

Practice Pearls

Avoiding Cognitive Bias in Radiology: New Brain Lesions in Homeopathically Treated Breast Cancer Patient

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Cognitive biases can impact diagnostic accuracy and timeliness of medical care. Crucially, these biases can be mitigated by carefully integrating clinical data. Herein, we present a case of a patient with metastatic breast cancer treated with homeopathic therapy, who presented with new hyperdense non-enhancing brain lesions on CT. This case highlights the risks of framing bias for radiologists when little clinical information is available and underscores the necessity of a thorough evaluation and review of clinical history to identify alternative diagnoses and ensure timely and accurate management. It also highlights the expected imaging appearance of treated versus untreated intracranial breast cancer metastases.

An adult female patient with ER+/HER2- invasive breast ductal carcinoma with chest wall and spine metastases presented with acute delirium several weeks after posterior spine decompression surgery for cord compression due to epidural metastasis. Thus far, she had been treated with homeopathic remedies without a conventional chemotherapy regimen. Her postoperative course was complicated by mildly decreased sodium level likely in the context of the syndrome of inappropriate antidiuretic hormone secretion and dehiscence of the surgical wound, for which she was followed by a wound care nurse. Approximately two weeks after the surgery, she became acutely confused and disoriented in a setting of still mildly decreased sodium level, a positive urinalysis and mild fever. Unenhanced CT brain performed in the emergency department showed multiple intra-axial hyperattenuating foci (Figure 1a), initially appropriately considered hemorrhagic metastases without differential considerations. Radiation oncology was consulted to manage further care. A subsequent gadolinium-enhanced MRI head showed multiple intraparenchymal foci of susceptibility without enhancement (Figure 1b,c) that were first considered metastases but then also prompted consideration of septic emboli as an alternative diagnosis since untreated breast cancer metastases should enhance. The radiology report triggered an infectious disease consult and a workup for a potential infectious source. Urine and blood cultures grew *Staphylococcus aureus*. MRI of the spine showed expected postoperative findings without evidence of abscess. A transesophageal echocardiogram then revealed the presence of mitral valve vegetation that was later

also demonstrated on a cardiac CT scan (Figure 1d). Cardiac surgery was not advised due to the fungating breast lesion metastatic to the manubrium and chest wall, and the patient was managed medically for infective endocarditis. She returned to her baseline and was discharged to a rehabilitation hospital.

Initially, multifocal hyperattenuating brain lesions were considered without differential diagnosis as hemorrhagic metastases in a breast cancer patient, previously treated with alternative therapies, who presented with delirium and fever. Often, when cancer patients present to the hospital with new neurological symptoms and are sent for brain imaging, the clinical question on the requisition asks to rule out intracranial metastases. Although metastatic disease is high on the differential diagnosis, it is important to remember that these patients are also at risk of other common conditions and at increased risk of infection if immunocompromised from previous treatments. Although hemorrhagic lesions on MRI could lead to the knee-jerk reflex of metastases, the interpreting radiologist correctly noted that the absence of enhancement is unusual considering the lack of prior chemotherapy or radiation treatment. Non-enhancing leptomeningeal and intraparenchymal brain metastases are extremely rare.^{1–3} Additionally, the incidence of brain metastasis in ER+/HER2- breast cancer is only 15%, the lowest among ductal carcinoma subtypes.⁴ The rarity of non-enhancing leptomeningeal and intraparenchymal brain metastases in breast cancer, particularly in the absence of prior chemotherapy or radiation treatment, emphasizes the need for careful consideration of atypical presentations to overcome cognitive bias. Ultimately, the unusual radiological findings prompted consideration of an alternative diagnosis, leading to the correct diagnosis of septic emboli. Failure to keep a broad initial differential diagnosis beyond the narrow question posed on the imaging test requisition is an example of framing bias.⁵ Seeking more information about the disease status and treatments to date, as much as possible in an emergent setting, is invaluable to guide the clinical team and ensure best care practices. Comprehensive integration of all available information and a broad differential diagnosis is necessary to combat cognitive bias, reduce diagnostic errors and ensure timely and appropriate care.

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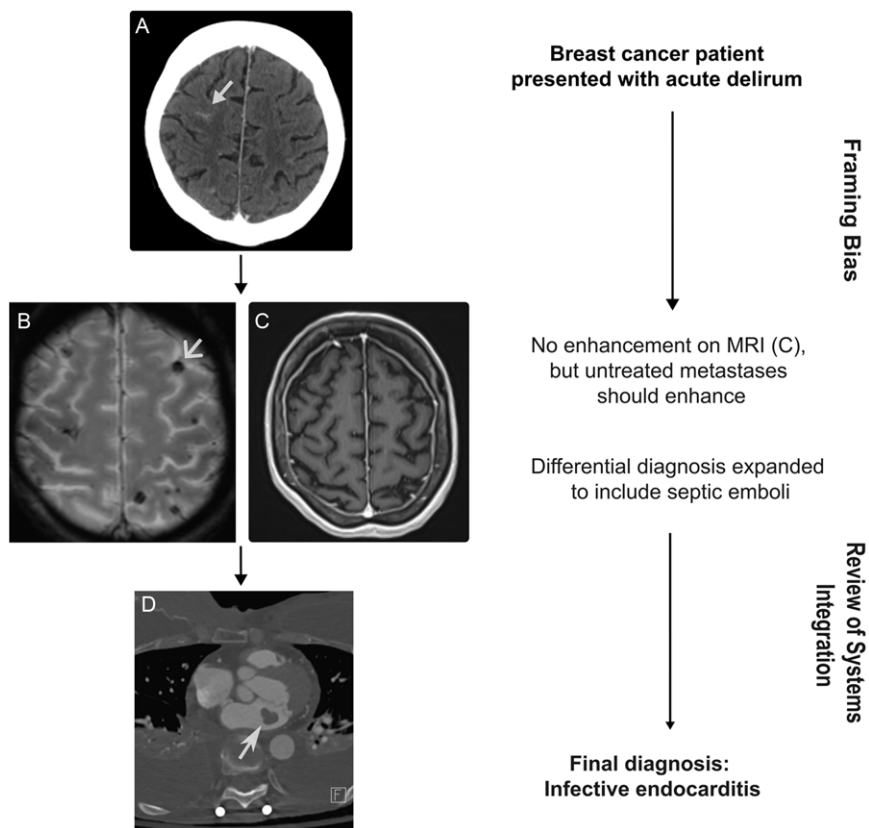


Figure 1. An adult female with ER+/HER2- invasive breast ductal carcinoma with spine metastasis managed with only homeopathic therapy presented with acute delirium. Unenhanced CT brain (a) showed multiple intra-axial hyperattenuating foci (closed arrow). Gadolinium-enhanced MRI obtained one day later (b) showed widespread foci of susceptibility (open arrow) but no enhancement (c). Subsequent cardiac CT (d) identified a 1.3 cm vegetation on the mitral valve (dart arrow). The brain findings were ultimately attributed to cardiogenic septic emboli.

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References

1. Karimi S, Lis E, Gilani S, D'Ambrosio N, Holodny A. Nonenhancing brain metastases. *J Neuroimaging*. 2011;21:184–7.
2. Hatzoglou V, Karimi S, Diamond EL, et al. Nonenhancing leptomeningeal metastases: imaging characteristics and potential causative factors. *Neurohospitalist*. 2016;6:24–8.
3. Bramlage L, Pollack A, Hall L, McCalip B. Non-enhancing metastatic disease of the CNS, a case report. *Neuro Oncol*. 2017;19:vi39. doi: [10.1093/neuonc/nox168.152](https://doi.org/10.1093/neuonc/nox168.152)
4. Kuksis M, Gao Y, Tran W, et al. The incidence of brain metastases among patients with metastatic breast cancer: a systematic review and meta-analysis. *Neuro Oncol*. 2021;23:894–904.
5. Busby LP, Courtier JL, Glastonbury CM. Bias in radiology: the how and why of misses and misinterpretations. *RadioGraphics*. 2018;38:236–47.