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Gastrointestinal Imaging: The Current Concepts and the Future Challenges

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Introduction

The Gastrointestinal Tract (GIT) is one of the difficult areas to evaluate with imaging. In the past, only gastrointestinal contrast studies were available which lacked the sensitivity and specificity. Recent advances in the imaging and endoscopic techniques have revolutionized the way GIT is imaged. The endoscopy now plays a leading role in evaluation of pathologies and is being equally supported by cross-sectional imaging modalities like Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). These cross-sectional techniques have found such widespread application that they have been incorporated in evaluation of most of the GIT conditions. On the other hand, newer techniques like CT and MR Enteroclysis, diffusion and perfusion imaging, virtual colonoscopy, and contrast-enhanced ultrasound are used to answer specific clinical questions. The subsequent sections briefly highlight various advanced imaging techniques and their clinical application.

Gastrointestinal Contrast Studies

There has been a decline in the utilization of the gastrointestinal contrast studies like barium meal, small bowel follow-through, and barium enema. However, these studies are still very relevant and serve to answer specific clinical questions like integrity of surgical anastomosis. These techniques are also useful for evaluation of the mucosal surface of the small bowel, especially the double contrast studies. An alternative method is video endoscopy, which however, does not provide any information about mural and extramural abnormalities.

Enterography and Enteroclysis

Enterography is performed after giving large volume of contrast orally. On the contrary, in enteroclysis contrast is instilled directly into the small bowel through an enteric tube. The added advantage of these techniques is more bowel distension especially with enteroclysis, which allows better evaluation of the pathology. Enterography, on the other hand, is more acceptable to the patient due to less discomfort. There is growing trend of using these techniques in combination with cross-sectional studies.

Ultrasound

The ultrasound is widely available but highly operator dependent. It is useful in pediatric patients as it lacks ionizing radiation. Being a real-time imaging, it allows for evaluation of bowel peristalsis, fixity, and compressibility. Contrast-enhanced ultrasound and hydrosonography are newer promising techniques.

Computed Tomography

CT is widely available. Current-generation multidetector CT allows thinner sections and multiplanar -imaging making CT the most widely utilized gastro intestinal imaging technique. Good luminal opacification and distension allows for optimal imaging. The enteral contrast is utilized for this purpose and can be positive, neutral, or negative. CT enterography or enteroclysis utilizes positive contrast. Neutral contrast allows better visualization of mucosa and hence useful in the evaluation of inflammatory bowel disease or gastrointestinal bleeding. Negative contrast is mainly used in CT Colonoscopy (CTC) where virtual colonoscopy images of gas-distended colon are obtained. Newer advances in CTC include automated polyp detection software and virtual dissection of the colon. Perfusion CT is a new technique that gives information about the vascular physiology and is a tool under investigation for tumor imaging especially in assessing the response to therapy.

Magnetic Resonance Imaging

MRI due to its mutiplanar capability and excellent soft tissue contrast is emerging as primary imaging modality for certain conditions including inflammatory bowel disease. The absence of ionizing radiation makes it especially useful in children and patients with IBD who may need repeated imaging. Diffusion weighted MRI application is increasing in IBD to asses disease activity after treatment. It is also used in malignancy especially for assessing lymph node involvement. MRI fluoroscopy is a new technique that gives useful information about bowel motility and peristalsis.

PET-CT/MRI

Positron Emission Tomography (PET) exploits abnormal metabolic profile of diseased tissue manifesting as increased radiotracer intake. Combining PET with CT or MRI give additional anatomical information. PET-CT/MRI is most useful in cancer imaging especially for detecting nodal or distant metastases.