

Duodenum - a Forgotten Segment of Gastro Intestinal Tract on Abdominal CT Scan

Research Article

Kavita U. Vaishnav, Janki B Jaradi* and Pranay Patel

Department of Radiodiagnosis, L.G. Hospital, AMC MET Medical College, India

*Corresponding author: Janki B. Jaradi, Department of Radiodiagnosis, L.G. Hospital, AMC MET medical college, Maninagar, Ahmedabad, India; E-mail: janki_jaradi@yahoo.com

Copyright: © 2019 Kavita UV, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article Information: Submission: 25/07/2019; Accepted: 05/09/2019; Published: 07/09/2019

Abstract

Introduction: Duodenum is 25-30 cm long segment of small bowel. Computed Tomography (CT) of abdomen is routinely performed to evaluate gastrointestinal pathologies, in patients presented with abdominal pain. In routine day to day practice CT scan is concentrated on the stomach, colon and ileo caecal junction than duodenum. Radiology literature is also more focused on the colon, stomach and distal small bowel.

Materials and method: All the patients having abdominal pain and suspecting duodenal lesions were referred for abdomen pelvis CT scan to the department of Radio diagnosis, LG hospital during the period of January 2012- June 2018 were evaluated to detect lesions of duodenum.

Result: Total 25 patients were included in study. The most common age group involved was 60-69 years followed by 20 to 40 years. Second part of duodenum was commonly involved segment for pathologies followed by third part and fourth part. Common benign pathology was duodenal diverticulum in five patients and malignant lesion was adenocarcinomas in seven patients. Other lesions of duodenum occur rarely.

Conclusion: CT scan is more helpful than other modalities for proper evaluation of duodenum and its pathologies.

Keywords: Duodenum; CT scan; Malignancy of duodenum

Introduction

This article presents the CT findings in various pathologies involving the duodenum. The main aim of this article is to prove importance of a commonly used modality- abdominal CT scan, in the diagnosis of various duodenal disorders.

In recent era abdominal CT has tremendous role in the detection, and sometimes as an incidental finding, of various duodenal pathologies. CT scan provides a three dimensional imaging capability of Gastrointestinal Tract (GIT) pathology, as it allows visualization of the lumen, wall abnormality and adjacent extramural structures as well as distant metastasis. As well as lesions of the other organs, lymphadenopathy and bony lesions were well evaluated by CT scan. This article illustrates the various CT features of a different pathology affecting the duodenum.

Aim

- To evaluate the duodenum and its pathology.
- To diagnose various lesions involving duodenum.
- To provide additional information involving other organs.

Materials and Methods

All the patients presented with abdominal pain, vomiting, diarrhea and for some other conditions were referred for CT scan abdomen and pelvis with or without contrast to the department of Radio diagnosis, LG hospital during the period of March 2012 - June 2018 were evaluated to detect various pathologies of duodenum. This study has been performed using 16 slice Phillips scan machine. Written informed consent was obtained. Routine pre procedure was done as per the protocol of the CT scan study.

1. Plain CT scans of abdomen and pelvis followed by
2. Arterial phases were obtained after negative test dose of the non-ionic contrast by injecting 1-2 ml/kg of bodyweight of intravenous contrast media through cubital vein by pressure injector at a rate of 1.5 ml/sec. Scan was obtained 6 sec after starting of the intravenous contrast.

3. Venous phase- after 45-60 second.

Scan parameters were as follows: Volumetric data was obtained from the vessels in axial plane and was reconstructed in sagittal, coronal plane. Slice thickness- 1mm, Collimation- 0.6 mm, Pitch- 1.5, MAS=200, Kvp120.

Conventional abdominal CT scans are done with the use of radio opaque oral contrast material to distend the gastrointestinal tract. When there is suspicion of a duodenal pathology, some techniques can be used to optimize imaging of duodenum.

Type of study

Retrospective study

Inclusion criteria

All patients referred for CT scan abdomen and pelvis were included in the study

Exclusion criteria

Patients with absolute contraindication for CT scan.

Results

Majority of the patients having complaints of abdominal pain, vomiting, upper GI bleeding were referred to radiology department for abdomen pelvis CT scan. Out of which 25 patients came across with duodenal pathology.

Males (14) were more involved than female (11). The most common age group involved was 60-69 years followed by 20 to 40 years. Second part of duodenum was common in involved in most of the pathologies followed by third part and fourth part. First part of the duodenum was least to involve and was commonly involved in peptic ulcer disease and commonly presented with peptic perforation.

The most common benign pathology was duodenal diverticulum in five patients and malignant lesion was adenocarcinomas in seven patients. Out of which two patients had liver metastasis, six patients had lymph nodal metastasis. Other pathologies were rare like; groove pancreatitis, lymphoma, tuberculosis, bezoar and carcinoid were respectively observed in one patient. Two patients had SMA syndrome (Superior mesenteric artery syndrome) and trauma respectively. A young Patient with SMA syndrome presented with bowel obstruction, vomiting and pain (Table 1).

Discussion

To start with brief anatomy of duodenum will help for proper evaluation and diagnosis of its lesions properly.

The duodenum is a 25-30 cm long C-loop segment of the Gastrointestinal Tract (GIT) situated in the anterior pararenal space of retro peritoneum, (except for the duodenal bulb). It extends from

the pylorus of stomach (to the right of the midline) to the ligament of Treitz (to the left of the midline). In this article we will try to discuss CT scan findings of various pathologies involving duodenum one by one.

Duodenal pathologies

Developmental pathologies: Duplications and diverticulum:

Duodenal diverticulum is a commonly occurring pathology of duodenum. It may be either congenital or acquired, and is always an incidental finding on CT scan and is found in 6% of upper GIT barium studies. The common location of diverticulum is along the mesenteric border of the second and third part of the duodenum. The diverticulum is seen on CT as an air-filled and an air-fluid/orally ingested contrast material level that may contain debris, medial to the duodenal loop [1-3] (Figure 1). Sometimes the diverticulum may complicate in to infection, perforation, hemorrhage, pancreatitis or biliary obstruction and very rarely in malignancy (Table 2).

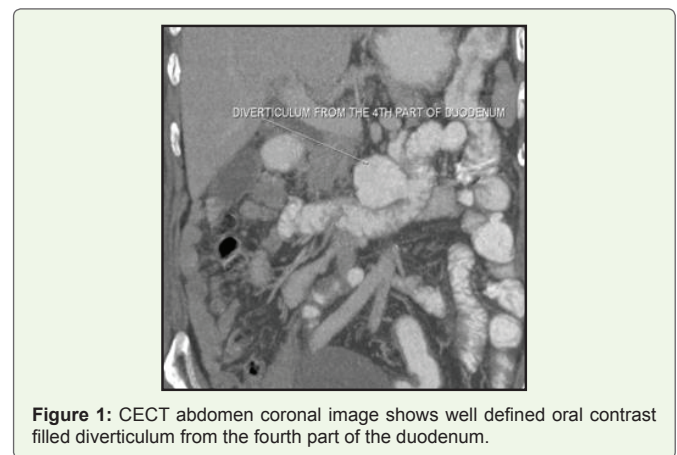


Figure 1: CECT abdomen coronal image shows well defined oral contrast filled diverticulum from the fourth part of the duodenum.

Table 1: Age wise distribution of duodenal pathology.

Age	Number	Percent
<10	1	4
10-19	1	4
20-29	4	16
30-39	4	16
40-49	2	8
50-59	3	12
60-69	5	20
70-79	3	12
>80	2	8
Total	25	100

Table 2: Pathology related distribution.

	Number
Adenoca	7
Diverticulum	5
Groove Pancreatitis	2
Carcinoid	2
Lymphoma	1
TB	1
Trauma	2
MISC	4

Duplication cysts are rare in the gastrointestinal tract, approximately 2 to 12% occur in the gastro duodenal region [4,5]. Duodenal duplication arises most often in the medial wall of the second and third portions of the duodenum and typically appears as a well-circumscribed cystic mass with fluid attenuation. The duplications typically do not communicate with the duodenal lumen and may communicate with pancreatic and bile ducts [4,5]. Rarely, carcinoma may arise inside a duplication cyst, and it appears as vegetation or mural nodules inside the cyst.

Malrotation

Malrotation is defined as a congenital abnormal position of the bowel within the peritoneal cavity and involves small and the large bowel. Malrotation is accompanied by abnormal bowel fixation by mesenteric bands or absence of fixation of portions of the bowel, leading to increased risks of bowel obstruction, acute or chronic volvulus, and bowel necrosis. Various degrees of malrotation of the small or large bowel may occur, and the positions of the duodenojejunal junction (and, by implication, the ligament of Treitz) and colon depend on the developmental stage at which normal embryologic rotation failed. Malrotation of the bowel is associated with a number of syndromes and other anomalies. Malrotation occurs in approximately 1 in 500 births. Malrotation is usually diagnosed in newborns and young infants; up to 75% of symptomatic cases occur in newborns, and up to 90% of symptomatic cases occur within the 1st year of life [6-8].

Infective and inflammatory diseases

Infective diseases in the duodenum are becoming difficult to diagnose from CT scans. Most infectious processes result in inflammation of the duodenum and secondary duodenal wall edema. The most common infectious cause of duodenitis is *Helicobacter pylori*. Sometimes, Crohn's disease may involve the duodenum. Less common infections include giardiasis and tropical sprue. The imaging findings may be nonspecific, like wall thickening and luminal dilatation, with or without adjacent nodes enlargement. Clinical correlation is always helpful in diagnosis.

Tuberculosis

Tuberculosis of the ileo caecal junction is the most common involvement in the gastrointestinal tract. Tubercular involvement of the duodenum accounts for only 2.3%. Duodenum along with stomach is a rare site for tuberculosis and is usually a result of secondary spread from a primary pulmonary disease [9]. The radiological features of duodenum tuberculosis are usually nonspecific. CT scan findings show circumferential wall thickening of the part of the duodenum with adjacent fat stranding and may be presented with symptoms of obstruction and associated with adjacent necrotic mesenteric lymphadenopathy and ascites [10,11] (Figure 2a and 2b).

Some extrinsic inflammatory diseases affecting the duodenum, like, in close relation to the pancreatic head and gall bladder. So, infection of the adjacent structure affecting the duodenum, like acute pancreatitis and cholecystitis may cause edema and mural thickening of the duodenum.

Mass lesions

Duodenal tumors account for about one-third of small bowel

neoplasms, which represent only 5-6% of all GIT neoplasia. Benign tumors include adenoma, adenomatous polyp, lipoma and leiomyoma. Amongst all leiomyoma is the commonest benign mass [12]. Gastro Intestinal Stromal Tumor (GIST) of the duodenum presents as an intramural, endoluminal, or exophytic mass, most commonly in the second or third portion of the duodenum. Patients with these tumors often present with gastrointestinal bleeding and, occasionally, abdominal pain.

The diagnostic criteria used to predict a benign lesion is the intraluminal location of a mass. Lipoma presents as a characteristic well-defined intraluminal fat density lesion on CT scan [12] (Figures 3, 4a and 4b).

There are three types of duodenal adenomas: tubular type, villous adenoma, and Brunner gland adenoma. Villous adenomas have a malignant potential and are treated with surgical resection while tubular adenomas and Brunner gland adenomas are typically surgically resectable.

The small bowel can be involved in various polyposis syndromes, Peutz-Jeghers syndrome, and Gardner syndrome. Presenting symptoms are bleeding and obstruction from intussusceptions. At CT, one may see intraluminal polyps, and the multiplicity of these lesions should suggest a polyposis syndrome.

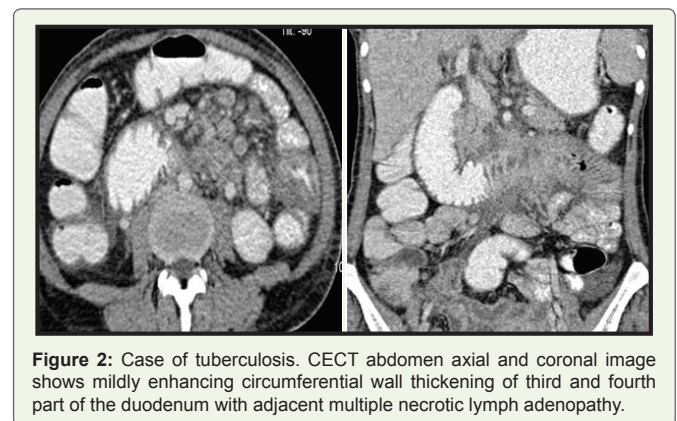


Figure 2: Case of tuberculosis. CECT abdomen axial and coronal image shows mildly enhancing circumferential wall thickening of third and fourth part of the duodenum with adjacent multiple necrotic lymphadenopathy.

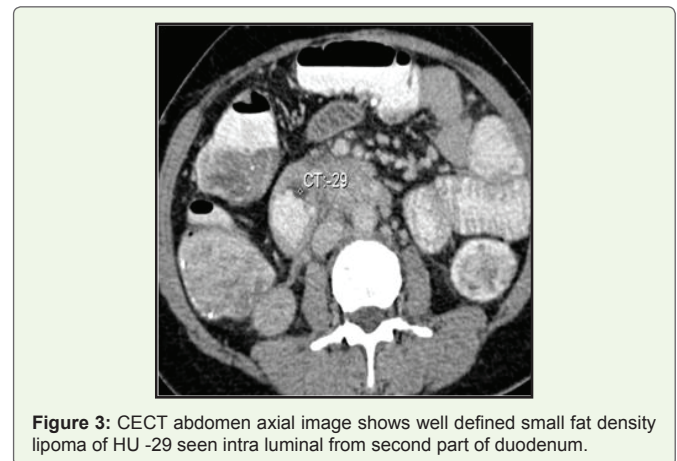


Figure 3: CECT abdomen axial image shows well-defined small fat density lipoma of HU -29 seen intraluminal from the second part of the duodenum.

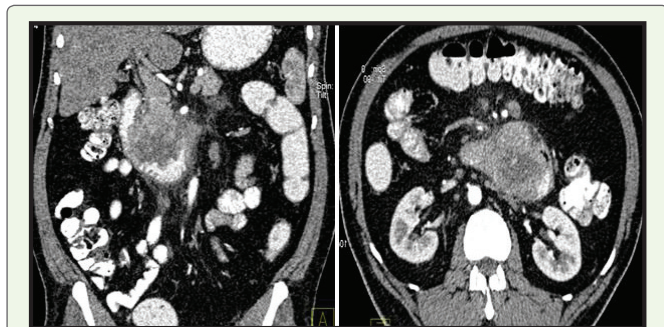


Figure 4: Histological proven case of GIST. CECT abdomen axial and coronal image shows large well defined lobulated heterogeneously enhancing mass lesion arising from medial wall of second and third part of duodenum with exophytic component.

Primary malignant tumors include adenocarcinomas, which comprise about 80-90% of all primary duodenal malignant neoplasm. Primary adenocarcinomas of the duodenum is usually found in the periampullary region [12-14]. Imaging features are as either a polypoid mass or an irregular, circumferential constricting lesion with wall thickening causing deformity of the lumen (Figure 5a and 5b). Additional CT findings are like infiltration of adjacent retroperitoneal fat planes or surrounding organs, adjacent lymph node enlargement, vascular encasement and distant metastases help in predicting tumor prognosis [12].

Other rare tumors like, duodenal leiomyosarcoma may appear as elsewhere in the GIT, typically has a large exophytic heterogeneously enhancing mass lesion with central necrotic and hemorrhagic component.

Lymphoma of the duodenum can occur with both primary lymphoma and secondary involvement from systemic disease. However, stomach lymphoma extending in to duodenum is common presentation. CT scan findings are symmetrical circumferential smooth or nodular large, homogeneously enhancing wall thickening, with normal mucosa. Aneurysmal dilatation of the affected segment is key feature of lymphoma (Figure 6a and 6b).

Metastatic involvement of the duodenum from other primary malignancies may occur due to local extension or metastases from distant sites. Common primaries are from pancreas, colon, ovarian, melanoma and breast.

Duodenal trauma

Duodenal trauma may result from penetrating or blunt injury. During blunt trauma, the duodenum may be crushed against the vertebral body, causing contusion or transaction. CT scan plays important role in duodenal trauma. Intramural hematoma without perforation is usually managed conservatively, but traumatic duodenal perforation is a surgical emergency. Free air with contrast in right anterior pararenal space is specific sign of duodenal perforation [15] (Figure 7a and 7b).

SMA Syndrome

Superior Mesenteric Artery (SMA) syndrome is an uncommon condition characterized by compression of the third part of the

duodenum between the aorta and the superior mesenteric artery. It is commonly seen in thin and lean patients, and usually presents with chronic, intermittent, or acute complete or partial duodenal obstruction. Superior mesenteric artery syndrome was first described in 1861 by Von Rokitansky, who proposed that its cause was obstruction of the third part of the duodenum as a result of arterio mesenteric compression. The incidence of superior mesenteric artery syndrome is from 0.1-0.3% according to study in literature [16]. Despite its rarity about 400 cases were described in the English language literature [17]. In SMA syndrome the fatty tissue between aorta and mesenteric artery is lost and causes compression of duodenum between it. The aortomesenteric angle is reduced below 60 0 to 150 between SMA and aorta is reduced.

Bezoar

A bezoar is composed of accumulation of foreign material in the GIT; most commonly in stomach may extend into duodenum. Amongst all bezoars, trichobezoars and phytobezoars are the two most common. Trichobezoar, a concentrated ingested hair material, occurs commonly in young women. It usually fills the stomach and the first part of the duodenum. The imaging features of a trichobezoar are characteristic of a large, heterogeneous, intraluminal mass with entrapment of air within the mass is considered a helpful diagnostic sign. Phytobezoar is composed of indigested food particles and is commonly seen in patients having poor digestion and decreased gastric motility [18] (Figure 8a and 8b).



Figure 5: CECT abdomen axial and coronal image shows adenocarcinoma of second and third part of the duodenum infiltrating uncinate process of pancreas with adjacent enlarged lymph nodes and liver metastasis.



Figure 6: Plain and CECT abdomen axial and coronal image shows mildly homogeneously circumferentially enhancing wall thickening of stomach extending up to second part of the duodenum with ascites in case of lymphoma.

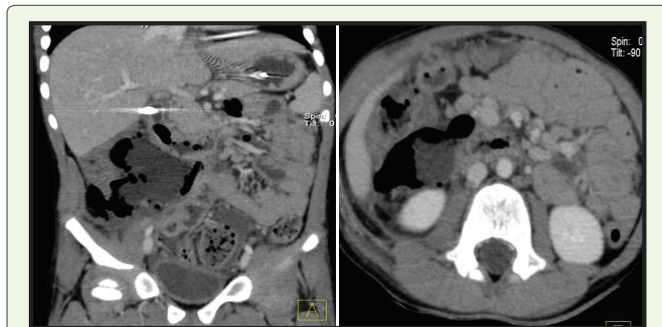


Figure 7: CECT abdomen axial and coronal image shows case of duodenal trauma having ill defined collection with internal air foci in right para duodenal location adjacent to second part of duodenum with minimal ascites.

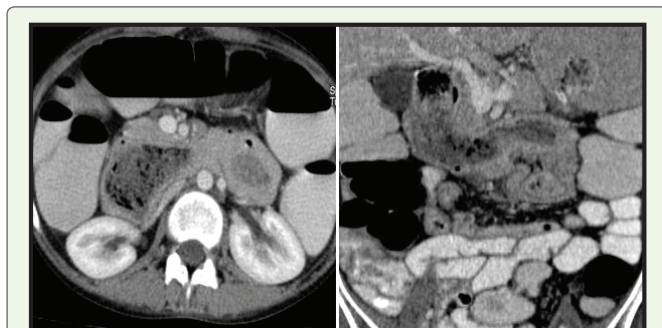


Figure 8: CECT abdomen axial and coronal image shows case of trichobezoar having a large, heterogeneous, intraluminal mass filled stomach extending into duodenum with entrapment of air within the mass.

Postsurgical changes of the duodenum

CT is the mainstay of imaging of the postoperative abdomen. Most postoperative complications, including abscess, wound dehiscence, hematoma, hernia, anastomotic leakage, and bowel obstruction, are well depicted with CT. Afferent loop syndrome, caused by obstruction of the duodenum and jejunum proximal to the gastrojejunostomy anastomosis, is an uncommon complication of subtotal gastrectomy with the Bilroth II procedure.

Conclusion

The duodenum is frequently overlooked during interpretation of abdominal CT examinations. To avoid it optimal knowledge about the duodenum and its pathologies is important to increase accuracy in diagnosis of it on abdominal CT.

References

- Gore RM, Ghahremani GG, Kirsch MD, Nemcek AA Jr, Karoll MP (1991) Diverticulitis of the duodenum: clinical and radiological manifestations of seven cases. *Am J Gastroenterol* 86: 981-985.
- Macari M, Lazarus D, Israel G, Megibow A (2003) Duodenal diverticula mimicking cystic neoplasms of the pancreas: CT and MR imaging findings in seven patients. *AJR Am J Roentgenol* 180: 195-199.
- Rao PM (1999) Case 11: perforated duodenal diverticulitis. *Radiology* 211: 711-713.
- Chen JJ, Lee HC, Yeung CY, Chan WT, Jiang CB, et al. (2010) Meta-analysis: the clinical features of the duodenal duplication cyst. *J Pediatr Surg* 45: 1598-1606.
- Morley NP, Pyrros AT, Yaghmai V, Miller FH, Nikolaidis P (2009) Biliary dilatation and duodenal intussusception secondary to enteric duplication cyst: MDCT diagnosis. *Emerg Radiol* 16: 243-245.
- TorresAM, Ziegler MM (1993) Malrotation of the intestine. *World J Surg* 17: 326-331.
- Strouse PJ (2004) Disorders of intestinal rotation and fixation ("malrotation"). *Pediatr Radiol* 34: 837-851.
- Spigland N, Brandt ML, Yazbeck S (1990) Malrotation presenting beyond the neonatal period. *J Pediatr Surg* 25: 1139-1142.
- Padussis J, Loffredo B, McAneny D (2005) Minimally invasive management of obstructive gastroduodenal tuberculosis. *Am Surg* 71: 698-700.
- Berney T, Badaoui E, Totsch M, Mentha G, Morel P (1998) Duodenal tuberculosis presenting as acute ulcer perforation. *Am J Gastroenterol* 93: 1989-1991.
- Ali W, Sikora SS, Banerjee D, Kapoor VK, Saraswat VA, et al. (1993) Gastroduodenal tuberculosis. *Aust N Z J Surg* 63: 466-467.
- Kazerooni EA, Quint LE, Francis IR (1992) Duodenal neoplasms: predictive value of CT for determining malignancy and tumor resectability. *AJR Am J Roentgenol* 159: 303-309.
- Hwang JL, Chiang JH, Yu C, Cheng HC, Chang CY, et al. (1998) Pictorial review: Radiological diagnosis of duodenal abnormalities. *Clin Radiol* 53: 323-332.
- Darrah ER, Nolan DJ (1999) Radiology of the duodenum. *Hosp Med* 60: 10-18.
- Kunin JR, Korobkin MA, Ellis JH, Francis IR, Kane NM, et al. (1993) Duodenal injuries caused by blunt abdominal trauma: value of CT in differentiating perforation from hematoma. *AJR Am J Roentgenol* 160: 1221-1223.
- Gerasimidis T, George F (2009) Superior Mesenteric Artery Syndrome. Wilkie Syndrome. *Dig Surg* 26: 213-214.
- Shiu JR, Chao HC, Luo CC, Lai MW, Kong MS, et al. (2010) Clinical and nutritional outcomes in children with idiopathic superior mesenteric artery syndrome. *J Pediatr Gastroenterol Nutr* 51: 177-1782.
- Gayer G, Jonas T, Apter S, Zissin R, Katz M, et al. (1999) Bezoars in the stomach and small bowel-CT appearance. *Clin Radiol* 54: 228-232.