Gross examination of the stomach

N Scott, P Quirke, M F Dixon

Introduction
Gastrectomy accounts for some 8% of all gastrointestinal surgical resections received at the Department of Histopathology in Leeds. Of these, 53% are subtotal (partial) and 47% are total. More than 80% are performed for malignant disease, and most of these for advanced gastric carcinoma. Therefore the examination of gastrectomy specimens will, in most cases, be concerned with confirming adequate local excision of tumour and describing pathological indicators of prognosis.

Gastrectomy is used less and less for the treatment of benign peptic ulcer disease, accounting for less than 10% of gastrectomies performed at Leeds General Infirmary between 1988–1990. This is mainly a consequence of the success of medical treatment with H2-receptor antagonists. However, subtotal gastrectomy, and rarely total gastrectomy, is still a treatment option in the management of perforated or bleeding gastric ulcers.

A minority of gastric resections are performed for primary gastric lymphoma, carcinoid tumour, stromal tumours of smooth muscle or neural origin, Zollinger-Ellison syndrome, gastric antral vascular ectasia (GAVE), and as an emergency procedure for uncontrollable haemorrhage due to example of a bleeding vascular malformation (table).1

Specimen reception
The specimen is ideally received fresh as soon as possible after resection. Overnight storage in a theatre refrigerator is acceptable unless special techniques are to be performed. DNA for use in the polymerase chain reaction (PCR) can be harvested up to six days after resection (as well as after fixation) but RNA and high molecular weight DNA for Southern blotting are more labile, and where possible fresh material should be stored at −80°C at the earliest opportunity. Immunocytochemistry may also require fresh, unfixed material, especially where a gastric lymphoma is suspected. Occasional antigens, such as oncogene products, deteriorate rapidly and tissue should be received within one to two hours of resection.

The stomach is generally opened along the greater curve unless this involves cutting across a focal lesion. Under these circumstances the lesser curve is opened. The opened stomach is pinned to a cork board under tension to reduce shrinkage artefact and to display the pathology to its maximum advantage. Despite the shrinkage induced by formalin we delay making measurements until after fixation. The specimen is then floated upside down in a bath of 10% formalin for 24 to 48 hours.

Before taking blocks a visual record is made of the specimen by photography, including identification number and a centimetre rule.

Macroscopic description
Length along the greater and lesser curve is always measured, as is the length of duodenal cuff. The location of any lesion, such as tumour or ulcer, is described and may be recorded on a simple diagram of the opened stomach (fig 1). This is particularly helpful when more than one lesion is present. Dimensions of the lesion including distance from the proximal and distal resection margins are
Gross examination of the stomach

Figure 2  Macroscopic classification of early gastric cancer.

Type I  Protruded
Type IIa  Raised
IIb  Flat
IIc  Depressed
Type III  Excavated

measured, and in the case of a carcinoma the macroscopic type is described—for example, ulcerating, diffusely infiltrating (linitis plastica), polypoid or fungating. The Borrmann classification can be used to categorise advanced gastric cancers according to macroscopic features, but despite types III and IV being more often poorly differentiated than types I and II, the classification is of little prognostic value. Early gastric cancers are classified macroscopically according to the descriptions given by Murakami into type I (protruded type), type II (elevated, flat, and depressed types), and type III (excavated type) lesions (fig 2). Although primarily intended for endoscopists and radiologists, such a classification provides a useful framework for clinicopathological correlations. Not uncommonly EGCs are multiple (up to 10%), and careful inspection of the fixed specimen may be required to exclude a second or third lesion. In Leeds 11·5% of carcinomas coming to gastrectomy over the past two years have been early gastric cancers.

Accurate measurement of the maximum diameter of gastric stromal tumours yields important prognostic information. Size, along with cellularity, mitotic count, and degree of nuclear pleomorphism, is an important criterion for predicting behaviour. Large tumours, especially those of more than 10 cm, have often metastasised while tumours less than 5·5 cm rarely metastasise.

Areas of high grade dysplasia in the stomach detected at biopsy are frequently associated with synchronous or metachronous adenocarcinomas, and in our experience have been found to be associated macroscopically with ulcers, elevated plaques, depressed areas, polyps or frank tumours. In individual cases extensive sampling of the gastric mucosa may be required to demonstrate the dysplasia. It is, of course, of largely academic interest to map the extent of dysplasia in the resected stomach, but of potential clinical importance is the discovery of dysplasia at a resection margin. Over the past two years we have found low grade dysplasia at the resection margin in 2% and high grade dysplasia in 1% of gastrectomies for carcinoma.

Apart from identifiable lesions the general appearance of the gastric mucosa should be commented on—for example, atrophic, thickened, erythematous, or haemorrhagic. Occasionally there may be a very distinctive mucosal appearance such as the haemorrhagic folds or “watermelon” appearance of GAVE, or the thickened rugal folds of Menetrier’s disease. A pronounced degree of mucosal atrophy confined to the body of the stomach should suggest autoimmune gastritis (pernicious anaemia), and dyes such as toluidine blue may be used to demonstrate the extent and distribution of intestinal metaplasia. Vario- liform gastritis presents a highly specific gross appearance that is characterised by multiple small erosions, often surmounting mucosal folds, usually located in the corpus. Most of these cases are associated with the microscopic features of lymphocytic gastritis.

Chronic gastric ulcers may be single or multiple (2·8%). Features suggestive of malignancy such as size of more than 2 cm, irregular elevated margins, and absence of radial mucosal folds should be recorded. The serosal aspect should be carefully examined, particularly in the vicinity of an ulcer or tumour as induration and pallor may indicate malignant disease.

Enlarged lymph nodes may be recorded on a diagram or verbally described. This aspect of the dissection is considered in more detail below. We do not practise clearance of adipose tissue using xylene, finding little difficulty in obtaining an adequate number of lymph nodes by careful dissection alone.

Taking blocks

Blocks are always taken from the proximal and distal resection margins. In our experience these have been affected by carcinoma in 15% and 1·3% of cases, respectively. Bozzetti et al reported proximal margin invasion in 7·3% of 343 gastrectomies, and found that extensive intramural spread beyond the macroscopic limits of the tumour correlated with serosal penetration and histologically diffuse carcinomas. Not surprisingly, resection margin disease is associated with a much reduced five year survival. Where adequate intraoperative frozen section has been performed it seems pointless to sample further the main specimen. It is necessary, however, to confirm the frozen section diagnosis on the appropriate paraffin wax-embedded tissue. The duodenal margin is less frequently invaded than the proximal one, the pyloric sphincter seemingly acting as a mechanical barrier to distal tumour spread.

We take, on average, four blocks from a tumour. At least one of these should include adjacent non-tumorous mucosa to assess dysplasia or intestinal metaplasia, and one, preferably all, should include serosa. Serial slices across the lesion may help in selection of a block showing the maximum depth of penetration of the stomach wall by tumour. In the case
of early gastric cancer the whole lesion should be embedded to exclude focal invasion of the muscularis propria.

Where a stromal tumour of the stomach has been resected it is recommended that at least one section is examined for every centimetre diameter of the tumour. This permits a proper assessment of mitotic activity and cellularity.

The importance of assessing the extent of tumour spread through the stomach wall cannot be overemphasised. Early gastric cancers confined to the mucosa or submucosa have an excellent five year survival irrespective of lymph node metastasis, while serosal penetration and invasion of contiguous structures—for example, spleen, liver, transverse colon, are associated with 30% and 5% five year survivals, respectively. Even focal invasion of the muscularis propria may be associated with a significant increase in mortality, a fact which highlights the importance of thorough sampling of EGCs.

Benign peptic ulcers, particularly large ones, should be extensively sampled (≥ 4 blocks), paying particular regard to the edge of the ulcer. Up to 10% of clinically benign gastric ulcers will prove to be malignant on histological examination, although the estimated incidence of carcinoma arising in a pre-existing peptic ulcer is thought to be less than 1%.

It is routine practice in our department to take a random block of antral and body mucosa in order to assess the presence, distribution and type of gastritis according to the Sydney System. However, the detection of Helicobacters in resection specimens by haematoxylin and cosin or rapid Giemsa staining is hampered by their adoption of a coccoïd morphology in the interval between removal and fixation. In situ hybridisation or PCR may be used to identify the organism under these circumstances.

Finally, dissection of the perigastric and related lymph nodes is of paramount importance in pathological staging of gastric carcinoma, and should not be hurried.

Figure 3 shows the standard format for reporting of gastric cancer developed at the Leeds General Infirmary. Such a protocol helps standardise reporting practices among individual pathologists and serves as an aide-memoire to the correct handling of the specimen.

Examination of lymph nodes

After resection margin disease and depth of invasion, lymph node involvement by carcinoma is the most important determinant of prognosis in "curative" gastric surgery. Careful attention to number and location of nodes harbouring metastatic tumour is therefore paramount. We use the TNM classification to assign tumours to N0 (no regional node involvement), N1 (metastasis in perigastric nodes within 3 cm of the primary tumour), or N2 (metastasis in perigastric lymph nodes greater than 3 cm from the primary tumour) groups. Involvement of hepatoduodenal, retroperitoneal, mesenteric or para-aortic lymph nodes is included under distant metastasis, M1. Nodes along the left gastric, common hepatic, splenic or coeliac arteries fall within the N2 category. Examination of a large series of radical gastrectomies in Japan has shown sharp differences in the pattern of nodal

---

**Figure 3** Protocol for the reporting of gastric cancers as used at the Leeds Infirmary.

**UNITED LEEDS TEACHING HOSPITALS N.H.A.S. LEEDS GASTRIC CANCER REPORT**

**PATIENT DETAILS**

Name: 
Age: 
Date of Birth: 
Sex: M/F: 
Discipline: 
Address: 
Consultant in Charge: 

**CLINICAL DETAILS**

Operation No.: 
Hospital No.: 
Diagnosis: 
Primary Site: 
Diameter of section examined for metastasis: 
Location of specimen: 
Site of specimen: 
(Tumours of perigastric nodes are excluded from this classification.)

**PATHOLOGICAL REPORT**

Pathology No.: 
Stage: 
Grade: 
Oesophagus: 
Surgical specimen: 

**Microscopic description**

Site of specimen: 
Type: 
Size of tumour: 
Nodal number assessed: 
Distance from the margin: 
Grade of tumour: 
Organic content: 
Type of tumour: 
Lymph node assessed: 
Type of tumour: 
Lymph node assessed: 

**NOTE**

The presence or absence of invasion is a matter of opinion by the advanced section of the tumour.

---

**Microscopic description**

Site of specimen: 
Type: 
Size of tumour: 
Nodal number assessed: 
Distance from the margin: 
Grade of tumour: 
Organic content: 
Type of tumour: 
Lymph node assessed: 
Type of tumour: 
Lymph node assessed: 

**NOTE**

The presence or absence of invasion is a matter of opinion by the advanced section of the tumour.
metastasis from tumours affecting the upper, middle, and distal thirds of stomach. Reference to such data may reveal lymph node disease.

Examination and reporting of gastrectomy cases must to some extent take account of the requirements of the local surgeon. Surgeons specialising in the treatment of gastric cancer may demand some comment on how curative the procedure is according to the guidelines of the Japanese research society for gastric cancer. Others may not.

Lymph nodes are examined microscopically at a single level. Although we have occasionally seen "microscopic involvement" by small numbers of tumour cells in the peripheral sinus which may easily be missed in a single level, the importance of this finding in gastric carcinoma is unknown.

**Special procedures**

Fresh tissue may occasionally be required for immunocytochemistry, RNA, or DNA extraction. The increasing interest in molecular biology and the availability of less complicated, more user-friendly techniques such as PCR makes it increasingly important to store unfixed tissue. We routinely take at least one block of "normal" tissue and one block of tumour from all gastric cancers. These are wrapped in aluminium foil, cassetted, and snap frozen in liquid nitrogen before storage in a freezer at −70°C. It is always important to include normal mucosa or lymph node for comparison with the tumour sample, otherwise chromosomal deletions or deletions of specific tumour suppressor genes cannot be evaluated. Recently, expression of the c-erbB-2 gene has been associated with reduced survival in Japanese patients with gastric cancer. Although several polyclonal antibodies are available which permit the immunohistochemical detection of c-erbB-2 glycoprotein in formalin fixed paraffin wax embedded tissue, quantitative estimates of the level of amplification of the gene by Southern blotting or dot-blot hybridisation currently require unfixed tissue.

Flow cytometric determination of tumour ploidy and proliferation rate can be performed on routinely processed or fresh material. DNA aneuploidy determined by flow cytometry has been found to correlate with survival in both adenocarcinomas of the stomach, and in the less common, more unpredictable gastric stromal tumours. Immunocytochemical markers of cellular proliferation such as Ki67 can also be used on frozen sections, whereas the proliferating cell nuclear antigen (PCNA) is resistant to formalin fixation and is detectable in paraffin wax embedded tissue. Cubes of tumour may be fixed in glutaraldehyde for electron microscopic examination to elucidate poorly differentiated neoplasms, and arteriography may be performed in cases of Dieulafy's malformation.

**Conclusion**

Most gastrectomies are performed for advanced gastric carcinoma, but with increasing use of endoscopic screening it is likely that over the next 20 years an increasing proportion of early gastric cancers and high grade dysplasias will be seen. The accurate staging of these lesions will be vital to assess prognosis, plan further treatment, and compare results between different centres and different treatment modalities. It should always be remembered that a careful and methodical approach to examination of the gross specimen is a prerequisite to the correct interpretation of microscopic findings.

We are indebted to Miss J Hamblin and Mr S Tomis for their assistance in the preparation of the manuscript.


N Scott, P Quirke and M F Dixon

doi: 10.1136/jcp.45.11.952

Updated information and services can be found at:
http://jcp.bmj.com/content/45/11/952.citation

**Email alerting service**

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

**Notes**

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/