

Comparison of Two Different Surgical Approaches for Resection of Olfactory Groove Meningiomas in a Neurosurgery Centre

Olfaktorinės daubos meningiomų pašalinimas Neurochirurgijos klinikoje: dviejų chirurginių technikų palyginimas

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SUMMARY

Introduction. Meningiomas are the most common primary brain tumours. Olfactory groove meningiomas (OGMs) are a subset of intracranial meningiomas. OGMs tend to grow slowly and gradually compress the frontal lobes. In the Neurosurgery Department of the Hospital of Lithuanian University of Health Sciences Kaunas Clinics two different surgical approaches for OGMs resection are practiced: the extended pterional approach and the endoscope assisted supraorbital key hole approach.

Aim. This study aimed to compare the outcomes between the extended pterional approach and the endoscope assisted supraorbital key hole approach in a Neurosurgery Centre.

Material and methods. OGM was diagnosed after magnetic resonance imaging. Patients were divided into two groups according to surgical approaches. Retrospective analysis of inpatients' medical records was performed.

Results. During the period of 2007–2016 forty-two patients with diagnosed OGM underwent surgical treatment. Frontally extended pterional approach was applied for 32 patients and endoscope assisted supraorbital key hole approach was applied for 10 patients. Mean size of tumour, duration of surgery, percentage of total tumour resection and number of complications did not differ significantly between different surgical approaches. Overall, three complications were observed.

Conclusions. Our study revealed that extended pterional and endoscope assisted supraorbital key hole craniotomies are comparably effective for resection of different size OGMs.

Key words: Olfactory groove meningioma, extended pterional approach, supraorbital key hole approach, outcomes.

SANTRAUKA

Įvadas. Meningiomos yra dažniausia pirminių smegenų navikų rūšis. Olfaktorinės daubos meningiomos auga lėtai ir palaipsniui spaudžia kaktinę smegenų skiltį. Lietuvos sveikatos mokslų universiteto ligoninės Kauno klinikų Neurochirurgijos klinikoje olfaktorinės daubos meningiomos šalinamos naudojant dvi skirtingas chirurgines technikas – išplėstinę pterionalinę kraniotomiją ir supraorbitalinę „rakto skylutės“ kraniotomiją panaudojant endoskopą.

Tikslas. Palyginti išeitis tarp pterionalinės kraniotomijos ir supraorbitalinės „rakto skylutės“ kraniotomijos panaudojant endoskopą.

Tyrimo medžiaga ir metodai. Olfaktorinės daubos meningiomos buvo diagnozuotos atlikus magnetinio rezonanso tyrimą. Pacientai buvo padalinti į dvi grupes pagal taikytą chirurginę techniką. Atlikta retrospektyvinė duomenų analizė iš pacientų ligos istorijų.

Rezultatai. 2007–2016 m. laikotarpiu 42 pacientams, kuriems buvo diagnozuota olfaktorinės daubos meningioma, buvo taikytas chirurginis gydymas. 32 pacientams buvo atlikta išplėstinė pterionalinė kraniotomija, 10 – supraorbitalinė „rakto skylutės“ kraniotomija. Naviko dydis, operacijos trukmė, naviko pašalinimo radikalumas ir komplikacijų skaičius statistiškai reikšmingai nesiskyrė tarp tirtų grupių. Iš viso stebėtos trys komplikacijos.

Išvados. Išplėstinė pterionalinė kraniotomija ir supraorbitalinė „rakto skylutės“ kraniotomija panaudojant endoskopą nesiskyrė savo saugumu ir efektyvumu šalinant įvairaus dydžio olfaktorinės daubos meningiomas.

Raktiniai žodžiai: olfaktorinės daubos meningioma, išplėstinė pterionalinė kraniotomija, supraorbitalinė „rakto skylutės“ kraniotomija, išeitys.

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INTRODUCTION

Meningiomas are the most common primary brain tumours which account for approximately 30 % of central nervous system (CNS) tumours in adults [1]. Olfactory groove meningiomas (OGMs) are a subset of intracranial meningiomas which originate from arachnoidal cells embedded in the midline dural coverings of ethmoid lamina cribrosa and frontosphenoidal suture [2, 3]. These tumours account for 8%–13% of all intracranial meningiomas [3]. OGMs tend to grow slowly and gradually compress the frontal lobes [4]. That is why these tumours usually remain clinically silent for a long period of time, and they reach a large size upon their diagnosis, so their resection can be challenging [2].

Two surgical approaches to olfactory groove meningiomas are traditionally practiced: the unilateral pterional approach and the subfrontal approach [4]. According to the scientific literature, the subfrontal approach is more suitable for large and giant OGMs, whereas the pterional approach is recommended for medium and large OGMs [5-7]. Some authors indicate that pterional approach provides quick access to the tumour with less brain exposure and allows frontal sinus preservation whereas subfrontal approach is associated with the risk of opening of the frontal sinuses [7, 8]. However it can be difficult to remove thin, long and giant tumours using pterional approach [5, 7, 9].

In the Neurosurgery Department of the Hospital of Lithuanian University of Health Sciences Kaunas Clinics two different surgical approaches for OGMs resection are practiced: the extended pterional approach and the endoscope assisted supraorbital key hole approach.

This study aimed to compare the outcomes of these two different approaches in a Neurosurgery Centre.

MATERIAL AND METHODS

Study object

During the period of 2007 and 2016 forty-two patients with newly diagnosed OGMs underwent surgical treatment in the Neurosurgery Department of the Hospital of Lithuanian University of Health Sciences Kaunas Clinics. OGM was diagnosed after magnetic resonance imaging.

Retrospective analysis of inpatients' medical records was performed. The following data were collected: demographic characteristics (age and gender), pre-operative symptoms, type of surgical approach, duration of surgery, radicality of surgical resection and complications after surgery.

The study was approved by the Kaunas Regional Biomedical Research Ethics Committee (No. P2-9/2003).

Descriptions of surgical approaches

Endoscope assisted supraorbital key hole approach

After giving full anaesthesia skull clamp is placed and head is fixed in a straight position with small recline. Incision is made right above eyebrow which starts laterally from supraorbital notch to angulus of orbit. This incision helps to preserve intact supraorbital nerve. After dissection of soft tissue and temporal muscle a small burrhole is made laterally at pterional point. Craniotomy 2x1 cm is made. Dura is opened in a "X" shape. Using retractor frontal lobe is elevated and cerebrospinal

fluid is evacuated by opening basal cisterns. Because of head recline gravity helps to reduce retraction to frontal lobe. Using microscope tumour is removed from olfactory groove. During the surgery endoscope is used because it helps to visualize residual tumour, to coagulate matrix and to stop bleeding. At the end of the surgical procedure dura mater is sutured and hermetised with Tachosil. Bone fragment is replaced. Soft tissues are sutured layer by layer. Skin dermis layer is sutured with continuous subcuticular suture. Incision place post-op of supraorbital approach is shown in picture 1.

Extended pterional approach

After giving full anaesthesia skull clamp is placed and head is fixed in a slight rotated position. After skin incision and dissection of soft tissue and temporal muscle from skull a burrhole is made at pterional point. Then frontotemporal craniotomy which extends supraorbitally is made. Dura is opened in a "C" shape. Sylvian fissure is opened and using retractor frontal lobe is elevated and cerebrospinal fluid is evacuated by opening basal cisterns. Using microscope tumour is removed from olfactory groove. At the end of procedure dura mater is sutured and hermetised with Tachosil. Bone fragment is returned. Soft tissues are sutured layer by layer. Skin layer is closed with continuous locking suture.

Statistical analysis

Statistical analysis was performed using SPSS 13. Patients were divided into two groups according to surgical approaches (extended pterional approach and endoscope assisted supraorbital key hole approach). χ^2 test and t test were used for the collected data comparison between these groups. A P value of <0.05 was considered statistically significant.

RESULTS

During the period of 2007-2016 forty-two patients (25 women and 17 men) with diagnosed OGM underwent surgical treatment. Their average age was 57.4±1.8 yrs. The most



Picture 1. Incision place post-op of supraorbital approach

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frequent symptoms were headache (n=24), epilepsy (n=11), visual impairment (n=8) and anosmia (n=7).

Frontally extended pterional approach was applied for 32 patients and endoscope assisted supraorbital key hole approach was applied for 10 patients. Mean size of tumour, duration of surgery, percentage of total tumour resection and number of complications did not differ significantly between different surgical approaches (table 1). Patient's who underwent endoscope assisted supraorbital key hole approach pre-operative and post-operative MRI is presented in picture 2.

According to the World Health Organization (WHO) classification of tumours, majority of OGMs were WHO grade I: meningotheial 73.8%, transitional 19.0% and microcystic 2.4%. Only two meningiomas were WHO grade II: atypical 4.8%.

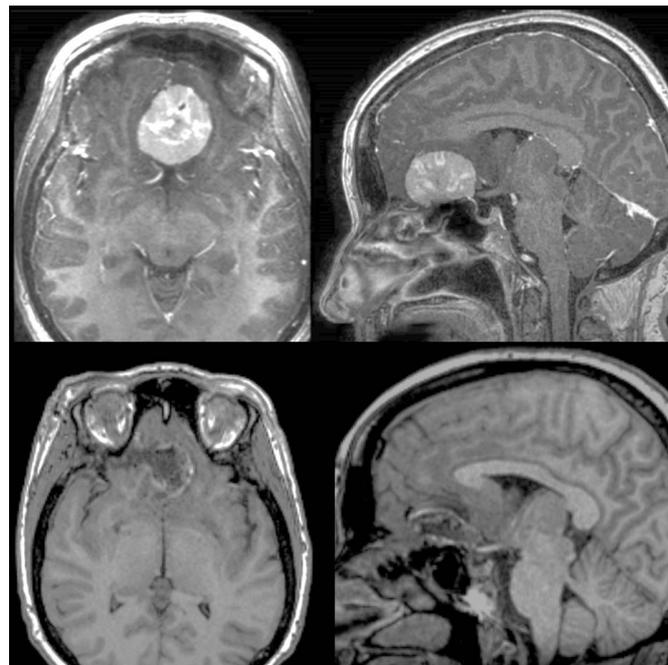
Overall, three complications were observed. External cerebrovascular fluid drainage was performed for 1 patient with cerebrospinal fluid leak and for 1 patient with subcutaneous accumulation of cerebrospinal fluid in the region of previous surgery. Meningitis was diagnosed for 1 patient. Overall, 2 patients did not survive after surgical treatment and they both underwent pterional approach (table 1). Deaths were not related to surgical procedure and were caused by pulmonary embolism and cardiovascular accident.

DISCUSSION

Our study revealed that the outcomes and efficacy between OGM's resection using extended pterional and endoscope assisted supraorbital key hole craniotomies did not differ. Using these two approaches the similar size tumours were resected safely and the same radicality of tumor resection was achieved (Simpson grade II).

The average age of studied patients and the main symptoms of OGMs in our study were similar to the data from scientific literature – headache, epilepsy, visual impairment and anosmia [2, 3, 4, 7, 9, 10, 11].

Results of our study are in agreement with other studies showing that extended pterional approach is simple, fast and preserving normal anatomy [10]. Lynch et al. analysed the outcomes of resection of meningiomas using extended pterional approach. Mean tumour size was similar to the data of our study. Lynch's study revealed that tumour was totally resected for 33 out of 38 patients (86 %) with anterior fossa meningiomas (30 cases of OGMs) who underwent surgery applying the extended pterional approach [10]. Seven complications were observed: 2 meningitis, 2 cerebrospinal



Picture 2. Pre-operative and post-operative MRI of supraorbital approach

fluid leak and 3 seizures [10]. 1 patient did not survive after surgical treatment because of pulmonary thromboembolism [10]. According to our study, tumour was resected totally for 96.9 % of patients and only 3 complications were observed. Two patients did not survive after surgery because of pulmonary embolism and cardiovascular accident.

Researches show that pterional approach can be successfully used for resection of various size meningiomas [9, 12]. Tomasello et al. revealed that in 17 of 18 patients (94.4%) with giant OGM, the tumour was resected completely using pterional approach and two deaths occurred [12]. Pallini et al. indicated that pterional approach was used for resection of different size OGMs (≤ 3 cm – ≥ 6 cm) and total tumour resection was achieved in 81 % and no death occurred [9]. Our study revealed similar results: using frontally extended pterional approach for resection of 1.5–7.8 cm OGMs high percentage of total tumour resection was achieved.

Our study showed that for all ten patients various size OGMs were resected totally applying endoscope assisted supraorbital key hole approach and no complications were observed. Banu et al. are in agreement with our results and present that total OGM resection was achieved in 100% of

Table 1. Outcomes after different surgical approaches of OGMs

	Frontally extended pterional approach (n=32)	Endoscope assisted supraorbital key hole approach (n=10)	P value ¹
Mean size of tumour, cm (range)	4.6±1.9 (1.5–7.8)	5.0±1.2 (3.6–6.2)	0.80
Duration of surgery, min.	233.1±49.8	222.0±81.5	0.13
Total tumour resection, %	96.9	100.0	0.46
Complications after surgery, n	3	0	0.66
Deaths after surgical treatment, n	2	0	0.30

Data are presented as mean±SEM

¹The differences between studied groups were not significant

the supraorbital eyebrow cases with endoscopic assistance and no complications were registered [13]. The mean tumor volume was 33.5 cm³ [13]. Results of the study performed by Igressa et al. suggest that with endoscope-assisted keyhole surgery complete resection of large anterior and middle fossa meningiomas can be achieved [14]. During this study 40 patients underwent surgery for large anterior cranial fossa meningiomas (diameter >5 cm) extending to the middle fossa. 90% patients showed a good outcome and returned at long-term follow-up to their previous occupations [14].

In conclusion, extended pterional and endoscope assisted supraorbital key hole craniotomies are comparably effective for resection of different size OGMs. Our study revealed that endoscope assisted supraorbital key hole approach is safe and determines radical tumour removal despite of the size of the meningioma.

Conflict of interest

None.

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