Stomach

3

Derek C. Allen, R. Iain Cameron,
and Maurice B. Loughrey

3.1 Anatomy

The stomach is a dilated portion of the gastrointestinal tract which has three main functions: storage of food, mixing food with gastric secretions, and control of the rate of release of food to the small intestine for further digestion and absorption. It is a J-shaped organ and much of it lies under the cover of the lower ribs. It has an anterior and posterior surface, two openings (the proximal cardiac and the distal pyloric orifices), and two curvatures (greater and lesser) (Fig. 3.1). Although relatively fixed at both ends, the intervening part is mobile and can undergo considerable variation in shape. The stomach is usually divided into the following parts:

Fundus – dome-shaped and projects upward and to the left of the cardiac orifice.

Body – extends from the level of the cardiac orifice to the incisura angularis (a constant notch at the junction of the lesser curve and antrum). The incisura is an important endoscopic landmark.

Antrum – extends from the incisura to the proximal part of the pylorus.

Pylorus – the most tubular part of the stomach and its thick muscular wall forms the physiological and anatomical pyloric sphincter, marked by a slight constriction on the surface of the stomach. The pylorus, which is approximately 2.5 cm long, joins the first part of the duodenum.

The cardiac orifice is where the abdominal part of the esophagus enters the stomach. Although no anatomical sphincter is present, a physiological mechanism exists, which prevents gastroesophageal regurgitation.

The lesser curvature forms the right border of the stomach, extending from the cardiac orifice to the pylorus. The greater curvature extends from the left of the cardiac orifice, over the fundus to the inferior part of the pylorus. Peritoneum completely surrounds the stomach and leaves its curvatures as double layers called omenta, which contain fat, lymph nodes, and vessels. The lesser omentum extends from the lesser curve to the liver. The gastrosplenic omentum extends from the upper part of the greater curve to the spleen, while the greater omentum runs to the transverse colon from the lower part.

The mucous membrane of the gastric body is thrown into numerous longitudinal folds or rugae. This facilitates flattening of the mucosa when the

D.C. Allen (✉)
Histopathology Laboratory, Belfast City Hospital,
Belfast Health and Social Care Trust,
Belfast, UK
e-mail: derek.allen@belfasttrust.hscni.net

R.I. Cameron
Histopathology Laboratory, Altnagelvin Hospital,
Western Health and Social Care Trust,
Londonderry, UK
e-mail: iain.cameron@westerntrust.hscni.net

M.B. Loughrey
Histopathology Laboratory, Institute of Pathology, Royal Victoria Hospital, Belfast Health and Social Care Trust,
Belfast, UK
e-mail: maurice.loughrey@belfasttrust.hscni.net

D.C. Allen, R.I. Cameron (eds.), *Histopathology Specimens*,
DOI 10.1007/978-0-85729-673-3_3,

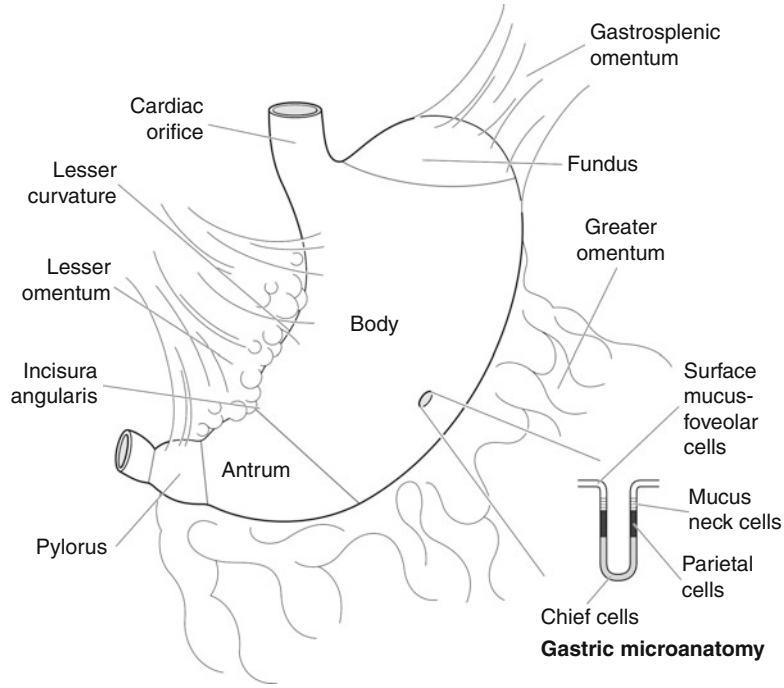

Fig. 3.1 Stomach (Reproduced, with permission, from Allen and Cameron (2004))

stomach is distended by food. The mucosal surface contains millions of gastric pits or foveolae that lead to mucosal glands. The mucosal surface is composed of columnar, mucin-secreting epithelium (surface mucus – foveolar cells), while deeper in the gastric pits are mucus neck cells. The gastric glands vary depending on their anatomic region (Fig. 3.1):

Cardia – mucin-secreting cells

Fundus/body – parietal cells (acid), chief cells (pepsin), and scattered endocrine cells

Antrum/pylorus – endocrine (mostly gastrin G cells) and mucin-secreting cells

Lymphovascular drainage:

The entire arterial supply of the stomach is derived from the celiac artery which arises from the aorta. Veins drain into the portal system. The lymphatics drain to the celiac lymph nodes. The so-called N1 and N2 node groups (12 in total) are situated along the arterial supply (Fig. 3.2). N1 nodes are within 3 cm of the primary malignancy and N2 nodes more than 3 cm from the tumor.

The main nerve supply to the stomach is from the anterior and posterior vagal trunks, with the innervation of the pylorus being mainly derived from the anterior vagus.

3.2 Clinical Presentation

Patients with gastroduodenal disease may be asymptomatic or experience one or more of the following: upper abdominal (epigastric) pain; dyspepsia ("indigestion"); vomiting, which may be projectile if there is pyloric outflow obstruction; hematemesis (vomiting blood); melena (altered blood per rectum); or dysphagia, if there is a proximal gastric lesion.

3.3 Clinical Investigations

- Endoscopy and Biopsy
- Erect CXR to detect "air under the diaphragm" in a perforation and also metastatic tumor deposits in the lungs.
- Barium swallow will outline the mucosal surface, demonstrate decreased distensibility and wall motility due to diffuse carcinoma (linitis plastica) and detect delayed emptying caused by pyloric outflow obstruction.

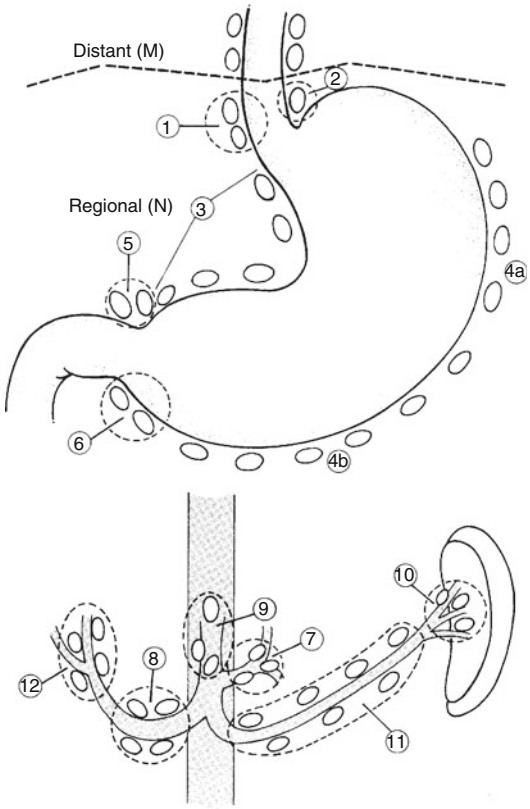

Fig. 3.2 Stomach: Regional lymph nodes. The regional lymph nodes are the perigastric nodes along the lesser (*1*, *3*, *5*) and greater (*2*, *4a*, *4b*, *6*) curvatures, the nodes located along the left gastric (*7*), common hepatic (*8*), splenic (*10*, *11*) and celiac arteries (*9*), and the hepatoduodenal nodes (*12*). Involvement of other intra-abdominal lymph nodes such as the retropancreatic, mesenteric, and para-aortic is classified as distant metastasis (Used with the permission of the Union for International Cancer Control (UICC), Geneva, Switzerland. The original source for this material is from Wittekind et al. (2005))

- For biopsy-proven cancer – ELUS and CT scan chest, abdomen, and pelvis to determine the pretreatment tumor stage.
- Peritoneal aspiration of ascitic fluid for malignant cells and staging laparoscopy with peritoneal biopsy and cytology washings. Peritoneal disease is a contraindication to radical curative intent therapy.
- Gastric function tests – peak acid output is measured by the pentagastrin test and will differentiate "hypersecretors" from "non-hypersecretors" – important if surgery is to be considered for duodenal peptic ulcer disease.

3.4 Pathological Conditions

3.4.1 Non-neoplastic Conditions

Acute gastritis: Acute hemorrhagic/erosive gastritis is usually antral and drug related (aspirin, NSAIDs, alcohol) or, less commonly, in the body secondary to shock and hypoperfusion, e.g., post-trauma, sepsis or burns, and, therefore, not biopsied. Acute neutrophilic gastritis is seen in food poisoning, sepsis, and helicobacter pylorii (HP) infection.

Chronic gastritis: With poor correlation between symptoms, endoscopic appearances, and histology, it is very common in biopsy material and is *a*utoimmune, *b*acterial or *c*hemical in nature (types A, B, and C). The latter is usually antral, related to drug ingestion, or bile reflux and comprises a reactive mucosa with a lack of inflammatory cells. Autoimmune gastritis affects the corpus, resulting in a spectrum of atrophic gastritis and gastric atrophy with hypochlorhydria, pernicious anemia, and a predisposition to gastric cancer. It is associated with other autoimmune diseases, e.g., diabetes and mucosal damage is mediated by circulating antibodies to gastrin receptors on the parietal cells. The anemia is due to lack of gastric intrinsic factor with decreased vitamin B12 absorption in the terminal ileum. HP infection is the commonest form of chronic gastritis and increases in incidence with age. The Gram-negative, curved bacillus is readily identified (H and E, Cresyl Violet, Giemsa) lying under the surface mucous layer, damaging the epithelium and producing a chronic inflammatory reaction in the lamina propria with focal neutrophil polymorph cryptitis. Treatment is by antibiotic eradication.

The *Sydney System* classifies and grades chronic gastritis based on an assessment of histological (neutrophils, chronic inflammation, atrophy, intestinal metaplasia), topographical (antral/corpus predominant or pangastritis), and etiological (HP, drugs) factors.

Chronic gastritis predisposes to peptic ulceration, gastric carcinoma, and malignant lymphoma. Unusual variants such as lymphocytic, granulomatous, or eosinophilic gastritis are

occasionally seen – infective gastritis occurs in immunosuppressed patients (e.g., CMV) or opportunistically overlying ulceration (e.g., candida fungus).

Peptic ulceration: there are two patient groups.

1. HP antral gastritis → loss of acid regulatory feedback → hyperchlorhydria → duodenitis → duodenal gastric metaplasia with HP colonization → further duodenitis and duodenal ulcer (DU)
2. HP pangastritis → hypoacidity → weakening of the mucosal mucous barrier → further gastritis → erosion and gastric ulceration (GU)

Further risk factors include smoking, alcohol, and drugs (NSAIDs, aspirin, steroids). DU outnumbers GU (4:1). Benign gastric ulcers are usually on the lesser curve in the vicinity of the incisura.

Complications include acute or chronic bleeding from the ulcer base, perforation with peritonitis, penetration and fistula to an adjacent organ (e.g., colon or pancreas), fibrotic repair resulting in mechanical obstruction such as pyloric stenosis, and, rarely, cancer. Surgery for peptic ulceration has decreased dramatically in the last two decades with the evolution of effective antiulcer treatments based largely on antibiotic eradication of HP infection and acid suppression (H_2 receptor antagonists, proton pump inhibitors (PPIs)). It is now reserved for those peptic ulcers refractory to medical treatment, in which complications have arisen or there is a suspicion of malignancy. Acute hemorrhage is managed conservatively by laser, electrocoagulation, or injection of sclerosant.

Hyperplastic polyps: Commonest in the antrum and up to 1.5 cm in size, they form 60% of gastric mucosal polyps and are characterized by dilated, hyperplastic glands in edematous, inflamed lamina propria. Single or multiple they probably represent healing of the mucosa after erosion – malignant change is extremely rare, although there can be cancer elsewhere in the stomach.

Other non-neoplastic polyps: rare, e.g., hamartomatous polyps (Peutz Jegher's/Cronkhite – Canada syndromes), inflammatory fibroid polyp or common, such as fundic gland cyst polyps – small, multiple, gastric body, cystic dilatation of specialized glands, incidental or associated with PPI therapy/familial adenomatous polyposis (FAP).

Note that various diseases can present as polypoidal gastric folds or hypertrophic gastropathy, e.g., Ménétrier's disease (hypochlordydria, protein loss from elongated gastric pits), Zollinger–Ellison syndrome (pancreatic/duodenal gastrinomas, hyperchlorhydria, multiple peptic ulcers), Crohn's disease, carcinoma, or malignant lymphoma.

3.4.2 Neoplastic Conditions

Predisposing conditions: Predisposition to gastric neoplasia occurs with HP gastritis, gastric atrophy, and previous partial gastrectomy with gastroenterostomy. Antecedent lesions include incomplete intestinal metaplasia (type IIb/III large intestinal variant) and epithelial dysplasia. Dysplasia occurs in flat (commonest), sessile, or polypoid mucosa and is categorized as low or high grade, corresponding to categories 3 and 4 of the Vienna Consensus Classification of Gastrointestinal Epithelial Neoplasia (Table 3.1). Low-grade dysplasia requires endoscopic follow-up, while high-grade dysplasia should be considered for surgical resection due to the strong association (30–80%) with concurrent or subsequent cancer. Polypoid adenomatous dysplasia comprises 8% of gastric polyps but has a 30–40% risk of malignancy related to size, villous architecture, and grade of dysplasia. Local resection (endoscopic or surgical) and careful background mucosal sampling are necessary for full histological assessment.

Adenocarcinoma: forms the majority of gastric malignancy and classically antral (50%) or

Table 3.1 Vienna classification of gastrointestinal epithelial neoplasia

Category	Neoplasia/dysplasia
1	Negative
2	Indefinite
3	Noninvasive low grade
4	Noninvasive high grade
5	Invasive – either intramucosal, submucosal, or beyond

lesser curve (15%) in site but with an increasing incidence in the proximal stomach and cardia, in part due to HP eradication and loss of its acid suppression effect. Histological patterns are intestinal (50%), diffuse (20%), or mixed/solid (25%), showing correlation with macroscopic appearances and behavior. Intestinal carcinomas arise from intestinal metaplasia/dysplasia, form ulcerated or polypoid lesions with expansile margins, and show lymphovascular spread to regional nodes, liver, lung, adrenal gland, and bone. Diffuse carcinomas (signet ring cells) form diffusely infiltrating linitis plastica (leather bottle stomach) undermining the mucosa with transmural spread to the peritoneum where seedlings and classical Krukenberg tumors (bilateral ovarian secondaries) occur. Gastric cancer may be multifocal – resection margins are routinely checked. Distal cancers can involve proximal duodenum, and proximal cancers, the distal esophagus. Tubule-rich, mucin-poor tumors with a circumscribed edge have a better prognosis than tubule-poor, mucin-rich tumors or an infiltrative edge. Depth of spread is defined as early gastric cancer (EGC) confined to the mucous membrane ± regional node involvement, or advanced muscle coat invasive disease which has a much worse prognosis. EGC (10% of cases) can be multifocal in distribution and raised, flat, or ulcerated in morphology.

Other carcinomas are rare (e.g., hepatoid, parietal cell, medullary) or metastatic in nature (e.g., breast, lung, kidney, malignant melanoma).

Carcinoid (*well-differentiated endocrine*) *tumor*: of gastric endocrine or enterochromaffin-like (ECL) cell origin, either related to gastric atrophy (type 1), ZE syndrome (type 2), or sporadic (type 3).

- Multiple (benign): atrophic gastritis/gastric atrophy → hypochlorhydria → hypergastrinemia → ECL hyperplasia → microcarcinoidosis (multiple, mucosal, <1.5 mm). If <1 cm endoscopic removal is sufficient: if 1–2 cm in size, treatment is by polypectomy or local resection as they have uncertain malignant potential.
- Single or sporadic (aggressive): surgical resection if >2 cm in size, invasion beyond submucosa, angioinvasion, or cellular atypia (including necrosis or mitoses). Functionally secreting tumors are also potentially malignant. Detection of metastatic disease is by CT and octreotide scintigraphy scan.

Gastrointestinal stromal tumors (GISTs): spindle or epithelioid cell in type a minority are leiomyomatous or neural and a majority stromal (CD117 (c-kit)/DOG-1 positive) in character with absent or incomplete myogenic/neural features. Malignancy cannot be accurately predicted but indicators are: size (>5 cm), cellularity and atypia, tumor necrosis and hemorrhage, infiltrative margins, and mitotic activity (>5/50 high power fields). Malignant spread is to peritoneum and liver. Endoscopic biopsy diagnosis can be problematic as GISTs are submucosal/mural lesions covered by intact mucosa except for a classical central area of "apple core" ulceration.

Malignant lymphoma: primary with disease bulk in the stomach and regional nodes, or secondary to systemic nodal disease. Single, multiple, plaque-like, ulcerated, or as thickened folds it has a rubbery, fleshy appearance. The majority are of B cell MALT (mucosa associated lymphoid tissue) type and strongly associated with HP chronic gastritis. Low or high grade, the former can be difficult to diagnose requiring an accumulation of histological, immunohistochemical, and molecular evidence over a number of biopsy episodes. Cardinal features are the density and uniformity of the lymphoid infiltrate, loss and destruction of mucosal glands, demonstration of immunoglobulin light chain restriction, and heavy chain gene rearrangements. High-grade lymphoma transforms from a low-grade lesion or presents de novo and must be distinguished immunohistochemically from poorly differentiated carcinoma. Rarely there can be an association between MALToma and concurrent or subsequent adenocarcinoma.

Prognosis: The majority of patients with gastric cancer present with advanced disease, and prognosis is poor (20–35% 5-year survival) relating to histological type, differentiation, excision margin involvement, and, crucially, stage of disease. Following a positive endoscopic biopsy, the tumor is staged radiologically

and laparoscopically to determine suitability for radical surgery. Current trials indicate a beneficial role for preoperative and postoperative chemotherapy, which traditionally had been limited to palliative treatment of advanced disease. Patients with Her 2 positive recurrent or metastatic disease (20% of cases) potentially respond to trastuzumab monoclonal antibody therapy. EGC has a better prognosis (80–95% 5-year survival) and may be amenable to local mucosal resection but is converted to completion gastrectomy if the cancer shows unfavorable features such as size >3 cm, >50% surface ulceration, poor differentiation, lymphovascular invasion, or involvement of the submucosa or specimen base.

Carcinoid tumors are of low-to-intermediate-grade malignancy – 70–80% 5-year survival. Low-grade MALTomas are indolent (65–95% 5-year survival), whereas high-grade lesions are more aggressive (40–55% 5-year survival). Treatment options for gastric lymphoma after appropriate typing, grading, and staging (CT scan, bone marrow trephine) include HP eradication (low-grade disease), chemotherapy (high-grade disease), and surgery, the latter particularly if there are anatomical alterations, e.g., gastric outlet obstruction, or complications of chemotherapy, e.g., perforation.

The primary treatment of GISTs is surgical resection, with targeted therapy in the form of small molecule inhibitors such as imatinib (Glivec) reserved for tumors which are unresectable or metastatic. Neoadjuvant therapy can produce tumor regression and shrinkage, facilitating success and choice of operative technique.

3.5 Surgical Pathology Specimens: Clinical Aspects

3.5.1 Biopsy Specimens

Flexible endoscopy is the cornerstone for investigation and diagnosis of gastric-related symptoms. Biopsies for gastritis should be taken according to the Sydney protocol from antrum, body, and incisura and any abnormal areas. Specific lesions such as ulcers need multiple (at least six) biopsies from the base and margin quadrants as some 10% of endoscopically suspicious lesions need rebiopsy. A peptic ulcer has a classic endoscopic appearance in that it is round/oval and sharply "punched out" with straight walls. Heaping up of mucosal margins is rare in benign ulcers and should raise the suspicion of malignancy. Size does not reliably differentiate between benign and malignant ulcers as 10% of benign ulcers are greater than 4 cm in diameter. Tumors covered by intact mucosa such as diffuse gastric carcinoma or GISTs are often difficult to demonstrate by mucosal biopsy, and endoscopic FNA may be employed. Localized nodular or polypoid lesions, e.g., hyperplastic polyp, adenomatous polyp, carcinoid tumor, EGC can be diagnosed and successfully removed by EMR.

3.5.2 Resection Specimens

3.5.2.1 Benign Conditions

As alluded to above, surgery for chronic peptic ulceration is now unusual. It aims to remove the gastric ulcer and the gastrin-producing G cells that drive acid secretion. This is accomplished by a Bilroth I distal gastrectomy with a gastroduodenal anastomosis (Fig. 3.3). Alternatively blockage of gastric innervation is achieved by transecting the vagus nerve trunks as they emerge through the diaphragmatic hiatus (truncal vagotomy), resulting in reduced gastric secretions and motility. Because of the latter, a drainage procedure, either pyloroplasty or gastrojejunostomy, must also be done. This approach is used in elderly frail patients or for refractory DU. Highly selective vagotomy preserves pyloric innervation, negating the need for a drainage procedure. The now rare Bilroth II gastrectomy for DU comprises a distal gastrectomy with oversewing of the duodenal stump and fashioning of a gastrojejunal anastomosis of either Polya or Roux-en-Y type. The latter prevents bile reflux as the distal duodenum is joined to the jejunum some 50 cm distal to the gastrojejunal anastomosis.

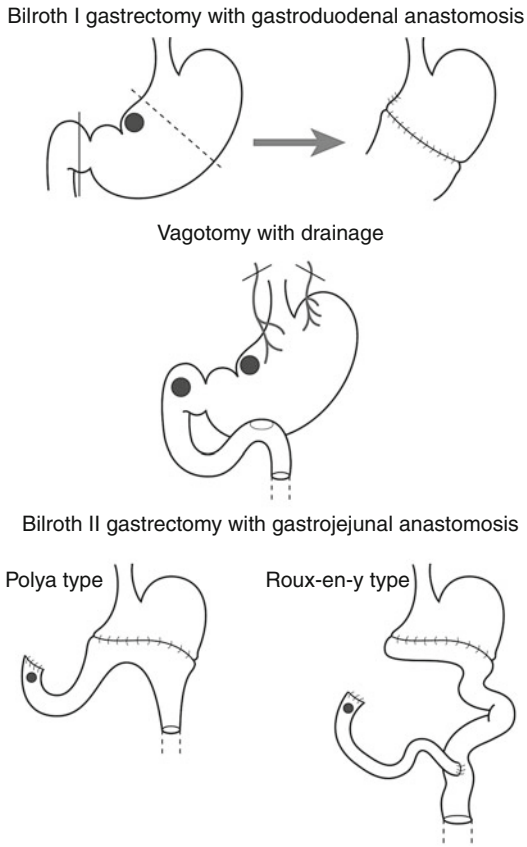

Fig. 3.3 Gastric surgery for gastroduodenal peptic ulceration (Reproduced, with permission, from Allen and Cameron (2004))

3.5.2.2 Malignant Conditions

Curative gastric surgery should involve removal of the tumor with a 5 cm rim of "normal" tissue and the related lymph nodes. The surgeon may prefer to perform a partial or total gastrectomy depending on the site and type of tumor (e.g., diffuse carcinoma) and medical fitness of the patient.

Total gastrectomy: This can be done with or without radical lymph node dissection. Both procedures employ an upper midline abdominal incision. In a total gastrectomy without radical lymph node dissection (D1 resection), the stomach is removed with the lesser and greater omenta (which contain local lymph nodes). In this resection, nodes may also be found along the greater curvature and the gastrosplenic omentum. A radical gastrectomy (D2 resection) involves removal of the stomach, lesser omentum with careful dissection of nodes along the hepatic artery and celiac plexus, greater omentum and gastrosplenic omentum. Nodes should also be removed from along the portal vein, splenic artery, and the retropancreatic area. In Japan, an even more radical procedure is popular, which involves en bloc resection of the stomach, spleen, distal pancreas, and associated lymph node groups.

Good margin clearance is crucial and so the esophagus is divided as far proximally as is needed and occasionally this may involve entering the chest. The distal margin of resection is formed by division of the first part of the duodenum. Continuity is restored by an esophagojejunostomy with a Roux-en-Y diverting limb for the duodenal stump.

Partial gastrectomy: The type of procedure employed will depend on the site of the tumor:

Proximal tumors – tumors in the vicinity of the EG junction may arise in the distal esophagus and infiltrate distally, or in the cardia/fundus and infiltrate proximally. Various procedures may be employed (see Chap. 2).

- Transhiatal distal esophagectomy with proximal gastrectomy for tumors of the distal esophagus/EG junction/cardia
- Transhiatal distal esophagectomy with total gastrectomy for tumors of the cardia with extensive distal spread
- A more extensive esophagectomy (via either a two-field approach or thoracotomy) with proximal/total gastrectomy for junctional tumors with extensive proximal spread.

Distal tumors – either a Bilroth I or Bilroth II procedure with the latter being favored as the anastomosis is wider (important if there is local recurrence) and further away from the likely site of recurrence.

3.6 Surgical Pathology Specimens – Laboratory Protocols

3.6.1 Biopsy and Local Mucosal Resection Specimens

See Chap. 1.

3.6.2 Resection Specimens

Specimen:

- The majority of gastric resections are for neoplastic conditions. However, because of the difficulty in reliably distinguishing between benign and malignant gastric ulcers on gross inspection, it is practical to use the same handling procedures. Irregular elevated mucosal margins and absence of radial mucosal folds are possible pointers to malignancy. Benign ulcers usually do not occur on the greater curvature.
- Partial gastrectomy (proximal or distal), total/radical gastrectomy, variable amounts of lesser and greater omental fat including unspecified or separately named regional lymph node groups, with or without spleen removed because of either direct involvement by gastric cancer or for technical reasons, e.g., operative access or capsular tear at surgery.

Initial procedure:

- By palpation and with the index finger locate the lumenal position of the tumor/ulcer.
- Open the specimen along the curvature opposite to and avoiding the tumor/ulcer.
- Measurements:
  Distal esophagus, greater curvature, duodenal cuff – lengths (cm)
  Tumor/ulcer
  - Length × width × depth (cm) or maximum dimension (cm)
  - Distances (cm) to the proximal and distal limits of excision
  - Relationship to the EG junction. TNM 7 includes as an esophageal cancer any tumor of the proximal stomach where its epicenter is within 5 cm of the junction and involves the esophagus (Siewert 3). External landmarks may be helpful – esophagus is orientated to adventitia, stomach to serosa.
- Photograph.
- Paint any relevant area of serosa and omental margin suspicious of tumor involvement or close to its edge.
- Fixation by immersion in 10% formalin for 48 h either gently packed with formalin-soaked lint or, if suitable, pinned out on a corkboard in the opened position.

Description:

- Tumor/ulcer site
  - Distal esophagus/cardia/fundus/corpus/antrum/pylorus/lesser curve/greater curve/anterior/posterior/multifocal/extension to duodenum or esophagus
- Tumor
  - Polypoid/ulcerated/scirrhous/mucoid/irregular margins: usual carcinoma
  - Thickened, non-expansile wall/intact granular mucosa: diffuse gastric carcinoma
  - Plaque/granular mucosa/depressed/multifocal: EGC
  - Plaque/thickened folds/ulcerated/fleshy/multifocal: malignant lymphoma
  - Nodular/ulcerated/yellow: carcinoid tumor
  - Polypoid/mural/dumb-bell shaped/apple core ulceration:GIST
- Ulcer
  - Mucosal edges: flat/punched out/elevated
  - Base: blood vessels/perforation/penetration (e.g., pancreas or fistula present)
- Mucosa
  - Edematous/atrophic/granular/thickened
- Wall
  - Tumor: confined to mucous membrane, in the wall or through the wall
  - Ulcer: perforation/penetration
- Serosa
  - Involved by tumor/coated in exudate
- Omenta
  - Involved by tumor: circumscribed/irregular margin
  - Maximum deposit size (cm)
  - Distance of tumor from the omental edge (mm)

Blocks for histology (Fig. 3.4):

- Sample the proximal and distal limits of resection – complete circumferential transverse sections (duodenum, esophagus) or multiple circumferential blocks (mid-stomach).
- Alternatively, if separate anastomotic doughnuts are submitted – one complete circumferential transverse section of each.
- Count and sample all lymph nodes (lesser/greater omenta, splenic hilum) and process separately any named lymph nodes.

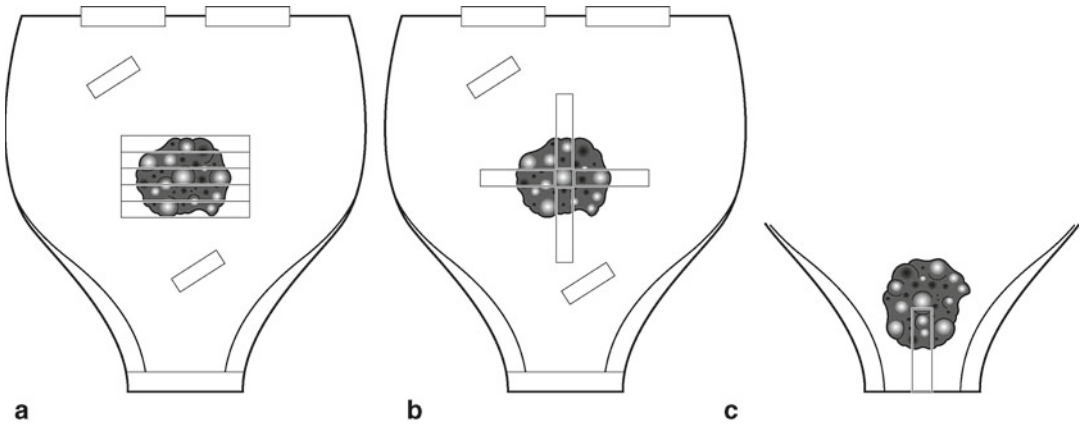

Fig. 3.4 Distal gastrectomy – serial, transverse slices (**a**) or quadrant sections (**b**) may be used according to the anatomy of the lesion and adjacent structures. A longitudinal limit block (**c**) may be taken if the tumor is close (<0.5 cm to it) (Reproduced, with permission, from Allen and Cameron (2004))

- Sample a minimum of four blocks of tumor and wall to show any serosal involvement and the deepest point of omental invasion. Serial transverse slices (3–4 mm thick) or quadrant sections may be used according to the anatomy of the lesion and adjacent structures.
  Tumor ulcer: four sections to include the ulcer base, edge, adjacent mucosa, and wall
  Tumor polyp: two sections from the body of the polyp and a minimum of two from the underlying base and wall
  Linitis plastica: six transmural blocks as a gross lesion is often not evident and the extent of local spread may vary
  GISTs: roughly one block per centimeter diameter to include mucosal, mural, and extramural components of the tumor
  Omental tumor: representative blocks in relation to the nearest omental edge/serosa
- Sample any other satellite lesions or abnormal areas of mucosa.
- Sample non-neoplastic gastric mucosa away from the tumor/ulcer (two blocks).
- Serially slice, at 1 cm intervals, spleen and pancreas (if present) and sample two blocks
  Histopathology report:
- Tumor type
  – Adenocarcinoma: intestinal/diffuse/mixed/mucin-rich/mucin-poor
  – Malignant lymphoma
  – GIST
- Tumor differentiation
  – Adenocarcinoma
  Well/moderate/poor defined as tubule-rich or tubule-poor
  – Malignant lymphoma
  MALToma/mantle cell/follicle center cell or other
  Low-grade/high-grade
  – GIST
  Spindle cell/epithelioid
  Cellularity/atypia/mitoses/necrosis/margins/size
  Leiomyomatous/neural/stromal (CD117/DOG-1)
- Tumor edge – Pushing/infiltrative/lymphoid response
- Extent of local tumor spread (for carcinoma).

pTis	Carcinoma in-situ: intraepithelial tumor without invasion of the lamina propria
pT1	Tumor invades lamina propria (pT1a) or submucosa (pT1b)
pT2	Tumor invades muscularis propria
pT3	Tumor invades subserosa or lesser/greater omenta
pT4	Tumor perforates serosa (pT4a) or invades adjacent structures (spleen, transverse colon, liver, diaphragm, pancreas, abdominal wall, adrenal gland, kidney, small intestine, retroperitoneum (pT4b))

EGC = pT1 ± lymph node involvement
Advanced carcinoma = pT2/pT3/pT4 ± lymph node involvement

- Lymphovascular invasion – present/not present
- Regional lymph nodes
  Perigastric, hepatoduodenal, nodes along the left gastric, common hepatic, splenic and celiac arteries. A regional lymphadenectomy will ordinarily include 16 or more lymph nodes. Other intra-abdominal lymph nodes (retropancreatic, mesenteric, para-aortic) are distant metastases (pM1).

pN0	No regional lymph node metastasis
pN1	1–2 involved regional node(s)
pN2	3–6 involved regional nodes
pN3	More than 6 involved regional nodes (pN3a: 7–15. pN3b: >15)

- Excision margins
  Proximal and distal limits of tumor clearance (cm)
  Separate proximal esophageal/gastric and distal gastric/duodenal anastomotic doughnuts – involved/not involved/presence of mucosal dysplasia
  Deep circumferential omental margin of clearance (mm)
  Deep margin of clearance (mm) in polypectomy and endoscopic mucosal resection specimens
- Other pathology
  Satellite foci, polyps, intestinal metaplasia, dysplasia, gastric atrophy, helicobacter gastritis, MALToma, hypertrophic gastropathy (e.g., Menetrier's disease, ZE Syndrome), ECL cell hyperplasia/microcarcinoidosis, response to neoadjuvant chemotherapy

Bibliography

Allen DC, Cameron RI. Histopathology specimens: clinical, pathological and laboratory aspects. 1st ed. Berlin/Heidelberg: Springer; 2004.

Allum WH, Blazeby JM, Griffin SM, Cunningham D, Jankowski JA, Wong R, On behalf of the Association of Upper Gastrointestinal Surgeons of Great Britain and Northern Ireland, the British Society of Gastroenterology and the British Association of Surgical Oncology. Guidelines for the management of oesophageal and gastric cancer. Gut. 2011;60:1449–72.

Bosman FT, Carneiro F. WHO classification of tumours of the digestive system. 4th ed. Lyon: IARC Press; 2010.

Cotton P, Williams C. Practical gastrointestinal endoscopy. 4th ed. London: Blackwell Science; 1996.

Day DW, Jass JR, Price AB, Shepherd NA, Sloan JM, Talbot IC, Warren BF, Williams GT. Morson and Dawson's gastrointestinal pathology. 4th ed. Oxford: Blackwell Science; 2003.

Lewin KJ, Appelman HD. Tumors of the esophagus and stomach, Atlas of tumor pathology, vol. 3rd series. Fascicle 18. Washington: AFIP; 1996.

Logan RPH, Harris A, Misciewicz JJ, Baron JH, editors. ABC of the upper gastrointestinal tract. London: BMJ Books; 2002.

Odze RD, Goldblum JR. Surgical pathology of the GI tract, liver, biliary tract and pancreas. 2nd ed. Philadelphia: Saunders/Elsevier; 2009.

Pritchard SA. ACP best practice. Best practice in macroscopic examination of gastric resections. J Clin Pathol. 2008;61:172–8.

Schlemper RJ, Riddell RH, Kato Y. The Vienna classification of gastrointestinal epithelial neoplasia. Gut. 2000;47:251–5.

The Royal College of Pathologists. Cancer datasets (oesophageal carcinoma, gastric carcinoma, carcinomas of the pancreas, ampulla of vater and common bile duct, colorectal cancer, gastrointestinal stromal tumours (GISTs), liver resection specimens and liver biopsies for primary and metastatic carcinoma, endocrine tumours of the gastrointestinal tract including pancreas) and tissue pathways (gastrointestinal and pancreatobiliary pathology, liver biopsies for the investigation of medical disease and for focal liver lesions). Accessed at http://www.rcpath.org/index.asp?PageID=254. Accessed on December 2011.

Wittekind C, Greene L, Hutter RVP, Klimfinger M, Sobin LH. TNM atlas: illustrated guide to the TNM/pTNM classification of malignant tumours. 5th ed. Berlin/Heidelberg: Springer; 2005.