (83 vs. 55%; p = 0.20). Complete versus incomplete resection had a higher complication rate (50 vs. 23%; p = 0.16) but no recurrence (0 vs. 25%; p = 0.07).

The risk of morbidity with OGM resection is high. Higher complication risk is associated with larger tumors and greater perilesional edema. Pre-operative dexamethasone for 3-5 days versus shorter periods may reduce the risk of complications. We describe a characteristic pattern of perilesional edema termed 'sabre-tooth' sign, whose presence is associated with a higher complication rate and may represent an important radiological prognostic sign. Elective post-operative ventilation for patients with high-risk tumors may reduce the risk of complications [8].

2013

40 patients with OGM underwent surgical resection and estimated the olfactory function using the Korean version of the “Sniffin'Sticks” test (KVSS). Variable factors, such as tumor size, degree of preoperative edema, tumor consistency, preoperative olfactory function, surgical approaches, patient's age, and gender were analyzed with attention to the post-operative olfactory function.

Results: Anatomical and functional preservation of olfactory structures were achieved in 26 patients (65%) and 22 patients (55%), respectively. Among the variable factors, the size of the tumor was significantly related to the preservation of post-operative olfaction. (78.6% in size<4 cm and 42.3% in size>4 cm, p=0.035). Sparing the olfaction was significantly better in patients without preoperative olfactory dysfunction (84.6%) compared with ones with preoperative olfactory dysfunction (40.7%, p=0.016). The frontolateral approach achieved much more excellent post-operative olfactory function (71.4%) than the bifrontal approach (36.8%, p=0.032).

If the tumor was smaller than 4 cm and the patients did not present olfactory dysfunction preoperatively, the possibility of sparing the post-operative olfaction was high. Among the variable surgical approaches, frontolateral route may be preferable sparing the post-operative olfaction [9].

A total of 61 patients underwent the removal of olfactory groove meningiomas via the pterional approach. These included 58 primary and 3 recurrent tumors. The mean overall follow-up time was 122 months. Results in Early exposure and dissection of the internal carotid artery, middle cerebral artery, anterior cerebral artery, and optic nerve were feasible in all cases. Complete tumor removal was achieved in 60 patients. Morbidity and mortality rates were 26% and 1.6% respectively. Postoperative complications included epileptic seizures (five patients) and cerebrospinal fluid (CSF) leak (two patients). During follow-up, we recorded three tumor recurrences. Conclusions The pterional approach appears to be an excellent solution for the treatment of olfactory groove meningiomas. Its foremost advantage is early visualization of the posterior neurovascular complex. Moreover, it allows frontal sinus preservation and timely tumor devascularization and avoids excessive brain retraction. The pterional view is familiar to most neurosurgeons and therefore the transition to this technique is fairly straightforward [10]

2009

Eighteen patients with OGM underwent microsurgical removal using the frontolateral approach. A retrospective study was conducted by analyzing clinical data, neuroimaging studies, operative findings, clinical outcome, and degree of tumor removal.

Findings: The patients were classified into group A with a tumor size less than 4 cm in diameter (7 out of 18 cases, 38.9%) and group B with a tumor size more than 4 cm in diameter (11 out of 18 cases, 61.1%). CSF rhinorrhea was observed in three patients (16.7%). Postoperative left frontal intracerebral hematoma occurred in one patient (5.6%) belonging to group A. In another patient (5.6%) belonging to group B, marked right frontal lobe swelling was evident after dural opening, which necessitated partial right frontal pole resection. Total tumor removal (Simpson grade 1 and 2) was achieved in 14 out of 18 patients (77.8%), while subtotal removal (Simpson grade 3 and 4) was achieved in 4 patients (22.2%). Of the 14 patients in whom total removal was achieved, 7 belonged to

group A (all 7 patients of group A with 100% removal), while the remaining 7 patients belonged to group B (7 out of 11 patients, 63.6% removal; one of them had anterior cerebral artery complex encasement). The four patients in whom subtotal removal was achieved belonged to group B; three of them showed anterior cerebral artery complex encasement, and one elderly patient had non-extensive paranasal sinus involvement. One patient (5.6%) in group B died from cerebral infarction after subtotal tumor removal with anterior cerebral artery injury during its dissection from the tumor capsule.

The frontolateral approach has the advantages of both the pterional and conventional bifrontal approaches. The frontolateral approach allows quick and minimally invasive access to OGMs less than 4 cm in diameter, and also to tumors more than 4 cm in diameter without encasement of the anterior cerebral artery complex. Tumor size more than 4 cm in diameter and encasement of the anterior cerebral artery complex are limiting factors for the frontolateral approach if radical tumor removal is considered [11)].

2007

56 patients suffering from olfactory groove meningioma were retrospectively reviewed.

Presenting symptoms of the 41 women and 15 men (mean age 51 years) were mental changes in 39.3%, visual impairment in 16.1% and anosmia in 14.3% of the patients. Preoperative neurological examination revealed deficits in olfaction in 71.7%, mental disturbances in 55.4%, and reduced vision in 21.4% of the cases. The tumor was resected via a bifrontal craniotomy in 36, a pterional route in 13, a unilateral frontal approach in 4, and via a supraorbital approach in 3 patients. The extent of tumor resection according to Simpson's classification system was grade I in 42.9% and grade II in 57.1% of the cases. After a mean follow-up period of 5.6 years (range 1-13 years) by clinical examination and magnetic resonance imaging (MRI), 86.8% of the patients resumed normal life activity. Olfaction was preserved in 24.4% of patients in whom pre- and postoperative data were available. Mental and visual disturbances improved in 88 and 83.3% of cases, respectively. Five recurrences (8.9%) were observed and had to be reoperated.

Frontal approaches allowed better resection of tumors with gross infiltration of the anterior cranial base, tumors extending into the ethmoids or nasal cavity, and in cases with deep olfactory grooves. Preservation of olfaction should be attempted in patients with normal or reduced smelling preoperative [12)].

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82 patients with olfactory groove meningiomas, including 63 women and 19 men with a mean age of 57.8 years (age range, 33-91 yr). Most patients presented with mental disturbance. Tumors were operated through the bifrontal (n = 46), frontolateral (n = 34), and pterional (n = 2) approaches. Total tumor removal (Simpson Grade 1 or 2) was achieved in most cases (91.2% frontolateral, 93.5% bifrontal). Perioperative mortality was 4.9% (four out of 82 patients, all operated through the bifrontal approach). The overall recurrence rate was 4.9%, with four patients requiring surgery. The mean follow-up period was 63.4 months (range, 4-270 mo).

Olfactory groove meningiomas were removed mainly through two different surgical approaches. Even in large tumors, high rates of total tumor resection could also be achieved with low recurrence rates

using the simple and minimally invasive frontolateral approach. In recent years, we have preferred to use the frontolateral approach, which provides quick access to the tumor with less brain exposure while still enabling total tumor removal with a low morbidity rate and no mortality [13) 14)].

2005

Eighty patients underwent 81 OGM surgeries. Tumor diameter varied from 2 to 9 cm (average, 4.6 cm). In 35 surgeries (43.2%), the tumor was removed through bifrontal craniotomy; nine operations (11.1%) were performed through a unilateral subfrontal approach; 18 surgeries (22.2%) were performed through a pterional approach; seven surgeries (8.6%) were carried out using a fronto-orbital craniotomy; and 12 procedures (14.8%) were accomplished via a subcranial approach. Nine patients (11.3%) had undergone surgery previously and had recurrent tumor.

Results: Total removal was obtained in 72 patients (90.0%); subtotal removal was achieved in 8 patients (10.0%). Two patients, one with total and one with subtotal removal, had atypical (World Health Organization Grade II) meningiomas, whereas 78 patients had World Health Organization Grade I tumors. There was no operative mortality and no new permanent focal neurological deficit besides anosmia. Twenty-five patients (31.3%) experienced surgery-related complications. There were no recurrences in 75 patients (93.8%) 6 to 164 months (mean, 70.8 mo) after surgery. Three patients (3.8%) were lost to follow-up. In two patients (2.5%) with subtotal removal, the residual evidenced growth on computed tomography and/or magnetic resonance imaging 1 year after surgery. One of them had an atypical meningioma. The second, a multiple meningiomata patient, was operated on twice in this series.

Conclusion: A variety of surgical approaches are used for OGM resection. An approach tailored to the tumor's size, location, and extension, combined with modern microsurgical cranial base techniques, allows full OGM removal with minimal permanent morbidity, excellent neurological outcome, and very low recurrence rates [15)].

2003

Fifteen consecutive patients with a diagnosis of olfactory groove meningioma were treated surgically between 1992 and 2001 (nine new cases, six recurrent). Only patients with benign meningiomas were included; atypical and malignant meningiomas were excluded. Surgical resection included the dura and drilling of the underlying bone and resection of the involved mucosa. We reviewed each patient's clinical records, radiological studies, sites of recurrence, grade of previous resection, and complications.

Results: Olfactory groove meningiomas invaded the underlying bone in 13 cases. All patients with recurrence had previously undergone a surgical resection corresponding only to Simpson Grade 2, which does not include the removal of underlying invaded bone. The sites of recurrence were in the cranial base or adjacent paranasal sinuses. The time to recurrence varied from 1 to 12 years (average, 7 yr; mean, 8 yr). Three patients had undergone one previous resection, two had undergone two previous resections, and one had undergone four previous operations. The ethmoid sinus was involved in all cases of recurrence, either with the sphenoid sinus or with an intracranial recurrence. Thirteen patients underwent complete resection of the underlying bone and the invaded paranasal sinuses, then reconstruction of the anterior fossa. No patient died. There were three instances of cerebrospinal fluid leakage (one requiring operative repair), one case of delayed worsening vision

after initial improvement, and two cases of transient cranial nerve palsy (Cranial Nerves III and IV). There was no recurrence at follow-up (average, 3.7 yr; range, 1-7.3 yr).

The cranial base and paranasal sinuses are sites of predilection for the recurrence of olfactory groove meningiomas. Recurrence is the result of a direct extension attributable to incomplete resection of involved bone and regrowth at the edge of a previous surgical field. Extensive resection of all suspicious underlying bone is a complement to the radical removal of these lesions. Reconstruction with a vascularized pericranial flap to prevent cerebrospinal fluid leakage is crucial [16)]

Thirteen patients, (12 women and one man, mean age 56 years) harbored OGMs (mean size 5.7 cm). All patients underwent bifrontal craniotomies and biorbital osteotomies. There were 11 complete resections (including the hyperostotic bone and dura of the cribriform plate and any extension into the ethmoid sinuses) and two subtotal resections with minimal residual tumor left in patients with recurrent lesions. No complication directly due to the surgery occurred in any patient. There were no recurrences in a mean follow-up period of 2 years (range 0-5 years).

With current microsurgical techniques, the results of OGM resection are excellent, with a high rate of total resection and a low incidence of complications. All hyperostotic bone should be removed with the dura of the anterior skull base to minimize the risk of recurrence [17)].

2001

Twelve patients (five men, seven women; mean age 52 years) with olfactory meningiomas were examined. In all patients extensive preoperative and postoperative lateralized olfactory testing was performed using the “Sniffin' Sticks” test battery, a psychometric testing tool. In eight cases the meningioma was lateralized (five left, three right), in four patients a bilateral meningioma was found. In addition to a detailed ear, nose, and throat examination MRI was performed on all patients.

Results: In preoperative testing, six patients were found to be anosmic on the side of the tumor, and two were hyposmic. Four patients were normosmic. Postoperative investigations showed lateralized anosmia in four patients on the operated side, three were normosmic on the contralateral side, and one was hyposmic. The remaining eight patients were completely anosmic postoperatively.

Conclusions: (1) Contrary to expectations, olfactory testing seems to be of little help in detecting olfactory meningiomas. (2) The likelihood of normal postoperative olfactory function contralateral to the tumor was high when the tumor was less than 3 cm in diameter and preoperative normosmia had been established. (3) Preservation of olfactory function ipsilateral to the tumor seems to be extremely difficult, irrespective of tumor size or surgical approach [18)].

1999

Between 1989 and 1996, a series of 37 consecutive patients underwent microsurgical tumor resection using the unilateral pterional approach; all patients except one underwent operations on the right side. In 23 patients (62%), the tumor diameter measured approximately 6 cm, and the size was less

than 4 cm in only 5 patients. The clinical presentation included mental dysfunction in 27 patients and visual impairment in 16 patients. The advantages of this approach are the early recognition of the posterior cerebrovascular complex, followed by a safe, rapid, and complete devascularization of the tumor and later by a favorable dissection of the capsular area from the frontal vascular branches and parenchyma.

Results: Total removal was achieved in all cases. There was one death unrelated to surgery. All patients presenting with mental dysfunction or with preoperative visual deficits recovered or improved. Postoperative magnetic resonance imaging confirmed complete tumor removal and demonstrated the brain parenchyma to be preserved and intact, primarily on the side opposite from the craniotomy.

Conclusion: Our experience with the pterional approach suggests a greater role for this procedure in the treatment of olfactory groove meningiomas [19].

1991

Experience with the surgical treatment of olfactory groove meningiomas using a pterional approach. This approach provides the advantages of previous techniques, such as preserving the frontal brain and superior sagittal sinus, early devascularization of the tumor, and late dissection of tumor borders. Moreover, it also compensates for the shortcomings of other techniques, e.g., compression of frontal bridging veins, late dissection of dorsal tumor aspects involving vessels and optic nerves as well as facultative infection and cerebrospinal fluid fistula-related complications caused by the opening of frontal sinuses. To date, 11 patients were treated in this way. As we encountered no surgical complications in our series we are encouraged to present our procedure [20].

1984

A series of 36 patients are presented; in all cases but one, their conditions were diagnosed late, and not until the tumor had reached a very large size. By the time the proper diagnosis was made and the tumors were surgically removed, mental or visual disability was often irreversible. Conditions of patients initially seen with anosmia should be investigated by presently available noninvasive diagnostic methods including computed tomographic scanning [21].

1983

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