

Wernicke Encephalopathy

Peter Fiester, MD; Blaze Emerson, DO; Patrick Natter, MD; Dinesh Rao, MD;
Sukhwinder Sandhu, MD; Erik Soule, MD, MS

CASE SUMMARY

A 53-year-old with a history of recently diagnosed metastatic pancreatic cancer was admitted with complaints of worsening diplopia, ataxia, and altered mental status. Following the diagnosis, the patient acknowledged drinking heavily owing to abdominal pain and depression.

IMAGING FINDINGS

Upon admission, pre- and postcontrast brain MRI scans demonstrated symmetric bilateral increased T2 signal in the medial thalami, hypothalamus, periaqueductal (PA) white matter in the left occipital and temporal lobes. Postcontrast imaging demonstrated faint enhancement in the bilateral mammillary bodies. Diffusion weighted imaging also revealed restricted diffusion in the bilateral medial thalami and periaqueductal gray matter.

DIAGNOSIS

Wernicke encephalopathy. Differential diagnoses: Artery of Percheron (AoP) infarct, viral encephalitis, and Creutzfeldt-Jacob disease (CJD).

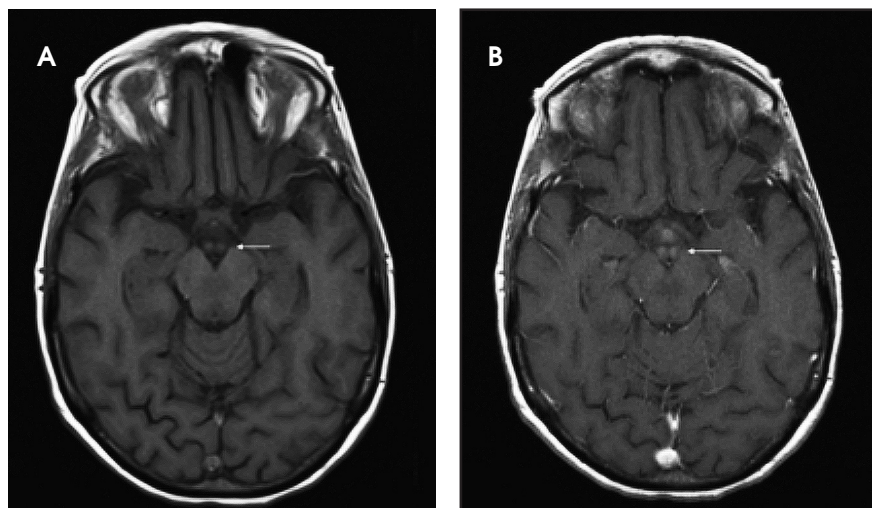


FIGURE 1. (A) Axial T1W without contrast demonstrates normal signal in the mammillary bodies on the pre-contrast image (thin arrow). (B) Axial T1 sequence following IV contrast demonstrates mild homogeneous enhancement in the mammillary bodies (thin arrow).

DISCUSSION

Wernicke encephalopathy (WE) was first described in 1881 by Carl Wernicke, and is defined as a neurologic disorder attributable to thiamine deficiency most often related to chronic alcohol consumption.⁵ The condition is fairly common, with some studies reporting an incidence of 2.8% in the general population and a prevalence as high as 12.5% in alcohol

abusers.⁶ It most often presents as the classic triad of encephalopathy, ocular-motor dysfunction, and gait ataxia.

Imaging is useful in cases of suspected WE, as abnormal findings may help rule out competing diagnoses. Head CT may depict lesions as symmetrical hypodense areas in the medial thalami, PA gray matter, and mammillary bodies that may enhance after contrast injection.

Table 1: Differential Diagnosis Table for Wernicke's Encephalopathy

	CT	MRI
Wernicke's encephalopathy	Symmetric hypodense areas in the medial thalami, PA gray matter, and mammillary bodies; may enhance after contrast injection	Decreased T1 signal and increased T2/FLAIR signal in medial thalami, hypothalamus, mammillary bodies, tectal plate, and PA gray matter; restricted diffusion on DWI; Mammillary body enhancement considered pathognomonic
Artery of Percheron Infarct	Symmetric hypodense areas in the medial thalami and midbrain	Increased T2/FLAIR signal in the medial thalami and midbrain with increased signal on DWI. Typically spares the mammillary bodies and PA gray matter
Viral Encephalitis	Variable hypodense areas in the basal ganglia and thalamus	Increased T2/FLAIR signal in the basal ganglia and thalamus with increased signal on DWI. Typically spares the mammillary bodies and PA gray matter.
Creutzfeldt Jacob disease	Variable hypodense areas in the basal ganglia, thalamus, and cortex	Increased T2/FLAIR signal in the basal ganglia, thalamus, and cortex with persistent restricted diffusion on DWI. Typically spares the mammillary bodies and PA gray matter

Table 2: Summary of Wernicke's Encephalopathy

Etiology	Wernicke's encephalopathy is a consequence of thiamine deficiency from alcoholic- or non-alcoholic related malabsorption. Thiamine is required for carbohydrate metabolism and to maintain the integrity of cellular membranes. Thiamine deficiency results in lactic acidosis with intra- and extracellular edema affecting the high metabolic demand areas of the brain.
Incidence	2-3% of general population; up to 12.5% of alcohol abusers
Gender Ratio	Slightly more common in males
Age Predilection	Evenly distributed between 30 – 70 y/o; much less commonly in children in the setting of malnutrition
Risk Factors	Chronic alcoholism, bariatric surgery, thiamine-restrictive diets, starvation, hyperemesis gravidarum, gastric malignancy, inflammatory bowel disease
Treatment	High dose thiamine 500 mg infused over 30 minutes, three times daily for two consecutive days and 250 mg intravenously or intramuscularly once daily for an additional five days.
Prognosis	WE has a high mortality if left untreated with up to 25% of patients requiring long term, institutionalized care. Prompt replacement of thiamine prevents the most serious sequelae of the ocular, ataxic and mental status deficits with usually some degree of residual impairment.
Imaging findings	CT may depict symmetric hypodense areas in the medial thalami, hypothalamus, PA gray matter, mammillary bodies. MRI depicts increased T2/FLAIR signal in these regions as well as restricted diffusion on diffusion weighted imaging (DWI). Postcontrast MRI may demonstrate mammillary body enhancement.

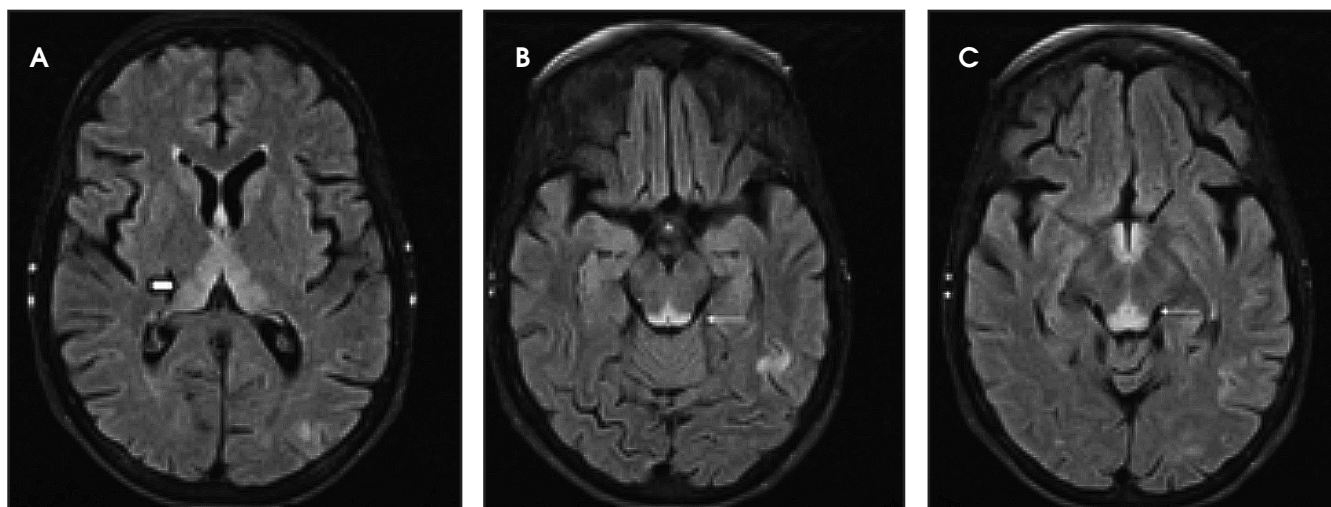


FIGURE 2. Axial FLAIR demonstrating (A) symmetric bilateral hyperintense signal in the thalami (short thick arrow); (B) hyperintense signal in the periaqueductal gray matter (thin arrow); and (C) hyperintense signal in the hypothalamus (thin black diagonal arrow) and also in the periaqueductal gray matter (thin white arrow).

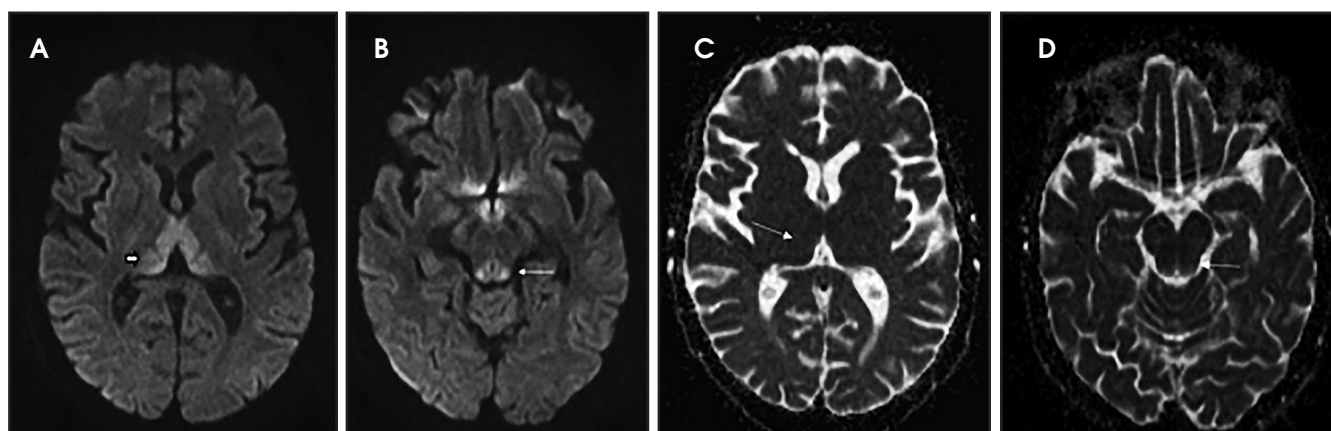


FIGURE 3. Axial DWI demonstrating (A) symmetric hyperintense signal in the bilateral thalami (short thick arrow) and (B) hyperintense signal in the periaqueductal gray matter (long thin arrow). Axial ADC images (C, D) do not demonstrate abnormal T2 prolongation at the level of the thalami or periaqueductal gray matter, respectively (long thin arrows).

MRI, however, is the most sensitive imaging modality for WE. In the acute setting, WE on MRI typically demonstrates decreased T1 signal (Figure 1) and increased T2 (Figure 2) signal in these regions, as well as restricted diffusion on diffusion weighted imaging (Figure 3). Most of these signal abnormalities are located in the medial thalami, hypothalamus, mammillary bodies, tectal plate, and the periventricular white matter.¹

Mammillary body enhancement is common in acute WE and considered pathognomonic. Indeed, mammillary body atrophy is a relatively specific

indicator of chronic WE. Charness, et al, demonstrated that 78% of patients with WE had smaller mammillary bodies than matched controls and patients with Alzheimer dementia.³

Petechial hemorrhage in the medial thalami and mammillary bodies may be observed in severe cases of acute WE. In chronic WE, the mammillary bodies and cerebellar vermis tend to be atrophic without the T2 hyperintense signal intensity observed.²

An AoP infarct demonstrates symmetric hypodense areas in the medial thalami and midbrain on CT and corresponding areas of increased T2 sig-

nal and restricted diffusion on DWI on brain MRI. However, an AoP infarct typically spares the mammillary bodies and periaqueductal gray matter, unlike acute WE. Numerous viral encephalitides, including West Nile, Japanese encephalitis, and St. Louis encephalitis, may variably involve the thalami and basal ganglia producing hyperintense T2 signal in those locations with restricted diffusion on DWI, but otherwise spares the mammillary bodies and periaqueductal gray matter. Finally, CJD, the spongiform encephalopathy, causes increased T2 signal in the basal ganglia, thalami,

and cortex with persistent restricted diffusion on DWI but will also spare the mammillary bodies and periaqueductal gray matter (Table 1). While brain MRI may aid in the diagnosis of WE and exclude competing diagnoses, this disease is predominantly a clinical diagnosis. The use of the Caine criteria (dietary deficiency, oculomotor abnormalities, cerebellar dysfunction, and either altered mental status or mild memory impairment) has been shown to have a sensitivity of 85% when 2 out of the 4 symptoms are present.⁴

Adults are primarily affected with an even distribution between 30-70 years old. Fifty percent of cases are alcohol-related with 50% of cases attributable to non-alcoholic-related malabsorption, including bariatric surgery, thiamine-restrictive diets, starvation, hyperemesis gravidarum, gastric malignancy, and inflammatory bowel disease.

Long term alcohol consumption depletes thiamine stores by decreasing nutritional intake and causing malabsorption. Thiamine helps maintain the integrity of cellular membranes and is an important cofactor for several enzymes chiefly transketolase, alpha-ketoglutarate dehydrogenase, and pyruvate dehydrogenase. These enzymes participate in carbohydrate metabolism and dysfunction results in decreased cerebral energy utilization leading to neuronal injury (both intra- and extracellular edema) in parts of the brain with high metabolic demand.⁷ The lesions are characteristically bilateral and most commonly involve the mammillary bodies, dorsomedial thal-

ami, locus ceruleus, periaqueductal gray matter, vestibular nuclei, and oculomotor nuclei.⁸

If WE is clinically suspected, treatment should begin promptly as progression to coma and death is common. Treatment involves high dose thiamine 500 mg infused over 30 minutes, three times daily for two consecutive days and 250 mg intravenously or intramuscularly once daily for an additional five days.⁹ Thiamine must be replaced before the administration of glucose as this may worsen the encephalopathy. MRI is helpful in the diagnosis and characterizing the chronicity of WE, while excluding other pathologies. When WE is suspected clinically however treatment should begin promptly, while failing to treat carries a high risk of progression to coma and death¹⁰ (Table 2).

CONCLUSION

MRI findings in the acute stage of WE include bilateral T2 hyperintensity in the mammillary bodies, medial thal-ami hypothalamus, and periaqueductal gray matter with variable restricted diffusion on DWI in the corresponding areas and enhancement of the mammillary bodies on postcontrast imaging.

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Affiliations: Department of Radiology, (Dr Fiester, Dr Natter, and Dr Rao), and Department of Interventional Radiology (Dr Soule), University of Florida Health, Jacksonville, FL. Department of Orthopedic Surgery, Broward Health, Fort Lauderdale, FL (Dr Emerson). Department of Radiology, Mayo Clinic, Jacksonville, FL (Dr Sandhu).