MRI Evaluation of Peritoneal Lesions

ESSAY

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Radiology

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Abstract

Ultrasound (US) is also a safe, relatively inexpensive, and readily accessible imaging tool for investigation of many peritoneal diseases. However it's of low value particularly in obtaining diagnostic images in obese and postoperative patients .also, many peritoneal diseases have non specific US findings so, it's used as complementary tool to CT and MR imaging.MRI can be performed with no ionizing radiation. Its also offers superior soft tissue contrast to CT as well as direct multiplanar acquisition capability.

Keyword

MRI- peritoneum- Pathological entities - DCE-MRI- *Carcinoma*

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To my father, my mother, all my family and my wife, to whom I am overwhelmingly indebted to, thank you and GOD bless you.

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LIST OF ABBREVIATION

ADC	*Apparent Diffusion Coefficient*
AIDS	*acquired immuno-deficiency syndrome*
DCE-MRI	*Dynamic Contrast-Enhanced MRI*
DPAM	*Disseminated Peritoneal Adenomucinosis*
DWI	*Diffusion-Weighted Imaging*
EPI	*Echo Planar Imaging*
FSPGR	*Fast Spoiled Gradient Recalled*
GIST	*Gastrointestinal Stromal Tumors*
IMA	*Inferior Mesenteric Artery*
MFH	*Malignant Fibrous Histiocytoma*
MPM	*Malignant Peritoneal Mesothelioma*
MRI	*Magnetic Resonance Imaging*
NF-1	*Neurofibromatosis Type 1*
PMCA	*Peritoneal Mucinous Carcinomatosis*
PSCP	*Primary Papillary Serous Carcinoma Of The Peritoneum*
SBM	*Small Bowel Mesentery*
SGE	*Spoiled Gradient-Recalled-Echo*
SMA	*Superior Mesenteric Artery*
SMV	*Superior Mesenteric Vein*
SNR	*Signal To Noise Ratio*
SPIR	*Self-consistent Parallel Imaging Reconstruction*
STIR	*Short Time Inversion Recovery*
US	*ultrasound*

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Introduction

The peritoneum is the largest and most complexly arranged serous membrane in the body. It is closed in men but open to the ends of the fallopian tubes in women ***(Healy and Reznek ,1998)***.

It consists of parietal and visceral layers which line the abdominal cavity, cover the internal organs and viscera, and form numerous mesenteries and ligaments that connect organs to the abdominal wall and to each other ***(Meyers , 2000).***

The major function of the peritoneum is to allow unimpeded activity and mobility of the contained viscera by providing a moist smooth surface between organs although it also has absorptive and immune functions ***(Coakley & Hricak , 1999).***

The peritoneum can be involved in many disease processes including developmental, inflammatory, neoplastic and traumatic conditions ***(Gordon et al, 2005)*** .The most commonly encountered pathologies are abnormal fluid collections, either abscesses or ascites, and transcoelomic metastatic disease (typically ovary, colon, stomach, pancreas) ***(Meyers , 2000).***

The vast majority of peritoneal neoplasms are malignant; most of them are secondary neoplasms. They can disseminate through the peritoneum by four pathways: direct invasion, intraperitoneal seeding, lymphatic permeation and embolic haematogeneous spread ***(Meyers , 2000).***

The depiction of peritoneal tumors on cross-sectional imaging is complicated by

the diffuse spread of tumor and the extensive surface area of the peritoneum, which may serve as sites for tumor deposition ***(Low et al, 2008).***

Although Multidetector CT scans have excellent spatial resolution and speed of acquisition, Magnetic resonance imaging (MRI) has superior contrast resolution allowing for acquisition of multiple image sequences that may be useful for depicting different inherent characteristics of a disease process affecting the peritoneum ***(Low et al, 2000).***

Ultrasound is of limited value for depicting peritoneal disease. PET can depict moderate to large peritoneal tumors but is of limited value for demonstrating small volume peritoneal tumors or carcinomatosis. On the other hand, MR imaging is uniquely suited to depict small peritoneal tumors and carcinomatosis ***(Low, 2007).***

The complementary nature of Diffusion-weighted imaging (DWI) for depicting peritoneal tumors is site-specific. Mesenteric tumors, bowel serosa tumors, and tumors involving the peritoneal reflections around the liver and pancreas are usually better seen on the DW images because of the high contrast of peritoneal tumors on these images ***(Low et al, 2009).***

Sheets of peritoneal tumor involving the subphrenic spaces or the free parietal peritoneum are often best seen on the delayed gadolinium-enhanced MR images because of their marked enhancement ***(Low et al, 2009).***

Gadolinium enhanced MR imaging combined with DW imaging affords a level of sensitivity for peritoneal diseases that makes MRI the examination of choice ***(Low, 2010)***

AIM OF WORK

The aim of this study is to highlight the role of MRI and the related new techniques as a non invasive tool in the evaluation of different peritoneal lesions compared to other imaging modalities.

Anatomy of the Peritoneum and Peritoneal Spaces

The peritoneal cavity is the potential space surrounded by the parietal peritoneal lining of the abdominal wall and the visceral peritoneal lining that envelop the abdominal organs, and it normally contains a small amount of serous fluid ***(Coakley&Hricak,1999***).

In fetal life, the parietal peritoneum is reflected over the peritoneal organs to form ligaments, mesenteries and omenta. These peritoneal reflections interconnect the organs and viscera enclosed within the peritoneal cavity *(figure 1)*. The name of a particular ligament corresponds to the two major structures that it joins, e.g. hepato-duodenal, spleno-renal ligament etc. ***(Meyers et al, 1987).***

Ligaments that attach the stomach to other structures are termed *'omenta'*. The *mesenteries* connect a portion of bowel with the posterior abdominal wall. The fatty tissue enclosed by peritoneal folds is in anatomic continuity with the retroperitoneal and properitoneal tissues ***(Meyers et al, 1987).***

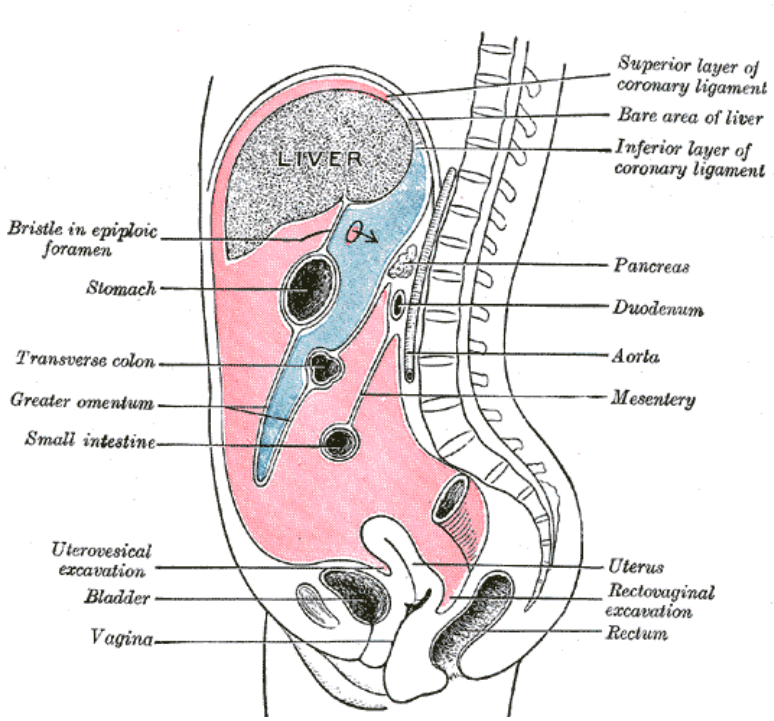


Figure 1: Vertical disposition of the peritoneum. Main cavity, red; omental bursa, blue (supplied online from http://scapula.pl/anatomia.php?strona=246)

The parietal peritoneum forms the anterior border of the anterior pararenal space, reflects over the retroperitoneal colon and laterally fuses with the lateral conal fascia to extend anteriorly. Inferiorly, the parietal peritoneum reflects over the bladder and uterus (***Katz et al, 1999).***

The visceral peritoneum covers the stomach, small bowel (except retroperitoneal (duodenum), colon (sometimes including and sometimes excluding cecum, transverse colon and sigmoid), the solid organs and all the connections between these organs and the other parietes **(*Katz et al, 1999).***

The sub-peritoneal space is defined as that space behind the visceral peritoneum but anterior to the retroperitoneum including the connecting fold, omentums,

ligaments and mesenteries, which enclose the alveolar tissue, vessels and nodes. These form a network of interconnections within and between the peritoneum and retroperitoneum. This sub peritoneal space is an anatomic continuum **(*Katz et al, 1999).***

The potential peritoneal spaces and the peritoneal reflections act as boundaries for pathological processes but may also become conduits for the spread of disease ***(Meyers et al, 1987)***.

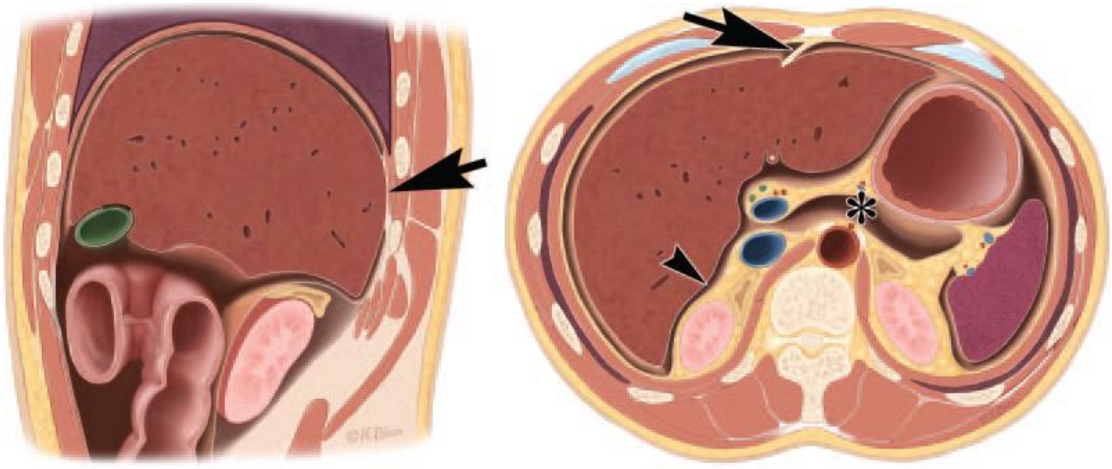
PERITONEAL SPACES

The peritoneal cavity can be conveniently divided into four quadrants with the cephlocaudad division defined by the transverse mesocolon into supra- and inframesocolic spaces and the mid-line division defined by the falciform ligament into right and left ***(Strafford et al, 1998).***

The peritoneal and extra-peritoneal spaces of the pelvis are much more complex. Simplistically, the peritoneal spaces of the pelvis can be divided into supravesical, retrovesical (Pouch of Douglas) and paravesical spaces (***Katz et al, 1999).***

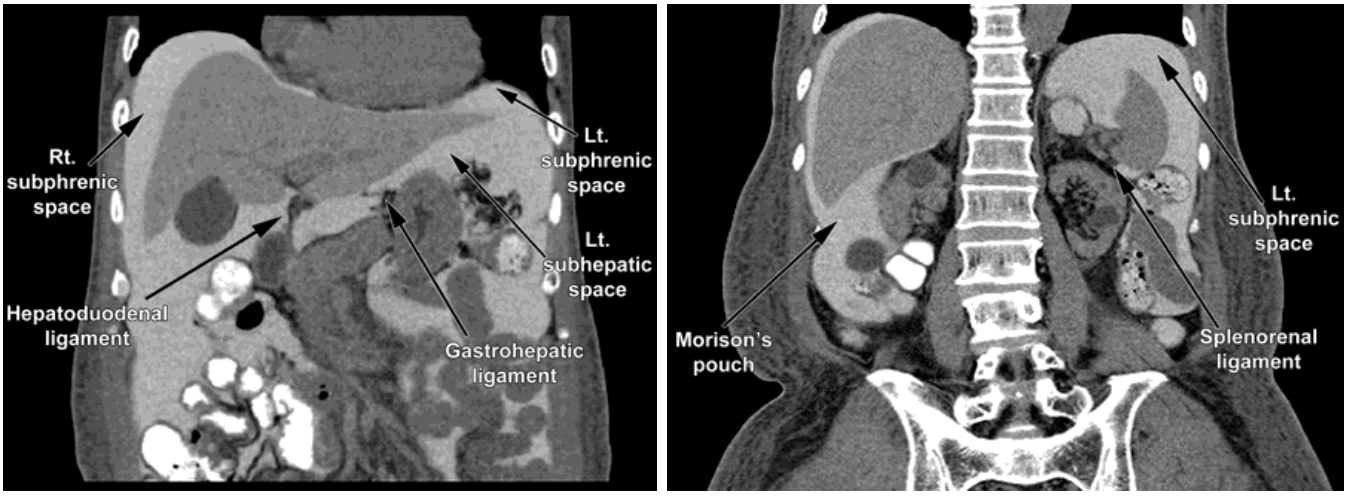
SUPRAMESOCOLIC SPACE

The supramesocolic space extends from the diaphragm to the transverse mesocolon. It is divided into right and left peritoneal compartments *(figure2& figure3),* which are arbitrarily subdivided into intercommunicating spaces (***Kim et al, 2007).***



a. b.

Figure 2: Normal peritoneal anatomy and recesses in the upper abdomen. (a) Sagittal drawing of the right upper abdomen shows the right subphrenic space, bare area of the liver (arrow), and right sub hepatic space. (b) Axial drawing of the upper abdomen at a level inferior to the bare area of the liver shows the right and left subphrenic spaces separated by the falciform ligament (arrow). The right sub hepatic space (arrowhead) and the superior recess of the lesser sac (*) are shown ***(Levy et al, 2008).***



(a) (b)

Figure 3. Coronal reformatted computed tomographic (CT) scans (a obtained anterior to b) show the peritoneal spaces and ligaments. The images were obtained with intraperitoneal contrast material in a patient undergoing continuous ambulatory peritoneal dialysis. Lt = left, Rt = right. Quitted from (http://radiographics.rsna.org/content/27/1/129/F3.medium.gif)