Role of PET/CT IN Staging of Gastric Carcinoma

Essay

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Tamer Hany

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List of Abbreviations

Abb.	Meaning
18F- FDG	Fluorine-18 Fluoro deoxy – D glucose
AGC	Advanced Gastric Carcinoma
AJCC	American Joint Committee on Cancer
CECT	Contrast enhancement computed tomography
CT	Computed tomography
EGC	Early Gastric Carcinoma
EUS	Endoscopic Ultrasound
Fig	Figure
FLT	Fluorothyamidine
GLUT	Glucose transporter
H&E stain	Hematoxylin and eosin stain
MDCT	Multi Detector Computed Tomography
NPV	Negative predictive value
PET	Positron emission tomography
PET/CT	Positron Emission Tomography-Computed Tomography
PPV	Positive predictive value
SUV MAX	Standerized uptake value Maximum
SUV	Standerized uptake value
WHO	World Health Organization

Abstract

18F-FDG-PET alone has a limited role in detecting and evaluating the local extent of primary gastric cancer with a low detection rate of early gastric cancer and variable uptake depending on histological subtype.

PET/CT imaging in gastric cancer, with it"s increased accuracy in preoperative staging precluding unnecessary surgery and increased sensitivity for detection of recurrence in post-operative follow-up of patients, will be utilized more in the future in the correct clinical setting. Prediction of early response to therapy for 18F-FDG-avid tumors, which helps to estimate prognosis and survival rates, will help to monitor individualized therapy, preventing unnecessary prolonged chemotherapy and therapy-related toxicity.

Keywords: Fluorine-18 Fluoro deoxy – D glucose, Positron Emission Tomography-Computed Tomography, gastric carcinoma

INTRODUCTION

Radiology plays an essential role in the diagnosis, staging and surveillance of oncology patients. CT is the most commonly utilized imaging modality in the work up of these patients ***(Moron et al., 2007)***.

Gastric cancer is the 4th most common cancer and the 2nd leading cause of cancer-related deaths worldwide after lung cancer (the flrst common deadly cancer) ***(Kamangar et al., 2006).*** Despite a steady decline in the incidence rate over the last few decades, the absolute incidence has risen due to the aging of the worldwide population ***(Parkin et al., 2005)***. The incidence of gastric cancer is particularly common in eastern Asia ***(Moore et al., 2010).***

Chronic inflammation (especially chronic Helicobacter pylori infection), exposure to diverse carcinogens and genetic susceptibility are among factors associated with an increased risk of gastric cancer ***(Han and Lauwers, 2010).***

The tumor-node metastasis (TNM) staging system is one of the most commonly used staging systems. The TNM system is well known to effectively predict the prognosis of gastric cancer patients ***(Lee et al., 2012).***

In the past, double-contrast barium examination and upper gastrointestinal endoscopy were used for the assessment

of gastric cancer. Currently, the standard imaging methods for gastric cancer are endoscopic ultrasonography (EUS), computed tomography (CT), magnetic resonance imaging (MRI), and diagnostic laparoscopy. Each modality has strengths and weaknesses in diagnosing and staging disease for treatment planning ***(Poeppel et al., 2009).***

CT has been used for pre-operative staging work ups, including assessment of liver metastases and distant spread after endoscopic evaluation. However, CT offers only morphological data for the evaluation of tumor stage ***(Kim, et al., 2005; Chen et al., 2007).***

The major clinical application of PET is in oncology, using 18F labeled fluorodeoxyglucose (18F-FDG). By this way, it gives quantitative and qualitative functional information about tumor cells depending on their increased rate of glucose metabolism. 18F-FDG PET is regarded to be effective in detection, staging and restaging of malignancies wth a remarkable high sensitivity. Its major limitations have been the lack of anatomical landmarks, relatively blurred images and limited spatial resolution ***(Rohren et al., 2008).***

In the last decade, the ***combination of PET and computed tomography (PET/CT)*** has been introduced in the fleld of oncologic imaging. Combined PET/CT represents a very unique imaging modality that scans the whole body in the

same session, providing functional and anatomic information in co-registered images. It combines the high sensitivity of PET to the superior anatomical localization by CT resulting in much more accurate detection and staging of malignancies. It also provides a better quality PET images due to better attenuation correction by CT scan in a relatively short time ***(Von Schulthess et al., 2006).***

Accordingly 18F- FDG PET/CT has acquired a flrm place in the evaluation of patients wth stomach cancer. It is rapidly becoming the key investigative tool for the loco-regional staging and detection of distant metastases. It has a quite greater role in assessment of recurrence and differentiating it from post therapeutic tissue changes. It has also gained widespread acceptance as a key tool used to demonstrate early response to therapy before other markers of response Therefore, the combined use of CT and PET can be helpful in preoperative staging and therapeutic monitoring in patients wth stomach cancer ***(Ben-Haim and Ell, 2009).***

AIM OF WORK

The aim of this study is to evaluate the role of PET/CT in staging and assessment of recurrence in gastric cancer.

Chapter (1)

ANATOMICAL CONSIDERATIONS

The stomach is the most dilated organ of the body. It lies in the epigastric, umbilical, and left hypochondrial areas of the abdomen ***(Healy, 2005)***.

It is J- Shaped but varies in size and shape with the volume of its contents with erect and supine position and even with inspiration and expiration ***(Anne et al., 2008)***.

Parts of the Stomach:

A plane passing through the incisura angularis on the lesser curvature and the left limit of the opposed dilatation on the greater curvature divides the stomach into a left portion or **body** and a right or **pyloric portion.** The left portion of the body is known as the **fundus,** and is marked off from the remainder of the body by a plane passing horizontally through the cardiac oriflce. The pyloric portion is divided by a plane through the sulcus intermedius at right angles to the long axis of this portion; the part to the right of this plane is the **pyloric antrum (flg.1).** Qouted from: ***(Flshman and Horton, 2002).***

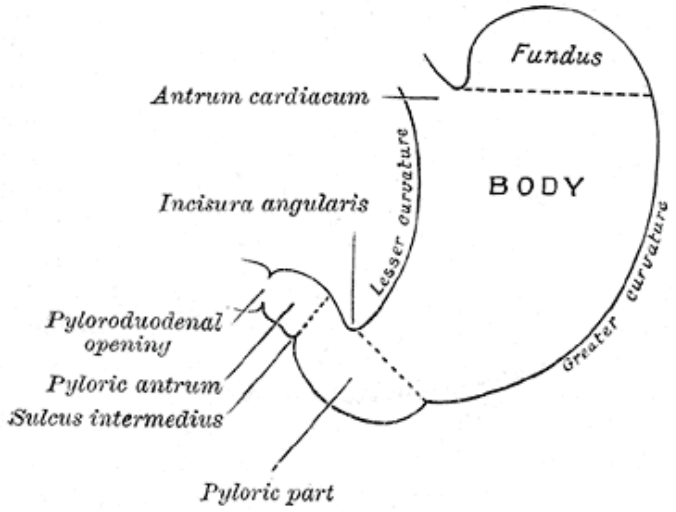

Figure (1): Outline of stomach, showing its anatomical parts. **Quoted from:** ***(Fishman and Horton, 2002)***.

Gastric Orifices:

The opening from the esophagus into the stomach is the cardiac orifice situated to the left of the midline behind the seventh costal cartilage. The cardia is the region immediately adjacent to the cardiac orifice. The part of the stomach above the level of the cardiac orifice is the fundus. The pyloric orifice, the opening into the duodenum, is usually indicated by a circular pyloric constriction of the surface of the organ, indicating the pyloric sphincter ***(Healy, 2005).***

Gastric Sphincters:

The pyloric sphincter is a muscular ring formed by a marked thickening of the circular gastric muscle, some longitudinal fibers also interlacing with it. **The cardiac**