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Original Article

Utility of 64-row multidetector computed tomography in diagnosis and management of small bowel obstruction

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ABSTRACT

Purpose: The goal of the study was to assess and confirm the role of 64-slice multidetector computed tomography (MDCT) with its new applications for diagnosis and its impact on management of small bowel obstruction.

Patients and methods: Prospective study included 40 patients, referred for radiological assessment of one or more of symptoms of intestinal obstruction or acute abdomen. Patients with clinical suspicion of high grade SBO (30 patients) underwent MDCT, while those with low grade SBO (10 patients) were offered MDCT enterography and the results were compared to the final clinical and surgical diagnosis as well as the histopathology results.

Results: 18 patients were found to have intrinsic cause of SBO. 17 patients found to have extrinsic cause of SBO including adhesions and different types of hernia. 1 patient with an intraluminal cause (gall stone ileus) and 4 patients with variety of causes involving ileus, midgut volvulus and Ladd's band compressing duodenum. Those results were compared to final clinical surgical diagnosis with 100% accuracy, sensitivity and specificity.

Conclusion: 64-slice MDCT have a very high sensitivity, specificity and accuracy to diagnose and determine the cause of SBO, allowing for better planning of required surgeries.

1. Introduction

Small bowel obstruction is a common clinical problem [1]. It is a common cause of hospital admission and surgical consultation, representing 20% of surgical admissions for acute abdomen [2]. The radiological investigations, indications and timing of surgical intervention of patients with SBO have changed over the past two decades [3]. Recently, due to the increased advanced modalities of abdominal imaging in cases of SBO, combined with the widespread assumption that most of these conditions resolved spontaneously with nonsurgical measures, namely naso-intestinal decompression, imaging has become the primary focus in the treatment of patients with SBO. Therefore, radiology play an important role in assisting the therapeutic decision of the surgeon in these cases by addressing many questions: Is the small bowel obstructed? Where is it located? How severe is the obstruction? and What is the etiology? Is there a strangulation? [4]. Computed tomography (CT) emerged two decades ago as an outstanding imaging tool for preoperative evaluation of SBO, with high sensitivity (90–96%), specificity (96%), and accuracy (95%). However, these results apply mostly to cases of high-grade obstruction, with low-grade obstruction being a relative "blind spot" for standard CT. Newer multidetector CT scanners with multiplanar reformation capability are significantly more efficient in SBO evaluation as well as correlation of the degree of obstruction with pathologic tissue damage. The examination is fast, does not require oral contrast material (the retained intraluminal fluid serves as a natural negative contrast agent) and it is capable of early demonstration of strangulation [5,6]. The goal of this study was to assess and confirm the role of 64 multislice computed tomography (64 MDCT) with its new applications such as reformatted images, high resolution imaging and enterography for diagnosis and its impact on management of SBO.

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2. Patients and methods

2.1. Patients

The study was prospective over the period from June 2014 to May 2016, and included 40 patients, 29 males and 11 females, ranging in age from 14 to 93 years. They referred for radiological assessment of one or more of the following symptoms: inability to pass stools, constipation, acute abdomen, vomiting and nausea. Pregnant females, patients with life threatening condition or severe cardiac disease causing orthopnea and patients with contraindications for contrast medium were excluded.

For each patient the following were done before imaging: full clinical assessment (including recording of age, sex and presentation), revision of the patient's laboratory investigations (including renal function tests) as well as the radiological & endoscopic diagnostic investigations previously done for the patients.

Patients with clinical suspicion of high grade SBO (complete obstruction where no feces nor flatus can be passed by the patient) were scheduled to undergo 64 MDCT (30 patients), while those with low grade SBO (partial obstruction where long periods of constipation is present but the patient passes flatus or feces from time to time) were offered MDCTE (10 patients) and the results were compared to the final clinical and surgical diagnosis as well as the histopathology results in all patients. All studies were performed after written consents from the patients.

2.2. MSCT and MDCTE techniques

All examinations were performed using 64 channels MDCT scanners (Philips easy vision & GE Medical Systems).

30 patients were examined by MDCT. The patient lies supine on the examination table and images were obtained from the diaphragm superiorly down to the symphysis pubis as determined from the scout image. Imaging was performed with slice collimation 2.5 mm, Pitch 1–1.5, matrix 512×512, 200–350 mA and 120–140 kilovolt with total scanning time of 6–10 s. IV contrast medium (about 50 ml) of non-ionic contrast medium iopromide (Ultravist 300; Berlin, Germany) according to the body built (1.5 ml/kg body weight) was given by infusion pump at rate 3 ml/s. Portal phase images were obtained usually 30–40 s after initiation of IV contrast.

10 patients were examined by MDCTE. Prior to examination, the patients had been fasting for at least 6 h. A large bore (18-gauge) intravenous line was placed in the antecubital fossa. Negative oral contrast medium solution was given; (a mixture of 1150 cc of water and 200 cc of lactulose 67%) within 54 min in a continuous regular manner (150 cc every 6 min). IV spasmolytic drug (Hyoscine-N-butyl bromide 0.2 mg/kg body weight) also was given just before imaging to relax any smooth muscle spasm that mimics bowel wall thickening & abnormal enhancement (3 patients did not take the spasmolytic drug due to presence of contraindications; e.g. glaucoma, cardiac disease and prostatic enlargement).

From this data set, a set of axial 3 mm sections and a set of 3 mm thick coronal, sagittal and oblique multi-planar reformatted images at 3 mm intervals encompassing the entire bowel were generated.

2.3. Image analysis

The studies were read by two consultant radiologists (double blind protocol) on the workstation of the CT machine with MPR which in turn helped a lot in determining the levels & causes of obstructions. They were interpreted in conjunction with help from referring clinicians.

2.4. Statistical analysis

The radiological findings were compared with the final clinical surgical diagnosis. From our 40 patients 29 had surgery which had confirmed the radiological diagnosis, while 11 patients had been managed conservatively by nasogastric suctions and clinical follow up (only one case with submucosal hematoma had a follow up CT). The sensitivity, specificity and accuracy were calculated.

3. Results

This study included 40 patients, 11 females (27.5%) and 29 males (72.5%). ranging in age from 14 to 93 years and the mean age was 49.6 years.

18 patients (45%) were found to have intrinsic cause of SBO which included (carcinoid tumor 11.1%, appendicular cause 11.1%, MVO 11.1%, Crohn's disease 11.1%, lymphoma 5.6%, ileal carcinoma 5.6%, renal carcinoma involving jejunum 5.6%, submucosal lesions 16.7% and colonic cancer 22.2%). 17 patients 42.5% found to have extrinsic cause of SBO including (adhesions 58.8% and different types of hernias 41.2%). One patient with an intraluminal cause 2.5% GSI (gall stone ileus) and 4 patients 10% with variety of causes involving ileus 50%, midgut volvulus 25% and Ladd's band compressing duodenum 25% (Table 1).

These results were compared to final clinical/surgical diagnosis with 100% accuracy, sensitivity and specificity.

Correlating patient gender to the causes revealed that the intrinsic and extrinsic causes of SBO were the dominant diagnoses encountered (Table 2).

30 patients (75%) where offered MDCT examination of the abdomen & pelvis and those were the patients who had a high grade SBO. While the rest of them (10 patients, 25%) underwent MDCTE as they had low grade small bowel obstruction (Table 3).

The intrinsic causes included colonic cancer, submucosal lesions e.g. carcinoid tumors, appendicitis and appendicular abscess, mesenteric venous thrombosis (MVT), Crohn's disease and ileal carcinomas.

In diagnosing colonic cancer that led to 2ry small bowel obstruction (met at three of our cases) the signs were straight forward. Two patients had a large cecal mass lesion which obstructed the ileocecal valve while another patient had a sigmoid colonic circumferential wall thickening which lead to large bowel obstruction (LBO) and 2ry small bowel obstruction.

In six of our patients we encountered submucosal pathologies. Carcinoid alone made about third of these cases (Fig. 1). Each was ileal carcinoid with mesenteric metastasis which made them easier to be spotted. Other causes of submucosal lesions included submucosal granuloma from previous surgical intervention (suture granuloma), submucosal lipoma (with 2ry intussusception), submucosal hematoma (which is rare but was spontaneous due to thrombocytopenia) & ileal carcinoma.

Two cases were due to appendicular pathologies namely appendicitis and appendicular abscess. Another one was due to surgical hernia at the site of appendectomy scar which is extremely rare. The mechanism of SBO secondary to appendicular inflammation is usually due to ileus rather than mechanical etiology. Usually the SBO would resolve spontaneously after treating the more grave pathology in those cases which is the inflammation. All three patients were young from 15 to 30 years.

We had two cases of MVT (Fig. 2) which is a relatively uncommon cause for SBO. In our cases we observed distended thrombosed superior mesenteric veins with filling defects, surrounding fatty stranding, free intraperitoneal fluid (ascites) and thickened small bowel wall with submucosal edema, luminal narrowing and proximal small bowel dilatation.

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