MRI patterns of duodenal benign and malignant pathologies

Poster No.: C-2265
Congress: ECR 2013
Type: Educational Exhibit
Authors: E. Dü#ünceli Atman, A. Erden, E. Ustuner, C. Uzun, M. Bekta#; Ankara/TR
Keywords: Abdomen, MR, Diagnostic procedure, Diverticula, Cysts, Inflammation
DOI: 10.1594/ecr2013/C-2265

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 ist 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
Learning objectives

To illustrate the magnetic resonance imaging (MRI) findings and presentation patterns of benign and malignant duodenal pathologies.

Background

Duodenal lesions, due to its meandering course, are sometimes difficult to identify on cross sectional imaging methods. These nonfrequent lesions predominantly appear incidentally and various appearances are encountered radiologically. In accordance with the recent increased and widespread use of MRI in abdominal imaging, such often asymptomatic lesions are encountered more frequently nowadays in patterns that radiologists are not familiar with.

Imaging findings OR Procedure details

Patients who had undergone abdominal MRI for various indications were evaluated and those with duodenal lesions were selected. MRI patterns of lesions were assessed and analysed.

Physiological sphincter contraction

The smooth circular muscle fibers surrounding the distal common bile duct (CBD) and the main pancreatic duct fuse at the level of the papilla of Vater to constitute the sphincter of Oddi. The role of this dynamic sphincter is to regulate the flow of bile and pancreatic excretion into the duodenum lumen and also to prevent the reflux of the duodenal contents into the pancreatic duct and the CBD by relaxing and contracting (figure 1).

Diverticulum

Herniation of the mucosa and the muscularis layers is the predominant feature of the diverticulum which is a lumen recanalization anomaly of the embryological development. Diverticula are second in prevalence in the duodenum after colon. Most often encountered in the medial wall of the second and third duodenal segments; 90% are asymptomatic and incidental (figures 2-4).

Intraluminal duodenal diverticulum (IDD)
IDD is a rare anomaly which appears between 3rd and 5th decades. The intraluminal fluid collection on T2W images with a hypointense rim that changes shape with peristalsism on MRCP (MR cholangiopancreatography) is almost a characteristic sign for IDD. In 40% of the cases it may accompany congenital heart diseases and intestinal tract malformations (figure 5).

**Opening of the distal end of the CBD to the third segment of the duodenum**

In 75% of the cases the major papilla is located at the middle 1/3 of the descending segment of the duodenum, and 25% is located in the horizontal (third) section (figure 6).

**Annular pancreas**

The annular pancreas is an abnormal pancreatic tissue band that covers the second part of the duodenum circumferentially. If a complete ring is formed a total duodenal obstruction after birth may occur. If the ring is incomplete the obstruction may come to clinical attention much later or may be asymptomatic (figures 7,8).

**Duplication cyst**

Duplication cysts originate from recanalization defects within the duodenum lumen in the embryologic period. They are often encountered incidentally, and may cause obstruction and pancreatitis because of their critical location. They must be differentiated from choledochal cysts and pancreatic pseudocysts (figure 9).

**Prominent papilla**

Normally papilla is hardly distinguished from the surrounding duodenal mucosal folds. However, sometimes papillas may be seen as oval protruding structures with a diameter of 5-10 mm (figure 10).

**Dilated duodenum secondary to superior mesenteric artery syndrome**

SMA syndrome is a very rare gastro-vascular disease and it is characterized by compression of the third portion of the duodenum by the aorta and the overlying superior mesenteric artery (SMA). The normal angle between the aorta and SMA ranges between 25°-60°. The narrowing of this angle due to lack of retroperitoneal and visceral fat causes compression of the third portion of duodenum, thus the proximal segments of the duodenum become dilated (figure 11).

**Choledochocele**
Cystic dilation of the intraduodenal segment of the CBD is called choledochocele which is consistent with the type III biliary cyst according to the Todani classification. Choledochocele is often encountered in elderly male and may present as acute pancreatitis (figure 12).

**Duodenal wall thickening secondary to acute pancreatitis**

Pancreatitis is the most common inflammatory process that affects the duodenum. Inflammation of the pancreas and release of exocrine enzymes may lead to mild to severe duodenal edema which leads to gastric outlet obstruction (figure 13).

**Duodenitis**

Duodenitis most often results from Helicobacter pylori infection, NSAID use, Crohn's disease and Coeliac sprue. The findings are mural thickening secondary to edema, mucosal ulcerations and inflammation of the surrounding fat tissue (figure 14).

**Postbulbar stenosis**

Postbulbar stenosis is most often related to scarring after peptic ulcer (figure 15).

**Effacement of mucosal folds**

Among the duodenal findings of Coeliac disease, decrease in the number of mucosal folds, focal mucosal erosions, mural asymmetry, diffuse or nodular thickening of the mucosal folds can be mentioned. Also the risk of development of adenocarcinoma and lymphoma may increase in these patients; therefore MRI is a useful tool in early diagnosis (figure 16).

**Choledochoduodenal fistula**

Spontaneous bilioenteric fistulas most commonly occur secondary to gallstones, and less from peptic ulcer, malignancy and trauma (figure 17).

**Choledochoduodenostomy**

Choledochoduodenostomy is used in the treatment of patients with recurrent and impacted bile duct stones; strictures of the bile ducts; stenosis of the sphincter of Oddi; biliary obstruction, and trauma to the extrahepatic bile ducts during cholecystectomy (figure 18).
Hamartomatous polyposis (Peutz-Jeghers syndrome)

Mucocutaneous pigmentation and hamartomatous gastrointestinal polyps are dominant features of Peutz-Jeghers syndrome which is otosomal dominant. Patients present with bleeding and obstruction related to intussusceptions (figure 19).

Hyperplastic polyp

Benign overgrowth of duodenal epithelium is called hyperplastic polyp. These types of polyps do not have any malignant potential. On MRI, these polyps can be depicted as nodular soft tissue structures protruding into the duodenal lumen and adherent to the wall (figure 20).

External compression of duodenum

Miscellaneous lesions may cause compression to the duodenum externally (figure 21).

Pseudocyst in the duodenum wall

Pseudocyst in the duodenal wall is uncommon. Usually it occurs in the posterior wall of the second portion of the duodenum. Since this part is retroperitoneal, inflammation in the pancreas can spread into this wall by direct contact (figure 22).

Crohn's disease

Crohn's disease is an inflammatory disease that can affect any segment of digestive system from the mouth to the rectum. However, duodenal involvement is uncommon, and occurs approximately in 0.5-4 % of patients with Crohn's disease. Mucosal ulcerations, mural thickening, stricture formation, skip lesions, fistula and abscess formation are dominant features. In the revised ECCO guidelines of 2009 it is stated that MR enterography is one of the most effective tools to depict these findings (figure 23).

Ampullary carcinoma

Ampullary carcinomas cause symptoms relatively early, therefore often small in size when detected. They may be too small to detect radiologically. Most common symptoms are jaundice, nausea, vomiting and abdominal pain. These tumors have a tendency to grow towards the lumen and most of them are polipoid or papillary in shape. They often present as small masses in the form of periductal thickening or papillar duodenal bulging (figure 24).

Adenocarcinoma
Adenocarcinomas are the most common malignant neoplasm of the small intestine and more than 60% occur in the duodenum. The incidence increases in the 5th-6th decades. Patients present with gastrointestinal bleeding, jaundice and obstruction. MRI findings include focal mural thickening, infiltrative annular stricture, polypoid intramural or intraluminal masses (figure 25).

Images for this section:

Fig. 1: On this MRCP image the major papilla appears very prominent at the medial part of the second section of the duodenum. The distal segment of the common bile duct (CBD is not visible (A). Only after relaxation of the sphincter of Oddi, the intramural segment of the CBD became apparent (B). This image represents the normal sphincter contractility.
Fig. 2: A diverticulum appears as a fluid containing pouch that protrudes from the lumen of third section of the duodenum on this MRCP image.

Fig. 3: A large diverticulum is located at the junction of the second and the third segments of the duodenum. If diverticula appear completely in fluid intensity, they may be misdiagnosed as cystic tumors of the pancreas on CT or MRI. Continuity with the duodenal lumen is an important feature to differentiate from choledochocal or pancreatic cysts.
**Fig. 4:** A 4 cm diverticulum is seen at the transverse segment of the duodenum on these axial T2W (A) and MRCP (B) images. On the axial section air within the diverticulum lumen causes signal void (A). Also the CBD is larger than expected with filling defects within its lumen related to stones and stent (B). Air-fluid level within the diverticulum is an important sign that allows its recognition on the axial sections and also allows differentiation from other cystic lesions that may be encountered within the region.

**Fig. 5:** In the barium study (A) a barium sulfate filled inpouching towards the lumen is detected at the second portion of the duodenum with a lucent rim (halo sign). On MRCP of the same patient an intraluminal fluid collection surrounded by a hypointense rim is demonstrated (B). Imaging findings are similar in both studies which are consistent with IDD. IDD may accompany many congenital anomalies and this case was operated for anal atresia during the neonatal period.
**Fig. 6:** On this MRCP image, the major papilla variationally opens to the third section of the duodenum (white arrow). Also in this patient a periampullary diverticulum is depicted (blue arrow). Periampullary and/or juxtacorporal diverticula often present within 2-3 cm circumferential area of the papilla of Vater and may cause biliopancreatic symptoms.
**Fig. 7:** On the axial T2W consecutive MR images (A, B) pancreatic tissue (blue arrow) that covers the postbulbar duodenum (white arrow) anterolaterally is detected in accordance with the incomplete annular pancreas.
**Fig. 8:** On MRCP image of another patient the pancreatic duct is superimposed with the second portion of the duodenum.
**Fig. 9:** On these coronal T2W (A) and heavily T2W (B) MR images, at the lateral wall of the second portion of the duodenum, medial to the gall bladder a smooth, thin walled cystic structure (duplication cyst) was noted. (GB: gall bladder).
Fig. 10: On coronal fat suppressed T2W MR image a nodular structure is detected at the level of the major papilla (hypertrophic/prominent papilla). However, in healthy subjects, as seen in this image papillas may be seen as oval protruding structures with a diameter of 5-10 mm.
Fig. 11: On coronal (A) T2W MR images, the second portion of the duodenum is dilated and measures 4 cm. On sagittal image (B) it is detected that the angle between the aorta and the SMA is narrowed (SMA syndrome).

Fig. 12: On coronal T2W (A) and MRCP (B) images a cystic dilation of the distal end of the CBD is noted at the level of hypertrophic major papilla (choledochocoele).
Fig. 13: In a patient with acute pancreatitis, on axial (A) and coronal (B) fat suppressed T2W MR images mural thickening and edema in the second portion of the duodenum is depicted (blue arrow). The wall of the distal choledochal end is mildly thickened (white arrow).

Fig. 14: In this 32-year-old male patient with Crohn's disease coronal T2W (A), and axial T2W (B) MR images mural edema (duodenitis) in the second portion of the duodenum can be seen.
Fig. 15: In this patient with gastrojejunostomy due to postbulbar ulcer stenosis, barium studies show the anastomosis between the greater curvature of stomach and jejunum (blue arrow). On MRCP image (B) both postbulbar stenosis (white arrow) and the obstruction of the choledochal end can be seen. In addition, the major papilla appears to be retracted cranially to the stenosis region. Intra and extrahepatic biliary ducts appear dilated.

Fig. 16: In this 32-year-old male patient with Coeliac disease, on T2W coronal MR images (A, B) the mucosal folds of the second portion of the duodenum appear indistinct and obscured.
Fig. 17: In this patient with jaundice, a fistula tract between the CBD and duodenum is depicted on barium studies (A) and MRCP image (B). In the barium study the filling of the bile ducts with contrast medium through the fistula is apparent.

Fig. 18: In this patient with chronic pancreatitis and recurrent cholangitis episodes, on barium studies (A) and MRCP (B) an anastomosis between CBD and duodenum (choledochoduodenostomy) is detected. On barium study bile ducts are opacified retrogradely (A). Intrahepatic bile ducts are mildly dilated and irregular due to cholangitis (B).
Fig. 19: In this 41-year-old female patient, multiple polypoid lesions protruding to the lumen were seen in the duodenum on coronal T2W MR image. In the more caudal sections many polyps were also present in the jejunum, ileum and colon.
**Fig. 20:** On T2W coronal (A) and axial (B) MR images, a polypoid mass which protrudes to the lumen from the inferomedial wall of the posterior part of the duodenal bulb is demonstrated. In the differential diagnosis aberrant pancreatic tissue, carcinoid tumor, adenoma, gastrointestinal stromal tumor, Brunner gland hamartoma, and lymphoma must be considered.
**Fig. 21:** On T2W axial MR image, a multiloculated, thick-walled cystic lesion with internal septations is seen at the level of the pancreatic head-neck junction (blue arrow). This lesion slightly compresses the duodenum (white arrow) medially from the right. Hydatid disease is a parasitic infestation that is commonly encountered in certain areas. Pancreas is rarely involved. In endemic regions, hydatid cyst should be included in the differential diagnosis in case of obstructive jaundice, acute pancreatitis, and cystic lesions around the bilio-pancreatic region.
**Fig. 22:** On MRCP (A) and axial T2W MR images (B) a cystic lesion consistent with a pseudocyst is seen at the lateral wall of the duodenum in a patient with chronic pancreatitis (blue arrow). The pancreatic duct (white arrow) is dilated and irregular due to chronic pancreatitis.

**Fig. 23:** In a 37-year-old male patient with known Crohn's disease, coronal T2W images (A, B) demonstrates significant focal narrowing of descending part of the duodenum due to mural thickening (stricture) (blue arrow) (A). Proximal duodenum is dilated (white arrow). In the distal portion of the duodenal loop, mural thickening, mucosal irregularities and luminal stenosis are present (B).
**Fig. 24:** At the level of the papilla of Vater a nodular mass that protrudes to the lumen was seen on fat suppressed T2W axial images (A). On MRCP (B) distal end of the CBD end abruptly and also the bile ducts and the pancreatic duct are dilated due to papillary obstruction.

**Fig. 25:** On the barium studies of this 73-year-old patient complaining from epigastric pain, a stricture of the lumen of the bulbus and postbulbar region is shown (A). Circumferential wall thickening of the duodenum is detected on T2W axial image (B).
Conclusion

MRI patterns of duodenal lesions are quite recognizable. Multiplanar imaging and high contrast resolution capabilities of MRI are especially helpful in delineating anatomical orientation and organ relationships.

References


**Personal Information**