The Role of Multidetector CT in the Diagnosis and Staging of Blunt Abdomino-Pelvic Trauma in Intially Stable Patients

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List of Abbreviations

Abb.	Meaning
3D	Three Dimensional
AAST	The American association for the surgery of trauma
BDR	Blunt diaphragmatic rupture
CT	Computed tomography
D.R	Diaphragmatic rupture
FAT Sat	Fat suppression
FFH	Fall from height
FIESTA	Fast imaging employing steady state acquisition
GRE	Gradient echo sequence
IVC	Inferior vena cava
L.S	Lumbar spine
MDCT	Multidetector computed tomography
MIP	Maximum intensity projection
MPD	Main pancreatic duct
MPR	Multiplanar reformat
MRCP	Magnetic resonance cholangiopancreatography
MRI	Magnetic Resonance Imaging
RTA	Road traffic accident
US	Ultrasonographic scans

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Introduction

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. It is one of the most challenging conditions emergency department physicians encounter because of varied presentations. An abdominal blunt injury which does not seem serious on initial presentation and on clinical examination can actually be a serious intra-abdominal organ injury **(Bodhit et al., 2011).**

The care of the trauma patient is demanding and requires speed and efficiency. Evaluating patients who have sustained blunt abdominal trauma (BAT) remains one of the most challenging and resource-intensive aspects of acute trauma care.

Blunt abdominal trauma usually results from motor vehicle collisions, recreational accidents, or falls. Men tend to be affected slightly more often than women. The most commonly injured organs are the spleen, liver, retroperitoneum, small bowel, kidneys, bladder, colorectum, diaphragm, and pancreas **(Udeani et al., 2011).**

The management of blunt abdominal injury has changed considerably, diagnostic peritoneal lavage (DPL) first described in 1965, resulted in a decrease in mortality and morbidity, following abdominal trauma the procedure of choice for the quick diagnosis of a hemoperitoneum. A focused assessment with sonography (FAST) examination has replaced the use of diagnostic peritoneal lavage, because the latter is an invasive procedure and provides no information about which organ is injured, resulting in a high rate of negative or non-therapeutic laparotomies **(Van Der Vlies et al., 2011).**

As early as 1971, the utility of ultrasound scanning was documented. The American College of Radiology also recommends the use of ultrasonography and specifically, the FAST scan to evaluate for free or localized intra-abdominal fluid collections **(Hwang et al., 2011).**

Despite its efficacy and non-invasive character, FAST has several important disadvantages. First, FAST does not accurately detect the extent (grade) or the exact site of the organ injury. Second, its sensitivity for direct demonstration of blunt abdominal injury is relatively low (between 34% and55%), since the presence of free fluid in sufficient quantity indirectly indicates intraperitoneal injury. Other limitations of FAST include operator dependence, limited retroperitoneal accuracy, and poor scanning results in obese patients or patients with overlying wounds **(Van Der Vlies et al., 2011).**

Computed tomography (CT) is currently a widely available imaging technique in clinical practice. Technical developments of CT imaging, especially the emergence of multislice CT, with increased scanning speed and volume as well as higher spatial and temporal resolution, CT has become an important diagnostic imaging modality in the emergency department, with high diagnostic accuracy and efficacy in trauma patient **(Sun and Vijayananthan ,2010).**

Currently, multidetector computed tomography (MDCT) scanning with intravenous contrast is the gold standard diagnostic modality in hemodynamically stable patients with intra-abdominal fluid detected with FAST. MDCT scanning with intravenous contrast has numerous advantages. First, the detection of injuries related to the liver, spleen and kidney can be reliably determined, with a sensitivity of 90-100%. Second, active bleeding (a contrast blush), can be diagnosed, the MDCT scan plays a decisive part in the order of treatment if more than one injury is present **(Van Der Vlies et al., 2011).**

MDCT readily detects direct and indirect features of bowel and/or mesenteric injury an important advance given that unrecognized bowel and mesenteric injuries may result in high morbidity and mortality **(Jinxing et al., 2010).**

Multidetector CT offers significantly faster scanning times and improved image resolution due to thinner collimation and reduced partial volume and motion artifacts **(Daly et al., 2008).**

The ability of CT to perform and produce fast-processing images, such as multiplanar reconstruction (MPR), is important for accurate interpretation of abnormalities **(Hassan et al., 2010).**

Aim of Work

To emphasize the role of MDCT in diagnosis and staging of blunt abdominal trauma patient, affecting the accurate assessment in the critical early period.

A- Gross Anatomy of the Abdomen and Pelvis

THE DIAPHRAGM

The diaphragm forms the highly convex floor of the thoracic cage. It arises from vertebral, costal and sternal origins and from the central tendon. The right crus is attached to the bodies and discs of L1-L3vertebra. The smaller left crus arises from the vertebral body and disc of L1and L2 vertebra **(Ryan et al., 2007).**

There are three major openings through which major structures pass from the thorax into the abdomen: the caval opening for the inferior vena cava, most anterior, at the T8 vertebral level to the right of the midline; the esophageal hiatus, intermediate, at T10 level and to the left; and the aortic hiatus, which allows the aorta to pass posterior to the vertebral attachment of the diaphragm in the midline at T12 **(Agur et al., 2009).**

Vascular supply:

The diaphragm is supplied from its abdominal surface by the inferior phrenic arteries from the abdominal aorta. The costal margins are supplied by the intercostal arteries **(Ryan et al., 2007).**

THE LIVER

The superior surface of the liver is dome-shaped, follows the contours of the diaphragm and may extend anteriorly as far as the inferior edge of the liver. Its major landmark is the sagittal groove, a notch for the ligamentum teres (formerly the umbilical vein), which lies in the free edge of the falciform ligament. The porta hepatis, the main feature of the inferior or visceral surface, is a central depression for the passage of the portal vein, hepatic artery and common bile duct **(Grainger et al., 2008).**

Anterior to this is the gallbladder fossa with the quadrate surface to its left. Posteriorly the caudate lobe separates the porta from the inferior vena cava (IVC). Several shallow impressions relate to the shape of adjacent organs, the most significant being that caused by the right kidney **(Grainger et al., 2008).**

Vascular supply:

The liver has a unique dual blood supply, with approximately 75% originating from the portal venous system and 25% coming from the hepatic artery. The hepatic veins drain filtered blood from the liver into the inferior vena cava (IVC) **(Grainger et al., 2008).**

The caudate lobe or segment I is considered autonomous, due to its blood supply. It receives vessels from both left and right branches of the portal vein and hepatic artery and it has an independent venous drainage directly into the IVC **(Grainger et al., 2008).**

THE SPLEEN

The spleen lies superficially in the left upper abdominal quadrant between the 9th and 11th ribs. Note the impressions (colic, renal and gastric areas) made by structures in contact with its visceral surface, the superior border is notched **(Agur et al., 2009).**

The spleen is the size of a fist, measuring up to 12 cm Long, 7 cm wide and 3-4 cm thick. Its long axis is in the line of the tenth rib and its lower pole does not usually extend beyond the mid axillary line **(Ryan et al., 2007).**

Vascular supply:

The splenic artery arises from the coeliac trunk. The splenic vein receives the inferior mesenteric vein and joins with the superior mesenteric vein to form the portal vein **(Ryan et al., 2007).**

THE PANCREAS

The pancreas is situated on the posterior abdominal wall at approximately L1 level. It is described as having a head, neck, body and tail. It is retroperitoneal with the exception of the tail, which lies in the splenorenal ligament. It is over 15 cm long and lies transversely and slightly obliquely, with the tail