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Cerebellar abscess secondary to metastatic lung adenocarcinoma: a case report

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Abstract

Background Cerebellar abscesses are rare, life-threatening infections often originating from bacterial sources, while metastatic brain lesions from lung adenocarcinoma are relatively common. However, the coexistence of a cerebellar abscess secondary to metastatic lung adenocarcinoma is exceedingly rare and presents unique diagnostic and management challenges.

Case Presentation
We report a case of a 35 year-old Pakistani female patient with persistent headaches, nausea, and vertigo, who was found to have a large cerebellar mass with features suggestive of metastatic lung adenocarcinoma. Further investigation revealed a concomitant cerebellar abscess. Surgical excision and broad-spectrum antibiotics were initiated, resulting in a favorable outcome.

Conclusion This case showcases the rarity and complexity of cerebellar abscesses due to metastatic lung adenocarcinoma. Timely intervention, including surgery and targeted therapy, is crucial for successful management. Further research is needed to enhance treatment strategies.

Keywords Cerebellar abscess, Lung adenocarcinoma, Metastasis, Brain metastases, Neurosurgery

Background

Cerebellar abscesses are rare, life-threatening cerebellum infections resulting from direct extension, hematogenous spread, or metastatic lesions [1]. The most common causes of cerebellar abscesses are bacterial infections, often from sinuses, ears, or lungs [2]. However, cerebellar abscesses secondary to metastatic lesions from lung adenocarcinoma are exceedingly rare and infrequently reported in the literature.

Lung adenocarcinoma is the most common subtype of non-small cell lung cancer, accounting for approximately 40% of all lung cancer cases [3]. Metastasis of the brain is a well-known complication of lung adenocarcinoma, with approximately 20–40% of patients developing brain metastases during their disease [4]. While metastatic brain lesions are typically solid tumors, the development of cerebellar abscesses due to metastatic lung adenocarcinoma is an unusual and complex clinical scenario [5].

Neuroimaging and the clinical picture still leave room for error in differentiating and diagnosing a brain abscess and a necrotic cyst within a brain tumor. Several studies have described methods to accurately distinguish between cystic brain metastasis and brain abscesses on the basis of comparisons of preoperative images and postoperative histological findings [6–8].

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In this case report, we present a rare instance of a cerebellar abscess resulting from a metastatic lesion secondary to lung adenocarcinoma. We discuss the clinical presentation, diagnostic challenges, and management strategies for this uncommon condition.

Case presentation

The patient, a 35 year-old Pakistani woman, presented to the emergency department with complaints of a headache persisting for 1.5 months, accompanied by nausea, vomiting, and vertigo. The vomitus was small in quantity, watery, and non-bloody. The patient's Glasgow Coma Scale (GCS) score was 15/15 during the evaluation. Her vital signs were 110/75 mmHg for blood pressure, 76 beats per minute for her heartbeat, and 17 breaths per minute for her breathing. Oxygen saturation was found to be 98%. The results of the chest exam were average, showing no anomalies. Lung sounds bilaterally were unobstructed, regular S1 and S2 heart sounds were heard, and the abdomen was soft and non-tender. The patient's pupils had a brisk, equal, and reactive reaction to light (BERL) and were measured at 2 mm. Her muscle groups demonstrated complete strength with a power rating of 5/5, and her sensory system was intact.

Magnetic resonance imaging (MRI) of the brain showed a sizeable abnormal mass in the right cerebellar hemisphere, measuring approximately 3.5×3.8×2.7 cm, causing compression of the fourth ventricle, leading to dilatation of bilateral lateral and third ventricles and displacement of the brainstem toward the left side. Another mass in the left frontal region, measuring approximately 1.2×1.2×1.0 cm, exhibited marked perilesional edema and a hypointense rim on T2-weighted images. Metastasis was likely. MRI with contrast also revealed enhancing masses in the left frontal lobe (12.0×13.0 mm), right cerebellum (39.0×36.0 mm), and a small focus in the left parietal cortex, associated with perilesional edema causing mass effect over the fourth ventricle and bilateral hydrocephalus. No intracranial hemorrhage or ischemia was found. Sinusitis was observed in the right maxillary sinus, and minimal segmental narrowing was noted in anterior and posterior circulations on MRA shown in Fig. 1.

Laboratory investigations revealed in the complete blood count (CBC) a hemoglobin level of 13.6 g/dL, hematocrit at 12.6%, and a platelet count of 292×10^3/μL. Additionally, erythrocyte sedimentation rate (ESR) was measured at 18 mm/h, and C-reactive protein (CRP) levels were elevated at 5.67 mg/L. In urine analysis, the protein level was elevated at 37 mg/dL, creatinine measured at 0.68 mg/dL, and glucose detected at 104 mg/dL. The pH level was 3.4, with a specific gravity recorded as 1.022.

Neurosurgery consultation was obtained, and the patient was advised to undergo posterior fossa craniectomy with excision of the posterior fossa space-occupying lesion and external ventricular drain placement. The patient was prepared for surgery, and informed consent was obtained. Anesthesia fitness was assessed. The surgery was performed without any intraoperative or postoperative complications. Intraoperatively a thick capsular space-occupying lesion (SOL) was identified with pus discharge from the capsular opening. Biopsy was taken and the section examined revealed multiple fragments of a neoplastic lesion arranged in sheets composed of atypical cells. The neoplastic cells exhibited enlarged hyperchromatic nuclei, inconspicuous nucleoli, moderately eosinophilic cytoplasm, and mitotic activity, shown in Fig. 2.

Immunohistochemical studies were performed using the DAKO Envision method with the following antibodies, as presented in Table 1. The immunohistochemical profile, in combination with the histopathological findings, suggested a primary adenocarcinoma of lung origin.

Following surgery, the patient was transferred to the high dependency unit for close monitoring and surveillance for potential complications. The external ventricular drain was removed without complications. Subsequently, the patient was stepped down to the ward for further care.

Discussion

Patients with lung adenocarcinoma have an increased risk of developing brain metastasis; one study reported that brain metastasis occurred in approximately 16% of patients, and another noted that 26.8% of patients with apparent diffusion coefficient (ADC) had brain metastasis. [9, 10] However, the coexistence of a brain abscess and a brain tumor is a very uncommon presentation, apart from intrasellar lesions, in which direct extension of microbial flora from the sinuses results in such complications [11].

The pathophysiology of such an abscess is not clearly understood; one hypothesized mechanism is that intratumoral necrosis, especially when the tumor mass is significant, is a medium for forming a seeded infection [12, 13]. The causative organisms implicated are *Toxoplasma*, *Staphylococcus* spp., *Streptococcus* spp., and *Pseudomonas* [14]. Factors that increase the risk of developing a brain abscess are a weakened immune system, such as in patients with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), chronic diseases such as cancer, immunosuppressive drugs such as corticosteroids and chemotherapy, and congenital heart diseases [15]. In 50% of cases, the most significant risk factor is disease transmission from

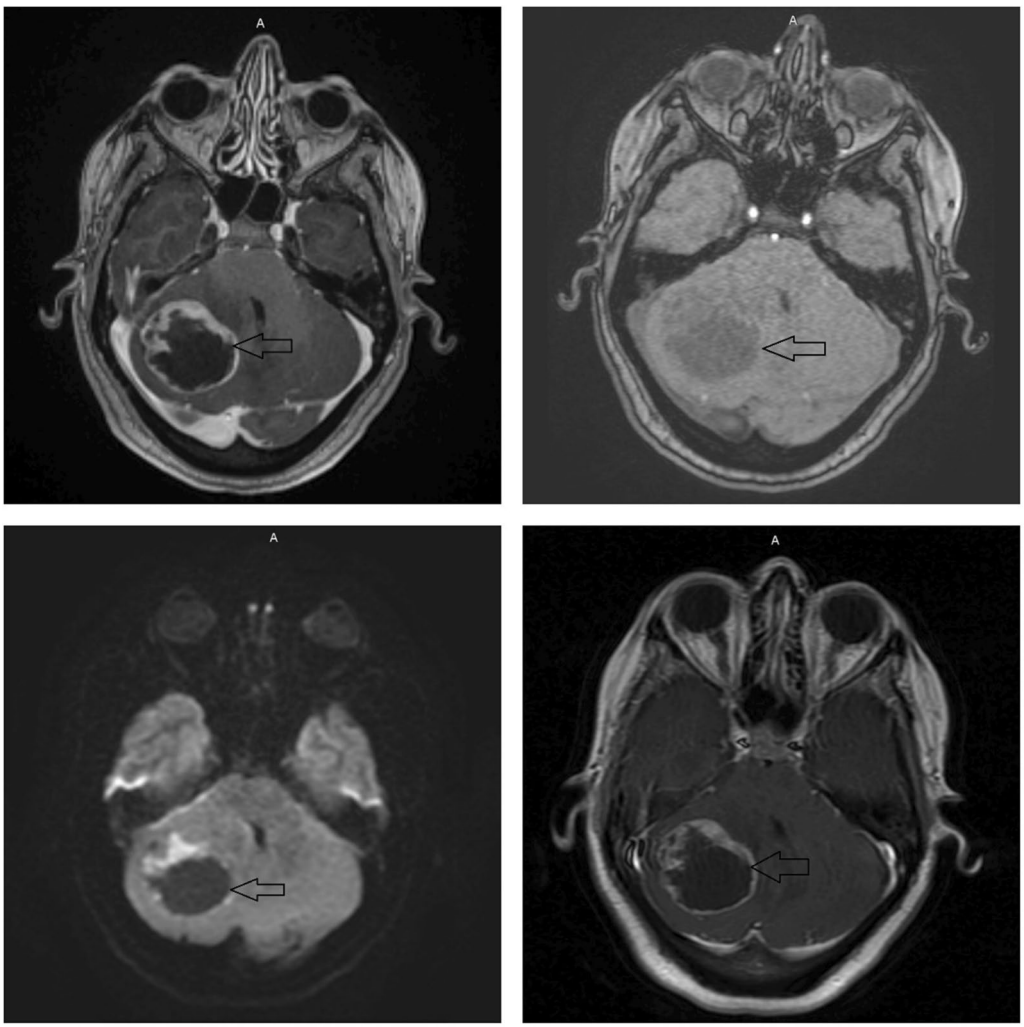

Fig. 1 Radiological investigations with arrows indicating a posterior fossa space-occupying lesion with hydrocephalus

neighboring areas, followed by otitis media, mastoiditis, sinusitis, meningitis, neurosurgery, or traumatic brain injury [16]. The development of a brain abscess, based on computed tomography (CT) and MRI scan findings, can be divided into four stages: (1) early cerebritis (1–4 days); (2) late cerebritis (4–10 days); (3) early capsule formation (11–14 days); and (4) late capsule formation (> 14 days) [14].

An abscess might manifest as one of four primary syndromes: focal mass enlargement, intracranial hypertension, diffuse destruction, or focal neurological deficit [14]. The most common clinical manifestations are headache, altered level of consciousness, nausea, and fever. [17] Clinical features also vary depending on where the abscess is located. Cerebellar abscesses may manifest as cranial nerve palsies, gait disturbances, headaches, or an altered level of consciousness due to hydrocephalus [16].

The diagnostic investigations include blood cultures, chest x-rays, CBC, head CT scan and MRI, electroencephalogram, presence of specific antibodies, and a needle biopsy to identify the causative organism [15]. The ring-like enhancement observed on contrast-enhanced imaging is nonspecific. To distinguish between abscesses and tumors, modalities such as diffusion-weighted MRI, Thallium-201 single photon emission computed tomography, and proton magnetic resonance spectroscopy (MRS) are utilized [14, 18]. Brain abscesses have apparent diffusion restriction on the diffusion-weighted imaging (DWI)/ADC map, whereas necrotizing brain tumors show weak diffusion restriction. The dual rim sign on susceptibility-weighted imaging (SWI) is another highly unique finding of a brain abscess [16].

The first line of treatment in such cases is usually broad-spectrum empirical antibiotics such as third-generation

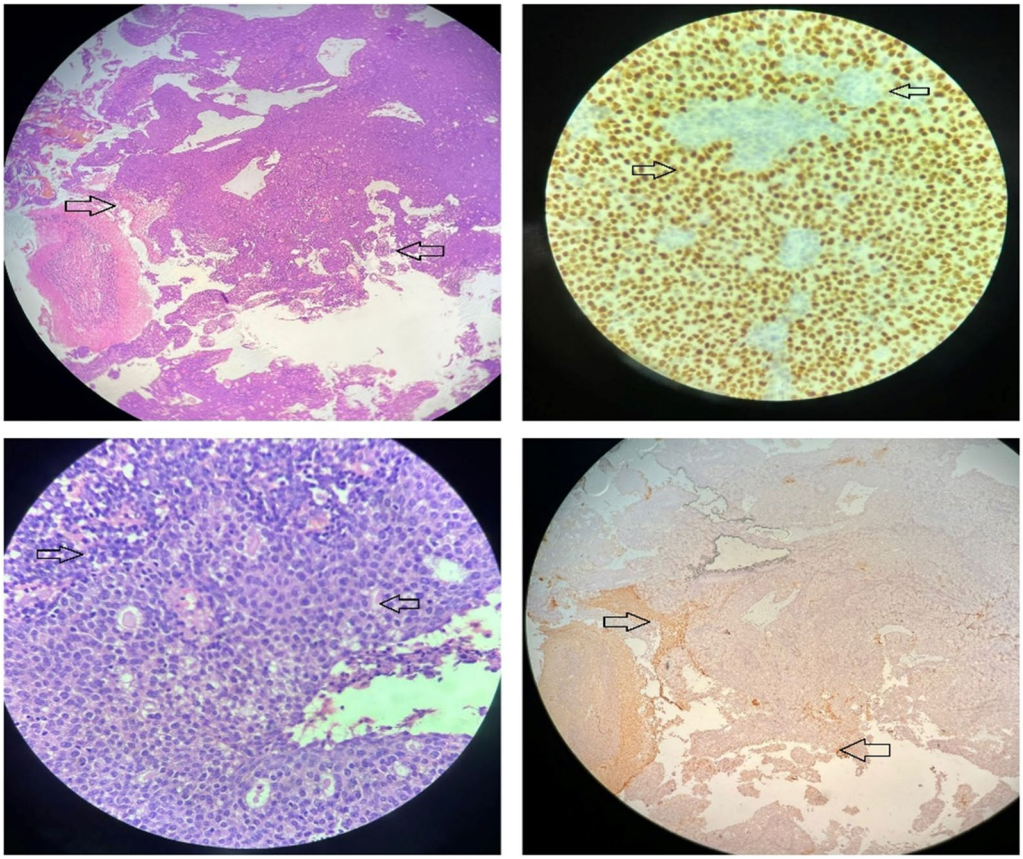

Fig. 2 Histopathological images with an arrow pointing to sheets of atypical cells displaying specific characteristics such as enlarged nuclei, inconspicuous nucleoli, eosinophilic cytoplasm, and mitotic activity

Table 1 Immunohistochemical profile of the patient

Immunohistochemical stains	Results
CKAE1/AE3	Positive staining
EMA (epithelial membrane antigen)	Positive staining
CK7	Positive staining
CK20	Negative staining
TIF1 (transcriptional intermediary factor 1)	Positive staining
p63	Focal positive
GFAP	Negative staining
Napsin A	Positive staining
Thyroglobulin	Negative staining
GATA3	Negative staining
CDX2	Negative staining

cephalosporins and metronidazole for 6–8 weeks. Intimating antibiotic therapy leads to beneficial results [16]. In patients whose abscesses have caused a shift in the brain leading to herniation, neurosurgical intervention may be required, which can either be repeated aspiration or excision [14, 16]. Regarding recovery and length of hospital stay, excision was better than aspiration [19].

Conclusion

The presented case highlights the rarity and clinical complexity of cerebellar abscesses secondary to metastatic lung adenocarcinoma. Despite their infrequent occurrence, these cases necessitate vigilant clinical assessment and a multidisciplinary approach for accurate diagnosis and timely intervention. The successful management of this patient underscores the importance of prompt recognition, appropriate surgical intervention, and targeted antimicrobial therapy. Further studies are warranted to elucidate the underlying pathophysiological mechanisms and optimize treatment strategies for this challenging clinical scenario.

Abbreviations

GCS	Glasgow Coma Scale
CBC	Complete blood count
MRI	Magnetic resonance imaging
CT	Computed tomography
ESR	Erythrocyte sedimentation rate
CRP	C-reactive protein

MRA Magnetic resonance angiography
SOL Space-occupying lesion
ADC Apparent diffusion coefficient
DWI Diffusion-weighted imaging
SWI Susceptibility-weighted imaging

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Author contributions
Hamza Ahmed: contributed to the conceptualization, writing—original draft, final approval, and agreeing to the accuracy of the work. Amanullah Khan: contributed to the conceptualization, writing—original draft, final approval, and agreeing to the accuracy of the work. Sameer Abdul Rauf: contributed to the conceptualization, writing—original draft, final approval, and agreeing to the accuracy of the work. Javed Somro: contributed to writing—original draft, final approval, and agreeing to the accuracy of the work. Shah Emaad Ur Rehman Saleem: contributed to writing—original draft, final approval, and agreeing to the accuracy of the work. Javaria Parvez: contributed to writing—original draft, final approval, and agreeing to the accuracy of the work. All authors approved the final version to be published.

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Availability of data and materials
Not applicable.

Declarations

Ethics approval and consent to participate
Ethical approval was obtained from Liaquat National Hospital and Medical College.

Consent for publication
Written Informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of written consent is available for review by the Editor-in-Chief of this Journal.

Competing interests
There are no conflicts of interest to declare.

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References

1. Brouwer MC, Coutinho JM, van de Beek D. Clinical characteristics and outcome of brain abscess: systematic review and meta-analysis. Neurology. 2014;82(9):806–13.
2. Mathisen GE, Johnson JP. Brain abscess. Clin Infect Dis. 1997;25(4):763–79.
3. Travis WD, Brambilla E, Nicholson AG, Yatabe Y, Austin JH, Beasley MB, Flieder DB. The 2015 World Health Organization classification of lung tumors: impact of genetic, clinical and radiologic advances since the 2004 classification. J Thorac Oncol. 2015;10(9):1243–60.
4. Sørensen JB, Hansen HH, Hansen M, Dombernowsky P. Brain metastases in adenocarcinoma of the lung: frequency, risk groups, and prognosis. J Clin Oncol. 1988;6(9):1474–80.
5. Eichler AF, Chung E, Kodack DP, Loeffler JS, Fukumura D, Jain RK. The biology of brain metastases-translation to new therapies. Nat Rev Clin Oncol. 2011;8(6):344–56. https://doi.org/10.1038/nrclinonc.2011.58.
6. Shetty P, Moiyadi A, Pantvaidya G, Arya S. Cystic metastasis versus brain abscess: role of MR imaging in accurate diagnosis and implications on treatment. J Cancer Res Ther. 2010;6:356–8.
7. Ebisu T, Tanaka C, Umeda M, Kitamura M, Naruse S, Higuchi T, *et al.* Discrimination of brain abscess from necrotic or cystic tumors by CASE REPORT–OPEN ACCESS 64 Y Goto *et al.*/International Journal of Surgery Case Reports 10 (2015) 59–64 diffusion-weighted echo planar imaging. Magn Reson Imag. 1996;14(9):1113–6.
8. Fertikh D, Krejza J, Cunqueiro A, Danish S, Alokaili R, Melhem ER. Discrimination of capsular stage brain abscesses from necrotic or cystic neoplasms using diffusion-weighted magnetic resonance imaging. J Neurosurg. 2007;106:76–81.
9. Yang B, Lee H, Um SW, Kim K, Zo JI, Shim YM, Jung Kwon O, Lee KS, Ahn MJ, Kim H. Incidence of brain metastasis in lung adenocarcinoma at initial diagnosis on the basis of stage and genetic alterations. Lung Cancer. 2019;129:28–34. https://doi.org/10.1016/j.lungcan.2018.12.027.
10. Cagney DN, Martin AM, Catalano PJ, Redig AJ, Lin NU, Lee EQ, Wen PY, Dunn IF, Bi WL, Weiss SE, Haas-Kogan DA, Alexander BM, Aizer AA. Incidence and prognosis of patients with brain metastases at diagnosis of systemic malignancy: a population-based study. Neuro Oncol. 2017;19(11):1511–21. https://doi.org/10.1093/neuonc/nox077.
11. Goto Y, Ebisu T, Mineura K. Abscess formation within a cerebellar metastasis: Case report and literature review. Int J Surg Case Rep. 2015;10:59–64. https://doi.org/10.1016/j.ijscr.2015.03.012.
12 Bhaisora KS, Prasad SN, Das KK, Lal H. Abscess inside craniopharyngioma: diagnostic and management implications. BMJ case reports. 2018. https://doi.org/10.1136/bcr-2017-223040.
13. Jho DH, Spiliopoulos K, Stein TD, Williams Z. Concomitant presentation of a glioblastoma multiforme with superimposed abscess. World Neurosurg. 2011;75(1):126–53. https://doi.org/10.1016/j.wneu.2010.09.014.
14. Muzumdar D, Jhawar S, Goel A. Brain abscess: an overview. Int J Surg. 2011;9(2):136–44. https://doi.org/10.1016/j.ijsu.2010.11.005.
15. (n.d.). Brain abscess: MedlinePlus Medical Encyclopedia. https://medlineplus.gov/ency/article/000783.htm
16 Radiansyah RS, Sugianto P, Cecilia C. Complete resolution of otogenic cerebellar abscess with conservative approach: two case reports. Ann Med Surg. 2022;79:104001. https://doi.org/10.1016/j.amsu.2022.104001.
17. Brouwer MC, Coutinho JM, van de Beek D. Clinical characteristics and outcome of brain abscess: systematic review and meta-analysis. Neurology. 2014;82(9):806–13. https://doi.org/10.1212/WNL.0000000000000172.
18. Umeda S, Fujikawa A, Tsuchiya K. No shinkei geka. Neurol Surg. 2021;49(2):368–74. https://doi.org/10.1477/mf.1436204400.
19. Wu S, Wei Y, Yu X, Peng Y, He P, Xu H, Qian C, Chen G. Retrospective analysis of brain abscess in 183 patients: A 10 year survey. Medicine. 2019;98(46): e17670. https://doi.org/10.1097/MD.0000000000017670.

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