Obstructive Ladd band and intraluminal duodenal diverticulum
(ECR 2012 Case of the Day)
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Clinical History:
A 29-year-old male patient presented with a prolonged history of progressively worsening upper abdominal pain, postprandial vomiting, and weight loss. His past medical history, physical examination and laboratory studies were unremarkable.

Imaging Findings:
An upper GI series showed a barium-filled sac-like structure surrounded by a radiolucent halo in the second portion of the duodenum. There was dilatation of the lower second and proximal third parts of the duodenal arch with mucosal fold thickening (Fig. 1). Contrast-enhanced CT demonstrated a ring-like soft-tissue density with heterogeneous fluid content within the lumen of the duodenum associated with dilatation of the second and proximal third parts of duodenum (Fig. 2). No other relevant abnormalities were noted.

Discussion:
Background: Intraluminal duodenal diverticulum (IDD) is a rare congenital duodenal malformation that is thought to result from chronic antegrade enteric propulsive forces on an incomplete duodenal congenital diaphragm [1]. It is composed of a double layered mucosal sac usually found within the second portion of the duodenum (rarely in the third part) close to the ampulla of Vater. There is a 40% incidence of coexisting congenital abnormalities, which include Ladd bands, annular pancreas, choledochocoele, portal vein anomalies, etc. [2]. Ladd bands can cause obstructive signs and symptoms, as occurred in our patient.

Clinical Perspective: IDD has no gender predilection and symptoms do not usually appear until the 3rd decade of life. Patients may describe longstanding nonspecific symptoms such as epigastric pain, nausea, vomiting, and abdominal fullness. Complications can occur in 20%–25% of adult patients, and include duodenal obstruction, peptic ulcer disease, haemorrhage, cholangitis and pancreatitis [3].

Imaging Perspective: This rare entity was first described by Nelson on barium studies of the upper GI tract. The classic findings consist of a saclike contrast-filled structure originating in the second portion of the duodenum, surrounded by a thin smooth radiolucent halo representing the wall of the diverticulum [4] (Fig. 1b). This typical
appearance has been coined the "wind sock sign", and is considered pathognomonic of this condition. However, if the diverticulum is already filled with fluid and/or other material and does not fill with barium, it may resemble other lesions, such as a pedunculated polyp, a submucosal tumour, or a choledochocele [3].

Abdominal MDCT reveals a low-density collection within the lumen of the duodenum [1] (Fig. 2). Multiplanar reformatted images may demonstrate the attachment of the diverticulum to the duodenal wall, the lumen of the duodenum, and the extent of duodenal obstruction [5] (Figs. 2b-c). Furthermore, it may also detect other coexisting congenital abnormalities.

Treatment: The treatment of an intraluminal duodenal diverticulum is surgical or endoscopic excision carefully avoiding injury to the ampulla of Vater [2].

Teaching points:
1. IDD is a rare developmental anomaly of the duodenum.
2. The duodenal "wind sock sign" is a pathognomonic finding of this entity.
3. MDCT with multiplanar reformations are helpful in demonstrating IDD and may demonstrate other associated congenital malformations.

Differential Diagnosis List: Obstructive Ladd band associated with congenital intraluminal duodenal diverticulum, Choledochocele and superior mesenteric artery syndrome, Duodenal intussusception and superior mesenteric artery syndrome, Obstructive duodenal duplication cyst

Final Diagnosis: Obstructive Ladd band associated with congenital intraluminal duodenal diverticulum

References:
Figure 1

Description: Image from the upper GI series demonstrates a barium-filled sac in the second portion of the duodenum, which is dilated. Origin: Ruivo C, Clinica Universitaria de Radiologia, Hospitais da Universidade de Coimbra - Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal
Description: A barium-filled sac surrounded by a radiolucent halo is seen in the second portion of the duodenum. Luminal dilatation and mucosal fold thickening are also noted. Origin: Ruivo C, Clínica Universitária de Radiologia, Hospitais da Universidade de Coimbra - Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal
Description: Axial abdominal contrast-enhanced CT depicts a ring-like soft-tissue density with heterogeneous fluid content within the lumen of the duodenum, with associated dilatation of the second and proximal third parts of the duodenal arch. Origin: Ruivo C, Clínica Universitária de Radiologia, Hospitais da Universidade de Coimbra - Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal
Description: Coronal reformatted image. A fluid-filled sac within the lumen of the duodenum is seen, along with dilatation of the second and proximal third parts of the duodenal arch. Origin: Ruivo C, Clínica Universitária de Radiologia, Hospitais da Universidade de Coimbra - Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal.
**Description:** Sagittal reformatted image. Note the attachment of the fluid-filled saclike structure to the duodenal wall. **Origin:** Ruivo C, Clínica Universitária de Radiologia, Hospitais da Universidade de Coimbra - Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal