

Abdominal computed tomography findings in patients with exudative ascites

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Abstract:

Background: peritoneal cavity can be involved in inflammatory and malignant diseases and using computed tomography (CT) findings of exudative ascites may help in the differentiation.

Objectives: 1-Describe CT features in patients with exudative ascites. 2-Obtain useful CT findings to differentiate between tuberculous (TB) peritonitis and peritoneal carcinomatosis.

Patients & methods: A cross sectional study conducted in Medical City Teaching Complex from September 2009 to September 2010 studied patients with exudative ascites using CT scan and confirmed later with histopathology examination. CT scan results were presented according to cytology examination and biochemical analysis.

Results: 35 patients with exudative ascites were studied, including 19 males & 16 females, age varied from 20 to 73 years. While the amount of ascites (large or small) did not show statistically significant association with malignant disease, the density of ascitic fluid was slightly higher in TB [range (18-22) Hounsfield Unit (HU), mean is 20HU] compared to malignant ascites [range (15-20)HU, mean is 18HU]. Right subphrenic ascitic collections are associated with malignant disease (12 or 60% compared to 2 or 13.3% in TB) and pelvic ascitic collections were associated with TB disease (8 or 53.3% compared to 3 or 15% in malignant disease).

Conclusion: In addition to omental cake & thickened bowel wall, malignant exudative ascites on CT scan is likely to have lower density, located in the right subphrenic space than in the pelvic region compared to benign (tuberculous) exudative ascites

Keywords: exudative, ascites, malignancy, TB, CT scan,

Introduction:

Ascites is a collection of serous fluid in the peritoneal cavity. Exudative ascites results from either inflammatory processes such as abscess, pancreatitis, peritonitis, bowel perforation or malignant processes. Exudative ascites in CT imaging is usually identified if fluid density exceeds 15 HU (1). Peritoneal carcinomatosis has been considered to be the terminal stage of malignant disease with poor prognosis if untreated (2). Tuberculosis remains an important burden disease worldwide especially in endemic regions. Although the incidence is still falling, it is falling too slowly. The estimated global incidence is 137 cases per 100,000 population and the estimated death from tuberculosis is 20 cases per 100,000 population in 2009 (3). Iraq is among the middle burden countries, with the estimated prevalence of 43 cases per 100,000 population in 2015 (4). A large percentage (20.6%) of TB cases initially present with extrapulmonary manifestations (5). The abdomen is the most common site of extrapulmonary tuberculosis with peritoneal TB being the most common form within the abdomen (6). TB peritonitis

is a result of peritoneal involvement with TB (7). The delay in the diagnosis of TB peritonitis resulted in an unnecessary radical resection of the patient's reproductive organs (8). Accurate and early diagnosis of TB peritonitis is crucial because delay in appropriate treatment can lead to significant mortality. However, the diagnosis of this disease is difficult because of its clinical and imaging findings can mimic other peritoneal diseases especially peritoneal carcinomatosis. If the differentiation between TB peritonitis and peritoneal carcinomatosis can be obtained based on imaging findings, it would avoid unnecessary invasive diagnostic tools such as peritoneoscopy or exploratory laparotomy (9). For all the reasons above and to improve the treatment of a lesion should improve its diagnosis (10), we use CT scan as it is fast, thinner collimation, faster reconstruction times and volume acquisition besides it has the advantage of evaluating extraluminal, peritoneal nodal and visceral involvement (11). As most CT findings overlapped in these diseases (malignant and inflammatory diseases), using a combination of CT findings increased the ability to distinguish TB peritonitis from peritoneal carcinomatosis (12).

Patients and Methods:

This is a cross sectional study conducted in radiology departments in Medical City Teaching complex (radiology institute, Martyr ghazi al Hariri) in Baghdad during the period September 2009 to September 2010 where recruited patients were

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examined by CT scan .Candidates were patients referred for CT scan examination by gastroenterology outpatient surgical clinic due to presence of ascites. Fluid aspiration and biochemical laboratory examination (ascitic fluid analysis) followed CT scan examination. Inclusion criteria were ascites with the protein level more than 30 gm /dl. Ultrasound was done to all patients .Data were collected for each patient using a standard questionnaire form gathering data for patients' characteristics (age, gender), and CT scan findings which were assessed as follows:

1. ascites : density [low : near water density - 10 to+ 10 HU, high : more than water density], location [right upper quadrant ,left upper quadrant, right paracolic gutter, left paracolic gutter and pelvis], amount [classified semi-quantitatively into :small if fluid in one or two locations and large if fluid in more than two locations] , and loculation,
2. mesenteric and omental abnormalities :fat stranding near the site of pathology and omental cake,
3. lymphadenopathies(LAP) :size, location, presence of calcification and central necrosis,
4. Abnormalities of gastrointestinal tract, lung bases, and venous thrombosis.

Spiral CT examination protocol: Abdominal spiral CT was performed using Siemens (Somatom plus4) in Martyr ghazi al Hariri and Toshiba Aquilon in Radiology Institute in the Medical City Teaching complex, the CT exam protocol used was as follows: 1- All patients were examined in supine position, in cranio-caudal direction

2- The CT protocol:

Slice thickness 5- 8 mm, Kvp 120-140, mA 100-200, pitch 1.5

Initially CT scan without contrast was done followed by post contrast study (IV and oral) the oral contrast was given by using Omnipaque 350 mg (iodine) /ml concentration diluted to 6-9 mg(iodine)/mL concentration and administer(1000- 2000 ml) in divided doses (500 ml each 30 minutes), then IV contrast medium was given by using iodinated non – ionic (low osmolar) contrast medium ,10 mg /kg (100-120 ml omnipaque 350 mg (iodine)/ml concentration).

The injection was either by certain suitable injector (3-4 ml / second) or manually through intravenous

line. After the examination, certain post processing procedure was done accordingly as MPR (multi planar reconstruction).The cases were interpreted by junior radiologist and consultant radiologist, all the exudative cases were followed for the final diagnosis according to cytology examination and biochemical analysis. Statistical Package for Social Sciences version 18 (SPSSv18) was used for data input and analysis. Discrete variables presented as numbers and percentages. Chi square test for independence was used to test the significance of association between discrete variables. Findings with P value less than 0.05 were considered significant.

Ethical Considerations: An approval to conduct the study by the Council for Arab Board for Health Specializations was obtained prior to study conduct. A verbal consent was obtained from participants before recruitment to this study.

Results:

Out of 125 patients examined with CT for having ascites, only 35 patients were found having exudative ascites. Laboratory findings concluded malignant etiology in 20 patients and Tuberculosis (TB) in 15 patients. CT findings for patients with malignant exudative ascites were: high density ascites (15-20 HU) mean density is 18 HU ,large amount of ascites in 14 patients (70%)(table 1, figure 1), ascites observed in right sub-phrenic region in 12 patients (60%), loculation seen in 5 patients (25%),fat stranding seen in 2patients(10%), omental cake seen in 4 patients(20%) as demonstrated in figure (2) and LAP were observed only in 6 patients (30%),also liver metastasis was seen in 5 patients (33.3%) and thickened bowel loops in 7 patients(35%). CT findings for patients with TB were: high density ascites (18-22 HU) mean density is 20 HU, 6 patients (40%) had large amount of ascites, ascites in 8 patients (53.3%) was found in the pelvic region, loculation was seen in 4 patients (26.6%) as shown in figure (3),fat stranding seen in 5 patients (33.3%)and LAP were found in 8 patients (53.3%) and none had omental cake (table 1).

Table 1: Representing summary of findings used in differentiation between malignant and inflammatory ascites

CT finding	malignant cases(total no=20)	inflammatory cases(total no=15)	P
Amount	Small	6 /20(30 %)	0.152
	Large	14/20 (70%)	0.152
Loculation	5 /20(25%)	4/15(26.6%)	0.776
Density	15-20 HU (mean =18HU)	18-22HU(mean= 20HU)	0.001
Location	Right subphrenic	12/20 (60%)	0.015
	Pelvic	3/20 (15%)	0.041
	All over the abdomen	3 /20(15%)	0.385
	Other sites	2 /20(10%)	0.599
Fat stranding	2 /20(10%)	5/15(33.3%)	0.200
Omental cake	4 /20(20%)	0/15	0.192
Thickening of bowel wall	7 /20(35%)	0/15	0.032
Lymphadenopathy	6 /20(30%)	8/15(53.3%)	0.297
Liver metastasis	5 /20(33.3%)	0/15	0.040

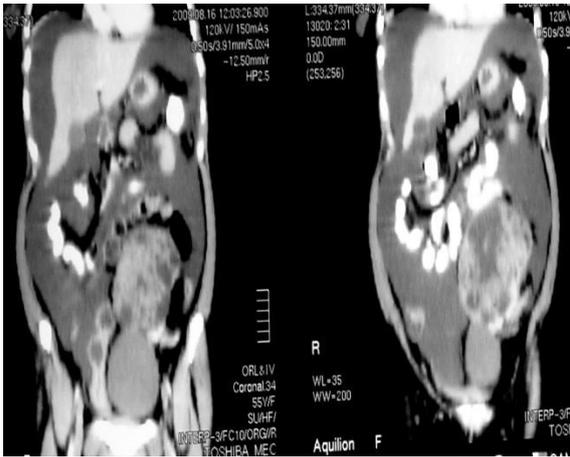


Figure 1: contrast enhanced (oral and IV) CT showing large amount of exudative ascites in a

patient (of our study) with ovarian carcinoma (mass in the left lower abdomen).

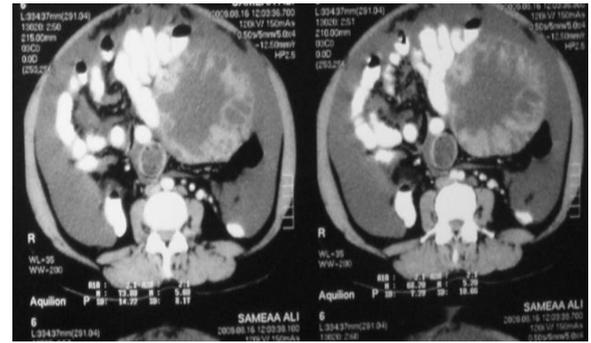


Figure 2: contrast enhanced (oral and IV) CT scan in one of the patients study showing omental cake and mesenteric infiltration.

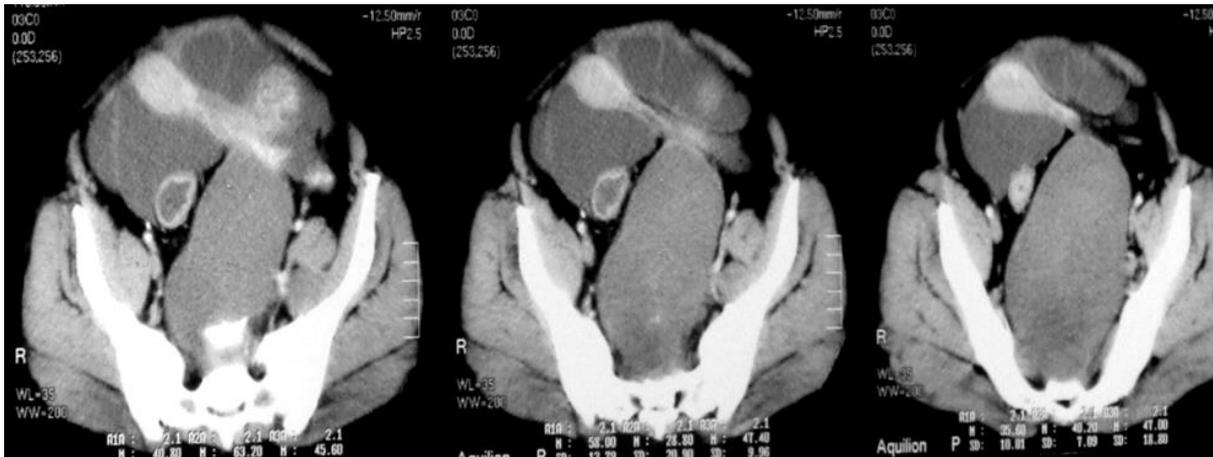


Figure 3: contrast enhanced (oral and IV) CT scan in TB peritonitis (patient in our study) showing high density loculated or septated ascites in pelvic region

Discussion:

CT is becoming increasingly important in evaluating mural and extramural lesions and in assessing mesenteric involvement and ancillary intra-abdominal findings associated with inflammatory or neoplastic diseases (13). CT has been chosen as a major diagnostic technique for diffuse or focal peritoneal disease (12).CT is superior to US in detecting the cause of ascites, as sectional images obtained added further information regarding the extent and staging of the disease (14, 15).In this study, the density of exudative ascites was high usually between (15-30) HU and is important in diagnosing the exudative pattern of ascites as the HU increased with increase in protein content. Although inflammatory ascites tends to be slightly of higher density than malignant ascites ,density is of little value in differentiating malignant from inflammatory causes of ascites, (Epstein et al,1982)(16).(Hanson and Hunter,1985) found that ascitic fluid density in T.B. peritonitis patients reaches 39 HU (17) . The amount of ascites in patients with T.B. peritonitis was less than the amount in patients with peritoneal carcinomatosis(12).The incidence of large amount of ascitic fluid in malignant cause is 70% of all malignant cases in this study and that agrees with (HA et al 1996) where they concluded that large amount of ascitic fluid is found in 74 % of malignant

cases(12).With the patient in a supine position, free fluid tends to accumulate in the right subphrenic region, and in the pelvis due to the effects of gravity and capillary attraction. Therefore, these areas should be carefully assessed when ascites is suspected(19).The right subphrenic location is the most common site for malignant ascites (60%) followed by pelvis (15%)and this agrees with a study of(Anthony E. Hanbidge,2003) who found that right subphrenic region is the most common site for ascitic fluid to accumulate in malignant causes followed by morrison 's pouch followed by pouch of douglas (19),also (Walky et al,1988) found malignant ascites in the right subphrenic region in 73% of malignant cases ,62% in cul de sac(18). Loculation was found in 25% of malignant cases and 26.6% of inflammatory cause which agrees with (Ha et al,1996)(12)who found loculation in 27% of malignant cases and 26 % of inflammatory cause ,but (Walky et al ,1988) found that loculation seen in 46% of malignant ascites and not seen in benign(TB) ascites because loculation could be due to surgical adhesions or peritonitis(18).Omentum was more irregular and thicker in patients with peritoneal carcinomatosis than in patients with TB peritonitis(12).In this study, omental cake found in 20% of all malignant cases but not seen in inflammatory cause ,(Ha et al, 1986) found it in 20%

of all malignant cases and in 8 % of all inflammatory cases(12),this could be due to small number of cases in this study as compared to Ha et al study sample. Abdominal LAP is the most common manifestation of TB on CT. Lymph nodes involved most commonly include mesenteric, peri-portal ,peri-pancreatic, and upper para-aortic groups of nodes(20).In our study LAP is seen in 30% of all patients of malignant causes while it is seen in 53.3% of all patients of inflammatory causes which agrees with (Ha et al, 1996) who showed that 60% of TB patients had LAP ,and 38% of carcinomatous patients had LAP(12) .Fat stranding is seen in our study in 10 % of malignant causes and 33.3 % of inflammatory causes of exudative ascites. Thickening of bowel wall was seen in 7 patients (35%) with known primary (ovarian and GIT) malignancy while (Walky et al, 1988) said it was seen in 37% of patients with known primary tumors (18).Liver metastasis was found in 5 patients (33.3%) with exudative ascites and known primary malignancy,(Walky et al ,1988) found it in 19% in patients with known primary tumors(18).

Conclusion:

Exudative ascites was high density, tended to loculate and the most common location of exudative ascites is right subphrenic region in malignant cause and pelvic in the tuberculous cause.

Compared to TB, malignant exudative ascites is more likely larger in amount and to be associated with omental cake and less to be associated with stranding. LAP is seen in both malignant and inflammatory causes of exudative ascites with slight higher incidence in the latter cause.

Author contributions:

Dr. Rasha Th. Fakhri and Dr. Ahmed M. Muhi: researchers

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