Bowel Obstruction in the Newborn: antenatal and postnatal diagnosis

Poster No.: C-1438
Congress: ECR 2014
Type: Scientific Exhibit
Authors: K. Ben Ameur, A. Bensalem, S. Elkamel, H. Elmhabrech, R. BRAHEM, K. Monastiri, C. Hafsa; Monastir/TN
Keywords: Abdomen, Foetal imaging, Pediatric, Ultrasound, Ultrasound-Colour Doppler, Diagnostic procedure, Congenital, Fetus, Obstruction / Occlusion
DOI: 10.1594/ecr2014/C-1438

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Aims and objectives

Bowel obstruction is one of the most common surgical emergencies in newborns. Etiologies are variable and dominated by malformations. Antenatal diagnosis is actually possible by ultrasonography and MRI. Imaging exploration of this neonatal digestive pathology is directed by prenatal context and clinical symptoms. The aim of this study is to remind the contribution of the various methods of imaging in diagnosis of neonatal digestive pathology.

Methods and materials

Retrospective study of newborn with neonatal bowel obstruction. Ultrasonography and MRI were used in antenatal period. Diagnosis were confirmed in postnatal surgical investigation.

Results

A/High Intestinal Obstruction

- COMPLETE HIGH INTESTINAL OBSTRUCTION

When no aeration is visible downstream dilated loops. Diagnostics: duodenal atresia or Midgut volvulus. Surgery is indicated immediately.

- INCOMPLETE HIGH INTESTINAL OBSTRUCTION

When it coexists dilated loops with fluid levels and normal one. Diagnostics: *When the duodenum-jejunal flexure is in place: duodena web; diaphragm; stenosis

* When the duodenum-jejunal flexure is not in place: incomplete volvolus.

A-1 Duodenal Atresia (DA): Results from lack of canalization of the periampullary segment of the foregut early in gestation.

There are 3 types of DA:

* Type I: duodenal diaphragm. The muscular wall is intact

* Type II: complete duodenal atresia. There is a fiber cord connecting the two ends of atresia.
Type III: Complete duodenal atresia. There is a complete separation between the two ends which can be associated with duodenal annular pancreas. The incidence is in 6-10,000 live births with no gender predilection. Many are diagnosed prenatally by the ultrasound which shows two anechoic masses, one corresponds to the dilated stomach and the second refers to proximal duodenum "double bubble" sign and polyhydramnios. (Fig 1)

The usual presentation is with bile stained vomiting, occasionally with jaundice and haematemesis. aXR reveals double bubble" sign

Duodenal atresia is associated with biliary and other anomalies in 50% of cases. (trisomy 21, preduodenal portal vein and annular pancreas)

A-2 Small bowel atresia and stenosis: results from ischemic insult to the developing jejunum. There are four types of atresia:

* Type I: Diaphragm mucosal
* Type II: fiber cord connecting the two ends of atresia.
* Type IIIA: Separation of the two ends of atresia with mesenteric defect.
* Type IIIB: apple peel syndrome.
* Type IV: multi-segmental atresia.

Two familial forms of atresia are recognised. One is a variant of type 3, also known as "apple peel" or "Christmas tree" atresia. This form is associated with prematurity, biliary atresia, pelviureteric junction obstruction and imperforate anus. The second familial form, usually of type 1 or 2, are multiple atresias with intraluminal calcifications.

Antenatal US may suggest the diagnosis in the presence of dilated fluid filled loops of bowel and polyhydramnios. (Fig 3; Fig 4).

Fetal MRI: reveals small bowel distension with fluid content on hypersignal T2(Fig5)

Postnatal clinical presentation is commonly with bilious vomiting if the atresia is proximal and abdominal distension and failure to pass meconium with the more distal atresias.

aXR demonstrates small bowel obstruction, a few loops in the left upper quadrant suggest a high jejunal atresia, the "triple bubble" sign, whereas, a low ileal atresia usually results in more numerous uniformly dilated loops. (Fig 6).

Fluoroscopic contrast enema shows the microcolon and may demonstrate the level of the atresia.
#Perforation in utero occurs in 10-15% of low atresia and results in meconium peritonitis evident on the aXR as speckled peritoneal calcification;

**A-3 Malrotation and Midgut Volvulus:**

#Intestinal malrotation represents embryologic nonrotation or lack of complete 270° of foregut rotation around the superior mesenteric artery (SMA) pedicle.

#The commonest type is incomplete rotation where the arrest of rotation occurs at 180°. This results in abnormal shortening of the mesenteric root which predisposes to twisting or volvulus. When this occurs, the duodeno-jejunal (DJ) flexure is located to the right of the midline or anterior to the superior mesenteric artery (SMA).

The incidence of midgut volvulus is 1 in 500 live births.

#Affected neonates present with bilious vomiting

Malrotation is almost always present with heterotaxy syndromes, congenital diaphragmatic hernia, omphalocele and gastroschisis.

#aRX used to analyze the distribution of clarity’s digestive and the aeration of the rectum. They show in case of acute volvulus, double bubble sign. (Fig7)

#Ultrasound with Doppler may demonstrate superior mesenteric vein (SMV) is in the left of SMA on transverse imaging and the “whirlpool” sign for malrotation with midgut volvulus. (Fig 8)

#An upper GI study shows the failure of the following normal course of duodenal C sweep on the oblique lateral projection and duodenojejunal junction to the left of the L1 pedicle and at the level of the first portion of the duodenum

**B/Low Intestinal Obstruction**

**B-1 Ileal Atresia** #Ileal atresia results from a local ischemic event to the developing ileum. The incidence is approximately 1 in 3000 live births.

Prenatal ultrasound in affected fetuses shows an abdomen full of moderately dilated anechoic loops showing hyperperistalsis.

#Radiographs of the abdomen in neonates with ileal atresia usually show multiple dilated, air-filled loops throughout the abdomen

**A water-soluble contrast enema is necessary for making a definitive diagnosis demonstrates a microcolon (unused colon)**

**B-2 Meconium ileus**
#is a result of thick succus entericus (secondary to lack of lubrication because of abnormal sodium-chloride pump) effectively blocking the distal ileum during fetal and early neonatal life.

#It constitutes approximately 20% of neonatal intestinal obstruction and almost is associated with cystic fibrosis.

Clinically, the neonate presents within the first day of life with abdominal distension, bilious vomiting and failure to pass meconium.

#Prenatal ultrasound typically shows dilated echogenic bowel, whereas postnatal ultrasound demonstrates dilated loops of bowel containing hyperechoic material with hypoperistalsis (Fig 9,10)

#Prenatal MRI may be a promising imaging modality in differentiating between ileal atresia and meconium ileus based on signal intensity of the succus entericus on T2-weighted images.

The differential diagnosis for echogenic bowel on prenatal ultrasound includes fetal systemic infection, chromosomai anomalies, and fetal swallowing of blood early in gestation from occult placental

#The aXR demonstrates gas filled loops of bowel.;A"soap bubble" appearance is sometimes evident and air fluid levels are commonly absent.

#Conventional water soluble contrast enema are performed to demonstrate the level of obstruction and the unused microcolon.Contrast outlines the multiple filling defects in the terminal ileum due to the inspissated meconium plugs. The more proximal small bowel loops are dilated .The contrast enema serves two purposes: diagnostic and therapeutic. (Fig 11)

**B-3 Hirschsprung Disease**

#Failure of craniocaudad migration of ganglion cells to the submucosal (Meißner's) and intermuscular (Auerbach's) plexus of the distal large bowel results in failed relaxation of the involved distal colonic segment of bowel with upstream obstruction

#Children with HD present with failure to pass meconium within the first 24 hours of birth and progressive abdominal distension.

#The most serious complication is Hirschsprung enterocolitis

#aRX reveals small gas filled rectum in the presence of marked proximal colonic dilatation.

#Water-soluble contrast reveals narrow caliber rectum, rectosigmoid index >1 (transverse diameter of the rectum greater than the sigmoid on the lateral decubitus
image taken as soon as the rectosigmoid fills), a "transition point," and serrations/contractions of the distal aganglionic colon (20%).

#Diagnosis is confirmed with surgical biopsy.

**B-4 Colonic Atresia** is caused by a prenatal vascular event resulting in an ischemic obliteration of the colonic lumen. This is the rarest form of intestinal atresia and has no known associations. Newborns present with progressive abdominal distension and vomiting. aRX shows a low intestinal obstruction pattern. Water-soluble enema demonstrates a microcolon (unused colon) that terminates blindly at the point of atresia.

**B-5 Imperforate Anus**

The incidence of imperforate anus is 1-4 in 5000 live births and is equal in frequency in boys and girls.

The diagnosis of imperforate anus is usually made during the newborn physical examination, where the anus is identified as a blind-ending pit, and the child fails to pass meconium.

Ultrasound has proven more accurate in differentiating intermediate and high (supralevator) versus low (translevator) lesions. The distance from the perineum to the distal rectal pouch is measured.

Distances <15 mm represent low lesions, and those greater represent intermediate and high lesions. This distinction is important in determining surgical approach. Postnatal MRI is most useful after surgical repair in evaluating the position of the rectal pull through and integrity of the levator sling.

Images for this section:
Fig. 1: Duodenal Atresia (DA) Prenatal ultrasound at 34 W shows two anechoic masses, one corresponds to the dilated stomach and the second refers to proximal duodenum "double bubble" sign, and polyhydramnios
Fig. 2: Duodenal Atresia (DA) reveals “double bubble” sign.
Fig. 3: Small bowel atresia. Prenatal ultrasound at 36 W shows a gastric and small bowel dilatation. The diagnosis of small bowel atresia type IIIB: apple peel syndrome was retained.
Fig. 4: Small bowel atresia. Antenatal ultrasound performed at 34 weeks reveals small bowel dilatation. The diagnosis of single small bowel atresia was retained.
Fig. 5: Small bowel atresia. Fetal MRI: small bowel distension with fluid content on hyperintense T2
**Fig. 6:** Small bowel atresia. Radiographs of the abdomen shows multiple dilated, air-filled loops throughout the abdomen and air fluid levels

![Radiograph of small bowel atresia]

**Fig. 7:** Malrotation and Midgut Volvulus. abdominal radiograph: gastroduodenal distension with small bowel loops located on the right spine; this distension decrease 6h after

![Radiograph of malrotation and midgut volvulus]
Fig. 8: Malrotation and Midgut Volvulus. Doppler Ultrasound demonstrates superior mesenteric vein (SMV) is in the left of SMA on transverse imaging and the "whirlpool" sign evoking malrotation with midgut volvulus.
Fig. 9: Meconium ileus. Antenatal ultrasound at 35 W shows dilated echogenic bowel
Fig. 10: Meconium ileus complicated by meconium peritonitis

Fig. 11: Meconium ileus. Conventional water soluble contrast enema demonstrate a microcolon with multiple filling defects due to the inspissated meconium plugs
Conclusion

Radiological imaging is an important part of the evaluation and management of neonates with suspected anomalies of the gastrointestinal tract. The diagnosis of Neonatal occlusion is now possible by ultrasound and magnetic resonance imaging (MRI). Radiographs may show life-threatening signs or identify classic features for high intestinal obstruction, with no need for further imaging. The contrast enema leads to definitive diagnosis in most cases of newborn low intestinal obstruction.

Personal information

References


(3) A. Ben Salem, H. Zrig, C. Hafsa. Occlusion néonatale par volvulus mésentérique Neonatal occlusion due to a small intestinal volvulus. science direct 2011.
