

of the 7 patients: patient S470 (ALA+ vs ALA- and ALA PALE vs ALA-), patient S473 (ALA+ vs ALA PALE and ALA PALE vs ALA-), and patient S509 (ALA+ vs ALA-).

Conclusion: This analysis showed, for the first time, that GASCs expressed a constitutive level of PD-L1 and that PD-L1 expression in GASCs was not uniform among patients or within the same patient. GASC analysis combined with 5-ALA-guided sampling (from core to periphery) made it possible to highlight the role of the tumor microenvironment at the infiltrating margin, which might cause clinical resistance, opening interesting perspectives for the future.

BRAIN AND SPINE 2 (2022) 101190 101531 CYTOKINES AS PROGNOSTIC AND DIAGNOSTIC TOOLS OF GLIOMAS

E. Xylouris¹, O. Kotronaki¹, E.C. Stamoulaki¹, A. Vakis^{1,2}, C.P. Tsitsipanis^{1,2}.
¹ University of Crete, School of Medicine, Heraklion, Greece² University Hospital of Heraklion, Department of Neurosurgery, Heraklion, Greece

Background: Gliomas are the commonest primary intracranial tumors, of which glioblastoma multiforme (GBM) is the most malignant form. According to WHO they are classified from grade I to IV. The forementioned tumors release numerous cytokines into the blood and cerebrospinal fluid (CSF), while the mediator role of the immune system seems to also be crucial in the secretion of them. Cytokines are small, signaling proteins released by cells that modulate numerous interactions and communications between cells, and can have significant value as biomarkers in diagnosis and prognosis of the glioma.

Methods: A systematic review of the literature via the PubMed was represented. 181 articles published within the last 10 years from 2012, with the following keywords: glioma, cytokines. Only 23 articles meeting the criteria were included into the current research.

Results: Cytokines like TNF- α , IL-6, IL-8 and IFN- γ are the most studied and promising diagnostic and prognostic cytokines for Gliomas. In patients with glioma, the concentration of IL-6 and IL-8 were considerably increased in the blood and CSF. Moreover, higher levels of IL-6 are associated with shorter survival, while the raised levels of IL-8 are associated with astrocytic glioma. The increasing tendency of IL-6, IL-1 β and TNF- α are correlated with the increasing of the grade. Another important observation was the elevated serum levels of INF- γ in GBM patients. Elevated levels of CCL22 in serum are associated with the risk of glioma more than 10 years before diagnosis and its concentration binds with poorer prognosis.

Conclusion: Great progress has been made in identifying new potential biomarkers for TBI. The identification of the cytokines mentioned above in serum and CSF will contribute to the early diagnosis and prognosis of glioma. However, there is still a need for new studies to find new potential molecules and how to use them in clinical practice.

4 SKULL BASE

4.1 Meningiomas

BRAIN AND SPINE 2 (2022) 101190 101532

SAFETY AND USEFULNESS OF 2 μ G-THULIUM LASER IN POSTERIOR FOSSA MENINGIOMAS

J.A. Andres Sanz¹, G. Cacciotti², S. Marrone³, A. Campione², C. Altamura⁴, C. Giacobbo-Scavo², F. Bocacci², E. Carpinetta², L. Mastronardi².
¹ Hospital Clínico Universitario Lozano Blesa, Neurosurgery, Zaragoza, Spain² Ospedale San Filippo Neri, Neurosurgery, Roma, Italy³ AOUP Paolo Giaccone, Neurosurgery, Palermo, Italy⁴ Ospedale Umberto I, Neurosurgery, Roma, Italy

Background: The 2mm-Thulium laser has been widely used in urological surgery. This instrument allows simultaneous coagulation and cutting in an aqueous medium, with limited penetration (less than 0,2 mm) and dispersion in the adjacent tissue. This offers complementary possibilities to the use of bipolar forceps or ultrasonic aspirators. In addition, it can be used as a hand-held instrument with liquid refrigeration and small volume equipment. All together renders it superior versus previous laser devices.

Since last decade, it has been increasing its applications in neurosurgery, being used in endoscopic ventriculostomy and vestibular neuromas.

Methods: Retrospective review of a clinical series of 44 patients diagnosed with infratentorial meningioma, operated on from July 2013 to December 2021, in a single centre. The aforementioned tool was used intraoperatively in all of them. We evaluated safety of using, moments or circumstances in which its use is most interesting, degree of resection, intraoperative and postoperative complications and neurological outcome.

Results: In this series of meningiomas, it has proved safe and effective, with no complications secondary to its use. It was particularly useful during the steps of tumour capsule opening, tumour debulking and in the coagulation of dural attachment site. Overall surgeon's impression was that it reduced notably bleeding. Clinical results of the interventions were comparable to those of previous series, in terms of degree of resection and postoperative neurological status.

Conclusions: Thulium laser is safe, effective and useful for its use in posterior cranial fossa meningiomas, offering new technical possibilities. It might play a relevant role in the present and future of this procedures.

BRAIN AND SPINE 2 (2022) 101190 101533 THE ASSESSMENT OF GAMMA PROBE-ASSISTED REMOVAL OF INTRACRANIAL MENINGIOMA

D. Kalasauskas¹, P.-E. Baqué², H. Reber², J. Conrad¹, E. Schwandt¹, N. Keric¹, M. Schreckenberger², F. Ringel¹.
¹ Johannes Gutenberg University Mainz, Department of Neurosurgery, Mainz, Germany² Johannes Gutenberg University Mainz, Department of Nuclear Medicine, Mainz, Germany

Background: Meningioma resection in case of extracranial expansion or the differentiation between relapsed tumor and scar tissue can be challenging, as the tumor margin may be difficult to identify. Somatostatin receptor (SSTR-2) is expressed by meningioma and can be used for visualization of the tumor extent in PET and SPECT imaging. Gamma probe, a hand-held device for detection of radionuclides is routinely used in other surgical specialties to identify target lesions. In this feasibility study, we examined the utility of intraoperative application of gamma probe to detect the remaining radioactivity after SSTR-2-specific tracer scintigraphy.

Methods: 99mTc-EDDA/HYNIC-TOC (Tectrotyd) was used to visualize intraosseous extent of meningioma in 4 cases, as part of routine preoperative SPECT imaging. The patients underwent tumor resection the next day. In 3 cases, a laparoscopic 45° gamma probe, and in 1 case, a short flexible 0° gamma probe (both Crystal Photonics, Germany) were used to measure the tracer radioactivity on the tumor surface, inside the tumor, on the dural tail as well in the intraosseous tumor extension.

Results: We performed a resection of frontobasal, petroclival, cerebellar and relapsed sphenoorbital meningioma using gamma probe in addition to navigation system as a resection guide. Gamma probe could readily identify the tumor margin and infiltration of bone in all 4 cases. The surgeon has found the 45° gamma probe a useful tool for the determination of tumor margin in frontobasal, sphenoorbital and cerebellar tumors. The probe was however too large for the use in case of deep-seated petroclival meningioma. A false-positive signal was registered next to the pituitary gland due to the presence of somatostatin receptors.

Conclusion: The use of gamma probe may be a valuable tool to guide and verify the resection of intracranial meningioma. Caution should be taken adjacent to the pituitary gland due to naturally occurring somatostatin receptors.

BRAIN AND SPINE 2 (2022) 101190 101534

ONE SIZE DOES NOT FIT ALL - TAILORED INDIVIDUALIZED TREATMENT APPROACHES FOR PETROCLIVAL AND SPHENOPETROCLIVAL MENINGIOMAS BASED ON DIFFERENCES IN EXPECTED OUTCOME

F. Behling¹, C. Fodi¹, J. Honegger¹, M. Tatagiba¹.
¹ University Hospital Tübingen, Department of Neurosurgery, Tübingen, Germany

Background: The neurosurgical treatment of petroclival and sphenopetroclival meningiomas is complex and challenging. Depending on the size and tumor extension surgical management can be very different. Therefore individualized surgical approaches, sometimes multi-staged, are necessary.

Methods: We present our clinical experience with primary petroclival and sphenopetroclival meningiomas, that were treated in our institution between 11/2003 and 03/2017. The distribution of clinical parameters, outcome data as well as management algorithms are described.

Results: Forty-four petroclival and twenty-four sphenopetroclival meningiomas were analyzed. A two-staged surgery was done for 10/24 sphenopetroclival and for 1/44 petroclival meningiomas. The extent of resection was Simpson grade 4 for all sphenopetroclival meningiomas, mainly due to cavernous sinus invasion, while some petroclival meningiomas could be resected with more radicality (13/44 Simpson grade 1-3). Atypical meningiomas were more often diagnosed in sphenopetroclival meningiomas (20.8% compared to 4.6%, p=0.0347). A mean

follow-up of 43.26 months showed a recurrence rate of 31.6% for petroclival and 72.2% for sphenopetroclival meningiomas, respectively ($p=0.0043$). A significant prognostic difference in favor of petroclival compared to sphenopetroclival meningiomas was also observed in the Kaplan-Meier analysis ($p=0.0406$).

Conclusions: The outcome of the surgical treatment of petroclival and sphenopetroclival meningiomas shows marked differences in favor of petroclival tumor location due to microsurgical accessibility and tumor biology. An individualized approach to the neurosurgical management of petroclival and sphenopetroclival meningiomas is important.

BRAIN AND SPINE 2 (2022) 101190 101535

RECURRENT MENINGIOMAS WITHIN AND AROUND THE CAVERNOUS SINUS AFTER RADIOSURGERY: THE PRETEMPORAL TRANSCAVERNOUS APPROACH

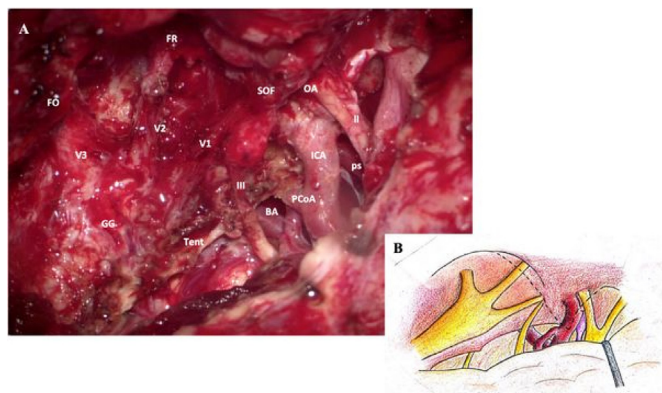
P. Ferrolì¹, G. Raccaia^{1,2}, G. Iess^{1,2}, A. Ciuffi^{1,2}, M.P. Schiariti¹. ¹ *Fondazione IRCCS Istituto Neurologico Carlo Besta, Department of Neurosurgery, Milan, Italy*; ² *San Carlo Borromeo Hospital ASST Santi Paolo e Carlo, Department of Neurosurgery, Milan, Italy*

Background: Meningiomas within and around the cavernous sinus are rare benign tumors which involve important neurovascular structures. Their surgical resection still represents a challenge for neurosurgeons. Thorough knowledge of the surgical landmarks around the cavernous sinus is necessary to achieve safe surgical manipulation of vascular and neurological structures and to choose a tailored treatment planning for each patient. Adjuvant radiotherapy plays a central role in the treatment of these lesions to obtain volumetric tumor control and neurologic preservation. When neurological deficits arise due to the progressive growth of the recurrent meningioma in this region, surgical complete resection is a valuable therapeutic option.

Methods: We report the case of a 60-year-old male with recurrent atypical meningioma of the left cavernous sinus, who previously underwent both surgery and radiosurgery. Due to disease progression with progressive vision loss, surgery was performed once again.

Results: Thanks to accurate surgical planning, the pretemporal transcaavernous approach was performed allowing a safe and complete removal of the tumor.

Conclusion: Despite adjuvant radiosurgery provides a high rate of tumor control for patients with parasellar and sellar meningiomas, surgical treatment is advisable when facing the onset of neurological deficits and progressive growth of the residual lesion at follow-up. The safe and complete resection of tumor recurrences constitutes our preferred treatment modality to achieve optimal control of the disease. The pretemporal transcaavernous approach is performed to achieve wide exposure of the lesions that involve the cavernous sinus while at the same time minimizing brain and neurovascular structures retraction.



BRAIN AND SPINE 2 (2022) 101190 101536

MEDIAL SPHENOID WING MENINGIOMAS WITH MAJOR ARTERY ENCASEMENT; RESULTS OF SINGLE INSTITUTION SERIES

E. Özgüray¹, N. Akıntürk¹, C. Çınar², İ. Oran². ¹ *Ege University, Medicine Faculty, Department of Neurosurgery, İzmir, Turkey*; ² *Ege University, Medicine Faculty, Department of Radiology, İzmir, Turkey*

Background: Medial sphenoid wing meningiomas are one of the challenging tumors of the skull base due to their close location to the optic canal, cavernous sinus, and major arteries.

Methods: Medial sphenoid wing meningiomas undergone surgery in our institute between 2015-2021 by a single senior surgeon were included in this study. Simpson grading scale was used for the extent of resection. Clinical data, surgical reports, imaging results were also analyzed retrospectively.

Results: This study includes 14 patients with a mean age of 50.78 years. The most common symptom was blurred vision. One patient suffered a recurrent meningioma which was resected previously in another clinic. Radiologic and surgical data was collected to evaluate major artery encasement, optic canal invasion and the lateral wall of cavernous sinus invasion, respectively were detected in 14, 3 and 6 patients. There was no mortality after surgery. However, 4 of the patients had postoperative transient 3rd nerve palsy. Only 1 patient had neurological impairment which got better with rehabilitation. Simpson grade 1 resection was achieved in 11 patients. There were 3 patients with residual tumors. Pathology resulted in atypical in 2 cases. The mean follow-up time was 28.85 months. Tumor recurrence was seen only in one patient. Both residual tumors and recurrence were closely followed and found to be radiographically stable.

Conclusion: The main goal of surgery for medial sphenoid wing meningiomas with major artery encasement resection should be total resection. Although major artery encasement of those tumors introduces high surgical risks, total resection is feasible with meticulous dissection resulting in low morbidity.

BRAIN AND SPINE 2 (2022) 101190 101537

MICROSURGICAL RESECTION OF THE MENINGIOMAS OF THE SKULL BASE: A MULTICENTRIC STUDY

M. May¹, V. Benes¹, D. Netuka¹. ¹ *First Faculty of Medicine, Charles University and Military University Hospital, Department of Neurosurgery and Neurooncology, Prague, Czech Republic*

Background: Meningiomas of the skull base are difficult to treat due to their close contact with critical neurovascular structures. Microsurgical resection is often associated with significant morbidity and mortality. In this study, we (1) report the outcomes of the surgical resection, (2) analyze the predictive factors, and (3) compare different meningiomas' locations.

Methods: A multicenter study of 552 patients with a skull base meningioma was conducted in 5 neurosurgical departments in the Czech republic. Univariate and multivariate analysis was performed to determine the predictive factors of higher WHO grade, Simpson grade of resection, unfavorable clinical outcome, and recurrence/progression rate.

Results: The GTR rate was 73,9%. The OS was 98,1%, the recurrence rate 4,5%, and the progression rate 4,3%. The mean follow-up was 2,3 years.

The predictors of higher grade were sex, symptoms/signs duration, volume, edema, shape, margins, tumor-brain interface, arachnoid cistern and dissection plane, dural tail, sunburst sign, and hyperostosis.

The predictors of resection grade were KPS, neurologic deficit, symptoms/signs duration, volume, location, arachnoid cistern, vessel encasement, vessel narrowing, cavernous sinus invasion, capsular enhancement, bone invasion, and hyperostosis.

The predictors of unfavorable clinical outcomes were age, KPS, neurologic deficit, volume, location, arachnoid cistern, arachnoid dissection plane, capsular enhancement, edema, vessel encasement, cavernous sinus invasion, and hyperostosis.

The predictors of recurrence/progression were sex, grade, volume, edema, tumor-brain interface, enhancement, and sunburst sign.

The shortest OS was documented in clival (HR 8,9) and petrous (HR 3,0) meningiomas and the shortest PFS in jugular foramen (HR 9,5), clival (HR 5,3), and petrous (HR 4,0) meningiomas.

Conclusion: GTR of meningiomas of the skull base meningiomas remains challenging. Individualized surgical strategies are crucial for the surgical management of these complex tumors. To facilitate therapeutic management our multicentric study analyses the preoperative predictive factors of the clinical, surgical and radiological outcome.