A Case of Catatonia due to Manganese Neurotoxicity from Total Parenteral Nutrition

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INTRODUCTION

- Total Parenteral Nutrition (TPN) is a common therapy for patients unable to absorb nutrition through their digestive tract.
  - Comprised of a customized formula of essential nutrients tailored to fit the needs of an individual patient
- While TPN is lifesaving, there are numerous complications associated with both long and short term dependence
  - Manganese (Mn) toxicity is a rare but documented complication of long-term TPN with a predominantly neuropsychiatric presentation[4]

This poster presents a case of catatonia due to presumed manganese neurotoxicity, a rarer but important manifestation of Mn poisoning for consult-liaison psychiatrists to recognize.

MANGANESE TOXICITY

Risk with TPN

- Mn is normally absorbed in GI tract and excreted in bile, but TPN bypasses this mode of excretion allowing it to cross blood-brain-barrier
- Current guidelines recommend monitoring for symptoms if receiving TPN longer than 30 days[4]
- Risk of toxicity is highest in infants and patients with hepatic failure

Mechanism of neurotoxicity

- High density of DMT1 ion transport proteins in basal ganglia
- Mn ions + dopamine → reactive oxygen species, disruption of mitochondrial membrane, dysregulation of antioxidative enzymes →neuronal cell death
- Serum levels are often normal despite pathologic accumulation in CNS

Neuropsychiatric presentation[1,4]

Psychiatric
- Mood lability/irritability
- Hallucinations
- Impulsivity
- Cognitive impairment
- **Catatonia**

Neurologic
- Weakness, rigidity, bradykinesia / akinesia
- Gait changes (retropulsion, postural instability)
- Dysarthria
- "Parkinson's without a tremor"

THE CASE

57-year-old Nigerian American male with no significant medical or psychiatric history who became TPN dependent after a complicated postoperative course for superior mesenteric ischemia leading to a prolonged hospitalization.

12/22-12/30/2022
TPN Initiated after near-total small bowel resection

10/19-11/6/2023
- Psychiatric consult for development of marked psychomotor retardation and speech latency
- Differential: MDD vs hypoactive delirium
- Recommendations: additional medical workup (unrevealing) and titration of fluoxetine and modafinil without improvement

12/29/2023-1/22/2024
- Psychiatry reconsulted for consideration of catatonia due to ongoing mutism, psychomotor retardation.
- Initiation of lorazepam 2 mg TID IV and memantine 5 mg daily → moderate but unsustained improvement in catatonic symptoms
- Referral placed for transfer to facility with ECT
- MRI findings consistent with Mn toxicity (see next panel), although serum Mn level was normal

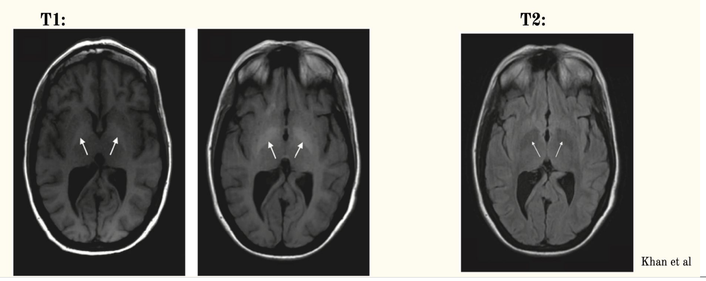
1/26/2024: Arrival to our hospital
- Bush Francis Catatonia Rating Scale (BFCRS) on admission: 16, scoring for immobility mutism, staring, posturing/catalepsy, stereotypy, rigidity, negativism
- Ativan 1.5 mg TID IV did not improve BFCRS but did not cause oversedation
- ECT consult placed

2/6/-2/13/2024
- 11 sessions of biweekly, bitemporal ECT administered resulting in increased spontaneous speech and movement, decrease in stereotypy, posturing.
- BFCRS at end of ECT course: 5, still scoring for rigidity, mutism, immobility, albeit much improved

MRI Findings

MRI brain on 1/10/2024 revealed symmetric T1 hyperintensities in the bilateral basal ganglia with corresponding hypointensities on T2 images, a characteristic finding associated with Mn toxicity[4]

Bilateral T1 signal hyperintensities in globus pallidi with corresponding T2 hypointensities in the same area



Khan et al

CONCLUSION

In this patient with no psychiatric history or other clear medical precipitants, as well as MRI findings consistent with manganese deposition, catatonia was thought to be secondary to manganese neurotoxicity, a known complication of TPN

- Consistent with a case report published in Psychosomatics in 2011 describing a 68 year old Ecuadorian male, previously employed as a miner, who developed mutism, decreased PO intake and decreased spontaneous movement consistent with catatonia.[1]
  - MRI showed T1 hyperintensities with corresponding T2 hypointensities in the basal ganglia
  - Improvement was unsustained with Ativan, and pt ultimately improved after 7 sessions of bitemporal ECT
- **Management of Manganese toxicity[3]:**
  - Remove the source: decrease or remove Mn from TPN
    - Limited evidence for use of antioxidants (NAC, glutathione, and vitamin E)
    - Chelating agents have limited utility:
      - EDTA increase urinary excretion but does not cross BBB
      - Para-aminosalicyclic acid (PAS) crosses BBB but less evidence for removing longstanding Mn deposits on brain tissue

References:
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3. Peres, T., Schettinger, M., Chen, P. et al. "Manganese-induced neurotoxicity: a Review of its Consequences and Neuroprotective Strategies". *BMC Pharmacology and Toxicology*. Nov 2016: 17(1)
4. Khan, A., Hingre, J., Dhamoon, A. "Manganese Neurotoxicity as a Complication of Chronic Total Parenteral Nutrition." *Case Reports in Neurological Medicine*. 2020

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