# Anaplastic meningioma

Anaplastic meningioma (also known as malignant meningiomas) is defined by several criteria including:

1) Invasion of adjacent brain parenchyma or skull. (see invasive meningioma)

2) Numerous mitosis (> 5/high-powered field)

3) Elevated proliferative index (>3%) as assessed by either 5-bromodeoxyuridine or KI-67 staining

4) Necrosis

5) Increased cellularity

6) Nuclear pleomorphism

7) metastases

## Epidemiology

Anaplastic meningiomas are uncommon, accounting for only ~1% of all meningiomas [1].

## Diagnosis

Generally, it is not possible to confidently distinguish benign (WHO grade I) and atypical (WHO grade II) from anaplastic (WHO grade III) meningiomas on general morphology. The most reliable feature in suggesting a non-grade I tumour is the presence of lower ADC values (reflecting higher cellularity) [2] [3].

Importantly presence of vasogenic oedema in adjacent brain parenchyma is not a predictor of atypical or anaplastic histology [4].

Brain invasion, although by definition denoting at least a grade II tumour, is also surprisingly difficult to predict on MRI.

There are, some CT or MRI trends that point in favor of malignant meningioma:

1) the absence of visible calcium aggregates [5].

2) “mushrooming” or the presence of a prominent pannus of tumor extending well away from the globoid mass [6] [7] [8].

## Treatment

see Anaplastic meningioma treatment.

## Outcome

Ki-67 index >10% was associated with a trend toward worse PFS. Given the long-term survival, high recurrence rates, and efficacy of salvage therapy, patients with atypical and malignant meningiomas should be monitored systematically long after initial treatment [9)].

Older age, male gender, distant metastasis, and radiotherapy were significantly related to poor prognosis; and the extent of resection did not affect survival [10)].

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Malignant progression with the accumulation of mutations in a benign meningioma can result in an atypical meningioma and/or anaplastic meningioma. Both tumors are difficult to manage and have a high recurrence and poor survival rates. The extent of tumor resection and histological grade are the key determinants for recurrence.

Anaplastic meningiomas are aggressive tumors, with a median overall survival time of 15 months [11)].

They have a higher rate of recurrence and metastases accompanied by a significantly shorter survival rate compared to benign variants. Meningioma cancer stem cells (CSCs) have been previously shown to be associated with resistance and aggressiveness. However, the role they play in meningioma progression is still being investigated [12)].

## Review

Maier AD. Malignant meningioma. APMIS. 2022 Nov;130 Suppl 145:1-58. doi: 10.1111/apm.13276. PMID: 36424331.

## Case series

Anaplastic meningioma case series.

## Case reports

A five-year-old girl presented with progressive right-sided exophthalmos, headaches, and seizures. Imaging revealed a large extra-axial mass in the right temporal region, extending into the cavernous sinus and orbital cavity. A subtotal resection was performed, and histological examination confirmed an anaplastic meningioma, World Health Organization grade 3. The patient was referred for adjuvant radiotherapy. This case highlights the importance of recognizing atypical presentations in children and underscores the need for a multidisciplinary management approach in pediatric high-grade meningiomas [13)].

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Baeesa et al. from the Division of Neurosurgery, Department of Surgery, King Abdulaziz University Hospital, Faculty of Medicine, Jeddah, Saudi Arabia, report a 29-year-old man who underwent a resection of a grade I meningioma in 2011. The patient had multiple local recurrences of the tumor that exhibited an aggressive change in behavior and transformation to grade III meningioma and developed extracranial metastases to the cervical spine. He underwent multiple operations and received radiotherapy. Analysis of the meningioma indicated the presence of CSCs markers before metastases and showed elevated expressions of associated markers in the metastasized tissue. Also, and similar to the patient's profile, the pharmacological testing of a primary cell line retrieved from the metastasized tissues showed a high level of drug tolerance and a loss of ability to initiate apoptosis.

Malignant progression of grade I meningioma can occur, and its eventuality may be anticipated by detecting CSCs. We included a comprehensive literature review of relevant cases and discussed the clinical, diagnostic and management characteristics of the reported cases [14].

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A patient had an intracranial malignant meningioma and developed a symptomatic osteolytic contrast-enhancing lesion in the left C-1 lateral mass suspicious for metastases. The authors performed a minimally invasive posterior resection of the lesion with vertebroplasty of C-1. Histopathology verified metastases of the malignant meningioma. The surgical procedure resulted in prompt and permanent pain reduction until the patient died 18 months later. Given the very limited life expectancy in this case, the authors did not consider occipitocervical fusion because of their desire to preserve the range of motion of the head. Therefore, they suggest minimally invasive tumor resection and vertebroplasty in selected palliative tumor patients [15].

1)
Backer-Grøndahl T, Moen BH, Torp SH. The histopathological spectrum of human meningiomas. Int J Clin Exp Pathol. 2012;5 (3): 231-42.
2)
Filippi CG, Edgar MA, Uluğ AM et-al. Appearance of meningiomas on diffusion-weighted images: correlating diffusion constants with histopathologic findings. AJNR Am J Neuroradiol. 2001;22 (1): 65-72. AJNR Am J Neuroradiol
3) , 4)
Toh CH, Castillo M, Wong AM et-al. Differentiation between classic and atypical meningiomas with use of diffusion tensor imaging. AJNR Am J Neuroradiol. 2008;29 (9): 1630-5. doi:10.3174/ajnr.A1170
5) , 8)
Younis GA, Sawaya R, DeMonte F, Hess KR, Albrecht S, Bruner JM. Aggressive meningeal tumors: review of a series. J Neurosurg 1995; 82:17-27.
6)
Mahmood A, Caccamo DV, Tomecek FJ, Malik GM. Atypical and malignant meningiomas: a clinicopathological review. Neurosurgery 1993;33:955-963.
7)
Jaaskelainen J, Haltia M, Servo A. Atypical and anaplastic meningiomas: radiology, surgery, radiotherapy, and outcome. Surg Neurol 1986; 25:233-242.
9)
Kent CL, Mowery YM, Babatunde O, Wright AO, Barak I, McSherry F, Herndon JE 2nd, Friedman AH, Zomorodi A, Peters K, Desjardins A, Friedman H, Sperduto W, Kirkpatrick JP. Long-Term Outcomes for Patients With Atypical or Malignant Meningiomas Treated With or Without Radiation Therapy: A 25-Year Retrospective Analysis of a Single-Institution Experience. Adv Radiat Oncol. 2021 Dec 24;7(3):100878. doi: 10.1016/j.adro.2021.100878. PMID: 35647401; PMCID: PMC9133398.
10)

Zhang GJ, Liu XY, Wang W, You C. Clinical factors and outcomes of malignant meningioma: a population-based study. Neurol Res. 2022 Mar 30:1-9. doi: 10.1080/01616412.2022.2056343. Epub ahead of print. PMID: 35353024.
[11]

Modha A, Gutin PH. Diagnosis and treatment of atypical and anaplastic meningiomas: a review. Neurosurgery. 2005 Sep;57(3):538-50; discussion 538-50. Review. PubMed PMID: 16145534.
[12] [14]
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Baeesa SS, Hussein D, Altalhy A, Bakhaidar MG, Alghamdi FA, Bangash M, Abuzenadah A. Malignant Transformation and Spine metastases of an Intracranial Grade I Meningioma: In Situ Immunofluorescence analysis of Cancer Stem Cells. World Neurosurg. 2018 Sep 8. pii: S1878-8750(18)32024-2. doi: 10.1016/j.wneu.2018.09.004. [Epub ahead of print] PubMed PMID: 30205223.
[13]

Mohammadine B, Hmamouche O, Mohammed B, Khalid C, Faiz Mohammed C. Pediatric Brain Tumors: A Case Report on the Rare Occurrence of Anaplastic Meningioma in a Young Child. Cureus. 2025 Apr 24;17(4):e82886. doi: 10.7759/cureus.82886. PMID: 40416230; PMCID: PMC12103695.
[15]

Klingler JH, Krüger MT, Kogias E, Brendecke SM, Hubbe U, Scheiwe C. Minimally invasive resection and vertebroplasty for an osteolytic C-1 metastases of malignant meningioma: case report. J Neurosurg Spine. 2015 Jul 17:1-5. [Epub ahead of print] PubMed PMID: 26185898.