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ROLE OF MSCT IN THE DIAGNOSIS OF PERFORATED GALL BLADDER; A RETROSPECTIVE STUDY IN ARMED FORCE HOSPITAL OF THE SOUTHERN REGION, SAUDI ARABIA

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ABSTRACT

Backgraound and Objective: Despite the rarely happening of Gall bladder perforation, it is considered as a dangerous illness and may consequence to developed fatal complications as acute cholecystitis. This study intended to evaluated the patients with Gall bladder perforation who were diagnosed by using multislice CT (MSCT). **Method:** this study included nineteen patients with Gall bladder perforation. The researcher followed a retrospective method to evaluate the patients who had done abdominal ultrasonography and contrast-enhanced abdominal MSCT. **Results:** after evaluating the patients over three years (2017-2019); it was found that about two thirds of patients (12) with type I GBP, six patients with type II, and only one patient with type III GBP. Gall stones, thickening of the wall, free intra-peritoneal fluid, air within the gallbladder and pericholecystic fluid collection were reported using the abdominal US. Additionally, abdominal US revealed a gall bladder wall defect in many patients. The most important finding should be noted from the MSCT review were the identification of wall

defects, whether single or numerous, connected to sub or intrahepatic abscess. **Conclusion:** It became clear that MSCT was a sensitive modality for the diagnosis of GBP and detecting its possible complications.

KEYWORDS: Gall bladder, CT, perforation.

Abbreviations: Gall bladder (GB); Gall bladder perforation (GBP); ultrasonography (US); computed tomography (CT); Multislice computed tomography (MSCT); multi-planner reformat (MPR), curved planner reformat (CPR).

INTRODUCTION

Gall bladder perforation (GBP) is rare life-threatening complication of acute cholecystitis. It has high morbidity and mortality rates due to delay in diagnosis and most cases only diagnosed during surgery.[1]

In 1934, Niemeier[2] presented his classification of gall bladder perforation. He classified GBP into three main categories: the first one is acute or type I which was characterized by the presence of gall perforation and biliary peritonitis, while the sub-acute were classified as type II in which the patients mainly presented with pericholecsytic abscess and localized peritonitis. The third category for the patients with chronic manifestations as cholecysto-enteric fistula and classified as type III.[3]

Considering the risk factors of GBP, it has been found that patients aged over 60 years were more likely to had a GBP especially those with systemic disorders such as diabetes and atherosclerotic heart disease, while in younger age it can be presented among immunosuppressed patients.[4]

Different biliary pathologic conditions can lead to acute abdominal pain. Specific diagnosis is not always possible clinically as many biliary diseases have similar signs and symptoms. Imaging can help in narrowing the differential diagnosis and guide to a specific diagnosis. Although ultrasonography (US) has been considered the most useful imaging modality for initial evaluation of the biliary system, multislice computed tomography (MSCT) is very helpful when US findings are non-conclusive, or equivocal. Diagnostic accuracy increased by optimizing the MSCT protocol and applying multiplanar reformations (MPR) to localize biliary obstruction.[5]

MSCT can be used effectively for diagnosis and detection of acute cholecystitis complications such as emphysematous, gangrenous, and hemorrhagic cholecystitis, as well as in gallbladder perforation, gallstone pancreatitis, gallstone ileus and Mirizzi syndrome.[6]

Understanding MSCT appearances plays a crucial role in the diagnosis and appropriate management of emergent biliary pathologic conditions.[7]

PATIENTS AND METHODS

In the review of 19 patients who presented with acute abdomen and acute cholecystitis over and had done MSCT during three years(2017-2019), there were 18 patients were verified histopathologically to have GBP (non-traumatic nor iatrogenic in origin) and only one patient to have cholecystoenteric fistula. Their mean age was 73 years (age range of 35 to 96 years). Most of study participants were male (thirteen) and six of them were female patients.

All patients' data, regarding the patient's history, complaints, and clinical and provisional diagnosis were collected. The radiological examination were re-evaluated again. Most of the patients had done abdominal US, and all of them had done contrast-enhanced abdominal MSCT.

Considering the MSCT technique, all the patients had done contrast enhanced abdominal MSCT using Revolution CT (512-slice multi-detector CT; General Electric, USA). The protocol was as follow: 10 mm slice thickness and a collimation of 5.0 mm for the pre-contrast scan, and slice thickness 5.0 mm and collimation 2.5 mm for post contrast scans. 120 kVp; 365mAs and rotation time 0.5s.750 ml of water-soluble iodinated contrast diluted to1% used as oral contrast. 2ml/kg of intravenous iodinated contrast injected at 2ml/s over a period of 30-40s.

Triphasic contrast scan was performed as follow; the arterial phase at 35s after contrast intravenous infusion start. The portal phase at 65s and the delayed phase at 180s after intravenous infusion of contrast material.

The MSCT studies were reviewed based on the following criteria: wall thickness of the GB (irregular or smooth), the presence of perforation, presence of fistula, presence of pericholecystic collection, and presence of gas within the gall bladder lumen/abscess (See figures 1-5).

Fig. 1 A. transabdominal US showing distended and thick-walled gallbladder with multiple tiny stones (arrow) and pericholecystic fluid. However, no clear wall defect was detected. B(Axial)&C(Coronal) contrast-enhanced CT showing the defect in the gallbladder wall and pericholecystic fluid.

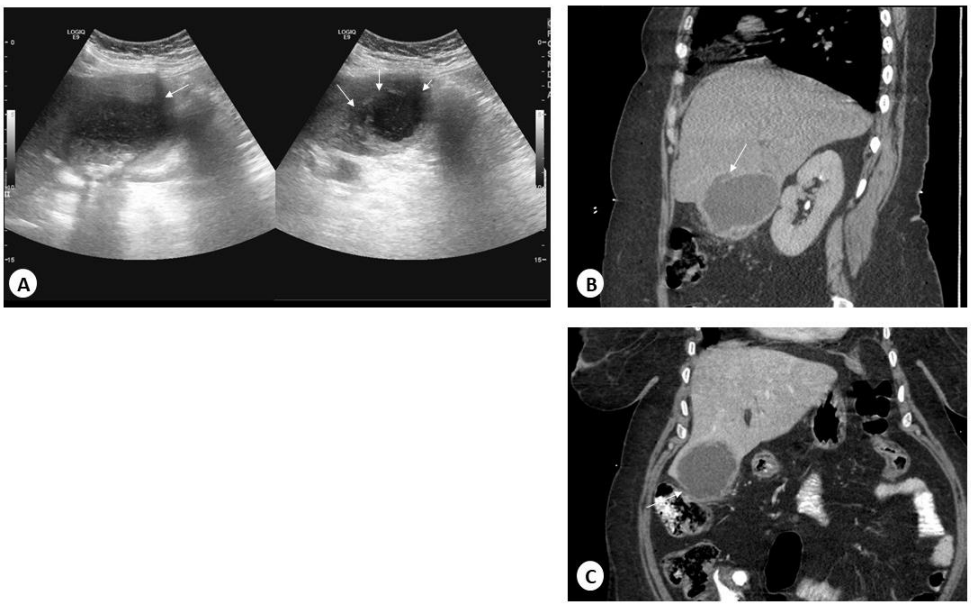

Fig. 2 A. transabdominal US showing distended and thick-walled gallbladder with multiple wall defect (arrows) and minimal pericholecystic fluid. B(Sagittal) & C(Coronal) contrast-enhanced CT showing the defects (arrows) in the gallbladder wall and minimal pericholecystic fluid.

Fig. 3 A. transabdominal US showing thick walled gallbladder (GB) and pericholecystic and subhepatic abscess (open arrow). However, no clear wall defect was detected. B(Axial) & C(Coronal) contrast enhanced CT showing the defect in gallbladder wall (arrow) and subhepatic abscess.

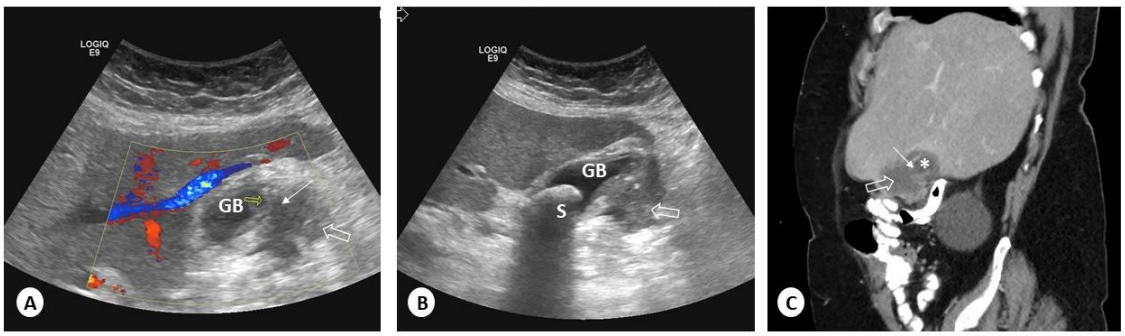

Fig. 4 A & B. Transabdominal US showing thick walled gallbladder (GB) harboring large stone (S) with wall defect (arrow) and minimal pericholecystic fluid. B(Sagittal) contrast enhanced CT showing the defects (arrows) in gallbladder (star) wall and small abscess (open arrow).

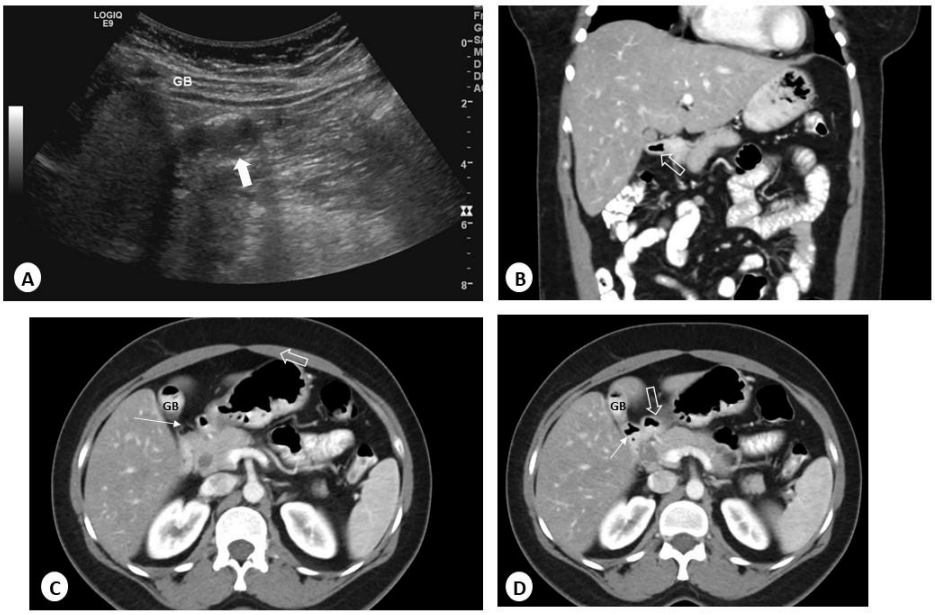

Fig. 5 A. transabdominal US showing gallbladder (thick arrow) reverberation artifact in its upper part suggestive of air. B(Coronal),C&D(Axial) contrast enhanced CT showing the gallbladder (GB) filled with oral contrast with air present within it. The fistula (arrow) identified connecting the gallbladder with duodenum (open arrow) suggestive of cholecystoduodenal fistula.

Statistical analysis: Descriptive statistics were calculated depending on patients' age, sex, history and provisional diagnosis. MSCT findings were correlated with US findings in most of the cases.

RESULTS

Nineteen patients were reviewed over a period of 3 years; their mean age was 73 years (age range of 35 to 96 years). There were 13 male and 6 female patients. The patients were presented to the hospital complaining of acute abdominal pain associated with other symptoms like fever, poor general condition, nausea and vomiting (**Table 1**).

Most of the patients had several associated systemic disorders (**Table 1**), diabetes mellitus was the most frequent one followed by hypertension. Some patients had more than one systemic disorder. However, three patients were medically free.

Table (1): Clinical presentations of the 19 studied patients. N.B. Most of patients had more than one symptom, sign and systemic disease.		
According to patient complaint	**Number of cases**	**Percentage %**
Acute abdominal pain	19	100%
Right hypochondrial pain	10	52.63%
Fever	11	57.89%
Nausea and vomiting	16	84.21%
Jaundice	10	52.63%
Toxic manifestation	2	10.52%
Associated systemic disease	**19**	**100%**
Hypertension	7	36.84%
Diabetes Mellitus	11	57.89%
Atherosclerotic heart disease	5	26.31%
Other known illness like (dyslipidemia, cerebrovascular accident, bronchial asthma, biliary pancreatitis, psychiatric illness).	7	36.84%
Medically free	2	10.52

Considering Niemeir classification for GBP, there were 12 patients with type I, 6 patients with type II and one patient with type III.

Abdominal US (**Table 2**) were performed for 16 patients, distinctive wall defect was noted in 4 patients. Pericholecystic fluid collection was detected in 5 patients with type II and 4 patients with type I and no collection was noted in type III.

Reviewing the MSCT findings (**Table 2**) of all patients considering the previously mentioned criteria, the most important finding was the detection of wall defect in all patients. MSCT was also able to define pericholecystic fluids and abscesses.

Table (2): US & MSCT findings of the 19 studied patients.						
Imaging Findings	**Ultrasound**			**MSCT**		
	Type I GBP	**Type II GBP**	**Type III GBP**	**Type I GBP**	**Type II GBP**	**Type III GBP**
Gallbladder Perforation.	3	1	0	12	6	1
Pericholecystic fluid or (collection/Abscess)	4	5	0	12	6	0

From the results, we found that GBP was commonly in elderly male patient with systemic disease. The clinical presentation and symptoms become worse in patients with complications like a sub-hepatic abscess.

The majority of the cases were elderly patients, especially those patients with diabetes, due to friability of the wall with a high possibility of parenchymal liver affections and sub-hepatic abscess formation.

Type I GBP was more common than type II. This may be related to the severe symptoms related to type I. One of the unexpected results was that the US has low sensitivity to detect GB wall defect in any patient, although it is the primary modality for biliary system examination, while the MSCT showed the defects obviously either single or multiple. This may be related to the clinical situation and uncooperation of the patients. MSCT was of great help in diagnosing the GBP and provided a good evaluation of the patient's condition and associated complications upon which the management plan and surgical procedure were decided.

DISCUSSION

Although gall bladder perforation is rare, it is one of the most sever complications of acute cholecystitis, with mortality rates reaching 15 %. Emphysematous, gangrenous and hemorrhagic cholecystitis could progress to gall bladder perforation. Diagnosis is often difficult due to similar clinical symptoms of gall bladder perforation and acute cholecystitis variants. The high morbidity and mortality rates are due to delayed diagnosis and late surgical interference.[5]

Acute non-complicated cholecystitis is more common among females; however, GBP was found to be more frequent in males.[8] On the other hand, GBP is common among elderly patients with a high incidence above 60 years, more evident in association with other systemic diseases such as diabetes mellitus, atherosclerosis, and hypertension.[4,9]

Our study included 19 patients with GBP, 6 female and 13 male patients, with age range from 35 to 96 years (mean age of 73 years). Similar age and sex incidence has been reported by Morris et al.[3] Most patients involved in our study had the systemic disease; some of them had more than one disease, and the most common systemic disease was diabetes mellitus, followed by hypertension.

The clinical symptoms of GBP may range from acute generalized peritonitis to benign non-specific abdominal complaints.[10] However, the clinical differentiation between GBP & uncomplicated cholecystitis could be difficult as the bile leak from the ruptured GB might be

contained in the extraperitoneal GB fossa & not produce immediate symptoms of peritonitis.[11] In addition, perforation and abscess formation might be suspected clinically in those patients with acute cholecystitis and suddenly become toxic or whose clinical condition was found to deteriorate rapidly.[12, 13] So, considering the clinical presentation of the patients, our study showed that all patients suffered from acute abdominal pain (100%) associated with nausea and vomiting in 16 patients (84.21%) while in 2 patients (10.52%) developed toxic manifestations. Similar findings were reported by Emre & Erdal.[1]

Different biliary pathologic conditions can lead to acute abdominal pain. Specific diagnosis is not always possible clinically as many biliary diseases have similar signs and symptoms. Imaging can help in narrowing the differential diagnosis and guide to a specific diagnosis. Ultrasonography (US) has been considered the most useful imaging modality for initial evaluation of the biliary system.[10]

Considering ultrasound examination, the findings of inflammatory reaction include thick edematous walled GB, distention, detection of gall bladder stone, pericholecystic fluid. The sonographic hole sign where the defect of GB wall is visualized is only reliable sign of GBP and it has been reported that GB wall defect could be shown by high resolution ultrasound machines in 70% of patients with GBP.[10] In another study it has reported that the site of the defect could not be visualized in ultrasound in any patient.[4]

In the current study, US examination was done for most of the patients with the previously mentioned signs of inflammation detected as well as the detected gall stones. Sub-hepatic abscess formations were detected in 5 cases and pericholecystic fluid detected in 4 patients also the hole signs or wall defect was detected in any 4 patients.

Patel et al[5] reported that, although ultrasonography (US) is the most useful imaging modality for initial evaluation of the biliary system, multi-detector computed tomography (CT) is helpful when US findings are non-conclusive, equivocal or when biliary disease is suspected. Diagnostic accuracy can be increased by optimizing the CT protocol and applying multiplanar reformations (MPR) to localize biliary obstruction. CT can be used to diagnose and stage acute cholecystitis, including complications such as emphysematous, gangrenous, and hemorrhagic cholecystitis; gallbladder perforation; gallstone pancreatitis; gallstone ileus; and Mirizzi syndrome.[6]

CT allows detailed evaluation of the biliary system, decreased operator dependence versus US, faster imaging speed, decreased artifacts and increase anatomic coverage during a single breath hold as well as its wide spread availability. MSCT shows more accurate signs of GBP such as free intra-peritoneal fluid, pericholecystic fluid & abscess formation as well as GB wall thickness & defect as described by Yeh BM.et al.[14] The most common mechanism of GBP involves cystic duct obstruction leading to GB distension, vascular compromise, ischemia, necrosis and ultimately rupture. Because of its poor blood supply, the fundus of the GB is the most common site of perforation as stated by Patel et al.[5]

Use of at least 64 detector rows at CT imaging will reduce scan times and motion artifact and increase anatomic coverage during a single breath hold. Thinner collimation allows increased spatial resolution and lesion detection but also creates increased image noise. The potentially increased patient radiation dose is a disadvantage that can be minimized by optimizing individual scan parameters. Isotropic voxel datasets obtained with CT allow the creation of multiplanar reformatted (MPR) images in the axial, coronal, sagittal, or any user-defined plane. Curved planar reformatted (CPR) images are particularly helpful for visualizing the entire common bile duct on a single image and assessing the ampulla of Vater.[7] The MSCT protocol should be designed to optimally image the biliary system to increase diagnostic accuracy. The imaging protocol corresponds to an appropriately designed clinical question. Parameters of the CT protocol include the number of imaging phases, extent of anatomic coverage, and use of oral or intravenous contrast materials.[6]

In agreement with similar study conducted by Emre & Erdal[1], the current study showed that, reviewing the MSCT findings of all patients, the most important finding to look for was wall defect detection, either single or multiple, and its site; fundus, body or neck. For all patients at least irregular wall defect detected in all patients. Six patients were associated with sub-hepatic abscess. It was found that, there is no relation between the site of the wall perforation and its type, Also, no direct relation of the wall thickness and site or type of perforation; it depends mainly on the friability of the wall as well as the vascular compromise.

Considering the complication associated with GBP, Patel et al[5] reported that the complication of GBP may include free intra-peritoneal air, bile leak, abscess formation in the liver, gall bladder fossa or peritoneum, small bowel obstruction and gall stone ileus. Studies

done by Derici H. et al[4] and Morris BS., et al[3] stated that some patients developed complication such as pneumonia, sub-hepatic abscess and pancreatitis.

In our present study, 12 patients had free intra-peritoneal fluid, 6 patients had sub-hepatic abscess. The early diagnosis of GBP and immediate surgical intervention are of crucial importance. Familiarity with CT imaging appearances plays an important factor in proper diagnosis and appropriate management of emergent biliary pathologic conditions.[7]

CONCLUSION

MSCT was found to be a sensitive modality for the diagnosis of gallbladder perforation and its related complications, and we recommended contrast enhanced MSCT for all cases with suspicion of GBP.

REFERENCES

1. Emre E, ErdalO. perforation of gall bladder. Bratislleklisty, 2008; 109(5): 210-214.
2. Niemeier OW. Acute free perforation of the gall-bladder. Ann Surg, 1934; 99(6): 922–924.
3. Morris BS, Balpande PR, Morani AC, Chaudhary RK, Maheshwari M, Raut AA. The CT appearances of gallbladder perforation. Br J Radiol, 2007; 80(959): 898–901.
4. Derici H, Kara C, Bozdag AD, Nazly O, Tansug T, Akca E. diagnosis and treatment of gall bladder perforation. World J Gastroenterol, 2006; 12: 7832-7836.
5. Patel NB, Oto A, Thomas S. multidetector CT of emergent biliary pathologic condition. Radiographics, 2013; 33: 1867-1888.
6. Kim SW, Shin HC, Kim HC, Hong MJ, Kim IY. Diagnostic performance of multidetector CT for acute cholangitis. Br J Radiol, 2012; 85(1014): 770–777.
7. Fuks D, Mouly C, Robert B, Hajji H, Yzet T, Regimbeau JM. Acute cholecystitis: preoperative CT can help the surgeon consider conversion from laparoscopic to open cholecystectomy. Radiology, 2012; 263(1): 128–138.
8. Stefanidis D, Sirinek KR, Bingener J. Gallbladder perforation: risk factors and outcome. J Surg Res, 2006; 131(2): 204–208.
9. Menakuru SR, Kaman L, Behera A, Singh R, Katariya RN. Current management of gall bladder perforation. ANZ J Surg, 2004; 74: 843-846.
10. Sood BP, Kalra N, Gupta S, Sidhu R, Gulati M, Khandelwal N, Suri S. Role of sonography in the diagnosis of gall bladder perforation. J Clin Ultrasound, 2002; 30: 270-274.

11. Wang AJ, Wang TE, Lin CC, Shih CC. Clinical predictor of severe gall bladder complication in acute cholecystitis.World J Gastroenterol, 2003; 9: 2821-2823.
12. Gore RM, Yaghmai V, Newmark GM, Berlin JW, Miller FH. Imaging benign and malignant disease of the gall bladder. RadiolClin North Am, 2002; 40: 1307-1323.
13. Hustey FM, Meldon SW, Banet GA, Gerson LW, Blanda M, Lewis LM. The use of abdominal computed tomography in older ED patients with acute abdominal pain. Am J Emerg Med, 2005; 23(3): 259–265.
14. Yeh BM, Liu PS, Soto JA, Corvera CA, Hussain HK. MR imaging and CT of the biliary tract. Radio Graphics, 2009; 29(6): 1669–1688.