Neonatal Intestinal Obstruction Syndrome

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ABSTRACT

Neonatal intestinal obstruction is caused by an anatomical abnormality that produces bowel movement failure. Intestinal obstruction presents with three classic clinical signs: vomiting, abdominal distention, and failure to pass meconium. Intestinal obstruction is one of the most common causes for admitting a pediatric patient to the pediatric surgery unit in his or her first weeks of postnatal life. Congenital obstruction of the digestive tract in neonates is a common problem, with the most frequent cause being anorectal malformations (41%), followed by esophageal obstruction (24%), and duodenal obstruction (20%).


Neonatal intestinal obstruction is caused by an anatomical abnormality that leads to bowel movement failure. Intestinal obstruction usually presents with three clinical signs: vomiting, abdominal distention, and failure to pass meconium.1 The word “obstruction” comes from the Latin “obstruer,” which means to plug, pointing to a mechanical impediment.2 Congenital obstruction of the digestive tract in neonates is a common problem, with the most common causes being anorectal malformations (41%), esophageal obstruction (24%), and duodenal obstruction (20%).3

Obstructive syndrome is characterized by interference with the flow of gases, liquids, and solids, and is manifested by vomiting, abdominal distention, and absence of bowel movements. It can be classified in three ways. The first is mechanical, which is either intrinsic (atresia, stenosis, membrane) or extrinsic (malrotation or Ladd’s bands). The second is functional, such as Hirschsprung’s disease, meconium ileus, or necrotizing enterocolitis. The third is according to the level of obstruction, which can be high, medium or low (ie, above the angle of Treitz, between the angle of Treitz and the ileocecal valve, or below it, respectively).4

Neonatal intestinal obstruction usually manifests with signs such as maternal polyhydramnios, vomiting, abdominal distension, and failure to pass meconium within 24 hours after birth.5 Changes that occur in the course of an intestinal obstruction as a result of the existing obstacle will cause an accumulation of liquids, gases, and alterations of the secretion and absorption above the occlusive lesion, giving rise to a whole cascade of events.6

SIGNS AND SYMPTOMS ARE THE BASIS OF DIAGNOSIS

Polyhydramnios

Polyhydramnios is defined as the presence of an amniotic fluid index greater than 25 cm in obstetric ultrasound using Phelan’s method.6 This method adds together the deepest pocket measured vertically in each of the four quadrants in which the uterus is divided, through two perpendicular lines (a vertical one from the symphysis of the pubis to the fundus of the uterus, and a horizontal one passing through the umbilicus).6 It occurs due to an imbalance between the inflow and outflow of amniotic fluid. Approximately 30% of cases with polyhydramnios are associated with fetal anomaly,7 with gastrointestinal abnormalities being the
most frequent malformations. The risk of developing a fetal anomaly increases significantly as the amount of amniotic fluid increases.\textsuperscript{7} Ultrasonographic abnormalities of small bowel atresia are manifested by dilatation of bowel loops distal to the duodenum in the third trimester of pregnancy.\textsuperscript{8}

Jejunum atresia is associated with polyhydramnios in 24\% of cases.\textsuperscript{9} The use of obstetrical ultrasound allows the provision of neonatal care in the event of a congenital malformation diagnosis and the timely transfer to specialized centers. The development of innovative surgical techniques allows for the improvement of survival and future quality of life in children who suffer from this disease.\textsuperscript{8}

**Vomiting**

The occurrence of vomiting is more frequent when the obstruction level is high. When at the duodenum, vomiting will depend on whether the obstruction is above the duodenal papilla or not. If it is above, then vomiting will be similar to pyloric stenosis, with absence of bile and pancreatic juice. If it is below the duodenum, then there will be loss of bile and pancreatic juice, which increases the loss of bicarbonate.\textsuperscript{2}

The classic teaching in pediatric surgery is that vomiting of biliary contents in newborns should be attributed to intestinal obstruction until proven otherwise. Because bile enters the intestine in the second part of the duodenum, obstruction below this level can result in vomiting bile. In newborns, this may be associated with surgical conditions, including intestinal atresia, malrotation, meconium ileus, necrotizing enterocolitis, and Hirschsprung’s disease.\textsuperscript{10}

General symptoms depend on dehydration and hypovolemia; in cases of strangulation, there may be fever, leukocytosis, and increased tenderness of the abdomen or hernial sac.\textsuperscript{2}

**Abdominal Distension**

Small bowel obstruction produces accumulation of liquids and gases in the portion next to the obstruction, causing distension of the intestine, which is initiated by gas, ingested fluid, and digestive secretions. Gas is derived from swallowing and bacterial fermentation in the intestine. Fluid comes from swallowing as well as salivary, gastric, biliopancreatic, and intestinal secretions. With dehydration, there is loss of water and electrolytic alteration. Finally, there may be edema and venous stasis, which can lead to perforation and sepsis.\textsuperscript{11}

**Absence of Bowel Movements**

Meconium, the first deposition of the newborn, is expelled between 12 and 48 hours after birth; its texture is viscous, sticky, and blackish green. It is composed of water, lipids, proteins, cholesterol precursors, free fatty acids, products of amniotic fluid, epithelial cells, bile, and intestinal secretions.\textsuperscript{12} Failure to pass meconium, when associated with other clinical data, indicates neonatal bowel obstruction. There is a lack of propulsion of intestinal contents, either partial or total. The cause may be mechanical or may be due to alterations in intestinal motility.\textsuperscript{15}

In partial obstructions, there may be a reduced elimination of intestinal contents and gases. In colonic and partial obstructions, especially on the left, what may be what is called “pseudodiarrhea,” in which there are aqueous losses caused by hypersecretion above the obstacle. In total obstructions, there may be an elimination of preexisting content in the colon at the onset.\textsuperscript{2}

**FREQUENT PATHOLOGIES OF INTESTINAL OBSTRUCTION**

**Intestinal Atresia**

Intestinal atresia is the most common cause of neonatal intestinal obstruction. The most common sites are the ileum (43.2\%), jejunum (31\%), duodenum (20.9\%), and colon (4.72\%).\textsuperscript{5} Mortality from atresia of the ileum is higher than that of the duodenum and has a higher incidence of early perforation. Duodenal atresia results from congenital failure of recanalization, which usually occurs at 9 to 11 weeks of gestation.\textsuperscript{5}

Prenatal diagnosis can be detected by the presence of polyhydramnios. Clinically, all patients with atresia present with bilious vomiting, except for those patients with obstructions found above the ampulla (Figure 1).

**Hirschsprung’s Disease**

Hirschsprung’s disease is defined as the congenital absence of neuronal ganglion in the intrinsic intestinal nerve plexus that results in overcontraction of the affected segment.\textsuperscript{14} Although rare (1 in 5,000 live births), it is one of the leading causes of intestinal obstruction and abdominal surgery in the newborn.\textsuperscript{14} The clinical presentation is delayed due to variability at onset of symptoms and lack of specificity.\textsuperscript{9} Pathogenetic bases and genetic aspects of the disease have been established, including 13 genes involved in morphogenesis and differentiation of the enteric nervous system.\textsuperscript{15}

The initial diagnosis is based on the clinical picture, which includes intermittent constipation, abdominal distension, and vomiting. If constipation does not have a mechanical cause (intestinal atresia, meconium ileus, malrotation, or imperforate anus), Hirschsprung’s disease should be considered.

Histological study is the gold standard for diagnosis.\textsuperscript{15} Before performing corrective surgery, diagnostic certainty should be established. A diagnosis is only confirmed with a biopsy of the rectal wall, which has a sensitivity and specificity close to 100\%, according to the quality of samples and the experi-
An adequate rectal biopsy (3 cm above the dentate line and with an adequate amount of mucosa) is required, and appropriate histological sample processing. De la Torre and Santos\textsuperscript{15} emphasize the use of intestinal biomarkers, mainly calretinin, which is absent from nerve fibers in the colon of patients with Hirschsprung’s disease but present in healthy patients.

**Intestinal Malrotation**

Intestinal malrotation is the third most common cause of neonatal intestinal obstruction, accounting for 11.7% of cases.\textsuperscript{9} Rotational abnormalities of the midgut include a wide spectrum of incomplete malrotation situations during fetal development. It may develop in isolation, but in some sufficiently extensive series, approximately 46% were associated with congenital abnormalities.\textsuperscript{16} It may be paucisymptomatic or even asymptomatic, and can remain throughout the patient’s life. The first manifestation is usually bilious vomiting, because the obstruction is distal to the ampulla of Vater. Less common symptoms would be meteorism (typanites), constipation, and gastrointestinal hemorrhage.\textsuperscript{16}

**Meconium Ileus**

Meconium ileus is the accumulation of viscous feces and a thick mucous secretion that adheres to the crypts of the terminal ileum and cecum that is difficult to mobilize. It is one of the common causes of neonatal intestinal obstruction (9%-33%);\textsuperscript{17,18} it is also the first manifestation of cystic fibrosis in approximately 15% of newborns.\textsuperscript{17,18} This complication presents itself with abdominal distention, failure to pass meconium, and fecal matter in the right iliac fossa that can be seen on an X-ray.\textsuperscript{17,18} Meconium is characterized by extreme viscosity, being rich in proteins, and causing intraluminal obstruction.\textsuperscript{19} Patients with cystic fibrosis who present later in life with distal intestinal occlusion syndrome suffer from recurrent hospitalizations and the presence of pathogens in the airway\textsuperscript{20} (Figure 2).
Figure 4. Algorithm of intestinal obstruction syndrome.
Necrotizing Enterocolitis

Necrotizing enterocolitis is the most frequent cause of acquired gastrointestinal disease and surgical emergency in the neonate. It predominantly affects premature infants with low birth weight, with a reported incidence of 5% to 15%. The pathogenesis is multifactorial and has not yet been clearly defined. Mortality remains high and varies from 20% to 50% depending on the severity of necrotizing enterocolitis and gestational age of the neonate.

In the early stages, necrotizing enterocolitis is difficult to diagnose because the symptoms are nonspecific, insidiously progressing for several days to a fulminating onset with different gastrointestinal signs, and finally to multiorgan dysfunction and shock. The signs may present as abdominal distention, bilious vomiting, and visible or hidden blood in feces. A small number of infants has a palpable abdominal mass and/or persistence of intestinal obstruction data (Figure 3).

DISCUSSION

Figure 4 provides a diagnostic algorithm for neonatal intestinal obstruction syndrome. Radiological signs characteristic of each disease can be observed, and they are divided into high and low intestinal obstructions. High intestinal obstruction is the most frequent surgical emergency in the unborn. This includes the gastric obstructions that cause the “single bubble sign”; duodenal obstruction will result in the “double bubble sign,” which occurs with the existence of a duodenal obstruction with dilatation of the gastric chamber and the duodenal bulb.

Intestinal obstruction is manifested radiologically according to the number of air-fluid levels (ie, the greater the number of air-fluid levels, the lower the obstruction; whereas the lower the number of levels, the higher the obstruction). In Hirschsprung’s disease, signs of low intestinal obstruction are observed, so one should perform an opaque enema, in which the transition from a normal or slightly reduced (aganglionic) intestine caliber to a distended one (ganglionic) is observed. In meconium ileus, signs of low intestine obstruction and images of “bubbles” or “bread crumbs” are observed in the right iliac fossa due to the mixture of air and meconium.

CONCLUSION

Neonatal intestinal obstruction syndrome continues to be a diagnostic challenge; however, by using obstetrical ultrasound a timely diagnosis can be obtained. In this literature review, it was shown that intestinal atresia is the most common cause of neonatal intestinal obstruction. Worth noting is the importance of joint collaboration between the obstetrician at the time of prenatal diagnosis, the pediatrician accepting the newborn in the delivery room, and the pediatric surgeon, who will determine the treatment according to the etiology.

REFERENCES