What is the difference between an ulcer and an erosion?
- **Ulcer**: a knockout of mucosa and part of the submucosa.
- **Erosion**: Restricted to mucosa only (an especially the epithelium).
  Notice that peptic ulcers occur in any portion of gastrointestinal tract exposed to the aggressive action of acid-peptic juices.

What are the most common complications of peptic ulcer disease?
- **Gastric ulcer**: hemorrhage in lesser sac and injury to the left gastric artery.
- **Duodenal ulcer**: acute pancreatitis and injury to gastroduodenal artery.

Pathogenesis of peptic ulcer disease:
- Imbalance between gastro-duodenal mucosal defense mechanisms and damaging forces of gastric acid and pepsin, combined with superimposed injury from environmental or immunologic agents.

<table>
<thead>
<tr>
<th>Defensive forces</th>
<th>Damaging forces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface mucus secretion</td>
<td>Gastric acidity</td>
</tr>
<tr>
<td>Bicarbonate secretion into mucus</td>
<td>Peptic enzymes</td>
</tr>
<tr>
<td>Mucosal blood flow</td>
<td>H. pylori infection</td>
</tr>
<tr>
<td>Epithelial regenerative capacity</td>
<td>NSAIDS and aspirin</td>
</tr>
<tr>
<td>Elaboration of prostaglandins</td>
<td>Alcohol and smoking</td>
</tr>
</tbody>
</table>

Sites of peptic ulcer:
- **Duodenum**: first portion; anterior wall is more often affected.
- **Stomach**: antrum and lesser curvature (more common).

Notes:
- There are multiple ulcers in the duodenum, stomach or jejunum of patients with Zollinger-Ellison syndrome.
- There are ulcers adjacent to a Meckle’s diverticulum that contains ectopic gastric mucosa.

Gastritis:
- **Acute (erosive):**
  - Disruption of mucosal barrier leading to inflammation.
  - Caused by:
    - Stress.
    - NSAIDs (reduced prostaglandins leads to decreased gastric mucosa protection).
    - Alcohol.
    - Uremia.
    - Burns (known as curling ulcer: due to decreased plasma volume which leads to sloughing of gastric mucosa).
    - Brain injury (known as cushing ulcer: due to increased vagal stimulation leading to increased Ach thus increasing acid production).
  - Morphology (see image-1): there is prominent neutrophil infiltration.
- **Chronic (non-erosive):**
  - Type A (fundus/ body):
    - *It is an autoimmune disorder characterized by:*
      - Autoantibodies to parietal cells of the stomach.
      - Pernicious anemia.
      - Achlorhydria.
      Notice that it is associated with other autoimmune disorders.
Type B (antrum):
- It is the most common type.
- Caused by H. pylori infection.
- There is increased risk of MALT lymphoma and gastric adenocarcinoma.
- Morphology (see image-2):
  - Chronic inflammatory cell infiltration.
  - Mucosal atrophy.
  - Intestinal (goblet cell) metaplasia.

Helicobacter pylori infection:
- Adapted to live in association with surface epithelium beneath mucus barrier.
- Causes cell damage and inflammatory cell infiltration.
- Important stains to confirm H. pylori infection:
  - Giemsa stain (image-3).
  - Silver stain (image-4).

Helicobacter gastritis: there are two patterns of the infection
- Diffuse involvement of body and antrum (pan-gastritis associated with diminishing acid output).
- Infection confined to antrum (antral gastritis associated with increased acid output).

Peptic ulcer disease:

<table>
<thead>
<tr>
<th></th>
<th>Gastric ulcer</th>
<th>Duodenal ulcer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Can be greater with meals- weight loss</td>
<td>Decreases with meals- weight gain</td>
</tr>
<tr>
<td>H. pylori infection</td>
<td>In 70%</td>
<td>In almost 100%</td>
</tr>
<tr>
<td>Mechanism</td>
<td>↓ mucosal protection against gastric acid</td>
<td>↓ mucosal protection or ↑ gastric acid secretion</td>
</tr>
<tr>
<td>Other causes</td>
<td>NSAIDs</td>
<td>Zollinger-Ellison syndrome</td>
</tr>
<tr>
<td>Risk of carcinoma</td>
<td>↑</td>
<td>Generally benign</td>
</tr>
<tr>
<td>Other</td>
<td>Often occurs in older patients</td>
<td>Hypertrophy of Brunner glands</td>
</tr>
</tbody>
</table>

Gross features of gastric ulcer (see image-5):
- Single; well-delineated lesion.
- Shape: Round, oval or linear.
- Size: usually less than 2cm in diameter.
  Notice that size does not differentiate benign from malignant ulcers.

Microscopic features of gastric ulcer (see image-6):
- Clean, non-elevated edges.
- Inflammatory granulation tissue at the base.
- Disruption of muscularis propria.
- Underlying fibrosis.
**Biopsy of peptic ulcer:**
- **Aim:** to distinguish between benign and malignant ulcers.
- Biopsy should be taken from the ulcer edge, at least from each quadrant.
- Up to 10-12 biopsies may be taken to exclude cancer.
- Repeat endoscopy may be needed if biopsies are negative and there is high index of suspicion.

**Ulcer complications:**

<table>
<thead>
<tr>
<th>Hemorrhage</th>
<th>Perforation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Occurring in gastric and duodenal ulcers (more common on the posterior wall)</td>
<td>• occurring in duodenal ulcer (more common on the anterior wall).</td>
</tr>
<tr>
<td>• Ruptured gastric ulcer on the lesser curvature of the stomach → bleeding from left gastric artery</td>
<td>• You may see free air under the diaphragm with referred pain to the shoulder.</td>
</tr>
<tr>
<td>• An ulcer on the posterior wall of the duodenum → bleeding from gastroduodenal artery</td>
<td></td>
</tr>
</tbody>
</table>

**Stomach cancer:**
- Almost always adenocarcinoma.
- Early aggressive local spread and lymph node/ liver metastasis.
- Often presents with acanthosis nigricans.
- **There are two types:**
  - **Intestinal adenocarcinoma:**
    - Associated with H.pylori infection, dietary nitrosamines (smoked foods), tobacco smoking, achlorhydria and chronic gastritis.
    - Commonly on lesser curvature.
    - Looks like ulcer with raised margins (see image-7). Microscopically, forming glands (see image-8).
    - *Virchow node:* involvement of left supraclavicular node by metastasis from stomach.
  - **Diffuse adenocarcinoma:**
    - Not associated with H.pylori.
    - *Histologically:* characterized by signet ring cells (see image-9).
    - Stomach wall grossly thickened and leathery (linitis plastica).