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RESEARCH ARTICLE

ROLE OF HELICAL COMPUTED TOMOGRAPHY IN EVALUATION OF NON TRAUMATIC ACUTE ABDOMEN

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ABSTRACT

A series of 100 patients presenting with suspected diagnosis of non traumatic acute abdomen have been studied by helical computed tomography with the aim diagnosing the etiology of pain, to suggest the mode of management and also to o compare CT findings with clinical, ultrasound and operative findings wherever surgery was done. In the present study, pancreatitis was the most common cause of non traumatic acute abdomen present in 40% of the cases. Abscess was the second most common cause present in 20% cases. Appendicitis and urolithiasis was seen equally in 10% cases followed by cholecystitis and intestinal obstruction in 5% cases each. No abnormality was seen in 10% cases. Helical CT is an effective technique in the evaluation of patients with non traumatic acute abdominal pain, and it should be considered as an initial imaging modality in the emergency department to obtain new diagnostic information for faster and more accurate diagnosis (MacKersie *et al*., 2005).

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INTRODUCTION

The term "acute abdomen" defines a clinical syndrome characterized by the sudden onset of severe abdominal pain requiring emergency medical or surgical treatment. A prompt and accurate diagnosis is essential to minimize morbidity and mortality (Trott and Lucas, 1998). The differential diagnosis includes an enormous spectrum of disorders ranging from benign self-limited diseases to conditions that require emergency surgery (Martin and Rossi, 1997). The clinical diagnosis of acute abdomen can be challenging because physical examination, clinical presentation and laboratory examination are often nonspecific and non diagnostic. The development of cross-sectional imaging has had a tremendous impact on the diagnosis and treatment of acute abdomen as it is a reliable, rapid, cost effective, highly accurate modality and most importantly or confusing signs and symptoms (Taourel *et al*., 1992; Fishman, 1996). The introduction of helical CT technology, with advances in contrast dynamics and high-resolution reformations and volumetric data acquisition, has further enhanced the utility of CT in abdominal imaging in patients with severe abdominal pain who may require surgery or other forms of intervention (Heiken *et al*.,1993, Zeman *et al*.,1993; Mindelzun and Jeffrey Jr,1997).

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MATERIALS AND METHODS

This study was conducted on 100 patients presenting with suspected diagnosis of non traumatic acute abdomen referred by surgery and other departments of Government Medical College, Jammu. Patients were excluded if they were pregnant or of abdominal trauma. Before evaluating a patient by computerized tomography, informed consent was obtained from the patient. All CT scans were obtained with helical CT scanner. A single breath-hold scan was obtained from diaphragm to beneath the symphysis pubis using a collimation of 5-7 mm and a pitch of 1.0 -1.5. Narrow collimation (3mm) was suggested for evaluation of suspected ureteral colic and evaluation of suspected acute pancreatic and biliary conditions. The data was reconstructed at intervals of 3-7 mm, depending on the clinical indication. Non-enhanced contrast (plain) helical CT was done in evaluation of suspected ureteral colic and, in some instances, evaluation of suspected appendicitis and diverticulitis. While in other cases, contrast enhanced helical CT using intravenous, oral or rectal route was done when needed.

An attempt was also made to compare CT findings with clinical, ultrasound and operative findings wherever surgery was done.

RESULTS

In the present study, the age of the patient ranged from 8 years to 80 years with mean age group of 44.02 years. Out of the 100 patients 60 were males and 40 were females. The commonest presenting clinical feature was abdominal pain seen in 100% patients, followed by elevated WBC, nausea, vomiting, fever, jaundice and haematuria. Normal chest and abdomen x-rays were seen in 70 cases.

Pleural effusion was seen in 22 cases, diffuse haze in abdomen was seen in 5 cases, ileus was seen in 2 cases, air fluid level was seen in 4 cases, raised dome of diaphragm in 3 cases, increased distance between diaphragm and stomach air bubble was seen in 2 cases and renal/ureteric calculi was seen in 3 cases. In the present study, pancreatitis was the most common cause of non traumatic acute abdomen present in 40% of the cases, out of which 9 patients had necrotic areas within pancreatic parenchyma, with ascitis in 14 patients and pseudocysts in 4 patients. In our study, there was no case of grade A pancreatitis, there were 10% cases in grade B, 55% in grade C, 15% in grade D and 20% in grade E. Abscess was the second most common cause present in 20% cases, out of which 4 were splenic, 5 nephric/ perinephric and 11 were hepatic.

Table. Characteristics of helical ct in acute abdomen

S.No	Characteristics	No.	Percentage (%)
1.	Age (yrs)		
	Range	8-80	
	Mean age	44.02	
2.	Sex		
	Male	60	60%
	Female	40	40%
3.	Clinical features of patients		
	Abdominal pain	100	100%
	Fever	23	23%
	Jaundice	6	6%
	Vomiting	40	40%
	Elevated WBC	52	52%
	Haematuria	3	3%
	Nausea	54	54%
4.	Localization of pain		
	Right upper quadrant	22	22%
	Left upper quadrant	8	8 %
	Middle upper quadrant	35	35%
	Right lower quadrant	12	12%
	Left lower quadrant	3	3%
	Periumblical	5	5%
	Suprapubic	5	5%
	Diffuse	10	10%
5.	Abdominal examination		
	Abdominal tenderness	86	86%
	Abdominal rigidity/guarding	40	40%
	Absent bowel sounds	5	5%
6.	X ray chest and abdomen findings		
	Normal	70	70%
	Pleural effusion	22	22%
	Diffuse haze in abdomen	5	5%
	Ileus	2	2%
	Air fluid level	4	4%
	Raised dome of diaphragm	3	3%
	Increased distance between diaphragm and stomach air bubble	2	2%
	Renal/ureteric calculi	3	3%
7.	Etiology of acute abdomen on CT		
	Pancreatitis	40	40%
	Appendicitis	10	10%
	Urolithiasis	10	10%
	Cholecystitis	5	5%
	Intestinal obstruction	5	5%
	Abscess	20	20%
	No abnormality	10	10%

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8.	Findings in pancreatitis	33	82.5%
	ULTRASOUND FINDINGS		
	Bulky, enlarged pancreas with blurred margins	14	35%
	Ascitis	20	50%
	Pleural effusion	8	20%
	Gallbladder stones	7	17.5%
	Failure to visualize pancreas optimally due to distended bowel loops/obesity	4	10%
	Pseudocysts	3	7.5%
	Pancreatic necrosis		
	CT FINDINGS		
	Pancreatic involvement	34/6	85%/15%
	Diffuse/Segmental		
	Peripancreatic fat stranding Pleural effusion	36	90%
	Ascitis	23	57.5%
	Pancreatic necrosis	14	35%
	Gallbladder stones	9	22.5%
	Pseudocysts	8	20%
	Peripancreatic abscess	4	10%
		5	12.5%
	Balthazar grading system for severity of acute pancreatitis		
	Grade	0	0%
	A- Normal pancreas	4	10%
	B- Focal or diffuse glandular enlargement, irregular contour of the gland, heterogeneous attenuation, no peripancreatic inflammation	22	55%
	C- Same findings as Grade B, with peripancreatic inflammation	6	15%
	D- Same findings as Grade C, with a single fluid collection	8	20%
	E- Same findings as Grade C, with multiple fluid collections or abscess formation		
9.	FINDINGS IN UROLITHIASIS		
	(A)ULTRASOUND FINDINGS Renal stone		
	Ureteric stone		
	Hydronephrosis	5	50%
	(B)CT FINDINGS	4	40%
	Renal stone	3	30%
	Ureteric stone		
	Location	5	50%
	- Proximal third	5	50%
	-Middle third		
	-Distal third	1	10%
	-Ureterovesical junction	1	10%
	Hydronephrosis	1	10%
	Absent	2	20%
	Present		
	Periureteral stranding	7	70%
	Absent	3	30%
	Present		
	Perinephric fluid	8	80%
	Absent	2	20%
	Present		
		8	80%
		2	20%
10.	FINDINGS IN APPENDICITIS (A) ULTRASOUND FINDINGS Failure to visualize appendix		
	Non compressible, aperistaltic tubular blind ended structure with diameter > 6mm	4	40%
	Probe tenderness	5	50%
	Periappendiceal fluid collection		
	Periappendiceal echogenic fat	10	100%
	Abscess	3	30%
	(B) CT FINDINGS	2	20%
	Thickened appendix	1	10%
	Abscess		
	Appendicolith		
	Periappendiceal fluid collection	6	60%
	Periappendiceal stranding	2	20%
	Perforation	1	10%
		4	40%
		8	80%
		2	20%

Continue……

11.	FINDINGS IN CHOLECYSTITIS		
	(A)ULTRASOUND FINDINGS Gallbladder wall thickening		
	Probe tenderness	3	60%
	Gallbladder distension	5	100%
	Pericholecystic fluid	2	40%
	Cholelithiasis	2	40%
	Failure to visualize gallbladder	3	60%
	(B) CT FINDINGS	1	20%
	Gallbladder wall thickening		
	Pericholecystic fat stranding	4	80%
	Gallbladder distension	3	60%
	Pericholecystic fluid	2	40%
	Cholelithiasis	2	40%
	Gas in lumen	3	60%
		1	20%
12.	FINDINGS IN INTESTINAL OBSTRUCTION		
	(A)ULTRASOUND FINDINGS Dilated gut loops		
	Interloop fluid		
	Failure to diagnose due to gut gases/ obesity	3	60%
	(B) CT FINDINGS	1	20%
	Dilated gut loops	2	40%
	Transition between dilated and non dilated loops		
	Interloop fluid		
		5	100%
		5	100%
		2	40%
13.	LOCATION OF ABSCESS		
	Nephric/perinephric	5	
	Nephric	3	15%
	Perinephric	2	10%
	Liver	11	55%
	Spleen	4	20%
14.	Cases in which helical CT was uniquely diagnostic & resulted in alteration of proposed management		
	Acute pancreatitis		
	Acute appendicitis	4	4%
	Acute cholecystitis	2	2%
	Renal abscess	1	1%
		1	1%
15.	Cases in which critical evaluation of diagnosis was done by helical CT		
	1.Primary clinical diagnosis confirmed on Helical CT.		
	Acute pancreatitis		
	Urolithiasis		
	Acute appendicitis	24	24%
	Acute cholecystitis	7	7%
	Renal/perirenal abscess	7	7%
	Hepatic abscess	3	3%
	Intestinal obstruction	1	1%
	Total	2	2%
	2.Second or third suspected clinical diagnosis confirmed on helical	5	5%
	CT	49	49%
	Acute pancreatitis		
	Urolithiasis		
	Acute appendicitis	12	12%
	Acute cholecystitis	3	3%
	Renal/perirenal abscess	1	1%
	Hepatic abscess	1	1%
	Total	2	2%
	3.Clinical diagnosis refuted by helical CT	6	6%
		25	25%
		26	26%
16.	Cases in which helical CT was more informative than plain film and ultrasound:		
	Acute pancreatitis		
	Acute appendicitis	36	36%
	Acute cholecystitis	4	4%
	Renal/perirenal abscess	2	2%
	Hepatic abscess	2	2%
	Intestinal obstruction	4	4%
		5	5%

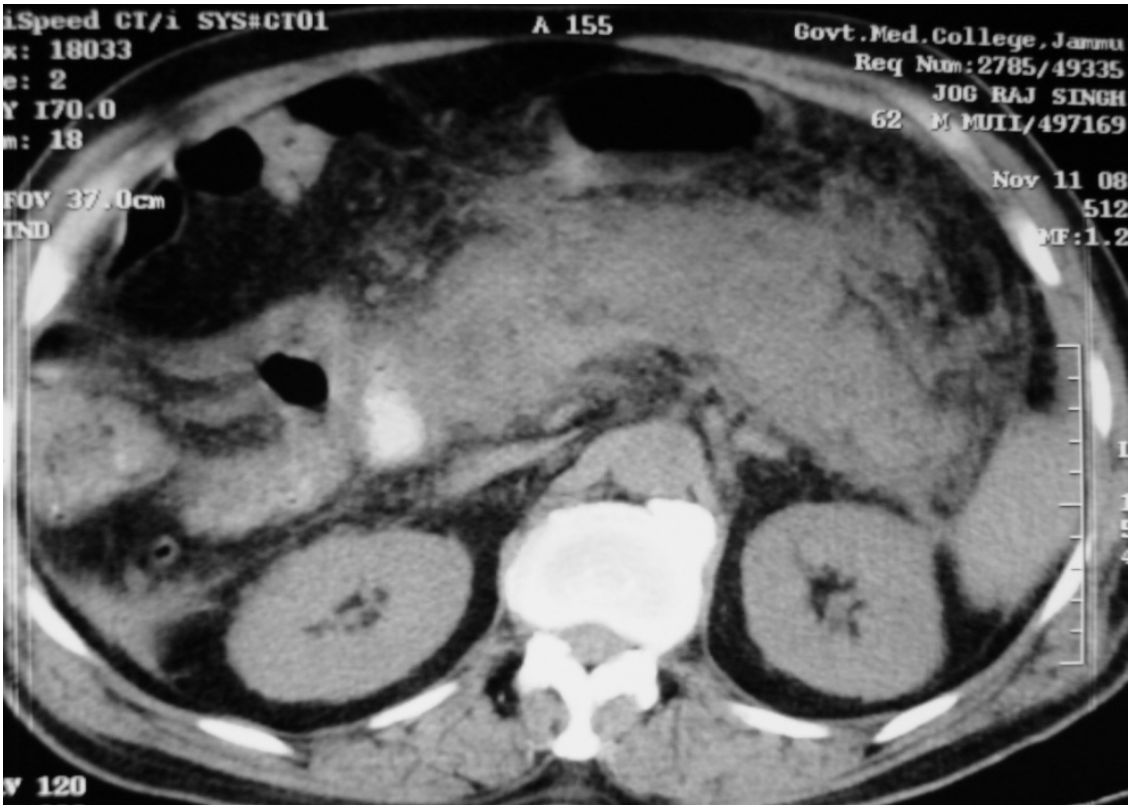

Figure 1. CT in acute pancreatitis: bulky enlarged pancreas with peripancreatic fat stranding with extension of inflammation to mesentry and pararenal space

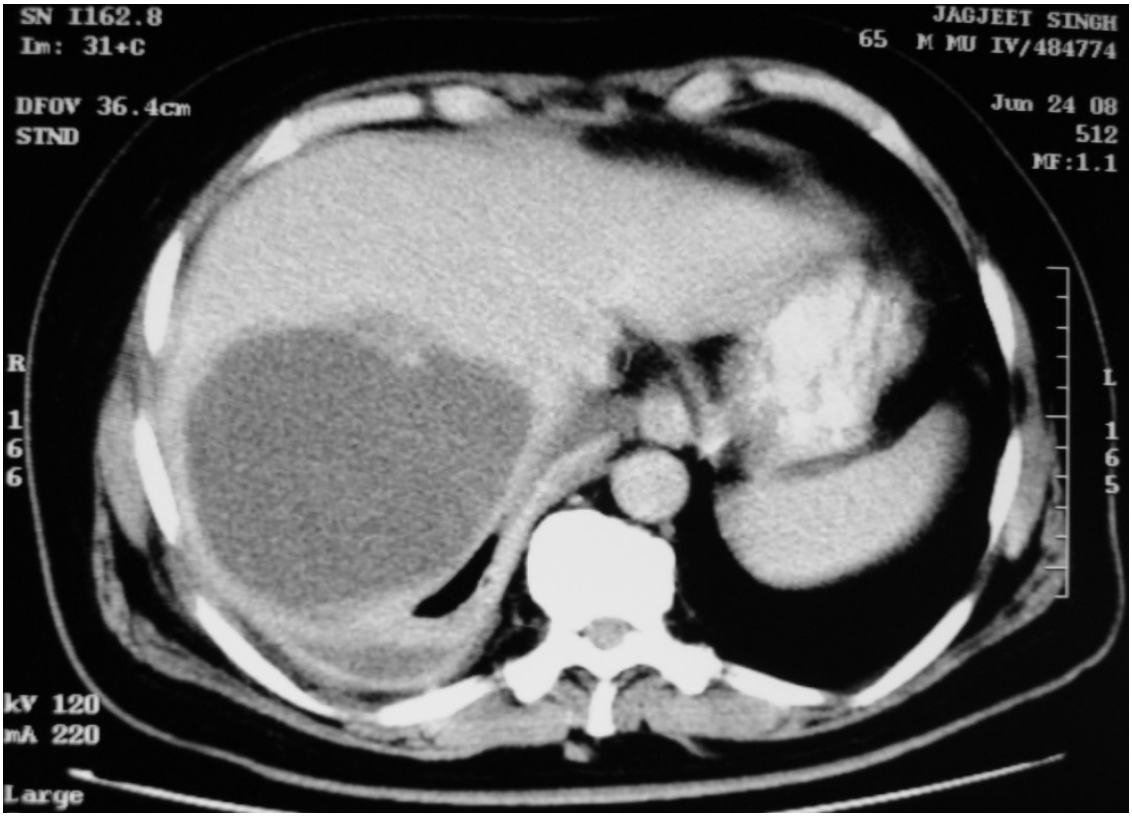

Figure 2. Liver abscess with right pleural effusion

Figure 3. CECT Abdomen in a case of cholecystitis: Distended gall bladder with thickened gall bladder wall with pericholecysic fat stranding with high attenuation bile

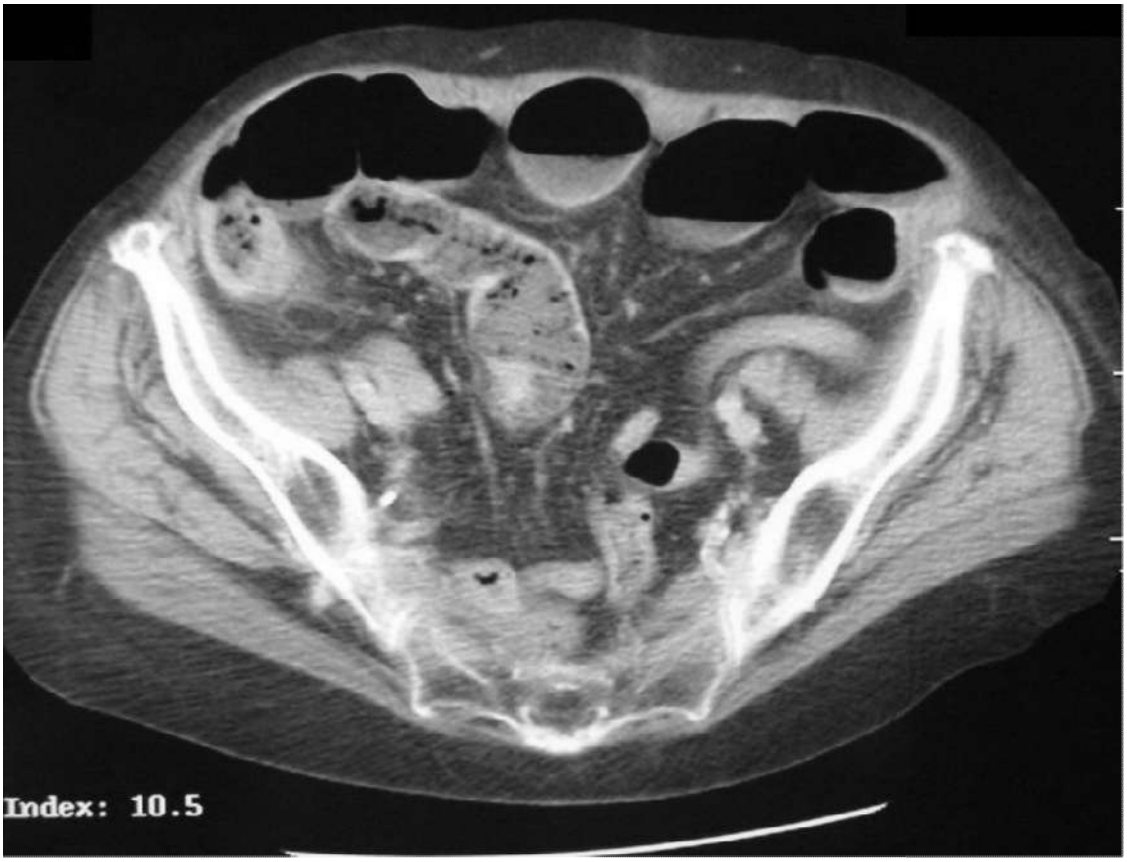

Figure 4. CT depicting dilated small bowel loops with air-fluid levels in case of intestinal obstruction.

Acute Appendicitis and urolithiasis was seen equally in 10% cases followed by cholecystitis and intestinal obstruction in 5% cases each. In cases of appendicitis, CT revealed Appendicolith within the thickened appendix was seen only in one case, Periappendiceal stranding of fat in 8 (80%) patients, Periappendiceal fluid collection in 4 (40%) patients, Perforation in 2 (20%) patients and appendicular abscess in 2 patients. In our study, there were 5 cases of cholecystitis. All five patients were female with age ranging from 45-75 years. Gallbladder wall thickening was seen in 4 (80%), pericholecystic stranding in 3 (60%), gallbladder distension in 2 (40%), pericholecystic fluid in 2 patients. Air within the gallbladder lumen was seen in 1 patient on CT study. Cholelithiasis was seen in 3 (60%) patients. No abnormality was seen in 10% cases of acute abdomen.

DISCUSSION

The term acute abdomen refers to any clinical condition characterized by severe abdominal pain that develops over a period of hours. The differential diagnosis of an acute abdomen includes a broad spectrum of causes ranging from self-limiting benign causes for which surgery may not be indicated to high-morbidity or high-mortality causes that necessitate prompt surgical intervention (Max P. Rosen *et al*., 2000). The development of cross-sectional imaging has had a tremendous impact on the diagnosis and treatment of acute abdomen. Helical CT findings in acute pancreatitis include glandular enlargement, increased attenuation and stranding in the peripancreatic fat. The pancreatic contour in acute pancreatitis may be irregular, with focal areas of decreased attenuation representing necrosis or edema. Helical CT can demonstrate progression of acute pancreatitis to a pathologic condition characterized by extensive phlegmon formation along with peripancreatic fluid collections, hemorrhage, peripancreatic abscess, and extraglandular fat necrosis and define the location and extent of pseudocysts and is helpful for surgical planning in affected patients (Bruce A. Urban and Elliot K. Fishman, 2000). Helical CT can also help detect an unsuspected, life-threatening pseudoaneurysm. A dilated, fluid-filled appendix is the most specific helical CT finding in acute appendicitis. Calcified appendicoliths and periappendiceal inflammation are helpful secondary findings. Enhancement of the appendiceal wall seen following intravenous bolus administration of contrast material and is a specific sign of inflammation. However, in patients with adequate intraperitoneal fat, diagnosis can be made without oral or intravenous contrast material because the focal nature of the periappendiceal stranding. Helical CT can also demonstrate complications of appendicitis, including perforation, phlegmon formation, small bowel obstruction, and mesenteric venous thrombosis. Associated mural thickening of the adjacent distal ileum and cecum may also occur (Bruce A. Urban and Elliot K. Fishman, 2000; Richard M. Gore *et al*., 2000).

Helical CT provides a rapid and accurate diagnosis for the presence of ureteral calculi. The level of obstruction was classified as the ureteropelvic junction; the proximal, middle, or distal third of the ureter; or the ureterovesical junction. Prone scans may be needed to differentiate ureterovesical junction stone from a recently passed stone. Secondary signs of perinephric stranding and edema provide supporting evidence for acute obstruction. Focal periureteral stranding can also help localize subtle calculi. In addition, helical CT can be used to document stone size and predict clinical outcome. Other secondary signs of obstruction, such as nephromegaly, periureteral and ureterovesical junction edema, and the "tissue rim" sign, were noted. The CT findings associated with acute cholecystitis include gallbladder wall thickening, indistinctness of the interface between the gallbladder and the liver, gallbladder distension, pericholecystic stranding, subserosal edema, pericholecystic fluid, high-attenuation bile, and the presence of luminal or mural gas. Air within gallbladder lumen or wall indicates the presence of emphysematous cholecystitis, which in turn implies underlying gangrenous changes. The most reliable CT finding in choledocholithiasis is a high-attenuation nidus within the duct (Bruce A. Urban and Elliot K. Fishman, 2000).

Tailored helical CT evaluation for suspected high-grade small bowel obstruction is best performed without oral contrast material. However, in cases of low-grade obstruction, use of oral contrast material is indicated. The essential helical CT finding in small bowel obstruction is a definable transition from dilated to decompressed small bowel. Careful inspection of the transition point and luminal contents of the bowel will often reveal the underlying cause of obstruction. Findings that suggest strangulation include poorly enhanced or unenhanced bowel wall and the serrated beak sign (Bruce A. Urban and Elliot K. Fishman, 2000). Air-fluid and fluid-fluid levels within the spleen are almost diagnostic for abscess and fluid-fluid levels have been recently demonstrated by CT and sonography. With CT, the renal abscesses characteristically appeared as well defined, low-density parenchymal lesions. There will be thickening of adjacent renal fascia in abscesses which were contiguous with perirenal fat whereas in abscesses confined to the cortex and not adjacent to perirenal fat, there was no fascial thickening. In perinephric abscess, CT findings included perirenal fluid collections or gas bubbles with distortion of the renal contour and thickening of adjacent renal fascia (William Hoddick *et al*., 1983). In liver abscess, CT scan appearances are in the form of a well-defined homogeneous, hypodense area. Intravenous contrast defines and highlights the abscess very well. The wall of the abscess is relatively avascular; therefore it does not enhance however the periphery may appear a bit hyperdense due to compressed hyperemic liver parenchyma (Kapoor, 1989).

The accurate clinical assessment of acute abdominal pain remains one of the most challenging areas of emergency medicine. CT has been shown to increase the referring physician's level of certainty in the diagnosis, reduce hospital admission rates, and help guide the therapeutic strategy, including surgical intervention (Max P. Rosen *et al*., 2000). Emergency helical CT examination was found more informative than plain radiography and ultrasound in case of acute pancreatitis, abscesses and urinary calculi. Helical CT is an effective technique in the evaluation of patients with non traumatic acute abdominal pain, and it should be considered as an initial imaging modality in the emergency department (MacKersie *et al*., ?)

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