Unusual Manifestation of Stomach Cancer; Pictorial review and review of the literature

Poster No.: C-1386
Congress: ECR 2014
Type: Educational Exhibit
Authors: D. H. Lee, S. K. Moon; Seoul/KR
Keywords: Cancer, Staging, CT, Stomach (incl. Esophagus), Oncology, Gastrointestinal tract
DOI: 10.1594/ecr2014/C-1386

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.
www.myESR.org
**Learning objectives**

The purpose of this pictorial review is to investigate the previous literature about MDCT diagnosis and staging of stomach cancer, and to illustrate various imaging features of characteristic histology subtypes and unusual disease spread of stomach cancer.

**Background**

Stomach cancer is the 4th most common cancer and the 2nd leading cause of cancer-related death worldwide. MDCT is a recently reliable and widely used diagnostic modalities for the diagnosis and preoperative staging with other modality (i.e. gastroscopy and EUS). Accurate assessment of local tumor invasion (T staging in the TNM staging system) is the most significant element in determining appropriate treatment plans. The advances of MDCT techniques renewed the interest in using CT for T staging. Some unusual histology of stomach cancers have characteristic radiologic features on MDCT images. On the other hand, some gastric cancer can show unusual manifestation or radiologic features.

**Findings and procedure details**

1. Staging of stomach cancer

   (1) Clinical staging of stomach cancer (Fig. 1)

   (2) CT T staging of stomach cancer

   * T1 stomach cancer

   - Invisible on MDCT images (especially T1a cancer)

   - Abnormally enhancing intraluminal mass or wall thickening, involving the most inner layer but maintaining the smooth outer border and the outer low attenuation layer (Fig. 2)

   - Abnormal fold change on 3D volume images (Fig. 3)

   * T2 stomach cancer
- Abnormally enhancing mass or wall thickening with/without ulceration, showing intramural involvement and irregular outer border of the lesion, but maintaining the thin most outer layer and clear perigastric fat plane around tumor (Fig. 4 and 5)

* T3 stomach cancer

- Transmural lesion involving the entire gastric wall and either maintaining clear perigastric fat plane around tumor or fine perigastric fat spiculation, but not invading beyond adjacent perigastric vessels, especially along the lesser and greater omentum (Fig. 6 and 7)

* T4a stomach cancer

- Transmural lesion involving the entire gastric wall with irregular/nodular outer border with perigastric fat infiltration and invading beyond the adjacent perigastric vessels (Fig. 8)

* T4b stomach cancer

- Transmural lesion obliterating fat plane between gastric tumor and adjacent organ or invading adjacent organ (Fig. 9)

(3) Local staging of stomach cancer with MDCT

* A systematic review by Kwee J Clin Oncol 2007;25:2107-2116)

- Diagnostic accuracy; moderate methodological quality.

; EUS 65 - 92.1%, MDCT 77.1% - 88.9%, MRI 71.4% - 82.6%

- Sensitivity for assessing serosal involvement

; EUS 77.8% - 100%, MDCT 82.8% - 100%, MRI 89.5% - 93.1%

- Specificity for assessing serosal involvement

; EUS 67.9% - 100%, MDCT 80% - 96.8%, MRI 91.4%-100%

- Early gastric cancer (EGC) ; EUS > MDCT

- Advanced gastric cancer (AGC); EUS < MDCT

; EUS has a limited depth of penetration, and is of limited usefulness in the overall assessment of more distant spread.

2. Advanced technique of MDCT in the diagnosis of stomach cancer
Adequate distension of stomach with water or gas improved lesion detection rates, and the accuracy of local T staging. Its thinner collimation, and faster scanning also improved the diagnostic accuracy by improving spatial resolution. 2D multi-planar reformatted (MPR) images and 3D volume rendering images or virtual gastroscopic images are valuable in the accurate diagnosis and staging of stomach cancer. Although it still has some limitation in staging of EGC and nodal staging (N), it currently plays the key role in the diagnosis and staging of stomach cancer.

3. Morphologic classification of stomach cancer

Stomach cancer is classified according to the morphologic type (Fig. 11~16).

4. Unusual manifestations of stomach cancer

In retrospective review of the cases of stomach cancer in our hospital for the recent 20 years, we recognized several unusual manifestations of stomach cancer. These may be related with following factors;

- Unusual histological subtypes
- Unusual configuration
- Unusual spread of the disease
- Unusual complication

The cases with stomach cancer which are demonstrated from now on manifest unusual imaging features.

Typical histological subtypes of stomach cancer

- Tubular adenocarcinoma; well, moderately, and poorly differentiated
- Papillary adenocarcinoma
- Mucinous adenocarcinoma
- Signet ring cell adenocarcinoma

; Poorly differentiated and signet ring cell adenocarcinoma which together are considered poorly differentiated. Poorly differentiated adenocarcinoma primarily corresponds with diffuse-type gastric cancers.

Atypical histological subtypes of stomach cancer
- Sarcomatoid adenocarcinoma
- Squamous cell carcinoma
- Hepatoid adenocarcinoma

**Atypical histological subtypes**

(1) Mucinous adenocarcinoma

WHO defines mucinous adenocarcinoma as an adenocarcinoma more than 50% of the tumor contains extracellular mucin pools. It was used to be confused with SRC because of mucus secretion. It has been characterized by layered enhancement and poorly enhanced outer or middle layer (Fig. 17 and 18). It may have calcifications (Fig. 19).

(2) Signet ring cell carcinoma (SRC)

SRC has been characterized by cells containing a sufficient intracytoplasmic volume of mucin to compress the nucleus against the periphery of the cell, and by its potential to diffusely infiltrate the stomach wall and to cause a marked scirrhus reaction. SRC has been known with its poor prognosis related with larger tumor size, more LN mets, deeper invasion, and more Borrmann type IV lesions than other histological subtypes. Abundant immature fibrosis of SRC may induce the high degree of enhancement on CT scan (Fig. 20).

(3) Poorly differentiated adenocarcinoma

Poorly differentiated adenocarcinoma primarily corresponds with diffuse-type stomach cancers (limitis plastica). With SRC, this undifferentiated cancer prefer to invade stomach wall deeply and spread lymphatics (Fig. 21).

(4) Sarcomatoid adenocarcinoma

Sarcomatoid adenocarcinoma (carcinosarcoma) is rare malignant tumor with biphasic histology of carcinomatous and sarcomatous component. In the upper GI tract, it most frequently observed in the esophagus. About 50 cases of stomach carcinosarcoma have been reported, mostly in Japan, and predominantly in the male population, mostly over the age of 60 years. Carcinosarcoma of stomach may be polypoid, exophytic or endophytic, with generally ulcerated surfaces, and form bulky tumor masses (Fig. 22).

(5) Hepatoid adenocarcinoma

The term "hepatoid adenocarcinoma of the stomach" was proposed for primary gastric carcinomas characterized histololgically by hepatoid differentiation and production of large amounts of AFP. However, the diagnosis of hepatoid adenocarcinoma is not dependent on whether AFP was produced and considered that diagnosis was better
based on the recognition of the characteristic histologic features (Fig. 23). There is sometimes confusion about whether hepatoid carcinoma originates from the stomach or the liver, because most patients show multiple liver metastasis preoperatively. Because of the extremely poor prognosis of hepatoid adenocarcinoma of the stomach, it is important to ensure that the diagnosis is accurate. Even if metastasis is absent preoperatively, liver metastasis can occur within a year after surgery. Thus, close observation and long-term follow-up of patients are required.

Imaging features

- Gastric wall thickening with eccentric contrast enhancement, ulceration, or irregular lobulation
- Diffuse hepatic metastasis and lymph node metastasis
- Predilection site; gastric antrum

(6) Squamous cell carcinoma

Squamous cell carcinoma of the stomach is uncommon, with an incidence of less than 1% worldwide. Because it is rare, the mechanism of this disease has not been well-understood (Fig. 24).

(7) Neuroendocrine carcinoma (gastric carcinoid)

* WHO classification

- Well-differentiated endocrine tumor (carcinoid)
- Well-differentiated endocrine carcinoma (malignant carcinoid)
- Poorly differentiated endocrine carcinoma

Neuroendocrine tumors of GI tract usually produce bioactive substances and show immunoreactivity to neuroendocrine markers. Stomach neuroendocrine carcinoma; 3 types

1. Type I; associated with chronic atrophic gastritis, grow from the fundus and body, the most common type of stomach carcinoid, usually small (<1-2cm), often multiple

2. Type II; frequently associated with Zollinger-Ellison syndrome and MEN 1, also small (1-2cm) and often multiple, sometimes metastasis

3. Type III; absence of underlying gastric disease or hypergastrinemia, usually large (>2cm) single neoplasm located in the body and fundus, typically vascular invasion at the time of diagnosis
* CT findings (Fig. 25)

- Small size; well-defined subepithelial tumor and well enhancement
- Large size; ulcerofungating or ulceroinfiltrative tumor, appear similar to AGC

**Unusual configuration of stomach cancer

(1) Exophytic stomach cancer

An adenocarcinoma arising in the gastric mucosa may present as an exophytic gastric mass with a tumor center lying beyond the confines of the stomach in rare circumstances (Fig. 26). It is hard to differentiate a malignant GIST from an exophytic adenocarcinoma of the stomach. Antral location, thickening of the gastric wall adjacent to an exogastric mass, LN enlargement and discordant images between US and CT are typical findings of exophytic stomach cancer, and allow distinction with between exophytic stomach cancer and GIST.

(2) Synchronous tumors

The synchronous occurrence of GIST in the stomach and EGC is very uncommon in the literature. GIST may be concomitant with gastric lymphomas or with carcinoid tumors (Fig. 27~28).

(3) Tumor thrombosis

Stomach cancer generally spreads through the lymphatic and/or portal venous system, frequently resulting in the occurrence of metastases to the regional LNs and liver. However, the formation of a tumor thrombus in the portal venous system is extremely rare in patients with stomach cancer (Fig. 29~30). Tumor thrombus can communicate with primary tumor, and it may invade vascular wall directly.

On US and CT images, contiguous thrombus is strongly suggested as having tumor origin. Tumor thrombus can occur in portal vein developed from the left gastric vein, right gastroepiploic vein, and short gastric vein (Fig. 29).

(4) Direct small bowel invasion

Stomach cancer can invade the transverse colon directly through the mesocolon. However, direct invasion of the small bowel is uncommon (Fig. 31).

(5) Ureter metastasis

Ureter metastasis from stomach cancer is rare and has been diagnosed only at autopsy.

* Mechanism; via perivascular lymphatic channel
* CT findings (Fig. 32)

- Thickened enhanced ureteral wall with periureteral infiltrations and obstructive hydronephrosis and hydroureter

- Accompanying multiple LN metastasis around the aorta and peritoneal seeding

(6) Cancer peritonitis vs. TB peritonitis in a AGC patient

Cancer peritonitis frequently shows ascites. The discovery of new-onset ascites, thickening, nodularity, omental cake/smudge and enhancement of the peritoneum are suggestive of a malignant process. However, TB peritonitis can show similar features. Classically, tuberculous peritonitis has been described as having three imaging patterns (wet, fibrotic fixed, and dry plastic). In all three patterns, soft-tissue masses or nodules that stud the peritoneal surfaces or infiltrate the omentum and mesenteries represent caseous nodules and fibrosis (Fig. 33).

(7) Stomach cancer perforation

Perforated stomach cancer is rare with an incidence of 0.56-3.9%, and is not frequently diagnosed peroperatively. The cause of gastric perforation is difficult to identify during emergency surgery. Malignant gastric perforation is commonly regarded as a sign of a terminal disease, because it is thought to contribute to the peritoneal dissemination of cancer cells and early recurrence (Fig. 34). Thus, the cause of gastric perforation should be thoroughly evaluated on imaging study.

Images for this section:
<table>
<thead>
<tr>
<th>TNM</th>
<th>Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T1a  Tumor invades lamina propria or muscularis mucosae</td>
</tr>
<tr>
<td></td>
<td>T1b  Tumor invades submucosa</td>
</tr>
<tr>
<td></td>
<td>T2   Tumor invades muscularis propria</td>
</tr>
<tr>
<td></td>
<td>T3   Tumor penetrates subserosal connective tissue without invasion of visceral peritoneum or adjacent structures</td>
</tr>
<tr>
<td></td>
<td>T4a  Tumor invades serosa (visceral peritoneum)</td>
</tr>
<tr>
<td></td>
<td>T4b  Tumor invades adjacent structures</td>
</tr>
<tr>
<td>N</td>
<td>N0   No regional lymph node metastasis</td>
</tr>
<tr>
<td></td>
<td>N1   Metastasis in 1-2 regional lymph nodes</td>
</tr>
<tr>
<td></td>
<td>N2   Metastasis in 3-6 regional lymph nodes</td>
</tr>
<tr>
<td></td>
<td>N3   Metastasis in seven or more regional lymph nodes</td>
</tr>
<tr>
<td>M</td>
<td>M0   Distant metastasis absent</td>
</tr>
<tr>
<td></td>
<td>M1   Distant metastasis present</td>
</tr>
</tbody>
</table>

**Fig. 1:** TNM staging system of stomach cancer in the 7th edition of AJCC cancer staging system
Fig. 2: T1 stomach cancer in CT images

Fig. 3: T1 stomach cancer in a 3D volume rendering image
Fig. 4: T2 stomach cancer in CT images.
Fig. 5: T2 stomach cancer in a CT image
Fig. 6: T3 stomach cancer in a CT axial image
Fig. 7: T3 stomach cancer in a CT coronal image
Fig. 8: T4a stomach cancer in CT images
**Fig. 9:** T4b stomach cancer

**Fig. 10**
Fig. 11: Morphologic classification of stomach cancer

Fig. 12: Barium study of Borrmann type I AGC
Fig. 13: A CT image of Borrmann type I stomach cancer
Fig. 14: Barium study and a CT image of Borrmann type II AGC
Borrmann type III AGC
Fig. 15: A CT image and barium study of Borrmann type III AGC
Borrmann type IV AGC
Fig. 16: Barium study and a CT image of Borrmann type IV AGC

Fig. 17: Mucinous adenocarcinoma
Fig. 18: Mucinous adenocarcinoma
Fig. 19: Mucinous adenocarcinoma

Fig. 20: Signet ring cell carcinoma penetrating serosa (T4a)
**Fig. 21:** A 43-year old woman with diffuse-type stomach cancer. Submucosal tumor spread shows prominent contrast enhancement on CT scans. Repeated endoscopic biopsy only revealed chronic gastritis. But it was confirmed as poorly differentiated adenocarcinoma.

**Fig. 22:** Sarcomatoid adenocarcinoma and multiple liver metastasis in a 69-year old woman

**Fig. 23:** A 65-year old man with pathologically proven hepatoid adenocarcinoma of the stomach. Wall thickening of gastric lower body and multiple liver metastases.
**Fig. 24:** Squamous cell carcinoma of the stomach and liver metastasis in a 56-year old man. Bulky necrotic mass at gastric cardia with exophytic growth

**Fig. 25:** A rapidly growing subepithelial tumor of the gastric cardia in a 82 year-old man, which was confirmed as a poorly differentiated neuroendocrine carcinoma

**Fig. 26:** An exophytic mucinous adenocarcinoma at the posterior wall of the stomach body. Abnormally thickened and enhanced overlying and adjacent gastric mucosa of the exogastric mass, and mass effect to the pancreas tail.
**Fig. 27:** A synchronous EGC and GIST in a 70-year old woman. EGC in a CT image and endoscopy.

**Fig. 28:** A synchronous EGC and GIST in a 70-year old woman. GIST in endoscopy and a CT image.
**Fig. 29**: A 78-year old man with AGC at the cardia, fundus, and high body. Direct extension of stomach cancer to coronary vein and extending to distal splenic vein, splenoportal and distal SMV.
**Fig. 30**: A 66-year old man with AGC at the antrum (small arrows. Tumor thrombus in the main portal vein and SMV.
**Fig. 31:** Direct invasion of mid jejunum by stomach cancer at the antrum in a patient with incomplete rotation of jejunum.

**Fig. 32:** A 69-year old man with AGC and ureter metastasis

**Fig. 33:** A 68-year old woman with AGC at the lower body (small arrow). Biopsy proven TB peritonitis and improvement after TB medication 3 months later.

**Fig. 34:** Stomach cancer perforation
Conclusion

MDCT gave a quantum leap in the diagnosis and staging of stomach cancer. It can demonstrate some unusual manifestation of stomach cancer, and be helpful for the accurate staging, and diagnosis of disease status.

Personal information

References


