CT Evaluation of Malignant Gastric Tumors

Essay

Submitted for partial fulfillment of
Master Degree in Radiodiagnosis

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2009

Acknowledgement

I would like to express my deep gratitude to Prof. Dr. ***Sahar Mohammed El-Fiky****, Professor of Radiodiagnosis, Faculty of Medicine, Ain-Shams University. Under whose supervision I had the honour to proceed with this work.*

I wish to express supreme respect to Dr. ***Samir Foaud Abd El-Ghaffar*** *Lecturer of Radiodiagnosis, Faculty of Medicine, Ain-Shams University for his continuous advice, and fruitful criticism that made this work come to existence.*

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1) **CT**: computed tomography
2) **GIST**: gastrointestinal stromal tumor
3) **EGC**: early gastric cancer.
4) **TNM**: tumor, nodule, metastases.
5) **MALT**: mucosal associated lymphoid tissue.
6) **T.B**: tuberculosis.
7) **SSD**: surface shaded display.
8) **MA**: mill amber.
9) **KV**: kilovolt
10) **3DCT**: three dimensional computed tomography.
11) **VR**: volume rendering.
12) **AIDS**: acquired immune deficiency syndrome.

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Introduction and aim of the work

The stomach is J- shaped structure, lies in the left hypochondrial, epigastric and umbilical areas, related anteriorly to left lobe of the liver, diaphragm and anterior abdominal wall, related posteriorly to lesser sac, pancreas, splenic tail, splenic artery, left kidney, left suprarenal gland, and transverse mesocolon **(Eric, et al., 2003).**

There are three groups of gastric glands: cardiac, principal and pyloric. These glands carry at least five cell types: chief, parietal, mucous neck, stem and neuroendocrine. The chief cells are the source of digestive enzymes pepsin and lipase. The parietal cells are the source of gastric acid and intrinsic factor. The mucous neck cells are mucous secreting cells. The stem cells are relatively undifferentiated mitotic cells. The neuro endocrine cells synthesize a number of biogenic amines important in control of motility and glandular secretion **(Yoo, et al., 1998).**

Carcinomas account for 90-95% of malignant tumors involving the stomach of which the majority is adenocarcinoma, other histological subtype such as small cell carcinoma, squamous cell carcinoma, lieomyosarcoma, lieomyoblastoma and carcinoid tumors are less common. Lymphomas account for less than 5% of gastric malignancies **(Prokop and Jorgensen, 2003).**

Other tumors are benign such as hyperplastic and adenomatous gastric polyps, lieomyomas and lipomas **(Prokop and Jorgensen, 2003).**

The modern technique of double contrast of the stomach was devised more than 30 years ago, with the aim of detecting cancer at early curable stage in which invasion is limited to mucosa and submucosa and at advanced stage in which barium examination shows narrowing, loss of peristalsis, mucosal destruction, ulceration and intraluminal filling defect**(Sutton, 2003).**

Ultrasound studies of the stomach are limited by presence of intraluminal gas in the stomach. If the stomach is gas free and fluid filled, the antrum and gastro-esophageal junction can be identified. The ability of endoscopic ultrasound to resolve individual layers of the stomach wall and defined its T stage **(Sutton, 2003).**

Triphasic spiral CT technique used for staging gastric carcinoma with better evaluation of liver metastasis. Endoscopic three dimensional CT allows early detection of gastric masses as seen with gastroscopy **(Chapman, 2003).**

There are only limited reports of the value of MRI in evaluation of gastric cancer because of lack of suitable bowel contrast and problems with the respiratory and peristalsis artifacts. However these studies using water as a contrast media to demonstrate serosal invasion of gastric carcinoma **(Park, et al., 1999).**

In spite of increasing the role of endoscopic ultrasound and MRI, CT still remains the highly diagnostic imaging in evaluation of gastric carcinoma **(Eric, et al., 2003).**

The aim of this study is to evaluate the CT criteria used for diagnosing and staging of malignant gastric tumors.

Anatomy

The stomach is the most distensible organ of the body. It is usually J shape but varies in size and shape with volume of its contents, with erect and supine position and even with inspiration and expiration **(Ryan and McNicholas, 2004).**

The stomach has two orifices; the cardiac orifice at eosophagogastric junction and the pylorus. It has two curvatures, the greater curvature and lesser curvature. The incisura is an angulation of the lesser curvature. The part of the stomach above the cardia is called the fundus. Between the cardia and incisura is the body of the stomach and distal to incisura is the antrum. The cardiac orifice and the fundus are relatively fixed and only move with respiratory movement of diaphragm **(Cunningham and Romanes, 2005).**

The stomach passes downward and to the right across the supracolic compartment of peritoneal cavity. It tapers from fundus on the left of median plane to narrow pylorus slightly to the right of the median plane**.** This pyloric part consists of proximal dilated portion, the pyloric antrum and narrow cylindrical portion, the pyloric canal; 2cm long that is continuous distally with the pylorus. The pylorus is the part of the stomach thickened by increase in the amount of circular muscle to form the pyloric sphincter that control the rate of discharge of the stomach content into the duodenum**(Cunningham and Romanes,2005) (Fig.1).**

The pylorus is highly mobile because the omentum is attached to it. It may lie any where between the first and the third lumbar vertebrae. It is 2-3 cm to the right of the median plane. But it is further transferred to the right when the stomach is full**.** In its higher position the pylorus is posterior to quadrate lobe of the liver and is separated from pancreas by the omental bursa **(Cunningham and Romanes, 2005).**

The fundus abuts on the left dome of diaphragm under the cover of the rib cage and reaches the level of the fifth rib in the midclavicular line anteriorly. The cardiac orifice lies approximately 10 cm posterior to the seventh left costal cartilage**,** 2-3 cm from the median plane between the liver and the diaphragm **(Cunningham and Romanes, 2005).**

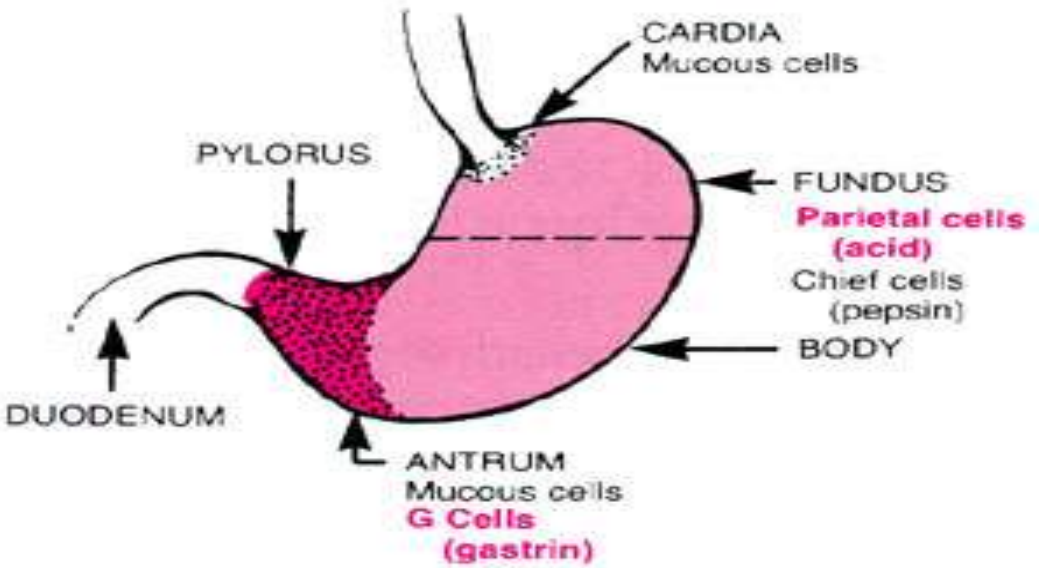


Figure 1 (stomach anatomy) (Cunningham and Romanes, 2005)

The stomach is lined by mucosa that is tiny nodular elevations called the area gastrica and is thrown into folds called rugae. The longitudinal folds parallel to the lesser curvature called magenstrasse; rugae elsewhere in the stomach are random and paternless **(Ryan and McNicholas, 2004).**

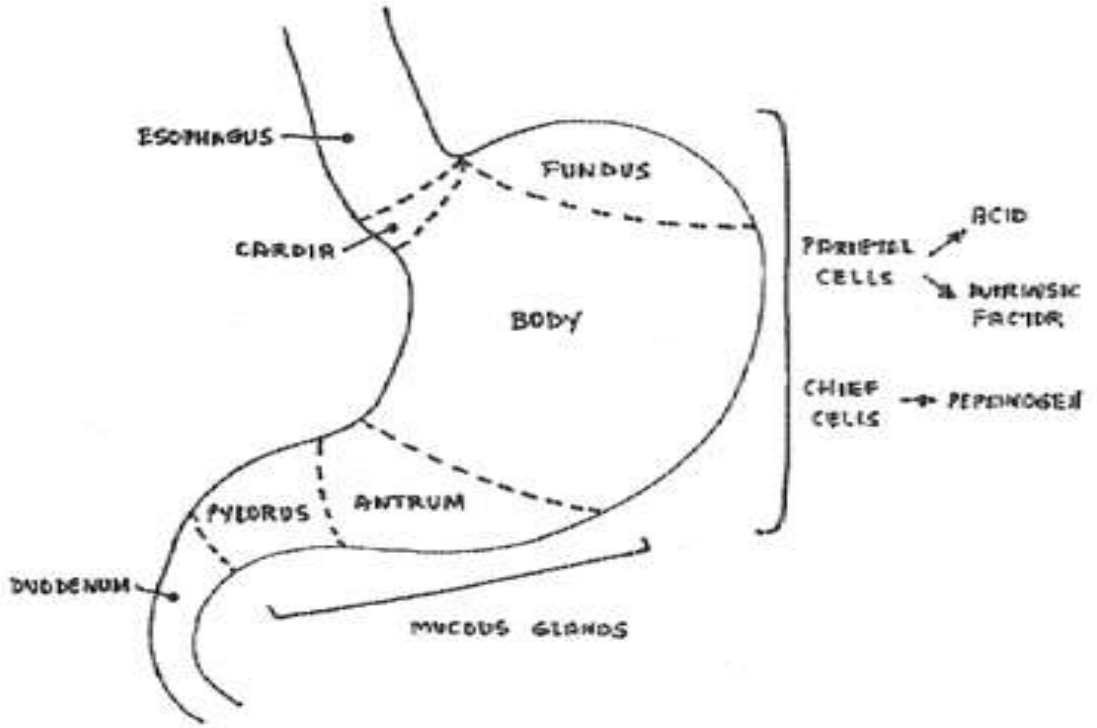
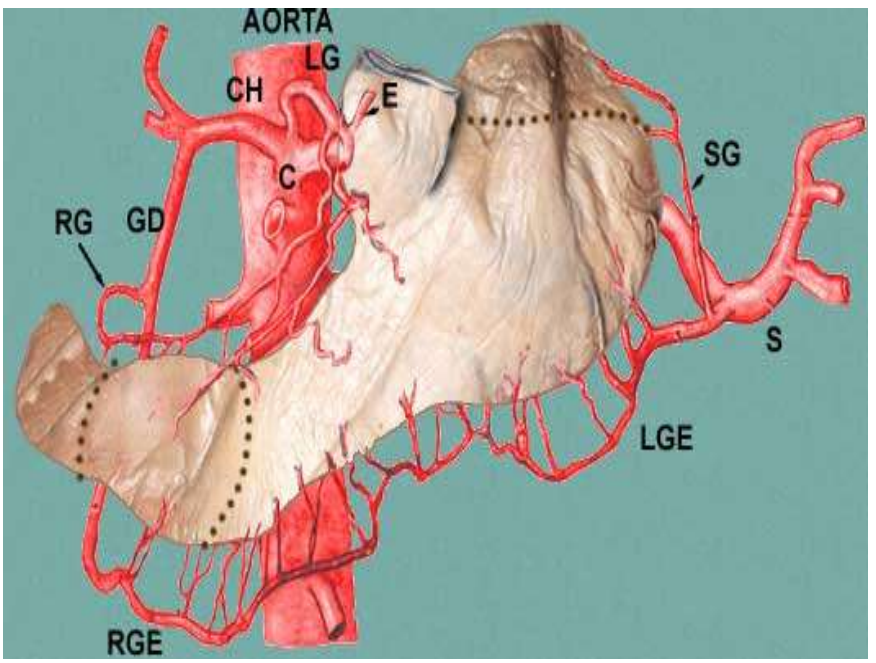


Figure 2 (stomach anatomy) (Ryan and McNicholas, 2004)

There are there muscle layers in the wall of the stomach, an outer longitudinal, inner circular and incomplete innermost oblique layer. The circular layer is thickened at the pylorus as a sphincter but not at esophagogasteric junction**.** Fibers of oblique layer loop around the notch between the fundus and esophagus and help to prevent reflux **(Ryan and McNicholas, 2004) (Fig 2).**

The upper part of the anterior surface of the stomach is covered by the left lobe of the liver on the left and by the diaphragm on the right. The fundus occupies the left dome of the diaphragm. The abdominal wall covers the remaining part of the anterior wall of the stomach. Posterior to the stomach lies the lesser sac, the structures of the posterior abdominal wall that are posterior to this, are referred to as the stomach bed. The pancreas lies across the mid-portion of the stomach bed with the splenic artery partly above and partly behind it, and the spleen at its tail. Above the pancreas are the aorta and its coeliac trunk and the surrounding plexus and nodes, the diaphragm, the left kidney and left adrenal gland. Attached to the anterior surface of the pancreas is the transverse mesocolon which form the inferior part of the stomach bed **(Ryan and McNicholas, 2004).**



C: Coeliac trunk
LG: left gastric artery
RG: right gastric artery
LGE: left gastroepiploic artery
RGE: right gastroepiploic artery
S: the splenic artery
SG: The short gastric arteries
CH: common hepatic artery
E: esophagus
GD: gastrodoudenal artery

Figure 3 (Stomach Blood supply) (Ryan and McNicholas, 2004)

Blood supply

Arteries reach the stomach along its greater and lesser curvatures from branches of coeliac trunk. The left gastric artery from the coeliac trunk supplies the lesser curvature. The right gastric artery from the hepatic artery supplies the lesser curvature. The short gastric arteries from the splenic supply the greater curvature and fundus. The left gastroepiploic artery from the splenic supplies the greater curvature. The right gastroepiploic artery from the gastroduodenal branch of the hepatic artery also supplies the greater curvature. The arteries of the stomach anastomose freely within the stomach wall **(Ryan and McNicholas, 2004) (Fig 3, 4).**

LG: Left gastric vein**.**
RG: Right gastric vein;
IVC: Inferior vena cava
PV: Portal vein
SM: Superior mesenteric vein
IM: Inferior mesenteric vein
RGE: Right gastroepiploic vein
LGE: Left gastroepiploic vein
S: Splenic vein
SG: Short gastric vein

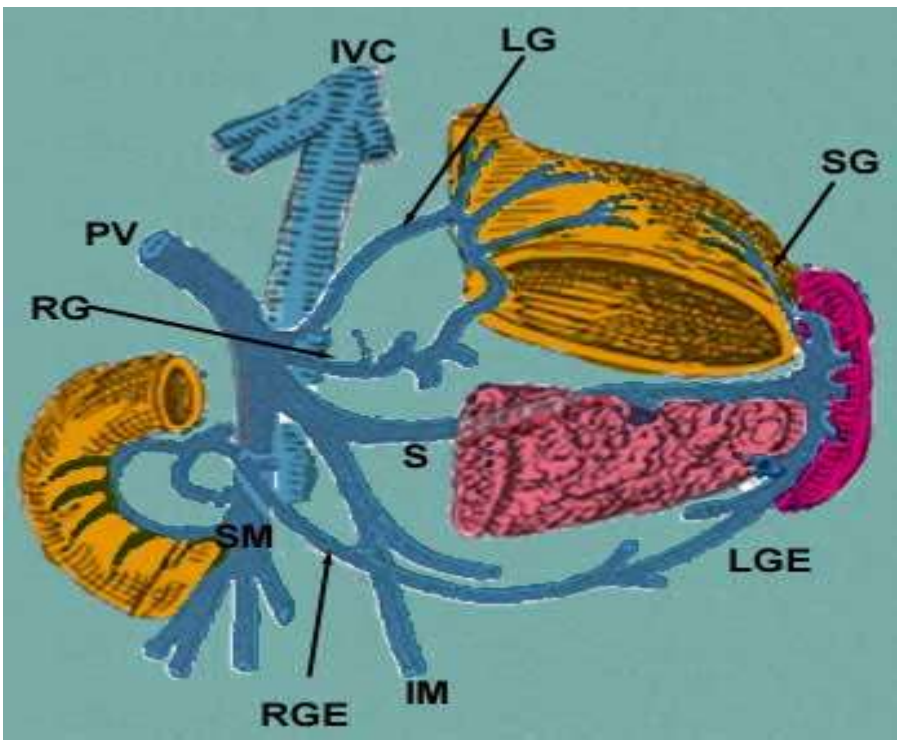


Figure 4 (Stomach blood supply) (Ryan and McNicholas, 2004).

The venous drainage follows a similar pattern to arterial supply. The left and right gastric veins drain to the portal vein. The short gastric and left gastroepiploic veins drain to the splenic vein and the right gastroepiploic veins drain to the superior mesenteric vein **(Ryan and McNicholas, 2004).**

Lymphatic drainage:

Five nodal zones are identified **(Fig 5, 6),** zone 1 (paracardial) nodes are adjacent to esophagi-gastric junction, this zone is further subdivided into 1a (lesser curvature) and 1b (greater curvature).Zone 2 nodes are the superior gastric nodes adjacent to the left and right gastric arteries within the lesser omentum. Zone 3 nodes are the subpyloric nodes seen in distal lesser curvature. Zone 4 nodes are inferior gastric nodes found along the greater curvature within the greater omentum. Zone 5 nodes are pancreaticolienal nodes located at the hilum of the spleen, the tail of the pancreas and along splenic arteries. All node groups drain into the celiac nodes and from there to cisterna chili **(Megibow, 2005).**