Role of MDCT in Diagnosis of Small Bowel Obstruction

Thesis

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Contents

LIST OF ABBREVIATIONS

BMFT	***Barium Meal Follow-Through***
CE	Contrast Enhancement
CF	Cystic Fibrosis
cm	Centi-meter
CT	Computed Tomograhy
CTE	Computed Tomography Enteroclysis
2D	Two Dimensional
3D	Three Dimensional
DIOS	Distal Intestinal Obstruction Syndrome
F	French
Fig.	Figure
FOV	Field Of View
GIST	Gastro Intestinal Stromal Tumour
GIT	Gastrointestinal Tract
GVHD	Graft Versus Host Disease
KV	Kilo-volt
IV	Intra-Venous
IVC	Inferior Vena Cava
LBO	Large Bowel Obstruction
LUQ	Left Upper Quadrant
m	Meter
mAs	MilliAmpere Second
MC	Methyl-Cellulose
MDCT	Multi-Detector Computed Tomography
MIP	Minimum Intensity Projection
mm	Milli-meter
MPR	Multi Planar Reformation
MRI	Magnetic Resonance Imaging
MSCT	Multi-Slice Computed Tomography
RLQ	Right Lower Quadrant
S	Second
SBO	Small Bowel Obstruction
SC	Section Collimation

SMV	Superior Mesenteric Vein
SSCT	Single Slice Computed Tomography
Tab	Table
US	Ultrasound
VRT	Volume Rendering Technique

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Introduction

Small bowel obstruction (SBO) is a common clinical condition that occurs 2ry to mechanical or functional obstruction of the small bowel, preventing normal transit of its contents and for which effective treatment depends on a rapid and an accurate diagnosis. It is a frequent cause of hospitalization and surgical consultation, representing 20% of all surgical admissions for acute abdominal pain **(Foster et al., 2006).**

Clinical signs and symptoms do not provide sufficient information for diagnosis or to guide management. Despite advances in imaging and the better understanding of small bowel pathophysiology, SBO is often diagnosed late or misdiagnosed, resulting in marked morbidity and mortality**(Silva et al., 2009; Taourel et al., 2011).**

Although "never let the sun set on a small bowel obstruction" was a surgical dictum for years, many patients will be successfully managed conservatively with nasogastric suctioning and bowel rest. Surgery may be needed if conservative treatment fails and emergent surgery is indicated in the presence of bowel ischemia. For guiding surgical management, it is critical to differentiate simple uncomplicated obstruction from that with superimposed ischemia or incarceration **(Desser & Gross, 2008; Maglinte et al., 2005).**

A comprehensive approach that includes patient history, clinical findings and triage examinations such as plain abdominal radiography will help the clinician develop an individualized treatment plan. Radiology assumes considerable relevance in assisting the therapeutic decision of the surgeon in cases of SBO by addressing the following questions: Is the small bowel obstructed? How severe is the obstruction? Where is it located? What is its cause? And is strangulation present? **(Silva et al., 2009).**

CT has become a mainstay in diagnosing bowel obstruction. Because the management of obstruction has dramatically changed with a decrease in the proportion of patients who need surgery, of the time of surgery, which may be delayed and the type of surgery, with sometimes a coelioscopic procedure, a precise CT evaluation is now both the gold standard and the common approach in patients with suspected bowel obstruction**(Taourel et al., 2011).**

Multidetector CT (multislice CT, multidetector- row CT, multisection CT) represented a breakthrough in computed tomography (CT) technology. It has transformed CT from a transaxial cross sectional technique into a true 3D imaging modality that allows for arbitrary cut planes as well as excellent 3D displays of the data volume. Multidetector CT scanners provide a huge gain in performance that can be used to reduce scan time, reduce section collimation (SC) or to increase scan length substantially**(Mahesh, 2002;Prokop, 2003).**

MDCT has the potential to provide high-resolution multiplanar imaging. This high-quality reformatted series and particularly coronal reformatting is useful in the identification of the transition point and in the analysis of the cause and of the mechanism of the obstruction, also allow accurate delineation of various pathological conditions. Furthermore, the rapid acquisition of images within one breath-hold reduces misregistration artifacts than can occur in critically ill or uncooperative patients also has overcome peristaltic intestinal artifacts, allowing optimal bowel visualisation and contrast enhancement (CE**) (Sinha & Verma, 2005;Taourel et al., 2011).**

Aim of the Work

The aim of this study is to discuss the usefulness of MDCT in the evaluation of SBO, the underlying causes and the related conditions. An algorithmic and schematic approach for imaging work-up and evaluation of patients with SBO would be included. A number of representative cases would be included in our study to highlight the importance of MDCT imaging in the diagnosis of SBO.

Anatomy of the Small Intestine

The intestine is divided according to diameter into two sections; the small and the large intestine. The small intestine is that portion of the gastrointestinal tract (GIT) between the pyloric sphincter of the stomach and the ileocecal valve that opens into the large intestine. The small intestine is divided into duodenum, jejunum and ileum **(Van De Graaff, 2001).**

1-Duodenum

The duodenum is the first and shortest (25 cm) part of the small intestine and is also the widest and most fixed part. It follows a C-shaped course around the head of the pancreas. The duodenum begins at the pylorus on the right side and ends at the duodenojejunal junction on the left side (Fig.1). The junction usually takes the form of an acute angle, the duodenojejunal flexure. Most of the duodenum is fixed by peritoneum to structures on the posterior abdominal wall and is considered partially retroperitoneal. The duodenum is divisible into four parts:

- Superior (first) part: short (approximately 5 cm) and lies anterolateral to the body of the L1 vertebra.
- Descending (second) part: longer (7 to 10 cm) and descends along the right sides of the L1 to L3 vertebrae.
- Horizontal (third) part: 6 to 8 cm long and crosses the L3 vertebra.
- Ascending (fourth) part: short (5 cm) and begins at the left of the L3 vertebra and rises superiorly as far as the superior border of the L2 vertebra(**Moore&Dalley, 2006).**

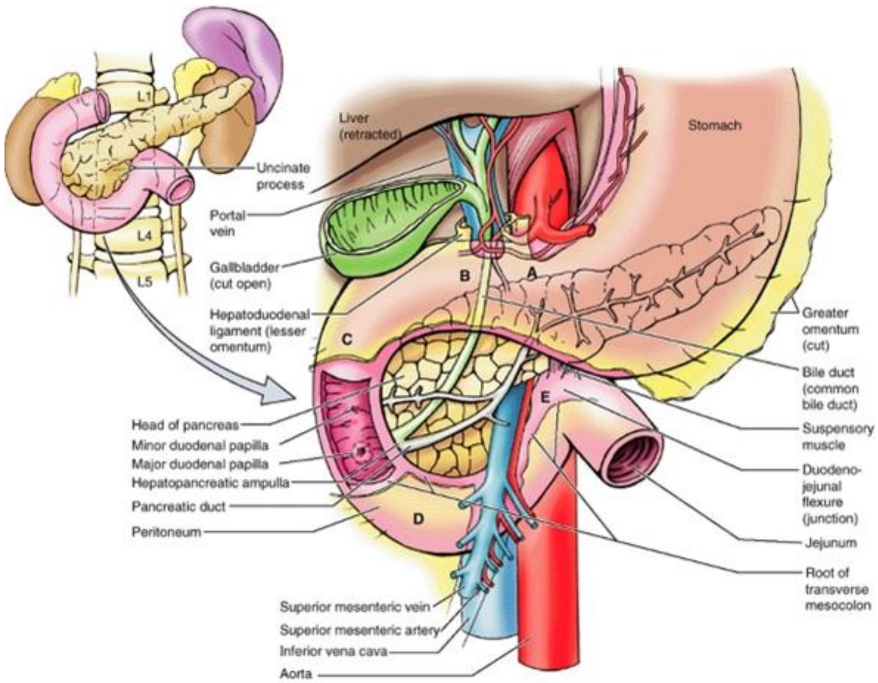

Figure 1: Relationships of the Duodenum (Moore &Dalley, 2006).

The first 2 cm of the superior part of the duodenum, immediately distal to the pylorus, has a mesentery and is mobile. This free part, called the ampulla (duodenal cap), has an appearance distinct from the remainder of the duodenum when observed radiographically using contrast medium. The principal relationships of the duodenum are shown in (Fig.1) **(Moore & Dalley, 2006).**

The arteries of the duodenum arise from the celiac trunk and the superior mesenteric artery. The veins of the duodenum follow the arteries and drain into the portal vein, some directly and others indirectly, through the superior mesenteric and splenic veins**(Moore &Dalley, 2006).**

2-Jejunum and Ileum

The second part of the small intestine, the jejunum, begins at the duodenojejunal flexure where the alimentary tract assumes an intraperitoneal course. The third part of the small intestine, the ileum, ends at the ileocecal junction, the union of the terminal ileum and the cecum (Figs.2& Fig.3). The jejunum and ileum make up the convolutions of the small intestine occupying most of the infracolic division of the greater sac of the peritoneal cavity. Together, the jejunum and ileum are 6-7 m long, the jejunum constituting approximately two fifths and the ileum approximately three fifths of the intraperitoneal section of the small intestine **(Moore &Dalley, 2006).**

Most of the jejunum lies in the left upper quadrant of the infracolic compartment, whereas most of the ileum lies in the right lower quadrant. The terminal ileum usually lies in the pelvis from which it ascends, ending in the medial aspect of the cecum. Although no clear line of demarcation between the jejunum and ileum exists, they have distinctive characteristics that are surgically important (Fig.4& tab.1)**(Moore &Dalley, 2006).**

The superior mesenteric artery supplies the jejunum and ileum (Fig.5). The SMA usually arises from the abdominal aorta at the level of the L1 vertebra, approximately 1 cm inferior to the celiac trunk and runs between the layers of the mesentery sending 15-18 branches to the jejunum and ileum. The arteries unite to form loops or arches, called arterial arcades, which give rise to straight arteries;called vasa recta (Figs.4& Fig.5)**(Moore &Dalley, 2006).**

The veins of the jejunum and ileum follow the arterial supply and drain into the superior mesenteric vein. It lies anterior and to the right of the SMA in the root of the mesentery. The SMV ends posterior to the neck of the pancreas, where it unites with the splenic vein to form the portal vein**(Robbins&Virjee, 2006).**

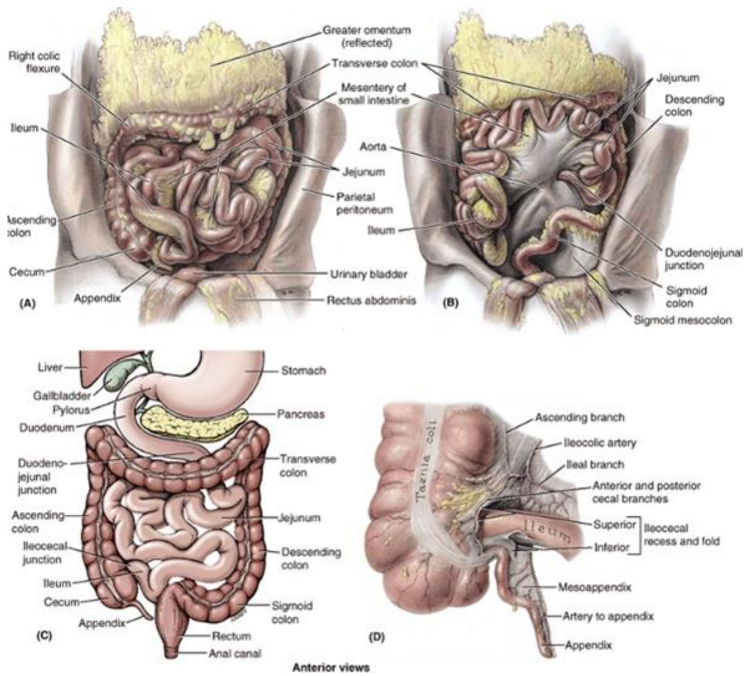

Figure 2: Small and large intestine. A) Note the convolutions of small intestine in situ, encircled on three sides by the large intestine and revealed by elevating greater omentum. B) The convolutions of small intestine have been retracted superiorly to demonstrate the mesentery. C) This orientation drawing of the alimentary system indicates the general position and relationships of the intestines. D) The blood supply of the ileocecal region is shown (Moore &Dalley, 2006).

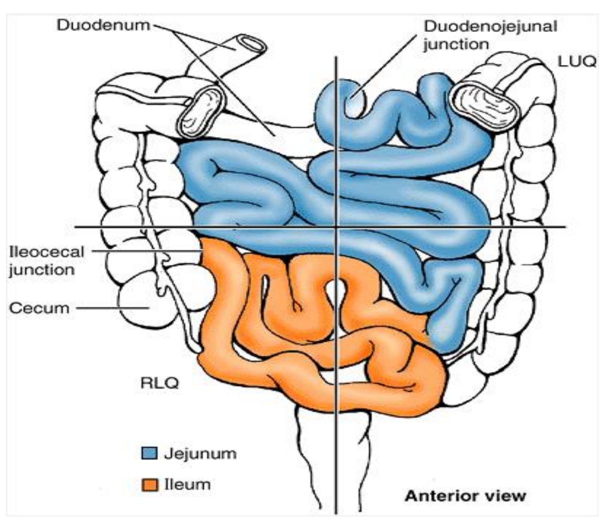

Figure 3: Jejunum and ileum. The jejunum begins at the duodenojejunal flexure and the ileum ends at the cecum. The combined term jejunoileum is sometimes used as an expression of the fact that there is no clear external line of demarcation between the jejunum and the ileum. LUQ, left upper quadrant; RLQ, right lower quadrant(Moore &Dalley, 2006).