Gastric Pneumatosis in a Preterm Infant: a Case Report and Review of Literature

Giacomo Bonitatibus
University of Pavia: Universita degli Studi di Pavia

Giuseppe Luigi Paterlini (✉ giuseppe.paterlini@gmail.com)
Poliambulanza Foundation Hospitals: Fondazione Poliambulanza Istituto Ospedaliero
https://orcid.org/0000-0002-7442-3036

Matteo Zanzucchi
Fondazione Poliambulanza Istituto Ospedaliero

Valentina Perotti
Fondazione Poliambulanza Istituto Ospedaliero

Paolo Ernesto Villani
Fondazione Poliambulanza Istituto Ospedaliero

Research Article

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Abstract

Background: gastric pneumatosis is a rare sign with a primarily radiological diagnosis. In newborn infants, this finding should raise the suspicion of necrotizing enterocolitis, which represents a serious clinical condition with high morbidity and mortality. However, other causes of gastric pneumatosis are reported in literature, including intramural displacement of a feeding tube. In this report we present a case of gastric pneumatosis in a preterm boy admitted to our NICU.

Case presentation: the baby appeared pale and poor responsive during the first days of life on positive pressure ventilation and gavage feeding. A distended upper abdomen with bloody and biliary gastric aspirates was noted; no bloody stools were reported. Blood cultures, cerebrospinal fluid culture and blood cell count were normal; acute phase proteins were negative on serial determinations. Abdominal X-Ray showed gastric pneumatosis with displacement of the feeding tube and no other pathological findings in the rest of the bowel. After few days of conservative management, the baby improved dramatically.

Conclusions: we suggest that the cause of this clinical picture could have been a mechanical lesion in gastric mucosa caused by the feeding tube; positive pressure ventilation then could have raised intragastric pressure, leading air to diffuse between the layers of the gastric wall.

Background

Pneumatosis intestinalis (PI) is an accumulation of gas within the bowel wall that can occur throughout the entire gastrointestinal tract. The etiology may be associated with life-threatening diseases. In infants, the most common cause of pneumatosis intestinalis is necrotizing enterocolitis, which occurs in 2–7.5% of preterm infants with a GA < 32 weeks; although the majority of infants with NEC are preterm, 10% of cases occur in term newborns with predisposing conditions1–6. Gastric pneumatosis, defined as the presence of gas within gastric wall, is a rare disease, especially in infants, and a primarily radiological diagnosis. To date, few case reports described this entity in newborns: from 1966 to 2003, only 32 infants presenting gastric pneumatosis were reported7. In this article, we describe a case of gastric pneumatosis in a preterm baby admitted to our NICU.

Case Presentation

We report a case of a North-African preterm boy born from unrelated parents at 28 weeks and 3 days of gestational age by a cesarean section performed for premature rupture of membranes and anidramnios, with a birth weight of 1250 g (75th percentile). His mother was healthy without any risk factor and she received a complete course of prenatal steroids.

At birth because of bradycardia we applied positive pressure ventilation with an inspired fraction of oxygen of 0.4 for 30 seconds by face-mask, then the respiratory support was switched to nCPAP. Apgar score was 8 at five minutes. At NICU admission respiratory support continued with nCPAP; we placed an umbilical vein catheter, the position of which was verified by abdominal X-Ray; then we started empirical
antibiotic therapy with ampicillin and gentamicin (dosage according to our national recommendations). For increasing need of oxygen, surfactant (Curosurf®) was administered by INSURE procedure, according to our protocol, without any complications. On the second day of life we started MEF, mainly with preterm formula feeding via orogastric tube for unavailability of mother’s milk. Antibiotic therapy was stopped at 48 hours for negative blood cultures.

On the fifth day of life biliary and bloody gastric aspirates were reported; the baby appeared frankly ill, pale and poor responsive, with normal blood pressure and distended abdomen. The respiratory support was switched to nIMV, enteral feeding was stopped and empirical antibiotic therapy with vancomycin and amikacin was started in suspected late onset sepsis (dosage according to our national recommendations). The laboratory findings showed normal white blood cell count, normal C reactive protein (< 1 mg/l) and mixed acidosis (ph 7.19, pCO2 53 mmHg, BE -7.9 mmol/L). For abdominal distension and reduced peristalsis we performed an upper body X-Ray, which showed an enlarged gastric bulla with linear gastric pneumatosis on inferior and lateral side of gastric wall; the dislodged umbilical venous catheter was promptly removed and a percutaneous central line was obtained. No other pathological findings were noted, in particular neither ascites nor pneumoperitoneum (Fig. 1).

Metronidazole was added to the ongoing antibiotic therapy in suspected necrotizing enterocolitis Bell stage II (dosage according to our national recommendations) and he was transfused for anemia (haemoglobin 9.53 g/dl). We found metabolic acidosis and hyperglicaemia, which was treated with reduced glucose intake and insulin administration. Over the next few days the baby gradually improved. On the ninth day of life bowel spontaneous movement increased and stools were normal. Blood culture and cerebrospinal uid culture were negative. Antibiotics were stopped. The upper body X-Ray performed on the ninth day of life showed absence of gas in the gastric wall. No other pathological findings were reported. After five days of NPO we started administering MEF, which was well tolerated. The subsequent neonatal course was unremarkable. See Supplementary material, Fig. 1 for timeline.

**Discussion And Conclusions**

Gastric pneumatosis is an extremely rare condition and a primarily radiological diagnosis. In infancy, it has been associated with pyloric stenosis, duodenal obstruction, annular pancreas, use of indomethacin with non-invasive respiratory support, jejunal atresia and necrotizing enterocolitis; in the latter setting, it has been attributed to widespread and severe disease requiring urgent surgical intervention. It may also be secondary to intramural misplacement of a feeding catheter. Gas collection in gastric wall could be related to infection by gas-forming organisms such as *E. Coli, Streptococcus* or *Enterococcus* species (emphysematous gastritis) or gastrointestinal tract obstruction leading to elevated intragastric luminal pressures and escape of intraluminal gas through tears in an otherwise healthy mucosa, or through weakened, inflamed or eroded areas of the mucosa (gastric emphysema). These entities are somehow distinguishable from a radiologic point of view: gastric emphysema is characterized by a linearly arrayed gas pattern, while emphysematous gastritis has a
cystic or bubbly appearance\textsuperscript{17}. Even if NEC is the major cause of pneumatosis intestinalis in infancy, especially in preterm infants, gastric involvement is rare, probably because of the copious blood supply of the stomach which makes ischemic events unlikely\textsuperscript{13}; however, isolated gastric pneumatosis has been reported in a case of NEC in a term infant following cardiogenic shock\textsuperscript{18}. In another case report, the authors hypothesized that vomiting together with a predisposition to mucosal damage following cardiac surgery could have been the cause of this particular location of pneumatosis\textsuperscript{19}. In our case, even if clinical signs and radiological findings made plausible a diagnosis of NEC Bell's stage II\textsuperscript{20}, the absence of grossly bloody stools, the demonstration of CRP values within normal range on serial determinations and the absence of leucocytosis or neutropenia or thrombocytopenia have raised some concerns. Furthermore there was no evidence of sepsis or gastrointestinal obstruction. The cause of gastric pneumatosis in this case remains unclear, but the rapid clinical improvement with conservative management led us to speculate that there could have been a damage in the gastric mucosa secondary to intramural misplacement of the feeding tube; the positive pressures generated by non-invasive ventilation and the subsequent raise in intragastric pressure could have led air to diffuse through minor tears in the gastric mucosa, thereby promoting submucosal dissection.

Gastric pneumatosis is a rare condition, especially in newborn infants. In preterm infants with no other predisposing diseases, necrotizing enterocolitis should be suspected first, as this condition requires immediate evaluation and treatment. Other clinical associations have been reported in literature, such as intramural displacement of feeding tube and increasing intragastric pressure, which could be the result of positive pressure ventilation. One should think about these associations, which could result in favourable outcome as in our case.

**Abbreviations**

NICU
Neonatal Intensive Care Unit
GA
Gestational Age
nCPAP
Nasal Continuous Positive Airway Pressure
INSURE
Intubation-Surfactant-Extubation
MEF
Minimal Enteral Feeding
nIMV
Nasal Intermittent Mandatory Ventilation
BE
Base Excess
NPO
Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Parents' consent for publication obtained.

Availability of data and materials

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed to the paper: GB and GLP collected data and reviewed literature, VP, MZ and PEV reviewed the paper. All authors read and approved the final manuscript.

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References


Figures
Figure 1

Chest and abdomen X-ray

**Legend:** AP X-ray projection of the chest and abdomen.

The black arrow indicates a rim of intramural gas in the wall of the stomach, consistent with gastric pneumatosis.

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

- Timelineimmagine.docx
• Carechecklistproposta.pdf