



Guidelines on autopsy practice: Autopsy examination following bariatric surgery

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Series authors: Dr Michael Osborn, Imperial College Healthcare NHS Trust

Specialist authors: Dr Jillian Davis, Nottingham University Hospitals NHS Trust

Dr Ian Scott, Nottingham University Hospitals NHS Trust

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Produced by	The specialist content of this guideline has been produced by Dr Jillian Davis (BSc, MB ChB, MRCP, Speciality Registrar) and Dr Ian Scott (BSc, MBBS, MD, DPhil, FRCPath, Consultant Neuropathologist), Department of Cellular Pathology, Nottingham University Hospitals NHS Trust.
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The Royal College of Pathologists

6 Alie Street, London E1 8QT

Tel: 020 7451 6700

Fax: 020 7451 6701

Web: www.rcpath.org

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Foreword

The autopsy guidelines published by the Royal College of Pathologists (RCPATH) are guidelines which enable pathologists to deal with non-forensic consent and coroner's post mortems in a consistent manner and to a high standard.

The guidelines are systematically developed statements to assist the decisions of practitioners and are based on the best available evidence at the time the document was prepared. Given that much autopsy work is single observer and one-time only in reality, it has to be recognised that there is no reviewable standard that is mandated beyond that of the FRCPath part 2 exam. Nevertheless, much of this can be reviewed against ante-mortem imaging and other data. This guideline has been developed to cover most common circumstances. However, we recognise that guidelines cannot anticipate every pathological specimen type and clinical scenario. Occasional variation from the practice recommended in this guideline may therefore be required to report a specimen in a way that maximises benefit to the coroner and the deceased's family.

There is a general requirement from the General Medical Council (GMC) to have continuing professional development in all practice areas and this will naturally encompass autopsy practice.

The guidelines themselves constitute the tools for implementation and dissemination of good practice.

The stakeholders consulted for this document were consultant pathologists, anatomical pathology technicians, upper gastrointestinal (GI) surgeons, undertakers, service managers and the Human Tissue Authority (HTA) and its Histopathology Working Group, which includes representatives from the Association of Anatomical Pathology Technology, Institute of Biomedical Science, The Coroners' Society of England and Wales, the Home Office Forensic Science Regulation Unit and Forensic Pathology Unit, and the British Medical Association.

The information used to develop this document was derived from current medical literature. Much of the content of the document represents custom and practice, and is based on the substantial clinical experience of the authors. All evidence included in this guideline has been graded using modified SIGN guidance (see Appendix C). The sections of this guideline that indicate compliance with each of the AGREE II standards are indicated in Appendix D.

No major organisational changes or cost implications have been identified that would hinder the implementation of the guidelines.

A formal revision cycle for all guidelines takes place on a five-year cycle. The College will ask the authors of the guideline, to consider whether or not the guideline needs to be revised. A full consultation process will be undertaken if major revisions are required. If minor revisions or changes are required, whereby a short note of the proposed changes will be placed on the College website for two weeks for members' attention. If members do not object to the changes, the short notice of change will be incorporated into the guideline and the full revised version (incorporating the changes) will replace the existing version on the College website.

The guideline has been reviewed by the Clinical Effectiveness department, Death Investigation Group and Lay Governance Group. It was placed on the College website for consultation with the membership from 19 December 2018 to 16 January 2019. All comments received from the membership were addressed by the author to the satisfaction of the Clinical Lead for Guideline Review (Cellular Pathology).

The guideline was developed without external funding to the writing group. The College requires the authors of guidelines to provide a list of potential conflicts of interest; these are monitored by the Clinical Effectiveness department and are available on request. The authors of this document have declared that there are no conflicts of interest.

1 Introduction

It is a requirement to report postoperative deaths in the UK to the coroner or procurator fiscal. With increasing levels of obesity, and a corresponding rise in the number of weight loss operations performed on individuals, it is important for the coroner's pathologist to understand the surgical procedures, postoperative course and the complications that can arise because of these procedures. The pathophysiology of bariatric surgery is also of importance as many deaths following this type of surgery may have a significant metabolic component. It has been reported previously that autopsies in obese patients are performed in a non-standardised manner.¹ This document was created to address the specific difficulties in performing autopsies in patients who have undergone bariatric surgery and indicates a technical approach and investigations that should prevent criticism of case analysis in medicolegal environments.

There has been a significant rise in the rates of obesity in the UK population. Between 1993 and 2015, the proportion of adults in the UK that were obese rose from 15% to 27%.² In 2015, 58% of women and 68% of men were overweight or obese.² Obesity is a risk factor for significant illness including hypertension, type 2 diabetes mellitus, cardiovascular disease and some malignancies, such as breast, oesophageal and colorectal cancers.³ Obstructive sleep apnoea and osteoarthritis⁴ are also associated comorbidities. Obesity causes significant psychological distress and social stigmatisation. In 2015/16, there were 525,000 admissions in NHS hospitals in which obesity was recorded as the primary or secondary diagnosis.² There are estimated to be 35,000 deaths attributed to obesity in the UK each year, which is equivalent to one in 16 of all deaths.⁵ The implication of these data is that the number of cases referred to the coroner's autopsy service is likely to increase.

Obesity is defined by the body mass index (BMI), which is calculated as the subject's weight in kilograms divided by the square of their height in metres. A BMI over 30 is classified as obese, with over 35 being classified as morbid obesity. Generally, obesity is caused by calorie intake exceeding energy expenditure, although a small proportion of cases may be attributed to drug side effects, endocrine disorders or other medical conditions. Rising rates of obesity in the population are attributed to easily accessible and high calorie diets with an increase in sedentary lifestyles.

1.1 Target users of these guidelines

The target primary users of these guidelines are established consultants performing coroner's autopsies. The recommendations will also be of value to trainee pathologists, particularly those approaching the Certificate of Higher Autopsy Training (CHAT) examination and the FRCPath Part 2 in forensic pathology. In addition, these recommendations may be of use to mortuary staff who routinely perform these cases, undertakers and hospital managers who need to provide equipment and facilities capable of delivering this type of service.

2 The role of the autopsy

- To determine whether the death is related to the bariatric surgical procedure.
- To consider whether death is due to an unrelated, otherwise natural, cause.
- To examine the integrity of all surgical anastomoses.
- To describe other comorbidities that may have contributed to death.

[Level of evidence – D.]

3 Surgical management of obesity

Surgical management of obesity is indicated for individuals with a BMI greater than 40 kg/m², or greater than 35 kg/m² with other significant disease (for example, type 2 diabetes or hypertension). National Institute for Health and Care Excellence (NICE) recommends that patients have also tried appropriate non-surgical measures that have failed to achieve or maintain adequate weight loss for at least six months, and the person is fit for anaesthesia and surgery, with commitment to long-term follow-up.⁶

There are several procedures commonly carried out in the UK, as described in Appendix A. The two most commonly performed procedures in the UK are gastric band surgery and Roux-en-Y gastric bypass surgery with duodenal switch.

4 Pathology encountered at the autopsy

Deaths following bariatric surgery can largely be divided into: recognised complications of surgery,⁷ complications of anaesthesia, hospital-acquired infection or natural causes precipitated by the physiological insult of major surgery in an obese individual. Careful inspection should be made so as to be able to discuss the relative contributions of each component. Deaths occurring some months or years after the initial weight loss surgery may still be related to the operation and are an important part of the past medical and surgical history. For a more thorough description of the types of injury that may occur please see Appendix B.

The following pathology may occur owing to bariatric surgery:

- anastomotic leaks, due to localised haemorrhage, infarction or technical failure
- intraluminal bleeding
- sepsis and multi-organ failure
- surgical wound infections
- visceral injury from trocar placement
- splenic injury
- hepatic injury or haemorrhage in the context of hepatomegaly due to non-alcoholic fatty liver disease
- portal vein injury and portal vein thrombosis
- bowel ischaemia and internal hernias
- misconstruction of the diverted GI tract
- venous thromboembolism (VTE) and pulmonary embolism
- myocardial infarction and congestive cardiac failure
- postoperative pneumonias
- gastric remnant distension following gastric bypass causing perforation and peritonitis
- marginal ulcers at the gastro-jejunostomy site
- infection of a gastric band or erosion of the band through the stomach wall.

Obesity provides a particular anaesthetic challenge with excess weight having a significant impact on an individual's physiology, with the additional risks of anaesthetising a patient with significant comorbidities.⁸ Concerns that a perioperative death is as a result of anaesthesia should lead to careful consultation with an anaesthetist. Conditions encountered include:

- pneumothorax
- gas embolism
- surgical emphysema
- aspiration pneumonia/pneumonitis
- airway difficulties
- anaesthetic agent reactions.

Deaths occurring in the medium to long term following bariatric surgery may include the following pathology:

- gastric band slippage, port or tubing malfunction
- leakage at the port site tubing or band
- anastomotic breakdown
- gastric pouch or oesophageal dilatation and oesophagitis
- acute alcohol intoxication due to changes in metabolism⁹
- alcohol abuse or dependence¹⁰
- cholelithiasis and choledocholithiasis with cholecystitis
- metabolic and nutritional derangements
- nephrolithiasis and renal failure
- postoperative hypoglycaemia.

[Level of evidence – C.]

5 Specific health and safety implications

Bariatric patients pose a challenge for the mortuary. It is necessary for equipment such as trays, trolleys and tables to be able to tolerate extra weight, but it is also necessary for refrigeration spaces to have the correct dimensions to accommodate a patient. Mortuary scales need regular calibration, and the mortuary should ensure it has equipment capable of weighing and transferring an increasing number of bariatric patients. Considerations are also needed for bariatric patients to be viewed in the chapel if requested by a family. In some instances, makeshift viewing facilities have been arranged in an access controlled corridor for patients unable to use the chapel beds, which is clearly not ideal for both family and staff. Redesigns and refitting of viewing facilities should take this into account. Contingency plans should be in place, including service level agreements, to accommodate bariatric patients at other facilities if local storage is full or otherwise unavailable.

When considering performing a bariatric post mortem, there are a significant number of manual handling events that need to occur. The transfer of the deceased from the trolley to the post-mortem table requires a lateral movement, with manual handling guidance being that at waist level each individual should be moving 15–20 kg, necessitating a large number of people for a safe transfer. This is also the case for rolling the deceased for the pathologist to view the back. Care should be taken to avoid increasing the risk of musculoskeletal problems. With future mortuary design, an element that allows trays that lock into tables for accommodating bariatric patients is likely to be desirable.

The evisceration procedure is technically more difficult in obese patients owing to increased subcutaneous fat making reflection of skin more difficult and there are significant risks to

anatomical pathology technicians and pathologists performing evisceration as the blade may not be easily visualised. Removal of the brain becomes technically more difficult to perform with a respectful incision, owing to reduced neck extension. Restoring the body is also more technically difficult as the sutured skin incision can be pulled open owing to strain on it from excess soft tissue. Local practice is to stitch the deep fascia prior to the skin so that the strain on the suture line is dissipated.

Some mortuaries may lack the facilities to accommodate a bariatric referral for post mortem and need to refer the case to another local hospital. This creates transportation issues and increases the time the deceased's body is not able to be released to the family.

[Level of evidence – GPP.]

6 Clinical information relevant to the autopsy

- Circumstances of death will assist in the assessment of the cause of death and the contribution, if any, of the surgical procedure.
- Past medical history will assist in the assessment of the cause of death and the contribution, if any, of the surgical procedure. Confounding factors such as tobacco smoking history or alcohol use can impact on the pathology assessment of obesity-related disease.
- It is important to assess the contribution of therapeutic drugs to the death. During the time of surgery, drugs may have been withheld or incorrectly continued. Immediately following surgery, there may be issues with altered absorption, and in the longer term with weight loss, there may be increases in plasma levels. Where appropriate, it should be assessed whether drugs had been adequately dose adjusted.
- The medical records and often witness statements are required to detail the operative and postoperative course. Identify from these the exact procedure and modifications performed and if there were any operative complications.
- Pre- and postoperative investigation results looking for evidence of potential metabolic abnormalities including diabetes, ketoacidosis, renal failure and pancreatitis. Look at temperature charts and electrocardiogram traces for evidence of sepsis or electrolyte imbalance.
- Review any imaging studies that may assist in determining the anatomy of the surgical procedure and the presence of any leaks.

[Level of evidence – GPP.]

7 The autopsy procedure

A complete post-mortem examination including the central nervous system should be performed. A limited post mortem confined to examination of surgical site is considered suboptimal.

[Level of evidence – GPP.]

8 Specific significant organ systems

Table 1 summarises common conditions that may be encountered in the context of a bariatric post mortem, although this is not an exhaustive list.

Table 1: Significant organ systems.

Organ/system	Pathology
Lungs	<ul style="list-style-type: none">• Pneumonia or aspiration pneumonia• Chronic obstructive pulmonary disease• Pulmonary hypertension• Pulmonary thromboembolism• Air embolism
Heart	<ul style="list-style-type: none">• Myocardial infarction• Hypertensive heart disease
Central nervous system	<ul style="list-style-type: none">• Cerebral haemorrhage• Cerebral infarction
Hepato-pancreatic biliary	<ul style="list-style-type: none">• Cholelithiasis• Pancreatitis• Cirrhosis
GI tract	<ul style="list-style-type: none">• Perforation of a viscus• Anastomotic leak• Bowel infarction• Superior/inferior mesenteric artery occlusion• Occlusion of the coeliac axis• Faecal peritonitis• Paralytic ileus• Incisional and internal hernias• Failure of gastric band or medical device
Haemoreticular system	<ul style="list-style-type: none">• Splenic haemorrhage
Metabolic	<ul style="list-style-type: none">• Hyper/hypoglycaemia• Drug toxicity

[Level of evidence – GPP.]

9 Organ retention

Organ and tissue sampling will largely depend on clinical suspicion and the need to exclude a particular pathology. It is not essential to retain whole organs or sagittal slices when adequately sampled tissue will suffice for purposes of diagnosis and causation. Where a death might result in a medicolegal claim, judicious sampling is encouraged. It is recommended that the time for tissue retention be at least five years to allow for the slow passage of medicolegal cases.

[Level of evidence – GPP.]

10 Post-mortem imaging

Post-mortem imaging is an emerging technique and may be requested for cultural or religious reasons.

There are often local arrangements for imaging, which may be off-site. To facilitate this, it has been confirmed by the HTA that non-invasive post-mortem examinations that do not include sampling do not need to be performed on HTA-licensed premises. Considerations for imaging obese patients include weight limitations on the scanner and trolleys necessary for

transporting, and the dimensions of the scanner aperture. CT scanning in live, obese patients can suffer from reductions in image quality owing to beam hardening and limited field of view; however, patients who have predominantly intraperitoneal fat may have improved visualisation of organs owing to delineation of internal organ structures by fat.¹¹ Unfortunately, for application in bariatric surgery, imaging autopsies cannot reliably recognise some of the common causes of death following this type of surgery including: coronary artery disease (unless combined with angiography), pulmonary embolism, perforation of a viscus and pneumonia. Local policies for post-mortem imaging need to include the maximum weight and dimensions of the scanner, and may require counselling of families prior to imaging that there may be an increased risk of an uncertain outcome and proceeding to conventional autopsy.

11 Histological examination

Clinical judgement must be used to assess the need for histology in each individual case in compliance with the Coroners (Investigations) Regulations 2013.

Histological sections may be considered:

- across all sites of anastomosis
- gastric mucosa for *Helicobacter pylori*
- any region of bowel suggestive of infarction
- the heart to exclude myocardial infarction or other cardiac causes of death
- the lung to confirm or refute aspiration pneumonia/pneumonia
- the liver should always be sampled, for microscopic changes related to obesity and metabolic factors
- other pathology as indicated.

12 Toxicology

Toxicology samples of blood, urine and vitreous fluid should be taken if any of the following are suspected:

- hypoglycaemia
- diabetic ketoacidosis
- pancreatitis
- drug reactions/overdose
- alcohol.

In addition, it is important to assess the contribution of therapeutic drugs to the death. During the time of surgery, drugs may have been withheld or incorrectly continued. Immediately following surgery, there may be issues with altered absorption, and in the longer term with weight loss, there may be increases in plasma levels. Where appropriate, it should be assessed whether or not drugs had been adequately dose adjusted for body weight or ideal body weight.

[Level of evidence – GPP.]

13 Clinicopathological correlation

With the permission of the coroner, it may be advisable to discuss perioperative deaths with the surgeon or invite them to the mortuary at the time of the examination. The case notes should be examined and any pathological abnormalities should be considered in the context of the clinical findings. In the context of bariatric surgery, metabolic abnormalities should be considered especially if there have been anaesthetic complications. Permission should always be sought to discuss anaesthetic deaths with the anaesthetist.

[Level of evidence – GPP.]

14 Examples of cause of death opinions/statements

- 1a. Peritonitis
- 1b. Breakdown of surgical anastomosis
- 1c. Roux-en-Y gastric bypass surgery with duodenal switch (date) for morbid obesity

- 1a. Multiple organ failure
- 1b. Postoperative haemorrhage and sepsis
- 1c. Sleeve gastrectomy (date) for morbid obesity
- 2. Diabetes mellitus

- 1a. Pulmonary embolism
- 1b. Deep venous thrombosis
- 1c. Morbid obesity
- 2. Gastric band surgery (date)

- 1a. Renal failure
- 1b. Nephrolithiasis
- 1c. Hyperoxaluria
- 2. Roux-en-Y gastric bypass surgery with duodenal switch (date) for morbid obesity

- 1a. Acute necrotising pancreatitis
- 1b. Choledocholithiasis
- 2. Gastric band surgery (date) for previous morbid obesity

- 1a Sepsis and multi-organ failure
- 1b. Perforated stomach (repaired)
- 1c. Morbid obesity (date of surgery)
- 2. Cirrhosis of the liver

[Level of evidence – GPP.]

15 Funeral arrangements

Funeral directors should be made aware of the patient's weight when arranging transfer of the deceased individual, so correct transportation allowances can be made. Mortuaries may consider transfer on a tray that can be returned by the funeral directors after transfer. Local crematoria have their own weight and size restrictions when cremating morbidly obese patients.

[Level of evidence – GPP.]

16 Criteria for audit

The following standards are suggested criteria that might be used in periodic reviews to ensure a post-mortem report for coronial autopsies conducted at an institution comply with the national recommendations provided by the 2006 NCEPOD study (www.ncepod.org.uk/2006Report/Downloads/Coronial%20Autopsy%20Report%202006.pdf):

- supporting documentations:
 - standards: 95% of supporting documentation was available at the time of the autopsy
 - standards: 95% of autopsy reports documented are satisfactory, good or excellent
- reporting internal examination:
 - standards: 100% of autopsy reports must explain the description of internal appearance
 - standards: 100% of autopsy reports documented are satisfactory, good or excellent
- reporting external examination:
 - standards: 100% of autopsy reports must explain the description of external appearance
 - standards: 100% of autopsy reports documented are satisfactory, good or excellent.

A template for coronial autopsy audit can be found on the Royal College of Pathologists website (www.rcpath.org/profession/quality-improvement/conducting-a-clinical-audit/clinical-audit-templates.html).

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Appendix A Surgical management of obesity

There are several procedures commonly carried out in the UK for surgical management of obesity that can be divided into those causing malabsorption (biliopancreatic diversion, jejunoileal bypass and endoluminal sleeve surgery), restrictive processes (vertical banded gastroplasty, adjustable gastric band surgery, sleeve gastrectomy, gastric balloon insertion and gastric plication) and mixed procedures including Roux-en-Y gastric bypass surgery with duodenal switch.

The two most commonly performed procedures in the UK are gastric band surgery and Roux-en-Y gastric bypass surgery with duodenal switch. Gastric banding is usually performed laproscopically under general anaesthesia. A band is placed around the stomach, dividing the stomach into two compartments, with the proximal pouch at the top of the stomach being small so as to induce satiety. The band can be inflated with sterile saline through an access port to allow adjustment. Gastric bypass is also performed laparoscopically under general anaesthesia and, in this procedure, a small pouch is created at the top of the stomach that is anastomosed to the small intestine. This operation induces early satiety and causes malabsorption.

A sleeve gastrectomy may be used to treat people with a BMI greater than 60. In this procedure, a section of the stomach is surgically removed, reducing the size of the stomach to a quarter of the normal volume. A biliopancreatic diversion uses the same principles as a gastric bypass; however, by bypassing a larger section of the small intestine, it can result in a high rate of complication and side effects. An intra-gastric balloon is a silicone balloon that is surgically implanted into the stomach endoscopically and filled with air or saline, effectively reducing the available space in the stomach and inducing early satiety. This is often a temporary procedure and used when an individual is unsuitable for permanent surgery.

The number of bariatric operations carried out in England was 4,200 in 2008/09 and increased to 8,600 in 2010/11.⁷ Increasing numbers of operations are being performed abroad, where costs are lower, and surgeons may operate on those with a BMI greater than or equal to 30.

Surgery leads to a stabilised weight loss of between 14% and 25% at 10 years depending on the operation type.¹² A meta-analysis identified a complication rate of 17% and reoperation rate of 7%.¹³

Appendix B Risks associated with surgical management of obesity

Deaths following bariatric surgery may be due to recognised complications of surgery, complications of anaesthesia, hospital-acquired infection or natural causes precipitated by the physiological insult of major surgery in an obese individual. Careful inspection should be made so as to be able to discuss the relative contributions of each component. Deaths occurring some months or years after the initial weight loss surgery may still be related to the operation and is an important part of the past medical and surgical history.

There are a number of risks specific to bariatric surgery itself.

- Injury to viscera may occur from trocar placement (a procedure that is more difficult in obese individuals).
- The spleen may be injured, requiring haemostasis measures.
- The portal vein can be injured with consequent portal vein thrombosis.
- Hepatomegaly, due to steatohepatitis, is frequently seen in obese patients and can cause difficulties in viewing the abdomen, as well as risk of bleeding during laparoscopic surgery.
- Bowel ischaemia may occur if the root of the mesentery is compromised during transection of the small bowel, or if the mesentery is under tension during anastomosis formation.
- Bowel ischaemia may result from internal hernias and it is important to look for these in a post-mortem case.
- There is a risk of misconstruction of the diverted GI tract, which leads to the biliopancreatic secretions returning to the stomach pouch, inversion of sections of the GI tract or the distal jejunum becoming disconnected from the proximal GI tract.
- Leaks following bariatric surgery have been seen in up to 6% of patients; most occur within a week,¹³ but are much more likely to occur after revisional surgery. Leaks can be caused by technical failure or after localised bleeding at the anastomosis, which causes failure. Obese patients are at increased risk of anastomotic leaks compared with non-obese patients undergoing GI surgery owing to their poor nutritional state.
- Patients may present with signs of sepsis. Surgical wound infection rates vary with the operation used, and whether it is performed laparoscopically or open. The incidence can be decreased by judicious use of perioperative antibiotics. The wound should be inspected in all postoperative deaths, and culture considered where sepsis is thought to have had a role.
- Bleeding after gastric bypass has been described in up to 4% of patients, and is usually intraluminal and from the anastomotic site.¹⁴ The presence of free blood in the thoracic cavity, abdominal cavity or GI tract should be quantified and commented on. A bleeding source should be identified.
- VTE and pulmonary embolism counts for a high proportion of deaths following bariatric surgery, with data from the BOLD database showing that the incidence of VTE was 0.29% for laparoscopic procedures and 1.2% for open procedures.^{15,16} Risk factors for VTE include severe venous stasis disease, BMI >60, truncal obesity and obesity-hypoventilation syndrome.¹⁶ Pulmonary embolism can present in a very similar way to a postoperative leak causing sepsis, and in a bariatric post mortem it is important to look directly for each entity regardless of the presumed diagnosis.
- Myocardial infarction and congestive cardiac failure occur in 0.2% of patients within 30 days of bariatric surgery.¹⁷ Routine weighing and inspection of the organs at post mortem, with judicious histological sampling, will identify such cases.
- Postoperative pneumonias associated with increased length of stay, ventilator use and atelectasis may occur. Predictors for postoperative pneumonia include past medical history

of heart failure, chronic obstructive pulmonary disorder, bleeding disorder, smoking, increasing age and the type of procedure performed.¹⁸

There are also less common complications that are specific to particular bariatric operations.

- After Roux-en-Y gastric bypass, gastric remnant distension may rarely occur if there is a paralytic ileus secondary to vagal injury, or distal mechanical obstruction occurs postoperatively. Continued distension can lead to perforation and peritonitis from the gastric contents.
- Marginal ulcers may be seen at the gastro-jejunostomy site due to acid entering the jejunum, poor tissue perfusion, the presence of suture or staple material, non-steroidal anti-inflammatory drug use, smoking or *Helicobacter* infection; the latter is high in bariatric surgical patients. Patients are at risk of bleeding and perforation of marginal ulcers.
- Roux-en-Y surgery places patients at risk of ventral incisional hernia and internal hernias with the additional risk of developing subsequent bowel obstruction, infarction and perforation.
- Gastric banding has been associated with several complications, such as causing an infection of the band or gastric perforation due to over distension of the pouch because of over eating or erosion of the band through the stomach wall.
- Postoperative changes in oesophageal peristalsis and sphincter relaxation increases the risk of regurgitation and resultant aspiration, particularly during general anaesthetic,^{19,20} and the post-mortem pathologist should assess potential aspiration in postoperative pneumonia.

Anaesthetic complications

Obesity provides a particular anaesthetic challenge with excess weight having a significant impact on an individual's physiology, with the additional risks of anaesthetising a patient with significant comorbidities. An obese patient's respiratory system has reductions in functional reserve capacity and total lung capacity, increased risk of intrapulmonary shunting, increased oxygen consumption and carbon dioxide production, decreased lung compliance and increased mechanical pressure from the abdomen that leads to decreased respiratory efficiency.²¹ High pressures may be needed to insufflate the abdomen during laparoscopic bariatric surgery with further increased intra-thoracic pressures and decreased functional capacity, and an increased risk of pneumothorax, gas embolism and surgical emphysema.⁸ When an obese patient undergoes anaesthesia, airway difficulties and desaturation at the time of induction may be encountered owing to restricted cervical spine movement and redundant oral tissue. The pharmacokinetics of anaesthetic agents are altered in morbid obesity. Concerns that a perioperative death is as a result of anaesthesia should lead to careful consultation with an anaesthetist.

Metabolic complications

Gastric bypass surgery changes the way alcohol is metabolised and patients are more susceptible to the effects of alcohol, experiencing longer, more intense acute intoxication and needing more time to become sober. Gastric bypass patients experience higher peak blood alcohol levels than they did before gastric bypass surgery.⁹ There is evidence that a small percentage of patients undergoing weight loss surgery appear to develop alcohol abuse or dependence.¹⁰ These combined factors might make taking samples for toxicology analysis important at a post-mortem examination of an individual with an appropriate history.

Rapid weight loss following gastric bypass can lead to cholelithiasis and choledocholithiasis, with patients at risk of cholecystitis. A number of metabolic and nutritional derangements are described after bariatric surgery that might contribute to morbidity and mortality, including hyperoxaluria causing nephrolithiasis and renal failure and postoperative hypoglycaemia causing seizures.²²

Long-term complications

Long-term complications include band slippage, port or tubing malfunction, leakage at the port site tubing or band, pouch or oesophageal dilatation, and oesophagitis.

Appendix C

Summary table – Explanation of grades of evidence

(modified from Palmer K *et al. BMJ* 2008;337:1832)

Grade (level) of evidence	Nature of evidence
Grade A	<p>At least one high-quality meta-analysis, systematic review of randomised controlled trials or a randomised controlled trial with a very low risk of bias and directly attributable to the target population</p> <p>or</p> <p>A body of evidence demonstrating consistency of results and comprising mainly well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias, directly applicable to the target population.</p>
Grade B	<p>A body of evidence demonstrating consistency of results and comprising mainly high-quality systematic reviews of case-control or cohort studies and high-quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relation is causal and which are directly applicable to the target population</p> <p>or</p> <p>Extrapolation evidence from studies described in A.</p>
Grade C	<p>A body of evidence demonstrating consistency of results and including well-conducted case-control or cohort studies and high-quality case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relation is causal and which are directly applicable to the target population</p> <p>or</p> <p>Extrapolation evidence from studies described in B.</p>
Grade D	<p>Non-analytic studies such as case reports, case series or expert opinion</p> <p>or</p> <p>Extrapolation evidence from studies described in C.</p>
Good practice point (GPP)	<p>Recommended best practice based on the clinical experience of the authors of the writing group.</p>

Appendix D AGREE II compliance monitoring sheet

The guidelines of the Royal College of Pathologists comply with the AGREE II standards for good quality clinical guidelines. The sections of this guideline that indicate compliance with each of the AGREE II standards are indicated in the table below.

AGREE standard	Section/page of guideline
SCOPE AND PURPOSE	
1. The overall objective(s) of the guideline is (are) specifically described.	Foreword, 1
2. The clinical question(s) covered by the guidelines is (are) specifically described.	Foreword, 1
3. The patients to whom the guideline is meant to apply are specifically described.	Foreword, 1
STAKEHOLDER INVOLVEMENT	
4. The guideline development group includes individuals from all the relevant professional groups.	Foreword
5. The patients' views and preferences have been sought.	Foreword
6. The target users of the guideline are clearly defined.	1
7. The guideline has been piloted among target users.	Foreword
RIGOUR OF DEVELOPMENT	
8. Systematic methods were used to search for evidence.	Foreword
9. The criteria for selecting the evidence are clearly described.	Foreword
10. The methods used for formulating the recommendations are clearly described.	Foreword
11. The health benefits, side effects and risks have been considered in formulating the recommendations.	n/a
12. There is an explicit link between the recommendations and the supporting evidence.	2–15
13. The guideline has been externally reviewed by experts prior to its publication.	Foreword
14. A procedure for updating the guideline is provided.	Foreword
CLARITY OF PRESENTATION	
15. The recommendations are specific and unambiguous.	2–15
16. The different options for management of the condition are clearly presented.	2–15
17. Key recommendations are easily identifiable.	2–15
18. The guideline is supported with tools for application.	Foreword
APPLICABILITY	
19. The potential organisational barriers in applying the recommendations have been discussed.	Foreword
20. The potential cost implications of applying the recommendations have been considered.	Foreword
21. The guideline presents key review criteria for monitoring and/audit purposes.	16
EDITORIAL INDEPENDENCE	
22. The guideline is editorially independent from the funding body.	Foreword
23. Conflicts of interest of guideline development members have been recorded.	Foreword