CASE REPORT

DOI: 10.5336/caserep.2019-72941

Metastatic Cavernous Sinus Meningioma: A Theory of Probable Predisposing Factor for Metastasis of Meningioma

Gökhan KURT[a], Müge AKMANSU[b], Ayfer ASLAN[c]

[a]Gazi University Faculty of Medicine, Department of Neurosurgery, Ankara, TURKEY
[b]Gazi University Faculty of Medicine, Department of Radiation Oncology, Ankara, TURKEY
[c]Edremit State Hospital, Clinic of Neurosurgery, Balıkesir, TURKEY

ABSTRACT Meningiomas are mostly benign, slowly-growing, non-metastatic, particularly limited to the central nervous system, however, they were occasionally reported for spreading to distant organs. While the risk factors still remain widely unknown for metastasis of meningiomas, the histopathological type and size of tumor are predicted to be predisposing factors for it. We aimed to discuss a possible new predisposing factor, which is contiguity of intracranial meningiomas to the dural sinuses, for metastasis to the body by presenting a case with metastatic cavernous meningioma and literature research. We presented a rare case that has been treated for cavernous sinus meningioma and then diagnosed with malign meningioma metastasis to the lung. We speculated that meningiomas adherent to the dural sinuses may be more inclined to distant organ metastasis, and they might use dural sinuses for seeding. This hypothesis can be likely verified by large case series, and this case report may inspire further investigations.

Keywords: Cavernous sinus; lung neoplasms; meningioma; neoplasm metastasis

The majority of meningiomas are histologically benign (WHO grade I), however, they are rarely presented with metastasis, particularly in malign (WHO grade III) and atypical (WHO grade II) meningiomas.[1] Although there is little data in the literature regarding to the incidence of metastatic meningiomas, extracranial metastases have been reported as 0.1-0.7% in several case series.[2,3] According to the reviews of various case reports, anaplastic meningioma was the most frequent metastatic meningioma, followed by atypical and meningothelial subtypes.[1]

Due to lack of large case series, the typical pattern of metastasis and management options for metastatic meningiomas remain unclear. The inclination of meningiomas to spread through the body should be rendered clearer with increasing case reports and reviews, which ensure to choose the most effective management. We aimed to make contributions to the literature with presenting a case with cavernous sinus meningioma which spread out to the lung, and we hypothesized that venous sinus invasion might be a predisposing factor for metastasis in meningioma regardless from grading of meningioma.

CASE REPORT

A 67-year-old male patient was presented with right sided facial numbness lasting for one month, and then diplopia was added without headache or nausea. He had right 6th cranial nerve paralysis and right facial hypoesthesia, when he was admitted to the Department of Neurosurgery on the December of 2017. In his medical history, there was no remarkable condition except for hypertension, spondyloarthropathy, and benign prostatic hyperplasia. In the magnetic res-

Correspondence: Ayfer ASLAN
Edremit State Hospital, Department of Neurosurgery, Balıkesir, TURKEY
E-mail: ayferaslan86@mail.com

Peer review under responsibility of Turkiye Klinikleri Journal of Case Reports.

Received: 16 Dec 2019 ***Received in revised form:*** 02 Mar 2020 ***Accepted:*** 07 Apr 2020 ***Available online:*** 17 Apr 2020

onance imaging (MRI) with contrast, a right cavernous sinus lesion showing contrast enhancement with extension to the pontocerebellar angle (PCA), which was first suspected for metastasis, was detected (Figure 1). At this time, there was no other lesion visible in the whole-body positron emission tomography (PET) which was performed to exclude any primary source of metastatic disease to the brain. Since it was neurologically symptomatic, stereotactic radiosurgery (SRS) with Cyber-Knife technology was applied to the lesion in that admission. After 7 months, control contrast enhanced MRI showed a prominent progression in the portion of tumour extended towards the PCA, but not in the cavernous portion (Figure 1). Due to progression of tumour, suspicion of metastasis was boosted, and therefore the whole-body PET was repeated in order to attain an origin in case of metastasis. Second PET revealed hypermetabolism for 68Ga-DOTATATE in the lung, in which multiple nodular lumps were found in further investigation (Figure 2). Computed tomography-guided percutaneous needle lung biopsy was per-

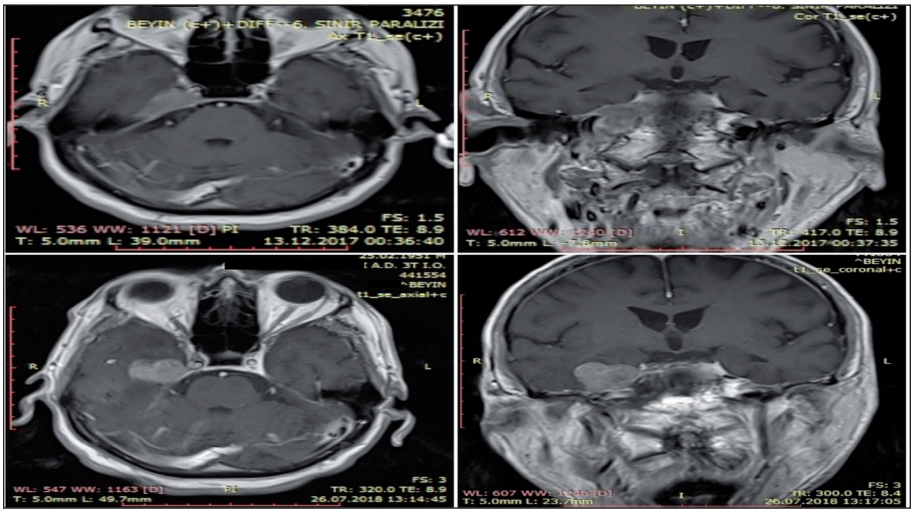

FIGURE 1: Cranial axial (first row) and coronal (second row) contrast-enhanced T1-weighted MRI scans at the admission (above) and follow-up (below). An enhancing tumour with extension to the right PCA, which had an increase in the size of temporal portion after seven months, had been detected in the right cavernous sinus.

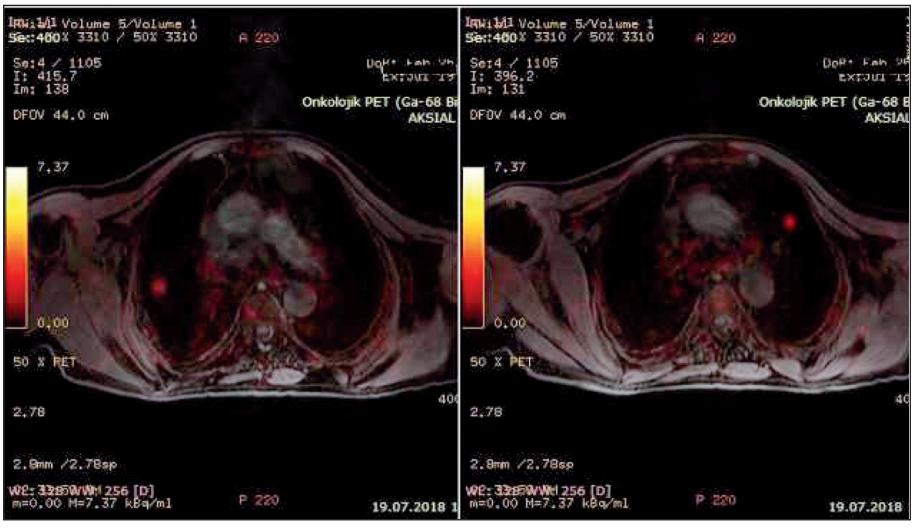

FIGURE 2: PET/CT showed parenchymal solid nodules with pathological increased enhancement for 68Ga-DOTATATE in bilateral lungs.

formed, and histopathological examination resulted in malign meningioma metastasis. The specimen showed atypical cells with wide eosinophilic cytoplasm, hyperchromatic nuclei, frequent mitosis, and lack of pattern. Immunohistochemical analysis disclosed positivity for markers of vimentin, progesterone receptor and CD99. According to the morphological findings, carcinoma was not suspected, and mesenchymal tumours were ruled out by immunohistochemical examinations. These findings along with radiological diagnosis of cavernous atypical meningioma were interpreted as a metastatic malign meningioma. Second SRS was applied in the form of hypofractionated stereotactic radiotherapy (HSRT) targeting the new progressive portion of meningioma extending to PCA, and fractional intensity modulated radiation therapy (IMRT) along with chemotherapy protocol for lung metastasis was planned.

DISCUSSION

Meningiomas, the most common primary brain tumor, are in majority benign, slowly growing and not inclined to metastasize. Nevertheless, they were rarely reported with aggressive behavior and metastasis to regional or distant organs in various case reports.[4-10] Meningiomas with aggressive behavior would either directly invade the surrounding tissue, or disseminate mostly via hematogenous route, and less frequently via lymphatic and cerebrospinal fluid (CSF) pathways.[10-13]

Intracranial meningiomas are expected for local invasion involving intracranial venous channels, bones, soft tissue and paranasal sinuses, in contrast to distant metastasis.[14] They metastasize extracranially in the rate of one in thousand.[15] The common sites for distant metastasis are lungs (60%), pleura (9%) and mediastinum (5%).[10] Moreover, liver, lymph nodes, bones, peritoneum, scalp and orbita were reported for being metastasized by meningiomas.[4-9]

Despite of case reports, the risk factors and metastasis pattern are quite unknown for intracranial meningiomas. Surov et al. reviewed the reports of 115 cases with metastatic meningiomas and found that the most frequent metastasized meningiomas were WHO grade III (40%), followed by grade I (33.9%), and grade II (20.9%) meningiomas. In this review of case reports, malignant (WHO grade III) meningiomas were found to be associated with higher risk of metastasis.[1] Although malign meningiomas tend to be metastatic more frequently, low grade meningiomas are not as uncommon as expected in extracranial metastasis.[1,10]

Predisposing factors for metastasis from meningiomas have been previously described as high cellularity, cellular heterogeneity, high mitotic rate, nuclear pleomorphism and tumor necrosis which are also the histological criteria determining the predisposition to malignancy.[15,16] Other factors that may be related to extracranial spreading are indicated as repeated surgical resection of primary tumor, previous craniotomy, local recurrence and venous sinus invasion.[16] Moreover, extracranial extension of meningiomas was previously correlated with large meningiomas.[17]

In the literature, although there is no exact statistical data about the role of features such as the location of meningioma or venous sinus invasion on metastasis, there are several case reports with metastatic meningiomas adherent to venous sinuses, as well as our case.[8,9,14] Even small and low grade intracranial meningiomas in the vicinity of venous sinuses have been reported with metastasis to distant organs.[9] In addition to those previous cases, our case report supported the idea of proximity to the venous sinuses might be a crucial predisposing factor for distant organ metastasis in meningiomas, giving the chance of dissemination even when they are small and in low grade. To authenticate this theory, there is exceedingly need for large case series or review of case reports in terms of location and metastasis rates.

In summary, even if the general belief has been in favor of meningiomas being benign, it has been challenged lately by increasing number of case reports with metastases. Owing to these cases, risk factors for the development of metastases from a meningioma are becoming clearer. This paper presented a rare case of cavernous sinus meningioma of which proximity to venous sinus has been blamed for the hematogenous metastasis to the lung, while the primary tumor was small and low grade. Finally, the

authors believe this case will take a part in ensuing attempts for understanding the mechanism of metastasis of meningiomas.

Informed Consent

There is no need for a consent form in this paper, since no personal information belonging to the patient was disclosed as all data and figures were anonymized.

Acknowledgements

I certify that the content of this manuscript, in part or in full, has not been submitted to any other journal in any form, and its publication has been approved by all co-authors. The abstract of this article has been presented as a poster at the Turkish Neurosurgical Society the 33rd Scientific Congress which had taken place on the 11th – 14th April, 2019 in Antalya, Turkey.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Gökhan Kurt, Müge Akmansu;* ***Design:*** *Ayfer Aslan;* ***Control/Supervision:*** *Gökhan Kurt, Müge Akmansu;* ***Data Collection and/or Processing:*** *Gökhan Kurt, Müge Akmansu;* ***Analysis and/or Interpretation:*** *Gökhan Kurt, Müge Akmansu, Ayfer Aslan;* ***Literature Review:*** *Ayfer Aslan;* ***Writing the Article:*** *Ayfer Aslan;* ***Critical Review:*** *Gökhan Kurt, Müge Akmansu;* ***References and Fundings:*** *Ayfer Aslan;* ***Materials:*** *Gökhan Kurt, Müge Akmansu.*

REFERENCES

1. Surov A, Gottschling S, Bolz J, Kornhuber M, Alfieri A, Holzhausen HJ, et al. Distant metastases in meningioma: an underestimated problem. J Neurooncol. 2013;112(3):323-7. [Crossref] [PubMed]
2. Adlakha A, Rao K, Adlakha H, Perry A, Crotty TB, Scheithauer BW, et al. Meningioma metastatic to the lung. Mayo Clin Proc. 1999;74(11):1129-33. [Crossref] [PubMed]
3. Enam SA, Abdulrauf S, Mehta B, Malik GM, Mahmood A. Metastasis in meningioma. Acta Neurochir (Wien). 1996;138(10):1172-7; discussion 1177-8. [Crossref] [PubMed]
4. Backhaus P, Huss S, Kösek V, Weckesser M, Rahbar K. Lung metastases of intracranial atypical meningioma diagnosed on posttherapeutic imaging after 177Lu-DOTATATE therapy. Clin Nucl Med. 2018;43(6):e184-5. [Crossref] [PubMed]
5. Bhanusali DG, Heath C, Gur D, Miller S. Metastatic meningioma of the scalp. Cutis. 2018;101(5):386-9. [PubMed]
6. Bond HL, O'Hare EM, Garvican JE, Minear FG. Metastatic meningioma: a rare cause of mediastinal lymphadenopathy. BMJ Case Rep. 2017;2017:bcr2017222179. [Crossref] [PubMed] [PMC]
7. Corniola MV, Landis BN, Migliorini D, Lobrinus JA, Ares C, Schaller K, et al. Rapidly growing pulmonary metastasis from anaplastic meningioma with lethal outcome: a case report. J Neurol Surg Rep. 2017;78(4):e129-34. [Crossref] [PubMed] [PMC]
8. Du Y, Lu T, Huang S, Ren F, Cui G, Chen J. Somatic mutation landscape of a meningioma and its pulmonary metastasis. Cancer Commun (Lond). 2018;38(1):16. [Crossref] [PubMed] [PMC]
9. Obiorah IE, Ozdemirli M. Incidental metastatic meningioma presenting as a large liver mass. Case Reports Hepatol. 2018;2018:1089394. [Crossref] [PubMed] [PMC]
10. Mutnuru PC, Ahmed SF, Uppin SG, Lachi PK. Pulmonary metastases from intracranial meningioma. Lung India. 2015;32(6):661-3. [Crossref] [PubMed] [PMC]
11. Akimura T, Orita T, Hayashida O, Nishizaki T, Fudaba H. Malignant meningioma metastasizing through the cerebrospinal pathway. Acta Neurol Scand. 1992;85(5):368-71. [Crossref] [PubMed]
12. Martin TA, Ye L, Sanders AJ, Lane J, Jiang WG. Cancer invasion and metastasis: molecular and cellular perspective. In: Jandial R, ed. Metastatic Cancer Clinical and Biological Perspectives. 1st ed. Molecular Biology Intelligence unit. Austin, TX: Landes Bioscience; 2013. p.135-68.
13. Lee GC, Choi SW, Kim SH, Kwon HJ. Multiple extracranial metastases of atypical meningiomas. J Korean Neurosurg Soc. 2009;45(2):107-11. [Crossref] [PubMed] [PMC]
14. Halani SH, Appin C, Brat DJ, Hadjipanayis CG. Distant multifocal bony metastasis of a grade II meningioma: case report. J Spine Neurosurg. 2016;5(3). [Crossref]
15. Delgado-López PD, Martín-Velasco V, Castilla-Díez JM, Fernández-Arconada O, Corrales-García EM, Galacho-Harnero A, et al. Metastatic meningioma to the eleventh dorsal vertebral body: total en bloc spondylectomy. Case report and review of the literature. Neurocirugia (Astur). 2006;17(3):240-9. [Crossref] [PubMed]
16. Kanthan R, Senger JL. Distant metastases from meningiomas – a myth or reality? Ann Clin Pathol. 2013;1(1):1001.
17. Uchibori M, Odake G, Ueda S, Yasuda N, Hisa I. Parapharyngeal meningioma extending from the intracranial space. Neuroradiology. 1990;32(1):53-5. [Crossref] [PubMed]