Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Hepatobiliary, Pancreatic and Intestinal Ascariasis-Spectrum of CECT and USG Features.

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Received: July 2017
Accepted: July 2017

ABSTRACT

Background: Ascariasis is the most common helminthic disease in humans. It has global distribution and is most prevalent in tropical countries where the temperature and humidity favor the development of eggs in the soil. Ascaris is transmitted through fecal-oral route. Most of the affected are asymptomatic or present with nonspecific abdominal symptoms. However because of the high prevalence of infection, complications can occur such as intestinal obstruction due to massive infestation, biliary colic, gallstone formation, cholecytitis, liver abscess recurrent pyogenic cholangitis and pancreatitis. Purpose: This article describes and demonstrates the gastrointestinal, hepatobiliary and pancreatic Ascariasis with useful diagnostic signs on computed tomography (CT) and ultrasonography (USG). **Methods:** Prospective study of ten patients with history of abdominal pain who were diagnosed based on the findings of USG and CT abdomen as having hepatobiliary, pancreatic and intestinal Ascariasis and subsequently confirmed with endoscopy. **Results:** USG features revealed echogenic non-shadowing linear structures in the biliary tract, intestine (inner tube, stripe, and spaghetti signs) and parenchymal liver lesion and also calcified lesions in the biliary tract. CT helped in better delineation of hepatic abscess, Cholangitis, cholecystitis, pancreatitis and worms in the dilated ampulla and second part of the duodenum. **Conclusions:** This study discusses various features of different types of Ascariasis useful for diagnosis.

Keywords: Ascariasis, Hepatobiliary Ascariasis, Pancreatic Ascariasis.

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INTRODUCTION

Ascariasis in human beings is a well-known condition with most common presentation being the intestinal Ascariasis (IA). The incidence of intestinal Ascariasis is high (60%) in children (4-14 yrs.) compared to adults (30%). The hepatobiliary Ascariasis (HBA) and pancreatic Ascariasis (PA) are the known complications of Ascariasis especially in endemic regions due to high prevalence of the infection. The HBA includes biliary colic, gall stone formation, cholelithiasis, acalculous cholecystitis, liver abscess and recurrent pyogenic cholangitis. PA is the presence of worms in the pancreatic/biliary ducts resulting in pancreatitis.

This study was conducted to describe and demonstrate the useful diagnostic features and signs of HBA, IA and PA on ultrasonography (USG) and computed tomography (CT), which help to narrow the diagnosis in patients with high clinical suspicion of Ascariasis.[1-3]

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MATERIALS & METHODS

It is a prospective, cross sectional and hospital based study of ten patients conducted over a period of three years from 2012 to 2015.The study was conducted after obtaining the approval from the institutional review board and ethical committee. Informed consent was obtained from the patients and/or guardians.

All of the patients underwent Ultrasonography [USG] [Philips HD 50 ultrasound machine] of abdomen and pelvis. Convex [3-5MHz] and linear [5-12MHz] probes were used.

Computed tomography [CT] scan was performed in all patients with normal renal parameters.

CT technique: Plain and contrast enhanced CT were performed in all patients [GE systems 16 slice CT].

Step 1. Plain CT scan was performed after giving negative oral contrast medium, [200 ml of 10% Mannitol was mixed in 1800 ml of water and patients were asked to drink 30 -60minutes prior to procedure].

Step 2. Triphasic CECT was performed after injecting intravenous contrast, [100 ml of non-ionic iodinated contrast material, Iohexol (ominipaque) at a rate of 3.5ml/sec]. The contrast enhanced scan was performed at arterial (scanning delay, 20-40 seconds), portal (scanning delay, 60-90 seconds),

and equilibrium (scanning delay, 2-5 minutes) phases.
Post procedural reconstruction of coronal and sagittal images of 1mm thickness were done.
All the patients were further followed up with USG abdomen and pelvis scan.
Diagnoses of HBA, IA and PA were made by USG and CECT and further confirmed by Endoscopic retrograde cholangiopancreaticography [ERCP].

RESULTS

Most of the observed patients were females [7/10, 70%] with age group between 7-33 years. The clinical presentation and clinical diagnosis of the patients were varied [Table-1] with most common symptom being abdominal pain. All of them had IA and excepting the patients of paediatric age group [7-16 years], and in two male patients, rest of them had either HBA [4/10, 40%] or PA [2/10, 20%] [Table 2].
In IA the Sonography findings were non-shadowing, echogenic, tubular structures or echogenic parallel lines in the lumen of the bowel with characteristic zigzag movements [Figure 1]. In HBA similar structures were seen in the hepatic ducts in linear [Stripe/Tube in tube sign] [Figure 2a,b] or coiled pattern [spaghetti sign] [Figure 2c]. Other findings observed were thickened oedematous walls of the bile ducts [Cholangitis] [Figure 2], mixed echogenic parenchymal lesion with perilesional oedema [liver abscess] [Figure 2] and multiple shadowing echogenic structures in the biliary tract [Choledocholithiasis].
In two patient with Pancreatic Ascariasis [PA], the MPD was dilated with thickened oedematous walls [Figure 4].
These findings were further evaluated and confirmed in CECT [Figure 3a, 3b, 3c, 3d, and 3e].
ERCP was done as a diagnostic and therapeutic procedure in six patients and showed round worms in the stomach, duodenum and at the ampulla [Figure 5].
The laboratory findings revealed elevated WBC with eosinophilia and alterations of liver function tests. The patient with Pancreatic Ascariasis the amylase and lipase levels were elevated. All the patients were treated with anthelminthic drugs and followed up. The patients with HBA and PA are in addition treated with antibiotics.

Table 1: Distribution of patients according to Clinical presentation, imaging study done and Imaging diagnosis.

Sn.	Sex	Age	Chief complaint	Clinical diagnosis	USG and/or CECT	Imaging diagnosis
1	F	7yrs	Recurrent lower abdominal pain, weight loss.	Recurrent sub-acute appendicitis	USG	IA
2	M	11yrs	Abdominal pain	Nonspecific Abdominal pain	USG	IA
3	F	10Yrs				
4	M	16yrs				
5	F	22Yrs	Right hypochondrium pain	Cholecystitis	USG + CECT	IA and HBA
6	F	17Yrs	Known case of intestinal ascariasis	Treated case of intestinal ascariasis	USG	HBA
7	F	30Yrs	Abdominal discomfort	cholecystitis	USG + CECT	IA and HBA
8	F	33Yrs	Right hypochondrium pain, jaundice, fever	Liver abscess	USG + CECT	IA and HBA
9	F	33Yrs	Chronic Pain abdomen	Acute pancreatitis	USG+CECT	IA+PA
10	F	29yrs				

HBA: Hepatobiliary Ascariasis, IA: Intestinal ascariasis, PA: Pancreatic ascariasis, F: Female, SN: Serial Number. CECT-Contrast enhanced computed tomography, USG-Ultrasonography, M: Male.

Table 2: Distribution of patients according to the location of Ascariasis.

Sn	Type of Ascariasis	Total no of patients n-10	Percentage 100%
1	Patients with IA	10	100
2	Patients with HBA	4	40
3	Patients with PA	2	20

HBA: Hepatobiliary Ascariasis, IA: Intestinal ascariasis, PA: Pancreatic ascariasis.

Table 3: USG and CECT features of hepatobiliary and pancreatic ascariasis by location and intestinal Ascariasis

Type and location of the disease	USG features /signs	CT features and signs (NECT/CECT)
Intraductal worms	Inner tube sign-Echogenic outer ring with central hypoechoic. Stripe sign-Non-shadowing echogenic linear structure within the dilated duct. Spaghetti sign-overlapping interfaces of single or multiple coiled worms within the dilated ducts.	Tubular/cystic dilatation of IHBR and CBD with intraluminal linear/ coiled / tubular structures. NECT-The live worm appears as hyperdense. When the negative oral contrast is given the hypodense inner tube appearance is observed due to the ingestion of the oral contrast in to the worm intestine. CECT-enhancing thickened walls of bile ducts with intraduuctal worms as tubular structures.
Cholangitis	Thickened hypoechoic walls of the bile ducts.	Enhancing thickened walls of bile ducts.
Abscess	Mixed echogenic lesion with coiled linear echogenic structure within.	Peripherally enhancing parenchymal liver lesion with hyperdense coiled structures within.

Choledocholithiasis	Linear/tubular/ring hyperechoic structures within the dilated bile ducts with post echoic shadowing	NECT-Tubular/cystic dilatation of IHBR and CBD with intraluminal linear/ coiled/tubular hyperdense structures/ parallel linear calcifications.
Cholecystitis	Thickened hypoechoic walls of the GB.	Enhancing, thickened walls of GB with/without intraluminal worm and pericholecystic collection
Intestinal Ascariasis	Parallel echogenic lines. Inner tube sign: Outer echogenic tube:–The outer body wall of the worm. Inner hypoechoic tube:-Digestive Tract of the worm. Characteristic movement.	Inner tube sign, Dilated ampulla with intra-ampullary linear / tubular structure. Intraluminal tubular / linear / ring structure.
Pancreatic Ascariasis	Mildly dilated ducts with periductal hypoechogenicity and intraductal tubular structure.	Dilated duct with thickened enhancing walls.
NECT: Non-enhanced computed tomography, CECT: Contrast enhanced computed tomography, USG: Ultrasonography, CBD: Common bile duct, IHBR: Intrahepatic biliary radicals, GB: Gall bladder. Note: Intraampullary and intestinal worms can be identified as tubular structures.		

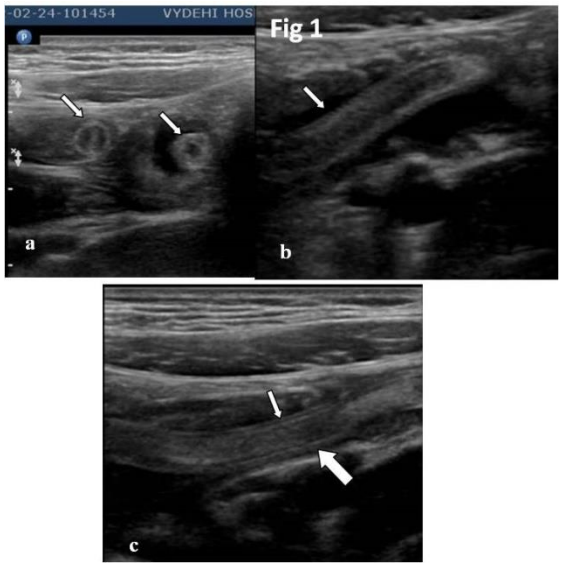

Figure 1: Intestinal Ascariasis. A,B,C shows TS and LS of bowel lumen with worm within. The TS shows worm as echogenic structure as ring structure in TS and as tube in LS.

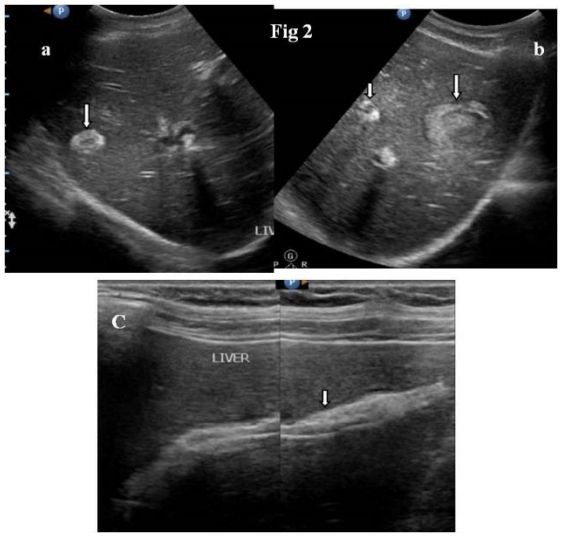

Figure 2: USG images of liver in patients with Hepatobiliary Ascariasis. a. Dilated ducts with worm within (Inner tube sign). b. Multiple dilated hepatic ducts with coiled worm within (Spaghetti sign). c. Dilated bile duct with intraluminal non-shadowing echogenic linear structure (Stripe sign).

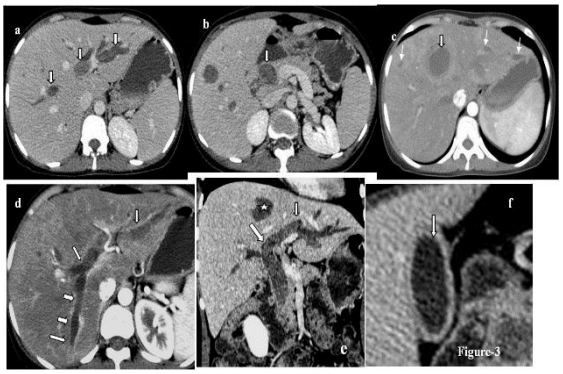

Figure 3. Hepatobiliary Ascariasis. CECT axial (a, b, c, d) and reformatted coronal (e, f) images showing dilated hepatic ducts (a) and dilated CBD (b) with intraluminal worms as hyperdense linear and tubular structures. c. Hepatic abscess as peripherally enhancing lesion. Thin white arrows reveal enhancing thickened walls of IHBR. d and e show Cholangitis as enhancing thickened walls of the bile ducts. Asterix in "e" indicates cystic dilatation of the duct with hyperdense worms within. f. shows cholecystitis as enhancing thickened walls of GB.

Figure 4: Pancreatic Ascariasis as Pancreatitis-dilated MPD with enhancing walls.

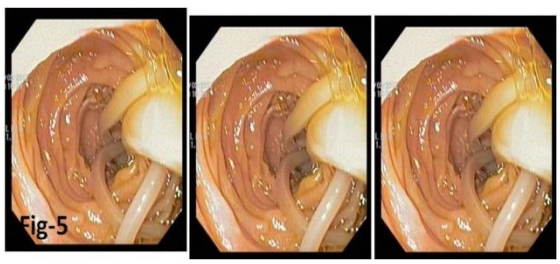

Figure 5: Endoscopy images shows D2 intraluminal worms.

DISCUSSION

Ascariasis is the commonest helminthic infection in humans caused by a Nematode Ascaris lumbricoides. Ascariasis is common in regions where poor sanitation, overcrowding and poverty favors the feco-oral spread of the parasite. Worm infestation is caused by ingestion of eggs from contaminated soil, food or water. The larvae emerge in the duodenum; migrate to the caecum, the veins of portal system and to the liver. From the hepatic veins they migrate to the lungs and heart. Transport to the lungs can also occur through the lymphatics of the bowel and the thoracic duct. After entering into the tracheobronchial tree the larvae are swallowed. Mature worms develop in the small intestine and eggs are passed in the feces. The adult worm resides in the duodenum and distal ileum.[5]

The Hepatobiliary Ascariasis (HBA) and pancreatic Ascariasis (PA) includes group of diseases caused by migration of adult worm through ampulla of vater into biliary and pancreatic ducts. The invasion of the worm into the pancreatic duct is rare due to the small caliber of the duct.[9,11] Although worms appear to migrate through ampulla into biliary tree and pancreatic ducts most appear to return spontaneously to the intestine within 72hrs of inducing biliary symptoms. Hence hepatobiliary and pancreatic Ascariasis escapes detection unless diagnostic imaging was performed during active clinical disease. HBA and PA can occur in any age group, the maximum incidence occurs in the third and fourth decade. HBA and PA are less prevalent in children due to narrow orifices. They are predominantly the diseases of the women with women to men ratio of 3:1. Pregnancy predisposes women to HBA and PA. In addition, interventional procedures related to biliary tract are also risk factors for HBA and PA.[1,3,5]

Based on the location of the worms five clinical presentations of HBA have been reported, biliary colic, cholangitis, acalculous cholecystitis and liver abscess.[1,5,8] Liver abscess is an uncommon (1% of total cases of HBA) but known presentation of biliary ascariasis.[4] This may have been caused by a gravid female worm which may have gone deep into the liver parenchyma through the bile duct, laid eggs and subsequently died. The area might then have been infected to form an abscess.[1,2] The presentation of PA can be either as dilated ducts, duct obstruction, parenchymal lesion leading to pancreatitis.[11]

Sonographic findings reflect the worm morphology [Figure 1, 2 & Table 3] with characteristic zig-zag movements of the live worms in the intestine. The live worm appears as Isodense / hyperdense [in comparison with the liver parenchyma] long linear, tubular/coiled structures on plain and contrast CT [Figure 6, Table 3]. When the negative oral contrast is given the hypodense inner tube appearance is observed due to the ingestion of the oral contrast in to the worm intestine. The follow-up cases and in the chronic cases the calcified worms in the ducts are clearly shown in the plain CT. The calcified worms appear hyperdense structures within the lumen [Figure 6].

In addition CECT features especially the reformatted images helps in diagnosing cholangitis, worms in the biliary ducts, ampullary region and in diagnosing pancreatitis. The features of cholangitis, parenchymal liver abscess, cholecystitis and pancreatitis are well demonstrated due to enhancing walls [Figure 3,4]. The findings suggest the presence of adult worms in the biliary tract and liver parenchyma with secondary infection. Endoscopy identified and confirmed active worms within the duodenal lumen and ampulla [Figure 5].

The treatment of intestinal ascariasis includes antihelminthic medication. For the biliary and pancreatic Ascariasis antibiotics and anthelminthic are recommended. The endoscopic treatment reserved for the patients who fail the initial medical treatment or have worms in the ducts after three weeks of observation. If signs of cholangitis are present IV broad spectrum of antibiotics are indicated. ERCP extraction and sphincterotomy with stenting is recommended in few patients. Worms in the biliary tract are not easily killed by antihelminthic drugs as these are poorly excreted in the bile and hence surgical /endoscopic interventions are required. In our study the patients presented with biliary ascariasis ERCP extraction, sphincterotomy with stenting was done. Follow-up scan revealed few calcified worms in the hepatic ducts.

USG is the primary modality in the evaluation of abdominal pain and other abdominal symptoms. Hence prior information of the features of ascariasis especially the three sonographic signs, along with the characteristic movement of the worm within the bowel lumen are very important clues for the diagnosis of the Ascariasis. Even though these features and signs are described first based on the USG appearance of the worm in previous studies, CECT revealed similar appearance in the hepatobiliary system and intestine with better demonstration of cholangitis and liver abscess.

CONCLUSION

Intestinal biliary and pancreatic Ascariasis should be included as a one of the important differential diagnosis in patients with high degree of clinical suspicion and the characteristic USG and CECT features are helpful in diagnosing the condition.

Radiological features in addition to clinical history are very crucial in the diagnosis of the hepatobiliary and intestinal ascariasis particularly when dealing with the population from the endemic areas and the immigrant population from the areas endemic with ascariasis. High index of suspicion followed by

endoscopy and medical therapy will reduce the morbidity and future recurrence.

Limitations

Main limitation of our study was small sample size. However our study results were confirmed clinically, by endoscopy and with follow-up studies. The larger sample size would definitely helpful in demonstrating different presentations of HBA and PA. Another limitation of our study is we could not demonstrate the round worm the pancreatic duct on CT and ERCP, which was identified on USG due to migration of the worm.

Acknowledgement

The authors would like to thank Dr. Praveen Mathew Gastroenterology for referring the cases for imaging studies, VIMS & RC hospital Director and radiology staff, Bangalore for their support in conducting the study.

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How to cite this article: Avantsa R, Kala P. Hepatobiliary, Pancreatic and Intestinal Ascariasis-Spectrum of CECT and USG Features. Ann. Int. Med. Den. Res. 2017; 3(5):RD01-RD05.

Source of Support: Nil, **Conflict of Interest:** None declared