N-Acetylcysteine for Gastric Lactobezoars in a 1-Month-Old

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Gastric lactobezoars are a result of the inability to digest milk and mucous. Formulas that contain high casein concentrations, medium triglyceride oils, or high caloric density can increase the risk of bezoar formation by decreasing gastric secretion or delaying gastric emptying. N-acetylcysteine (NAC) is used to clear thick mucus secretions and is hypothesized to be effective in the treatment of gastric lactobezoars due to the cleavage of disulfide bonds in mucoproteins. We describe the use of NAC in a 1-month-old full term male (4.5 kg) who was diagnosed with a gastric lactobezoar following an upper gastrointestinal series that showed a large persistent filling defect in the distal body, which was suggestive of a gastric lactobezoar. A dose of 45 mg (10 mg/kg) of 10% NAC was diluted in 50 mL of normal saline and given every 6 hours via a nasogastric (NG) tube. Administration was followed by clamping of the NG tube for 2 hours and aspiration of the stomach contents. NAC was discontinued when aspirates were a clear mucus consistency. The patient's gastric lactobezoar was successfully treated with a 10 mg/kg/dose of NAC that was given every 6 hours for a total of 4 doses.

ABBREVIATIONS G-tube, gastrostomy tube; GI, gastrointestinal; NAC, N-acetylcysteine; NICU, neonatal intensive care unit; NG, nasogastric; NPO, nothing by mouth; PMA, post-menstrual age; PNA, postnatal age

KEYWORDS gastric lactobezoar; gastric outlet obstruction/etiology; infant, newborn; n-acetylcysteine; NAC; treatment outcome

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Introduction

Gastric lactobezoars are a result of disruption in digestion of milk and mucous.¹ Although gastric lactobezoars are the most common type of bezoars in infants, other types include trichobezoars, phytobezoars, mixed-food bezoars, and medication bezoars. Gastric lactobezoars have been reported in the literature, with 96 cases reported in pediatric and adult patients since the first description of gastric lactobezoars in 1959.¹ Risk factors for gastric lactobezoars are both formula specific and/or endogenous factors. Formulas that contain high casein concentrations, medium triglyceride oils, or high caloric density increase the incidence of gastric lactobezoars.^{1–5} Other endogenous factors include dehydration, immature gastrointestinal (GI) tract, low birth weight, and medications that decrease gastric secretion or delay gastric emptying.^{1–5}

Infants with gastric lactobezoars often present with GI symptoms including, but not limited to, abdominal distention, vomiting or regurgitation, or gastric residuals.¹ Other symptoms can include dehydration, respiratory distress, or infection.¹ Diagnosis is typically done by abdominal radiography; however, other methods including gastroscopy or laparotomy have led to diagnosis of gastric lactobezoars in infants.¹ Severe consequences of gastric lactobezoars include gastric perforation, intestinal obstruction, and necrotizing

enterocolitis, which necessitate treatment strategies that are more aggressive than nothing by mouth and intravenous hydration.¹

N-acetylcysteine (NAC) is a mucolytic agent used to clear secretions in multiple diseases including chronic obstructive pulmonary disease, meconium ileus, meconium aspiration syndrome, and pulmonary fibrosis.⁶ Side effects of NAC are very uncommon; however, they may include nausea, vomiting, epigastric pain, and possible transient skin rashes. NAC is hypothesized to be effective in the treatment of gastric lactobezoars due to the cleavage of disulfide bonds in mucoproteins.¹ To date, 4 case reports have described the use of NAC for chemical dissolution of a lactobezoar in pediatric patients (Table).^{2–5} We describe the successful use of NAC for this purpose in a neonate.

Case Report

The patient was a 1-month-old male (40 week old; 4.5 kg) who was transferred to the general pediatrics floor for continued poor oral feeding after a 1-month stay in the neonatal intensive care unit (NICU). During his NICU stay, the infant had respiratory failure secondary to meconium aspiration syndrome with pulmonary hypertension requiring nitric oxide support, suspected sepsis, metabolic acidosis, and neonatal abstinence syndrome. He also completed a cooling protocol for moderate

Table. Previous Use of NAC in Pediatric Patients With Gastric Lactobezoars

Reference	Gestational Age	Birth Complications	PNA (Sex)	Feeding Source	Formulation of NAC	Dose of NAC	Route of NAC	Doses Given	Time to Lactobezoar Dissolution	Definition of Treatment Termination
Heinz-Erian et al 2010 ²	Full term	None	15 mo (F)	Cow's milk	NR	10 mg/kg/dose every 6 hr	NGT	8	48 hr	No milk curds present in gastric aspiration AND ultrasound
			15 mo (F)						48 hr	scan confirmation of complete dissolution of lactobezoar
			19 mo (F)						30 hr	
Bajorek et al 2012 ³	Full term	Meconium aspiration syndrome and persistent pulmonary hypertension	NR (M)	Calorie-dense formula (24 kcal/oz)	10% NAC	10 mg/kg/dose every 6 hr	NGT	7	48 hr	Clear gastric aspiration AND ultrasound confirmation post-treatment
Mai et al 2014 ⁴	36-3/7 wk	Hospitalization for 2 days for phototherapy due to neonatal jaundice	10 wk (M)	Similac Sensitive	10% NAC	20 mL of 10% NAC mixed in 100 mL	Endoscopy	1	2 min	Dissolution during endoscopy
Sparks and Kesavan 2014 ⁵	Full term	Hospitalized since birth with a history of trisomy 21, congenital hypothyroidism, failure to thrive, pulmonary hypertension, and complete atrioventricular canal defect with repair	4 mo (M)	Enfaport (30 kcal/oz)	10% NAC	10 mg/kg/dose every 6 hr	NGT	8	72 hr	Clear gastric aspiration AND ultrasound confirmation post-treatment

NAC, N-acetylcysteine; NGT, nasogastric tube; NR, not reported; PNA, postnatal age

Figure. Radiographic findings confirming gastric lactobezoar. A) Abdomen x-ray showing residual contrast with no free air or pneumatosis. B) Fluoroscopic upper GI with kidney, ureter, and bladder view showing a large persistent filling defect noted in the distal body suggestive of milk bezoar.

GI, gastrointestinal

hypoxic ischemic encephalopathy. His APGAR scores were 5, 7, and 8 before being intubated and transported to our NICU. The patient was tolerating small amounts (82 mL) of Similac Sensitive 22 kcal/oz formula (Abbott Nutrition Abbott Laboratories, Columbus, OH) that was administered over 1 hour via a nasogastric (NG) tube feeding and given every 3 hours. He was also taking ergocalciferol 400 units (Vitamin D; Mead Johnson & Company, Washington, DC) once daily and 1 mL of a pediatric multivitamin (Poly-Vi-Sol; Mead Johnson & Company, Washington, DC) once daily. Pediatric surgery recommended an abdominal x-ray and upper GI series followed by placement of a gastrostomy tube (G-tube). Although the abdominal x-ray with contrast did not show a bezoar (Figure A), the upper GI study identified a large persistent filling defect in the distal body of the stomach, which was suggestive of a milk bezoar (Figure B). Neither of these radiographic procedures showed any other GI defects, such as reflux, in this patient.

The medical plan was to remove the milk bezoar before G-tube placement. The options of conservative treatment with fluids versus NAC treatment were discussed with the family. It was the family preference to try NAC therapy given the benign side effect profile (i.e., including nausea, vomiting, and epigastric pain) as well as the patient's prolonged history of poor feeding. After discussion with Pediatric Surgery, pharmacy was consulted to review the literature supporting the use of NAC for the management of the patient's milk bezoar.

A dose of 10 mg/kg of 10% NAC (American Regent, Shirley, NY; NDC # 00517751003) diluted in 50 mL of normal saline was recommended. Based on the patient's weight (4.5 kg), the total NAC 10% dose was 45 mg; hence, a total of 0.45 mL of NAC 10% was added to 50 mL of normal saline. NAC was administered over 30 minutes via NG tube and was given every 6 hours. The NG tube was clamped for 2 hours following each dose. In order to ensure the dissolving effects of NAC on the bezoar and to allow for optimal aspiration of the stomach contents, the stomach contents were

aspirated at 3 and 6 hours after NAC administration.³ Because previous case reports showed that 8 doses provided optimal effect, we recommended an initial duration of 48 hours.^{2,5} One dose was administered every 6 hours for a total of 4 doses with total aspirate volumes of 8, 5, 5, and less than 1 mL, respectively. The patient did not experience any adverse events with any of the NAC doses. Treatment was stopped when final aspirates were a clear mucus consistency. At this time the medical team determined that the milk bezoar had resolved. No repeat imaging was done to confirm bezoar dissolution. The patient underwent G-tube placement the next day with no further complications and the ability to advance feeds. The patient was discharged 2 days later with follow-up in 2 weeks with pediatric surgery. Upon follow-up with pediatric surgery, our patient did not exhibit any further issues attributable to a gastric lactobezoar.

Discussion

Gastric lactobezoars are a common type of bezoar formation in infants. However, their clinical presentation is associated with non-specific symptoms such as abdominal distention, vomiting, gastric residuals, and poor feeding; therefore, the diagnosis of a gastric lactobezoar can be difficult in both inpatient and outpatient settings. An upper GI series was used to diagnose lactobezoars, as in our patient; however, some studies suggest the use of ultrasound for diagnosis.⁴ First-line treatment of gastric lactobezoars includes conservative strategies of discontinuation of oral feedings in addition to hydration and parenteral nutrition.¹ These conservative strategies often lead to success, with about 85% cases of gastric lactobezoars not requiring further treatment.¹ Other treatment strategies include gastric decompression, gastric lavage, and surgical interventions including laparotomy.¹ In previous cases of infants with gastric lactobezoars, surgery has been required in about 9% of infants.

Our patient had a complicated neonatal course, which could have contributed to his poor feeding by mouth. He also did not have common symptoms suggestive of a gastric lactobezoar, which is inconsistent with the normal presentation since < 5% of patients present asymptomatic.¹ All of this made the diagnosis of a gastric lactobezoars challenging. As previously mentioned, multiple cases have been reported describing the use of NAC in the dissolution of gastric lactobezoars after failure of conservative treatments. Our case is novel in 2 ways: 1) our patient's age and 2) the number of doses needed to dissolve the gastric lactobezoar.

The youngest case reported previously was an infant with a postmenstrual age of 46 weeks, and a postnatal age of 10 weeks. Our infant had a postmenstrual age of 44 weeks, and a postnatal of 4 weeks. Although our report involves only 1 patient, it demonstrates that NAC may be safe and effective in this younger patient population. Additionally, our infant only required 4 doses of NAC for resolution of the gastric lactobezoar. Previous reports showed that 5 to 8 doses of NAC, administered through an NG tube, were required to dissolve gastric lactobezoars. One limitation of our case is the lack of confirmatory imaging to prove dissolution of the gastric lactobezoar. However, our patient's symptoms did resolve, and gastric aspirates suggested that the gastric lactobezoar had dissolved.

Normally conservative management (i.e., holding feeds and administering parenteral nutrition or fluids) of a lactobezoar is successful³; however, surgery is recommended in those who have an intestinal obstruction or gastric perforation. NAC can successfully treat lactobezoars through its ability to decrease the viscosity of the lactobezoar, allowing it to be aspirated.^{3,4} Use of NAC can prevent severe GI complications of gastric lactobezoars, and it is well tolerated in infants.

Summary

This is a patient case report that shows the successful treatment of gastric lactobezoar in a 1-month-old following 4 doses of 10 mg/kg/dose of 10% NAC given every 6 hours via a NG tube.

ARTICLE INFORMATION

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