**Abstract**

A 49-year-old male presented with a gradually progressive loss of vision in both eyes. Funduscopic examination revealed bilateral optic disc swelling and two yellowish elevated choroidal lesions in the LE. Ophthalmic imaging raised suspicion of choroidal metastasis. Adenocarcinoma of the lung was detected in further systemic evaluation.

**Key clinical massage:** The present report highlights a rare clinical entity associated with variable clinical and imaging features. Symptomatic choroidal metastasis is an uncommon presentation of lung cancer. Being familiar with the characteristics of choroidal metastasis on examination and imaging is essential in the diagnosis and management of this condition.

**Key words:** lung cancer, adenocarcinoma, choroidal metastasis, optic nerve, ocular metastasis

**Introduction**

Metastatic tumors are the most prevalent intraocular malignancies. The choroid is the most common location of metastasis due to its copious vascular supply[1]. The majority of choroidal metastasis originated from breast and lung cancer. Vision impairment is an infrequent initial presentation in primary lung cancer. The prevalence of symptomatic choroidal metastasis (CM) is reported as less than 3% [2]. Multimodal imaging aids in the diagnosis of choroidal lesions. Metastasis to the optic nerve is also unusual, accounting for only 4.5 percent of all ocular metastasis documented in prior reports [3]. In the present report, we introduced a case with infiltrative optic neuropathy and CM,treated with a diagnosis of lung adenocarcinoma.

**Case presentation**

A 49-year-old man presented with a gradually progressive loss of vision accompanied by a headache during the past two weeks. No significant medical history was documented. There was no history of smoking. Ophthalmic examination revealed a best-corrected visual acuity (BCVA) of 20/100 for the right eye (RE) and 20/70 for the left eye (LE). There was no relative afferent pupillary defect. Extraocular motility was intact in both eyes. Intraocular pressure was measured 14mmHg in both eyes in applanation tonometry. The anterior segment examination was unremarkable. Dilated fundus examination demonstrated bilateral optic disc swelling and peripapillary flame-shaped hemorrhages and also two yellowish elevated choroidal lesions measuring about 6 disc diameters, one placed in the posterior pole and the other along the superotemporal arcade with overlying RPE changes in the LE (figure 1- A, B). The results of B scan ultrasonography were unremarkable for the RE and showed a choroidal mass with high internal reflectivity in the LE (figure 1- C). Enhanced depth optical coherence tomography (EDI-OCT) (Heidelberg Eye Explorer version 1.9.13.0, Spectralis Viewing Module 6.5.2.0; Heidelberg Engineering) of the macula of the RE revealed normal findings but in the LE, Spectral domain OCT (SD-OCT) of choroidal lesions showed dome-shaped elevation of the neurosensory retina and RPE and overlying RPE alterations (figure1-D). Fluorescein angiography (FA) (Heidelberg Eye Explorer version 1.9.13.0, Spectralis Viewing Module 6.5.2.0; Heidelberg Engineering) demonstrated a hyperfluorescent right optic nerve head suggestive of infiltrative optic neuropathy. FA in the LE showed a hypoﬂuorescent area containing dilated retinal capillaries with a pinpoint leakage corresponding to the location of the lesion observed on examination of the patient’s fundus, and also leakage from the optic nerve head (figure 2). Brain MRI (T2-weighted) revealed bilateral perineural involvement of the intra-orbital optic nerves and multiple hyper signal round lesions in both cerebral hemispheres and the right cerebellum (figure 3). Intracranial pressure was within normal limit and analysis of cerebrospinal fluid was unremarkable. According to clinical evaluation, CM from an occult primary source was suggested. So chest and abdominopelvic computed tomography scans (CT-Scan) with contrast were requested. A High-resolution CT-Scan of the lung showed a speculated hypodense mass (measured 24\*30 mm) in the superior segment of the inferior lobe of the left lung with encasement of the inferior branch of the left main bronchus and multiple satellite nodules adjacent to the mass and pleural nodules; and also a small amount of pleural effusion was noted (figure 4-A). No abnormal finding was detected in the abdominopelvic CT scan. A bronchial fiberscopy was performed and a biopsy was taken. The bronchial fluid cytologic evaluation revealed squamous cells, bronchial cells, and alveolar macrophages with infiltration of inflammatory neutrophils in a hemorrhagic background. Histopathologic evaluation of bronchial biopsy was indicative of an adenocarcinoma (figure 4-B). The patient was referred to an oncologist for further examination and necessary interventions. The patient was screened for epidermal growth factor receptor (EGFR) mutation and since the mutation was not detected chemotherapy with cisplatin and pemetrexed and brain radiotherapy were planned. 3 and 6 months later the patient was visited. BCVA was improved to 20/25 in both eyes and choroidal tumors regression was detected in fundoscopy and retinal imaging (figure 5).

**Discussion**

The choroid is one of the most common locations for intraocular metastases, Because of its extensive vascular supply and the ideal environment for seeding cancer cells. However CM is an infrequent primary presentation, and in the vast majority of cases, CM is detected after a systemic cancer diagnosis has been made [4]. Asymptomatic intraocular metastases may have gone undetected because the eye is not a common site for screening metastatic neoplasms, and the region involved with metastasis often does not interfere with vision. On the other hand, although the prevalence of symptomatic CM is less than 3%, patients with malignancies have a longer survival time due to advances in anti-tumor agents and the availability of advanced diagnostic exams that have allowed CM to be discovered more frequently [5]. Breast and lung cancer are the most prevalent origins of choroidal metastases. Even though lung cancer is the most common cancer in both men and women, fewer cases of CM have been reported than in breast cancer, which may be attributable to lung cancer's poorer prognosis and survival [6].CM is more frequently detected in middle-aged men with left eye dominancy[7]. In addition to intraocular metastasis, other organs such as the liver, adrenals, bone, brain, cerebellum, pancreas, esophagus, skin, and kidney have been discovered to be implicated[8]. In our patient brain metastasis was present at the time of diagnosis. The most-reported histologic type of lung cancer metastasis to eye is adenocarcinoma, followed by small cell carcinoma, squamous cell carcinoma, large cell carcinoma, and carcinoid tumor[8]. Based on the location and degree of invasion of the lesion, the symptoms differ greatly including decreased visual acuity, blurred vision, visual field loss, pain, and other less frequent manifestations such as floater, red-eye, increased intraocular pressure, metamorphopsia and diplopia[9]. Patients with CM due to lung cancer experience more ocular pain than those with primary uveal malignancy or CM from breast cancer[10, 11]. Diagnosis can be challenging in cases without a primary malignancy, especially when about half of the cases have no detectable primary tumor. Choroidal metastases have specific features that distinguish them from other choroidal tumors on ophthalmoscopy and in multi-modal imaging. In fundus examination CM presents with flattened or slightly raised uni- or multifocal mass in the posterior pole and the color of the lesion might be white brown, gray, or orange, but more frequently CM appeared in yellow and white [12]. Often scattered clumps of brown pigment are seen on the surface of the choroidal lesions in fundoscopy which represents the accumulation of lipofuscin. The tumor is hypoautofluorescent in Autofluorescence (AF), with bright regions overlying it. Hyper autofluorescence is associated with lipofuscin deposits and subretinal fluid. In addition, to determine tumor surface characteristics, the findings of AF can be used to assess tumor margin progression. OCT findings in CM include undulating surface, with thickening of the RPE along with overlying subretinal ﬂuid and areas of hyperintense irregularities in the photoreceptor layer. EDI-OCT provides a better assessment of deeper retinal and choroidal morphology and features like characteristic “lumpy bumpy” choroidal surface, compression of the overlying choriocapillaris, and irregularities of the outer retinal layer are found in CM. Also, EDI-OCT makes us able to detect micrometastasis often invisible in fundoscopy. Ultrasonography besides determining tumor size and echogenicity can distinguish metastases from other intraocular neoplasms, especially melanomas. In comparison to choroidal melanoma which has a medium to low reflectivity on A-scan and is acoustically hollow on B scan, CM has a higher reflectivity on A-scan and appears to echo dense on B scan, with a significantly lower height to base ratio. In FA CM presents with an early hypoﬂuorescent pattern followed by hyperﬂuorescent in the late venous phase, later than most choroidal melanomas[13]. Also dilated retinal capillaries with pinpoint leakage at the tumor border are common in choroidal metastases [14]. The treatment of CM depends on factors such as systemic status, number and location of tumors, and laterality.

**Conclusion**

The presence of ocular metastases with a lung origin in the absence of any previous medical history or smoking history, as well as bilateral optic nerve and choroidal involvement, renders our case interesting. On the other hand, tumor regression was observed solely with systemic treatment in our patient, whereas tumor regression with systemic treatment was not common in previous cases.

## **Declarations**

**Consent for publication**: Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

**Competing interests:** The authors declare that they have no competing interests.

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**Availability of data and materials**: The authors confirm that the data supporting the findings of this study are available within the article.

#### **Authors' contributions:** S.K collected the patient data (examination, retinal imaging, chest and brain imaging, and histopathologic photo) and interpreted them, also contributed to the writing of the manuscript. M.MS interpreted the imaging and was a major contributor to the writing of the manuscript. All authors read and approved the final manuscript.

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**Figure legends**

Figure 1. Fundus photography( A,B) : Bilateral optic disc swelling, peripapillary flame-shaped hemorrhages, and two yellowish elevated choroidal lesions with overlying RPE changes in the LE are visible.Ultrasonography of the LE (C): A choroidal mass with high internal reflectivity. Enhanced depth optical coherence tomography (EDI-OCT) of the LE (D): Dome-shaped elevation of neurosensory retina and RPE and overlying RPE alterations.

Figure 2. Fluorescein angiography: A hyperfluorescent right optic nerve head (A). A hypoﬂuorescent area containing dilated retinal capillaries with a pinpoint leakage and also leakage from the optic nerve head in the LE (B, C).

Figure 3.Brain magnetic resonance imaging (MRI) shows bilateral perineural involvement of the intra-orbital optic nerves.

Figure 4. **A:** High-resolution CT-Scan of the lung showed a speculated hypodense mass (measured 24\*30 mm) in the superior segment of the inferior lobe of the left lung. **B:** Hematoxylin and eosin stain; original magnification 40: A cluster of tumor cells  
with coarse chromatin and conspicuous nucleoli with glandular pattern

Figure 5. **A, B:** Fundus photography 3 months after the first visit: the resolution of optic disc swelling in both eyes and regression of choroidal lesions in the LE. Spectoral domain optical coherence tomography (SD-OCT) of the LE: Indicative of regression of the tumor.

**References**

1. Konstantinidis, L. and B. Damato, *Intraocular metastases—a review.* The Asia-Pacific Journal of Ophthalmology, 2017. **6**(2).

2. Jarrett 2nd, W., et al., *Retinal detachment as the initial manifestation of carcinoma of the lung.* Transactions-American Academy of Ophthalmology and Otolaryngology. American Academy of Ophthalmology and Otolaryngology, 1970. **74**(1).

3. Shields, J.A., C.L. Shields, and A.D. Singh, *Metastatic neoplasms in the optic disc: the 1999 Bjerrum Lecture: part 2.* Archives of Ophthalmology, 2000. **118**(2).

4. Kanthan, G.L., et al., *Management of metastatic carcinoma of the uveal tract: an evidence‐based analysis.* Clinical & experimental ophthalmology, 2007. **35**(6).

5. Qu, Z., et al., *A comprehensive understanding of choroidal metastasis from lung cancer.* OncoTargets and therapy, 2021. **14.**

6. Youlden, D.R., S.M. Cramb, and P.D. Baade, *The International Epidemiology of Lung Cancer: geographical distribution and secular trends.* Journal of thoracic oncology, 2008. **3**(8): p. 819-831.

7. Yan, X., et al., *Ocular Metastasis in Lung Cancer: a Retrospective Analysis in a Single Chinese Hospital and Literature Review.* Chinese Journal of Lung Cancer, 2017. **20**(5).

8. Kreusel, K.M., et al., *Incidence and clinical characteristics of symptomatic choroidal metastasis from lung cancer.* Acta ophthalmologica, 2008. **86**(5).

9. Yang, C.-J., et al., *The effect of chemotherapy with cisplatin and pemetrexed for choroidal metastasis of non-squamous cell carcinoma.* Cancer chemotherapy and pharmacology, 2014. **73**(1).

10. Shah, S.U., et al., *Uveal metastasis from lung cancer: clinical features, treatment, and outcome in 194 patients.* Ophthalmology, 2014. **121**(1).

11. Demirci, H., et al., *Uveal metastasis from breast cancer in 264 patients.* American journal of ophthalmology, 2003. **136**(2): p. 264-271.

12. Konstantinidis, L., et al., *Management of patients with uveal metastases at the Liverpool Ocular Oncology Centre.* British Journal of Ophthalmology, 2014. **98**(1).

13. Arepalli, S., S. Kaliki, and C.L. Shields, *Choroidal metastases: origin, features, and therapy.* Indian journal of ophthalmology, 2015. **63**(2).

14. Li, L., et al., *Fundus fluorescein angiography in metastatic choroidal carcinomas and differentiating metastatic choroidal carcinomas from primary choroidal melanomas.* [Zhonghua yan ke za Zhi] Chinese Journal of Ophthalmology, 2011. **47**(1).