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Comparative Evaluation of Ultrasonography and Computed Tomography imaging in Diagnosis of Abdominal Masses.

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Abstract

Background: To study the role of ultrasonography and computed tomography in the evaluation of abdominal masses and comparison of their diagnostic accuracies, evaluation of their imaging features and to know the exact site of origin and extension into surrounding structures. **Methods:** A prospective study of 95 patients with abdominal masses. USG was done with Mind ray and CT-Scan examination was performed in all patients on Philips 64-slice whole body CT scanner. **Results:** There were 29(30.20%) cases of hepatobiliary masses, renal14 (14.70%) cases, pancreatic 7(7.36%)cases, 4(4.21%) cases of splenic masses and 27 (28.42%) cases of pelvic masses 14 (14.73)cases with other abdominal masses. Hepatic SOL were detected in 6(6.31%) and 8(8.42%), 5(5.26%) cases of gall bladder masses and 4(4.21%), Omental caking was seen in 2(2.10%) cases and 4(4.21%), calcification was seen in 2(2.10%) cases and 4(4.21%) cases, renal calculi were seen in 4(4.21%) cases and 6(6.31%) cases, on sonography and CT examination. Peritoneal deposits were seen in 3(3.15%) cases of ovarian carcinoma and unknown malignancy on US and in 5(5.26%) cases on CT. Ascites and lymphadenopathy was more accurately detected on CT as compared to US.CT detected splenic infarcts which were missed on ultrasonography. **Conclusion**: Computed Tomography is more accurate and sensitive for lesion characterization evaluation in terms of site and size of lesion, presence of calcification, adjacent organ infiltration and associated lymphadenopathy. The limitations of CT are ionizing radiation, high cost and contrast administration. Therefore, ultrasound should be used for primary screening of masses and CT should be used for further characterization of these masses.

Keywords**:** Abdominal Masses, Sonography, Computed Tomography.

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INTRODUCTION

An abdominal mass is any localized enlargement or swelling in the human anatomy. The causes of these masses depending on location include hepatomegaly, splenomegaly, a pancreatic mass, a retro peritoneum, an abdominal aortic aneurysm or various tumors, such as those caused by abdominal carcinomatosis and omental metastasis.[1]

Various signs and symptoms encountered with abdominal masses are pain in abdomen, awareness of mass, fever, dysuria, hematuria, jaundice, weight loss, bowel disturbance & menstrual irregularities etc. Modalities used for the investigation of abdominal masses are Plain X-Ray Abdomen which identifies only soft tissue shadow or any calcification if present; IVP used for evaluating renal masses, Barium studies for gastrointestinal masses, Ultrasonography, Computed Tomography and MRI.

Sonography is a unique real time imaging which is multi planar, operator dependent, without radiation exposure and is a low cost modality. The limitation of sonography is the presence of bowel gas and excessive obesity. Ultrasounds do not accurately reflect the full extent of disease and is also limited in diagnosis of metastasis to peritoneum and lymph nodes.[2]

Sonography is unexcelled in showing the relationship of liver tumours to critical structures such as veins, bile ducts and arteries. Spiral computed tomography has rapidly gained acceptance as preferred technique for routine liver evaluation because it provides image acquisition at peak enhancement of the liver parenchyma during single breath hold.[3]

In case of GB masses, sonographic findings include thickening of the GB wall (>3mm), distension of GB lumen (>4cm), gallstones, impacted stones in cystic duct/GB neck, positive sonographic murphy's sign, hyperemic GB wall on Doppler, and interrogation. CT may be useful for depiction of complications.[4]

Transvaginal sonography is very useful in uterine and adnexal masses. Transrectal sonography is helpful in rectal and prostatic masses.

Computed tomography is superior to sonography in diagnosis and management of abdominal masses. The exact origin of mass, size, shape and localization can be done with CT. Contrast enhanced CT scan helps in better localization, determining exact size of mass and degree of vascularity of the mass. Abdominal lymphadenopathy can also be better assessed.[3] Presence of bowel gas and obesity does not have any hindrance in detection of the abdominal lesions in comparison to sonography. The disadvantages of computed tomography are high cost, ionization radiation and motion artifacts.

AIMS AND OBJECTIVES: To study the role of Ultrasound and CT in evaluation of abdominal masses, characterize the morphology of lesion, solid versus cystic and to know the exact site of origin and extension into surrounding structures.

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MATERIAL AND METHODS

This study on the role of Ultrasonography and Computed tomography in evaluation of abdominal masses was conducted on 95 consecutive patients presenting with abdominal masses. Case selection was done from patients referred to department of radiodiagnos is from indoor and outdoor departments of Government Medical College, Amritsar.

The sonographic evaluation and CT examination was carried out using a Mindray machine and Philips 64-slice whole body CT scanner.

Ultrasonic evaluation was done in detail for site of origin of mass, its nature whether solid or cystic, echo texture and echogenicity. Associated findings in the abdomen were also recorded.

CT-Scan examination was performed in all patients on Philips 64-slice whole body scanner after giving oral and intravenous contrast as and when required. The axial scans with coronal and sagittal reformatting were done as and when required.

RESULTS

A prospective study of 95 patients was conducted to study and evaluate different abdominal masses by ultrasonography and computed tomography. Nature and extent of lesions were studied. The main observations of this study were as follows.

There were 29 (30.20%) cases of hepatobiliary masses, renal14 (14.7%) cases, pancreatic 7(7.36%) cases, 4(4.21%) cases of splenic masses and 27(28.42%) cases of pelvic masses. 14 (14.73%)cases with other abdominal masses.

Hepatic SOL were detected in 6(6.31%) and 8(8.42%), 5(5.26%) cases of gall bladder masses and 4(4.21%), Omental caking was seen in 2(2.10%) cases and 4(4.21%), calcification was seen in 2(2.10%) cases and 4(4.21%) cases, renal calculi were seen in 4(4.21%) cases and 6(6.31%) cases, on sonography and CT examination. Peritoneal deposits were seen in 3(3.15%) cases of ovarian carcinoma and unknown malignancy on US and in 5(5.26%) cases on CT. Ascites and lymphadenopathy was more accurately detected on CT as compared to US.CT detected splenic infarct which were missed on ultrasonography.

DISCUSSION

Ultrasound helps by detecting lesions, give idea about its internal structure and also give opportunity to evaluate other abdominal organs. However, evaluation by CT scans can give additional information which can modify the course of treatment and prognosis of patient. It has advantage of depecting the organ of origin, extent of lesions, surrounding organ tissue invasion, assessment of lymphnodes, intra spinal extensions and distant metastasis thereby helping in correct diagnosis.[5,6]

Hatimota P et al performed a study on 50 patients with renal masses and evaluated them on US and CT to stage these tumors and correlate the imaging findings with operative and histopathological findings. US had an advantage over CT in detection of nature of

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lesion(solid/cystic) and evaluation of renal vein invasion.[2]

Tevfik et al reported a case with incidental left retroperitoneal mass discovered on ultrasound. CT revealed the extent of tumor, organ of origin, regional invasion, vascular encasement, adenopathy and calcification.[7]

Pablo R Ras et al reviewed acute pancreatitis on US, CT, MRI abdomen with or without contrast. US was found to be effective to detect GB stones in patients with acute pancreatitis, but less successful in diagnosing choledocholithiasis. CT is superb in delineating the pancreas and acute pancreatitis associated abnormalities.[8]

Elshazly et al reported 4 cases who were suffering from abdominal pain and GIT manifestations. A provisional diagnosis of hydatid disease was made based on clinical manifestation, haematological, biochemical parameter and serological test. US showed well circumscribed cystic masses in liver and diagnosis of hydatid cysts was confirmed by CT.[9]

Lt Col George RA et al did a study on 50 cases of GB carcinoma on abdominal helical computed tomography scan. The presence of focal or diffuse mass lesions in the gall bladder fossa, infiltration of liver and second part duodenum was the most reliable diagnostic features in carcinoma gallbladder. Regional spread was better delineated on CT and was an effective method for evaluating, characterizing and detecting the spread of GB carcinomas.[10]

Sayed et al reviewed the case record of 120 patients who underwent CT scan for 2 years. US was used as a screening test for suspicious hepatic tumors. CT was found to be the mainstay imaging modality of first choice in diagnosis of hepatic malignancies.[11]
M khandhedia et al conducted study on 84 patients and concluded CT and sonography are comparable in differentiating malignant from benign ovarian tumours. CT scan was more sensitive than USG but sonography was more specific than CT in diagnosis of malignant lesions.[12]

RESULT

Out of 95 patients, Maximum no. of patients were in age group of 51-60 years (25.96%) and the minimum number was in the age group of0-10 years (3.84%). The oldest patient was 76 years old male. Male and female populations contributed 50.96% & 49.03% respectively.

Most common complaint was pain abdomen in 64.42% of patients, followed by abdominal distension in 14.42% cases. Palpable abdominal masses were seen in 9.60% of cases. Urinary symptoms were seen in 7.69% of cases and bowel symptoms were seen in 5.70% of cases.

Total patients presenting with masses of hepatobiliary origin were 29 (30.20%), 14(14.70%) cases of renal masses, 7(7.36%) cases of pancreatic masses, 4(4.21%) cases of splenic masses and 27(28.42%) cases of pelvic masses. Fourteen were the other cases which included gut masses, adrenal mass and lymph node masses. Out of 95 cases, 64(67.30%)of case shad solid masses, 31(32.63%) cases had cystic masses. Cystic masses on US were well marginated, anechoic without internal septations and distal acoustic enhancement. Cystic masses which had thick septations,

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coarse echoes and solid components but had good through transmission confirming their cystic nature were predominantly solid masses. On CT, 64 (67.30%) of cases had solid masses and showed contrast enhancement. 31(32.63%) of cystic masses were hypoatte nuating with4-18HU showing no demonstrable contrast enhancement. Out of 95 masses, 65(68.43%) were showing homogenous enhancement and 30(31.57%) showed heterogeneous enhancement. Splenic infarct and contusion in two cases were diagnosed on CT whereas these lesions were missed on ultrasonography.

Hydatid cysts were seen in 4 cases in liver and in one case in kidney. On ultrasound, lesions were seen as smooth marginated, multiloculated with interspersed solid hypoechoic masses in two cases and multiseptated in 2 cases out of which one case showed marginal calcification. On CT, the cysts appeared as sharply marginated, round or oval masses of fluid density, well demarcated from adjacent liver parenchyma. CT helped in one case to show the rupture of hydatid cyst and its extension into the right pleural cavity and dissemination into peritoneal cavity. Dissecting aneurysm was detected in a case on US; it was seen as hypoechoic lesion adjacent to aorta with in timal flap separating aneurysm. CT was superior in this case to demonstrate the site of dissection and extent of dissection up to iliac vessels.

CONCLUSION

Ultrasonography is the primary screening modality of choice for evaluation of various abdominal masses, their relationship, internal characteristics, echo pattern and vascularity. However, it is operator dependent and images can be oscured by obesity, bowel gases, lung bases, etc. MDCT is comparatively better imaging modality for cross sectional imaging of the lesions, density, extent, enhancement patterns as well as staging of malignant lesions.

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HYDATID CYST LIVER

Fig. 1(a) Fig. 1(b)

Figure 1(a): Ultrasound liver showing a well-defined cystic mass with thick septa and central hyperechogenic area giving "spoke wheel" appearance.(b)Computed Tomography showing well defined mass with septation.

HEMANGIOMA LIVER

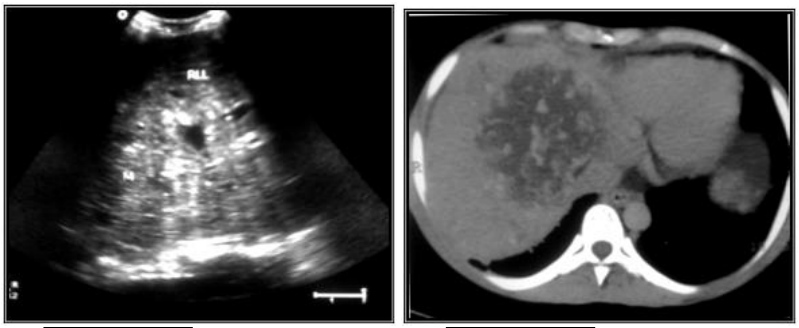

Fig. 2(a) Fig. 2(b)

Figure 2(a): Ultrasound of Liver mass showing an isoechoic mass with small cystic spaces.(b)Computed tomography of same patient showing a well-defined hypodense mass with centripetal type of enhancement-better visualization and localization of mass than sonography.

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HEPATIC INJURY (CONTUSION)

Fig. 3(a)

Fig. 3(b)

Figure 3(a): Ultrasound liver showing a hypoechoic lesion in right lobe with poor localization of the hepatic segment. (b)Computed tomography shows a well-defined lesion in the antero-inferior segment of Right lobe of liver- better visualized on CT than Sonography

EXTRAHEPATIC CHOALGIOCARCINOMA

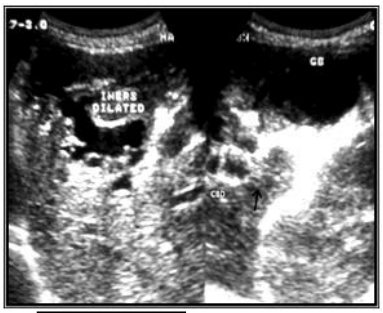

Fig. 4(a)

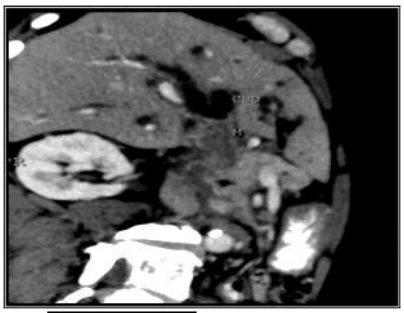

Fig. 4(b)

Figure 4(a): Ultrasound showing dilated intrahepatic and extrahepatic biliary radicles with isoechoic mass CBD (black arrow) – poorly distinguished. (b) Computed tomography showing well defined hypodense mass completely filling the lumen of CBD with Obstructive Biliopathy.

SPLENIC INFARCT

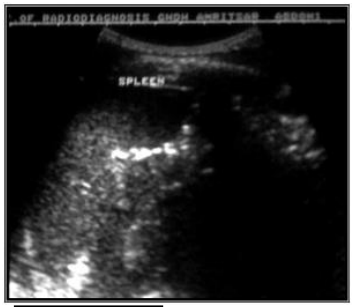

Fig. 5(a)

Fig. 5(b)

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Figure 5(a): Ultrasound spleen of patient with pain left hypochondrium showing no focal or diffuse pathology. (b)CECT Upper abdomen shows a wedge shaped hypodense area in subcapsular region in relation to the splenic convexity visualized on CT only- Splenic Infarct

GALL BLADDER MASS

Fig. 6(a)

Fig. 6(b)

Figure 6(a): Ultrasound gall bladder showing a hypoechoic mass near neck region with associated findings of gall bladder calculi. (b)Computed tomography showing well defined gall bladder mass the calculi could not be visualized on CT (Sonography is better for non-calcified GB calculi)

NECROTISING PANCREATITIS

Fig. 7(a)

Fig. 7(b)

Figure 7(a): Ultrasound showing marked enlargement of pancreas and pancreatic tissue replaced by the gangrenous tissue "phlegmon formation."(b)Computed tomography shows enlarged pancreas with pancreatic tissue replaced by a large hypodense area.

PANCREATIC PSEUDOCYST

Fig.8(a)

Fig.8(b)

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Figure 8(a): Ultrasound pancreas showing large intra pancreatic cyst with coarse level internal echoes. (b)Computed tomography shows large well defined high attenuation intra pancreatic hypodense collection, head of the pancreas is spared.

BENIGN CYSTIC NEPHROMA

Fig. 9(a)

Fig. 9(b)

Figure 9(a): Ultrasound Left kidney shows mutiseptated cystic mass which is poorly localized. (b)Computed tomography shows a well-defined mass in relation to anterior cortex of left kidney, cystic component is poorly visualized as compared to US.

EMPHYSEMATOUS PYELONEPHRITIS

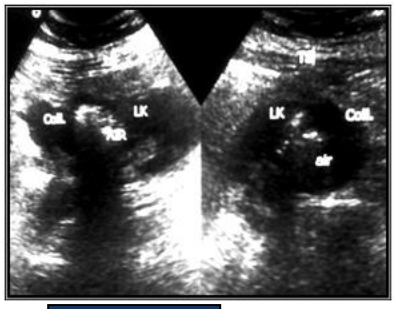

Fig. 10(a)

Fig. 10(b)

Figure 10(a): Ultrasound both kidneys showing small echogenic areas in sinus and cortical regions suggestive of air pockets. (b)Computed tomography of both kidneys showing air pockets in both sinus and cortical regions

RENAL INJURY (SHATTERED KIDNEY)

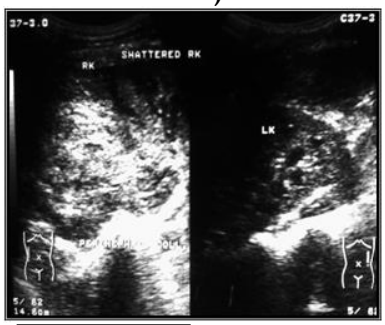

Fig. 11(a)

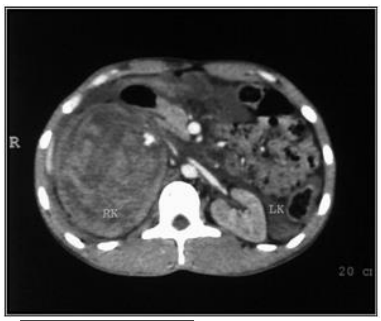

Fig. 11(b)

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Figure 11(a): Ultrasound right kidney of patient with trauma shows ill-defined heterogeneous mass replacing renal tissue. (b)Computed tomography of same patient shows whole of renal parenchyma replaced by the heterogeneous mass with intrarenal hematoma and perinephric collection suggestive of shattered kidney.

RENAL CELL CARCINOMA

Fig. 12(a)

Fig. 12(b)

Figure 12(a): Ultrasound left kidney shows a hypoechoic mass with central necrosis in upper pole. (b)Computed tomography shows well defined lobulated left renal mass with central necrosis

GASTRIC ANTRAL GROWTH

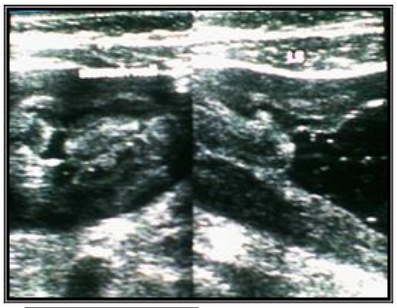

Fig. 13(a)

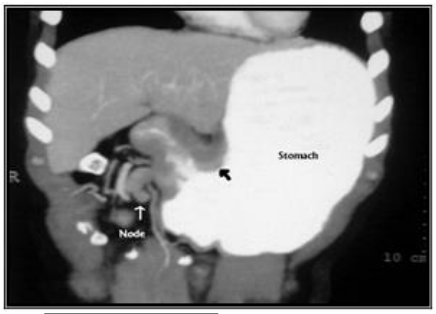

Fig. 13(b)

Figure 13(a): High resolution Ultrasound showing thickening of walls of the gastric antrum. (b)CECT Upper abdomen shows thickening of walls of the antrum (black arrow) with narrowing pyloric canal and gastric dilatation. Enlarged periantral lymph nodes are seen (white arrow).

ECTOPIC TUBAL PREGNANCY

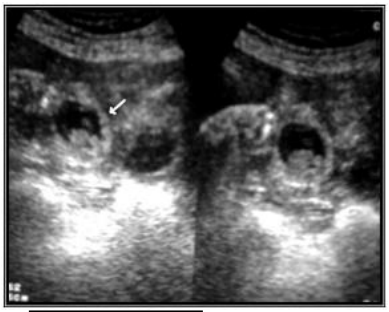

Fig. 14(a)

Fig. 14(b)

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Figure 14(a): Pelvic Ultrasound showing cystic mass with peripheral echogenic rim in right adnexal region – a small fetal node visualized in it. (b)CECT Pelvis showing a well-defined cystic area in right adnexal region with peripheral ring like enhancement. No fetal node visualized as seen in sonography. Collection with hematoma formation seen in pelvis

LARGE MULTISEPTATED CYSTIC OVARIAN MASS

Fig. 15(a) **Fig. 15(b)**

Figure 15(a): Ultrasoundpelvisshowingalargecysticmasswithseptawithanill-defined solid component. (b)Computedtomographyshowsalargemultiseptatedmasswithsolidcomponentsalongleftlateralwall

OMENTAL DEPOSITS (OMENTAL CAKE)

Fig. 16(a) **Fig. 16(b)**

Figure 16(a): Ultrasound abdomen showing hypoechoic mass in relation to the omentum –omental cake. (b)CECT Abdomen showing thickening of the omentum with formation of Omental cake in a case of ovarian carcinoma better visualized on CT scan.

DISSECTING ABDOMINAL AORTIC ANEURYSM

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Fig. 17(a)

Fig. 17(b)

Figure 17(a): Ultrasound abdominal showing dilated aorta with an echogenic flap in its lumen. (b)CECT Abdomen showing dilated abdominal aorta with an intimal flap. Contrast is seen in true and false lumen suggestive of dissecting type of aortic aneurysm

GROWTH URINARY BLADDER

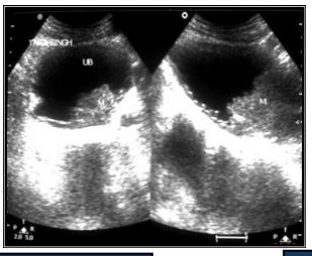

Fig. 18(a)

Fig. 18(b)

Figure 18(a): Ultrasound urinary bladder shows a sessile type of intraluminal mass along left lateral wall. (b)CECT Pelvis shows intraluminal mass with a small calcified speck. Perivesical stranding seen which helps in staging of the carcinoma.

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