A somewhat smelly case of antiperspirant choice and aluminum toxicity

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Background

Aluminum is a non-nutrient contaminant of parenteral nutrition (PN) solution. The additive effects of PN components can contribute to toxicity and cause central nervous system issues as well as contribute to metabolic bone disease as observed in adults with osteomalacia. When renal function and gastrointestinal mechanisms are impaired, aluminum can accumulate in the body. Aluminum toxicity can result in anemia, dementia, bone disease and encephalopathy. Symptoms of aluminum toxicity may include mental status change, bone pain, muscle weakness, nonhealing fractures and premature osteoporosis. In July 2004, the U.S. Food and Drug Administration (FDA) mandated labeling of aluminum content with a goal to limit exposure to less than 5mCg/kg/day. Adult and pediatric dialysis patients, as well as patients of all ages receiving PN support, have an increased risk of high aluminum exposure. Reducing PN additives high in aluminum is the most effective way to decrease aluminum exposure and risk of toxicity. This abstract presents a unique case where antiperspirant use contributed to an accumulation of aluminum in an adult PN patient.

Methods

A patient on long-term PN (Table 1) often had results of low ionized calcium of <3mg/dL, leading to consideration of other contributing factors. In addition, patient was taking very high doses of vitamin D daily (by mouth) to stay in normal range (50,000IU orally 6 days/week).

Risk factors for developing metabolic bone disease include mineral imbalances of calcium, magnesium, phosphorus, vitamin D, corticosteroid use, long-term PN use and aluminum toxicity (Table 2). A patient with known osteoporosis diagnosis had two stress fractures in left lower leg. Aluminum testing was completed in order to identify other factors that may be contributing to low ionized calcium values and osteoporosis.

During patient discussion, the patient revealed they used an aluminum-containing antiperspirant one time daily. The range of aluminum content in antiperspirants is unknown, but studies show that minimal absorption may be possible, especially in populations with kidney insufficiency.

Table 1: Patient demographics

Age	42
Gender	Male
Diagnosis	Gastroparesis
Past medical history	DM type 1, gastroparesis, stage 3 CKD, gastrojejunostomy tube, bacteremia, chronic lung disease, short bowel syndrome (SBS), irritable bowel syndrome (IBS), gastroesophageal reflux disease (GERD), osteoporosis, vitamin D deficiency, hypocalcemia, peripheral neuropathy, Addison's disease, Hashimoto's disease
Weight (kg)	163.6kg
Height (cm)	177.8cm
Body mass index (BMI)	51.6
Nutrition-related medications	bumetanide, fenofibrate, folate, insulin lispro, ferric carboxymaltose, insulin glargine, liothyronine, atorvastatin, famotidine, promethazine, prednisone, pantoprazole, levothyroxine, ursodiol, vitamin B-12, vitamin D-3, zinc, ondansetron

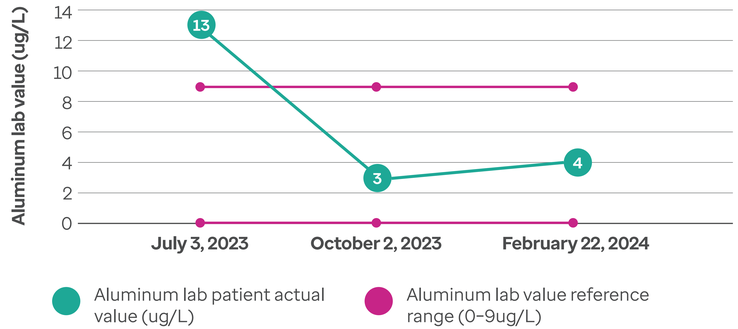
Table 2: Aluminum content in PN prescription

PN component	Aluminum content mcg/bag
Amino acid	240
Dextrose	71.43
Four oil-based ILE	1.275
Sodium chloride	7.75
Potassium chloride	3.25
Potassium acetate	0.5
Potassium phosphate	15
Calcium gluconate	27.42
Magnesium sulfate	1.847
Adult multiple vitamins	0.3
Levocarnitine	0
Zinc sulfate	2.6
Selenium	2.6
Insulin	Traces of aluminum cannot be excluded due to the container closure system
Ascorbic acid	Manufacturer unable to provide information
Total	**2.28mcg/kg per bag**

Results

After an elevated aluminum value resulted on July 3, 2023 (Figure 1), patient changed products to a non-aluminum containing antiperspirant. Aluminum values were rechecked at 3 and 7 months. Results indicate that patient's antiperspirant choice may have been contributing to aluminum content through skin absorption. Antiperspirant choice may not lead to aluminum toxicity but can contribute to an increased total daily aluminum content.

Figure 1: Aluminum lab value result



Conclusion

Preventing aluminum accumulation is vital for patients receiving long-term PN support due to heightened risk of aluminum toxicity. Other potential sources of contamination outside of PN include dialysis, processed food, aluminum foil, cosmetic products (antiperspirants, deodorant, toothpaste) medications (antacids), vaccinations, work environment with aluminum welding and certain processing industry plants. Aluminum content of medications and PN additives vary based on brands and amount. Clinicians should review all potential aluminum containing sources and assess ways to reduce aluminum exposure and prevent potential aluminum toxicity in long-term PN patients.