Case Report

Ruptured cerebral abscess with ventriculitis and leptomeningitis; A rare complication in the setting of metastatic esophageal cancer: Case report and literature review

Chad J. Mackay, DO[a,], Yao Chen, MD[b]*

[a] St. Joseph's Hospital, Department of Radiology, Medical College of Wisconsin, Affiliated Hospitals, 5000 W. Chambers Street, Milwaukee, WI 53210, USA
[b] Milwaukee Radiologists Limited, Milwaukee, WI

ABSTRACT

Esophageal cancer is one of the deadliest cancers worldwide, and metastatic esophageal carcinoma carries a very poor prognosis. Patients tend to decline rapidly, with an overall 5-year survival rate less than 20%. Furthermore, understanding the eventual cause of death in patients with esophageal cancer may serve to guide treatment and hopefully improve the patient's quality of life. Less common causes of death in patients with metastatic esophageal cancer have infrequently been described in the literature. Our report outlines a unique case of metastatic esophageal carcinoma, complicated by ruptured intracranial abscess, with subsequent ventriculitis and leptomeningitis.

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Introduction

Among the most difficult forms of cancer to cure, esophageal carcinoma carries an extremely poor prognosis in patients. Esophageal cancer represents 0.5%-1.0% of all new cancer cases, with an annual prevalence of 4.2 per 100,000 [1]. Median survival for patients is less than 10 months, while some studies project the 5-year survival to be less than 10% [2]. There is a documented male predominance of esophageal carcinoma, and the disease exhibits a slight predilection for the caucasian ethnicity [1].

When esophageal carcinoma metastasizes, it most often spreads to the lung, with some studies reporting a prevalence up to 31% lung involvement [3]. The same study reported infrequent incidence of metastasis to the brain, at less than 5%. Other common sites of metastatic spread include the pleura, liver, stomach, peritoneum, kidney, adrenal gland, and bone [4].

While the majority of patients with metastatic esophageal cancer die from the disease itself, patients may be particularly susceptible to other fatal disease processes [5]. As discussed in the literature, the second highest cause of mortality in patients with esophageal cancer is death from a secondary
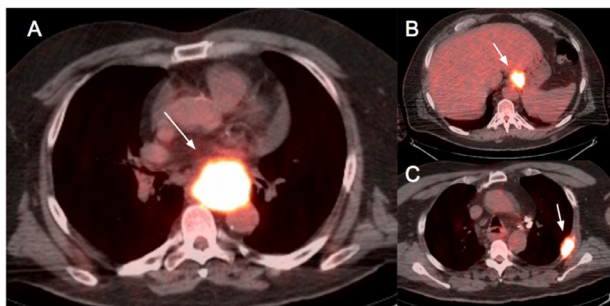
Fig. 1 – (a) Axial positron emission tomography (PET)/CT showing hypermetabolic thickening of the distal esophagus, characterized as the primary esophageal carcinoma. (b) Axial PET/CT showing hypermetabolic gastrohepatic lymphadenopathy, a metastatic lesion. (c) Axial PET/CT showing an fluorodeoxyglucose (FDG) avid metastatic left rib lesion.
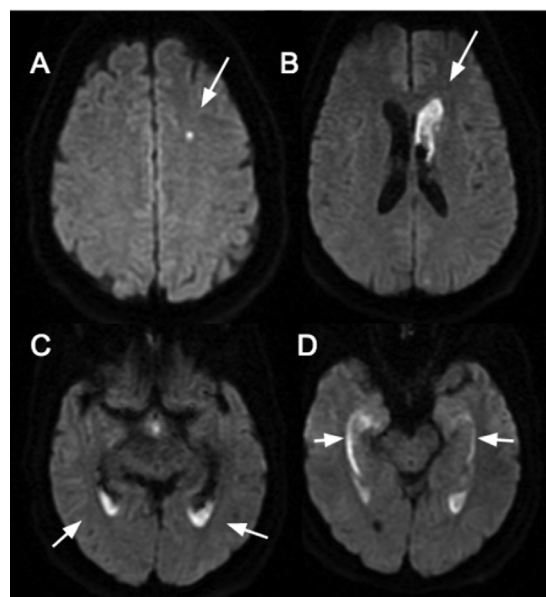

Fig. 2 – (a) Axial diffusion-weighted MR images demonstrating a focus of restricted diffusion in the left frontal lobe, most compatible with a microabscess. (b) diffusion-weighted imaging (DWI) signal abnormality is also seen within the frontal horn of the left lateral ventricle from intraventricular extension of a ruptured microabscess in the adjacent caudate lobe. Signal abnormality layers within the occipital (c) and temporal horns (d), compatible with ventriculitis.

malignancy [5,6]. Infectious and parasitic diseases (including ventriculitis) are very uncommon causes of death in patients with esophageal cancer, observed at a rate of 0.1% [5].

Ventriculitis is a rare infection or inflammation of the ventricular ependyma, usually resulting from ruptured intracranial abscess or ventricular catheter placement. The prognosis is extremely poor, with mortality rates reported between 40% and 80% [7]. Further understanding the eventual cause of death in patients with esophageal cancer may serve to improve long-term prognosis.

Case report

The patient was a 58-year-old male with a medical history of hypertension, chronic back pain, and seizures. He had also been recently diagnosed with squamous cell esophageal carcinoma, which had metastasized to the mediastinum, mesentery, and axial skeleton (Fig. 1). There was no evidence of intracranial metastasis on the patients' prior imaging. Shortly after completing the second of 10 planned radiation therapy treatments, the patient presented to the emergency department with worsening neck pain, restlessness, and weight loss.

Differential consideration was given to intracranial/intraspinal metastatic progression or meningitis, and multisequence magnetic resonance imaging (MRI) of the brain was performed with intravenous contrast. Axial T2 and fluid-attenuated inversion recovery (FLAIR) sequences revealed multiple cystic ovoid lesions throughout the supratentorial parenchyma, one of which openly communicated with the left lateral ventricle. On diffusion-weighted imaging, there was diffuse signal abnormality seen within the left lateral ventricle, as well as the bilateral occipital and temporal horns (Fig. 2). T1 pre- and postcontrast images also showed ependymal enhancement, predominantly within the lateral ventricles, consistent with ventriculitis, and a microabscess within the left caudate nucleus, with intraventricular communication (Fig. 3). Additionally, periventricular enhancement

of the left lateral ventricle was observed, compatible with ventriculitis.

Subsequent lumbar puncture yielded cloudy purulent cerebrospinal fluid (CSF), which stained positive for beta hemolytic *Streptococcus*. A diagnosis of bacterial meningitis was made and empiric antibiotic therapy was further specified following sensitivity results. Despite the antibiotic regimen and pain management, the patient's status continued to decline. He soon became less responsive, the family decided on comfort measures, and shortly thereafter, the patient expired.

Discussion

MRI findings in this case led to differential consideration for 2 main intracranial processes: microabscess or spread of esophageal metastasis. Prior imaging of the brain was negative for intracranial metastasis, and this differential was considered less likely due to the absence of significant perilesional vasogenic edema. Extensive vasogenic edema is often described as a hallmark sign of an intracranial metastatic process [8].

While esophageal cancer is rare, intracranial metastasis from esophageal cancer is exceptionally rare, with a reported incidence of 0.5%-4.8% [9]. More common patterns of esophageal cancer spread include the neck and mediastinum, which is likely due to unique anatomical features; the absence
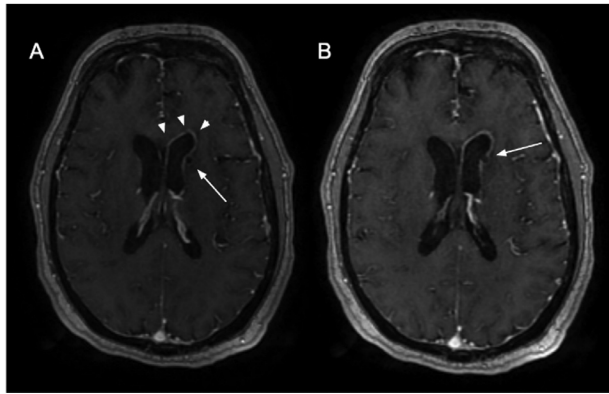
Fig. 3 – (a) Axial T1 postcontrast image demonstrating ependymal enhancement along the left lateral ventricle (arrowheads). A hypointense microabscess within the left caudate nucleus which communicates with the left lateral ventricle (arrow). (b) Axial T1 postcontrast image showing communication of the left caudate pyogenic abscess with the left lateral ventricle.

of serosal coating and the presence of periesophageal adventitia [4]. Venous drainage of the esophagus facilitates hematogenous spread of metastasis to the most common sites, the liver and lungs [5].

Two major histologic subtypes of esophageal cancer are discussed in the literature: adenocarcinoma and squamous cell carcinoma [2–4,10,11]. The former is more common in Europe and North America, while the latter shows a higher incidence worldwide [4,11]. Additionally, certain demographic regions like China, Italy, Africa, and Iran are particularly high risk of developing esophageal cancer [12]. Both subtypes occur most commonly in the distal third of the esophagus [13]. Squamous cell carcinoma occurs in response to chronic irritation or inflammation, while adenocarcinoma often develops as a result of long-term gastroesophageal reflux [13]. A number of predisposing factors are also associated with developing esophageal cancer; alcohol, barrett esophagus (adenocarcinoma), achalasia, obesity, Plummer–Vinson syndrome, and human papilloma virus to name a few [12].

A population-based study including over 18,000 patients with esophageal cancer evaluated the eventual cause of patient mortality. They concluded that the vast majority of patients (74%) of those diagnosed with esophageal cancer would die from the disease, which is especially true if death occurs within the first year of diagnosis [5]. Death from a secondary (nonesophageal) cancer was observed at 10%, while death related to cerebrovascular and ischemic heart disease was significantly less common (4.2%) [5]. Interestingly, although there is a relatively high incidence of esophageal metastasis to the lungs, only a small percentage of deaths occurred as a result of respiratory disease (1.3%) [5]. Death from infectious or parasitic causes was much less common (0.1%). To the best of our knowledge, mortality resulting from intracranial pyogenic abscess and subsequent ventriculitis in a patient with esophageal cancer has yet to be described in the literature.

Streptococcus pneumonia and *Neisseria meningitidis* are the most common causes of community-acquired bacterial meningitis in adults in developed countries [3]. Approximately 30% of patients with meningitis will go on to develop ventriculitis, which is inflammation of the ventricular system [14]. Ventriculitis may result from trauma, neurosurgical procedures, or result from contiguous extension of ruptured cerebral abscess [14], as in the presented case. *Staphylococcus* and *Enterobacter* are the 2 most common micro-organisms found in confirmed cases of ventriculitis [15].

In the case presented, the facilitating factor of infection is not clear, although immunosuppression from recent radiation therapy is an acceptable explanation. While the incidence of brain abscess in patients with metastatic esophageal cancer has not been established in the literature, patients undergoing immunosuppressive therapy are at a higher risk of developing intracranial infection, as well as subsequent abscess formation [16]. Bacterial, fungal, and viral pathogenesis of ventriculitis may all occur in an immunosuppressed patient [16], and may be facilitated by rupture of intracranial abscess.

Conclusion

Metastatic esophageal carcinoma carries a very poor prognosis, with resulting mortality most often directly related to the primary malignancy [5]. Improving overall mortality in these patients relies on our understanding of the various causes of death to which patients are susceptible, and infectious or parasitic processes are among the more rare complications [5]. While CSF analysis remains the definitive diagnostic step in confirming suspected bacterial meningitis, MRI continues to play a pivotal role in diagnosis of intracranial infections and assessing the extent of potential complications [7]. Ruptured intracranial pyogenic abscess with subsequent ventriculitis is one such rare, and potentially fatal complication.

REFERENCES

[1] Noone AM, Howlader N, Krapcho M, Miller D, Brest A, Yu M, et al. SEER cancer statistics review, 1975-2015. Bethesda, MD: National Cancer Institute; 2018 https://seer.cancer.gov/csr/1975_2015/ based on November 2017 SEER data submission.

[2] Kazuhiko O, Takafumi T, Hiroo S, Nobukazu F, Yasumasa K, Minoru K, et al. Brain metastases from esophageal carcinoma. Cancer 2002;94(3).

[3] Weinberg JS, Suki D, Hanbali F, Cohen Z, Lenzi R, Sawaya R. Metastasis of esophageal carcinoma to the brain. Cancer 2003;98(9).

[4] Shaheen O, Ghibour A, Alsaid B. Esophageal cancer metastases to unexpected sites: a systematic review. Gastrointest Res Pract 2017;2017:1657310.

[5] Xie SH, Wahlin K, Lagergren J. Cause of death in patients diagnosed with esophageal cancer in Sweden: a population-based study. Oncotarget 2017;8(31).

[6] Chuang SC, Hashibe M, Scelo G, Brewster D, Pukkala E, Friis S, et al. Risk of second primary cancer among esophageal cancer patients: a pooled analysis of 13 cancer registries. Cancer Epidemiol Biomark Prev 2008;17:1543–9.

[7] Hazany S, Go JL, Law M. Magnetic resonance imaging of infectious meningitis and ventriculitis in adults. Top Magn Reson Imaging 2014;23(5).

[8] Fink KR, Fink JR. Imaging of brain metastasis. Surg Neurol Int 2013 S209-19. doi:10.4103/2152-7806.111298.

[9] Smith RS, Miller RC. Incidence of brain metastasis in patients with esophageal carcinoma. World J Gastroenterol 2011;17(19):2407–10.

[10] Almasi S, Bashashati M, Rezael N, Markazi-Moghaddam N. Brain metastasis from esophageal carcinoma. Case report. Neurol India 2004;52:492–3.

[11] Siewert JR, Stein HJ, Feith M, Bruecher BL, Bartels H, Fink U. Histologic tumor type is an independent prognostic parameter in esophageal cancer: lessons from more than 1,000 consecutive resections at a single center in the western world. Ann Surg 2001;234(3).

[12] Charles TR, Hunter JG, Jobe BA. Esophageal cancer: principles and practice. Demos Medical. ISBN: B004HO6S24.

[13] Enzinger PC, Mayer RJ. Esophageal cancer. N Engl J Med 2003;349:2241–52.

[14] Mohan S, Jain KK, Arabi M, Shah GV. Imaging of meningitis and ventriculitis. Neuroimaging Clin N Am 2012;22:557–83.

[15] Fukui MB, Williams RL, Mudigonda S. CT and MR imaging features of pyogenic ventriculitis. AJNR Am J Neuroradiol 2001;22:1510–16.

[16] Patel K, Clifford DB. Bacterial brain abscess. Neurohospitalist 2014;4(4):196–204.