

Preface

PET/CT in Gastrointestinal Tumors: Fast Technological Changes Lead to Improved Patient Management



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Guest Editor

Colorectal, stomach, liver, and esophageal cancers rank third, fourth, sixth, and eighth, respectively, in terms of worldwide incidence. Furthermore, liver, esophageal, stomach, and pancreatic cancers figure among the tumors with the highest mortality-to-incidence rate ratios.¹ Gastrointestinal malignancies are thus a major health issue, with an estimated number of new diagnoses close to 3 million worldwide annually. Screening strategies are being designed, and treatments are increasingly effective, especially for colorectal cancer, which is the most common gastrointestinal cancer in the western world. Surgery is proposed to an increasing number of patients with recurrence of colorectal cancer, mostly but not exclusively, in patients with liver metastases. Locoregional treatments, such as radiofrequency ablation, can be used in combination with other modalities, as chemotherapy regimens have been improved as well. In parallel with therapeutic improvements, radiological imaging techniques have evolved tremendously. Multislice CT allow for extremely fast scanning, therefore suppressing all respiratory artifacts and providing high-resolution images of the organs and tissues at the various phases of contrast enhancement. Virtual colonoscopy using a single breath-hold spiral thin-slice CT acquisition after appropriate bowel cleansing generates high-quality 2- and 3-dimensional representations of the entire large bowel.² Ultrasonography (US)

with IV contrast agents (microbubbles) show much improved diagnostic performances compared to unenhanced US, especially in the liver. MR imaging has witnessed several major technological advances, with stronger magnetic gradients and improved coils, along with new, liver-specific contrast agents. Finally, PET/CT has become the standard positron imaging procedure, replacing standalone PET, with better crystals and faster electronics. Moreover, the most recent PET/CT devices are equipped with high-end multislice spiral CT, so that full diagnostic CT, including complex procedures such as virtual colonoscopy, can now be combined with FDG imaging.³ Such dramatic progress in the field of imaging has considerably modified the diagnostic and staging work-up of many cancer diseases, with new diagnostic algorithms being proposed, although the field is changing so rapidly that consensus or widely accepted guidelines are yet to be established in several instances.

MAJOR INDICATIONS OF PET/CT GASTROINTESTINAL CANCERS *Colorectal Cancer*

FDG PET/CT is now considered the standard of care for detecting and staging suspected recurrence of colorectal carcinoma. PET has a direct impact on patient management in up to two-thirds

of cases.⁴ PET/CT is recommended in the preoperative assessment of patients who are candidates for surgical resection of liver metastases.⁵ Regarding liver metastases, PET/CT in fact offers the best combination of sensitivity and specificity among all available techniques, with the exception of small subcentimeter lesions, which might be better depicted using MRI with liver-specific contrast enhancement.^{6,7} In addition, recent data support using PET as a first-line imaging procedure in the systematic surveillance of high-risk patients,⁸ although such an approach remains to be fully validated. Another emerging application is the initial staging of rectal cancers, particularly before multimodal therapies such as neoadjuvant chemo-radiation⁹.

Esophageal and Gastric Cancer

FDG-PET/CT is clearly useful in the initial staging of patients who have esophageal cancers, prior to curative surgical resection. Its role is limited in the evaluation of the primary tumor and in the detection of loco-regional nodal metastases, which are better obtained with endoscopy and echoendoscopy. However, PET imaging is important in the detection of distant metastases. In this regard, PET and PET/CT can spare inappropriate surgical resections, mainly because of the detection of distant metastases not diagnosed by conventional evaluation.¹⁰ Furthermore, there is growing evidence supporting the use of FDG-PET for early evaluation of the response to treatment, whether the treatment is chemotherapy or radiotherapy.^{11,12} Similarly, evaluating the metabolic response in order to adapt the treatment scheme appears to be a very promising indication of FDG-PET in gastric cancer.¹³ Additionally, in patients with suspected recurrent disease, PET and PET/CT can be helpful to detect sites of metastatic disease.

Cancer of the Pancreas

Although the initially enthusiastic results of FDG-PET imaging have been somehow tempered by more recent data, it remains useful in selected cases of preoperative diagnosis.¹⁴ This includes in particular, patients who have suspected pancreatic cancer in whom CT fails to identify a discrete tumor mass or in whom fine-needle aspirations are nondiagnostic. FDG-PET imaging has an additional clinical impact in patients who have a proven cancer, especially with regard to the M staging by detecting CT-occult metastatic disease, thus sparing unnecessary nontherapeutic surgeries.¹⁵ FDG-PET can differentiate between post-therapy changes and recurrence of tumors which are often similar, and is being investigated as a tool for

monitoring neo-adjuvant chemo-radiation therapy, with promising results.¹⁶ Despite reasonably good diagnostic performances, PET has not produced a significant impact on management of periampullary carcinomas.¹⁷

Primary Tumors of the Liver

FDG-PET has shown a poor sensitivity for detecting primary intrahepatic low grade hepatocellular carcinomas (HCC). This does not mean, however, that the technique is useless in this setting. Indeed, increased FDG uptake within tumors may well be a surrogate marker of aggressive behavior and poor clinical outcome in HCCs. Furthermore, FDG-PET appears to be more sensitive for detecting extrahepatic metastases and therefore useful in the pretherapeutic staging of HCCs.¹⁸ Fatty acid metabolism is another target available for molecular imaging, and it is very possible that using dual tracer approaches, FDG and C11-acetate for instance, might be of great help in selecting patients for surgery, thanks to a very high negative predictive value.¹⁹ FDG-PET and PET/CT are useful in staging, prediction of prognosis, evaluation of recurrence, and treatment response in cholangiocarcinomas with the notable exception of periductal-infiltrating cholangiocarcinomas.^{20,21}

Neuroendocrine Tumors

Although neuroendocrine tumors are infrequent, this is a very exciting field of nuclear medicine. Except for poorly differentiated subtypes, the role of FDG-PET is very limited in the evaluation of neuroendocrine tumors.²² Recently, however, various somatostatine analogues such as DOTA-NOC and DOTA-TOC, have been labeled with the generator-produced ⁶⁸Ga. The combined PET/CT modality using these highly specific compounds has shown extremely encouraging results that are significantly better than the classical monophotonic scintigraphy.^{23,24} F-DOPA is another potentially useful compound, but it is not clear whether it will prove useful in comparison with the somatostatine analogues.²⁴ In any case, there is a whole new field of investigation lying ahead, with the advantage of using tracers that can be widely available at a reasonable cost.

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