The vermiform appendix
(Lecture two)

Differential diagnosis in Adult females

1) **Salpingitis**

Typically, the pain is lower than in appendicitis and is bilateral. A history of vaginal discharge, dysmenorrhoea and burning pain on micturition are all helpful differential diagnostic points. There may be a history of contact with sexually transmitted disease. When suspected, the opinion of a gynaecologist should be obtained, and high vaginal swab taken for Chlamydia culture. When serious diagnostic uncertainty persists, diagnostic laparoscopy should be undertaken.

2) **Mittelschmerz**

Midcycle rupture of a follicular cyst with bleeding produces lower abdominal and pelvic pain, typically midcycle. Systemic upset is rare, pregnancy test is negative and symptoms usually subside within hours. Occasionally, diagnostic laparoscopy is required.

3) **Torsion/haemorrhage of an ovarian cyst**

This can prove a difficult differential diagnosis. When suspected, pelvic ultrasound and a gynaecological opinion should be sought. If encountered at operation, ovarian cystectomy should be performed, if necessary, in women of child-bearing years. Documented visualisation of the contralateral ovary is an essential medicolegal precaution.

4) **Ectopic gestation**

Usually there is a history of a missed menstrual period and urinary pregnancy test may be positive. Severe pain is felt when the cervix is moved on vaginal examination. Signs of intraperitoneal bleeding usually become apparent and the patient should be questioned specifically regarding referred pain in the shoulder. Pelvic ultrasonography should be carried out in all cases where an ectopic pregnancy is a possible diagnosis.

Differential diagnosis in Elderly

Sigmoid diverticulitis

In some patients with a long sigmoid loop, the colon lies to the right of the midline and it may be impossible to differentiate between diverticulitis and appendicitis. A trial of conservative management with intravenous fluids and antibiotics is often appropriate, with a low threshold for exploratory laparotomy in the face of deterioration or lack of clinical response.

Intestinal obstruction

The diagnosis of intestinal obstruction is usually clear. As with diverticulitis, intravenous fluids, antibiotics and nasogastric decompression should be instigated with early resort to laparotomy.

Carcinoma of the caecum

When obstructed or locally perforated, carcinoma of the caecum may mimic or cause obstructive appendicitis in adults. A history of antecedent discomfort, altered bowel habit or unexplained anaemia should raise suspicion. A mass may be palpable and barium enema or colonoscopy is diagnostic.

Investigation

The diagnosis of acute appendicitis is essentially clinical. A full blood count and urinalysis should be performed in all cases. In women of reproductive years, it is wise to obtain a urinary pregnancy test before proceeding to exploration. Pelvic ultrasound is of value in excluding tubal or ovarian disease if suspected. Abdominal ultrasound examination is a useful diagnostic tool, particularly in children, with a diagnostic accuracy of appendicitis in excess of 90 per cent.
In dehydrated or elderly patients or where comorbid conditions dictate, serum urea and electrolytes should be checked. If a diagnosis of intestinal obstruction, intussusception or ureteric colic is being entertained, a supine abdominal X-ray should be performed.

Preoperative investigations in appendicitis

Routine

- Full blood count
- Urinalysis

Selective

- Pregnancy test
- Urea and electrolytes
- Supine abdominal radiograph
- Ultrasound of the abdomen/pelvis
- Contrast-enhanced CT scan of the abdomen

Differential diagnosis of acute appendicitis

Children	Adult	Adul female	Elderly
Gastroenteritis	Regional enteritis	Mittelschmerz	Diverticulitis
Mesenteric adenitis	Ureteric colic	Pelvic inflammatory disease	Intestinal obstruction
Meckel's diverticulitis	Perforated peptic ulcer	Pyelonephritis	Colonic carcinoma
Intussusception	Torsion of testis	Ectopic pregnancy	Torsion appendix epiploicae
Henoch–Schnlein purpura	Pancreatitis	Torsion/rupture of ovarian cyst	Mesenteric infarction
Lobar pneumonia	Rectus sheath haematoma	Endometriosis	Leaking aortic aneurysm

Treatment
The treatment of acute appendicitis is appendicectomy.

Conventional appendicectomy (keep in your mind the names of the incisions)
When the preoperative diagnosis is considered reasonably certain, the incision that is widely used for appendicectomy is the so-called **gridiron incision**. The gridiron incision is made at right angles to a line joining the anterior superior iliac spine to the umbilicus, its centre being along the line at McBurney's point

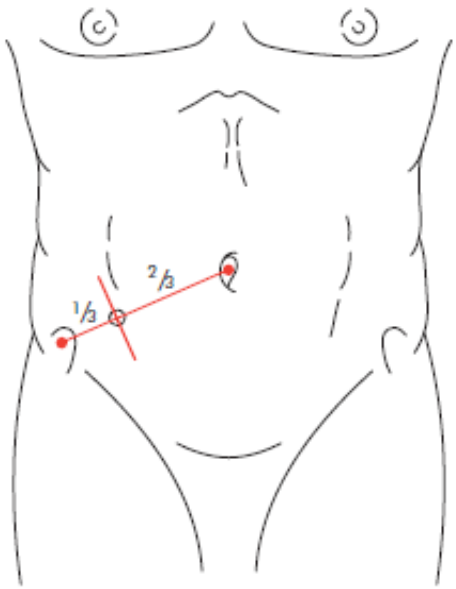

Figure 67.12 Gridiron incision for appendicitis, at right angles to a line joining the anterior superior iliac spine and umbilicus, centred on McBurney's point (courtesy of Mr M. Earley, FRSCI, Dublin, Ireland).

In the subcutaneous tissues an arterial twig from the superficial circumflex iliac artery usually requires ligation. The external oblique is incised in the line of its fibres along the length of the incision. The fibres of the internal oblique and transversus abdominis are split, and with suitable retrac-tion the peritoneum is opened. If better access is required, it is possible to convert the grid-iron to a Rutherford Morrison incision by cutting the internal oblique and transversus muscles in the line of the incision.
In recent years, a transverse skin crease **(Lanz) incision** has become more popular, as the exposure is better and extension, when needed, is easier. The incision, appropriate in length to the size and obesity of the patient, is made approximately 2 cm below the umbilicus centred on the midclavicular midinguinal line. The external oblique aponeurosis, internal oblique and transversus muscles are split in the direction of the fibres and the peritoneum is opened. When necessary the incision may be extended medially, with retraction or suitable division of the rectus abdominis muscle.

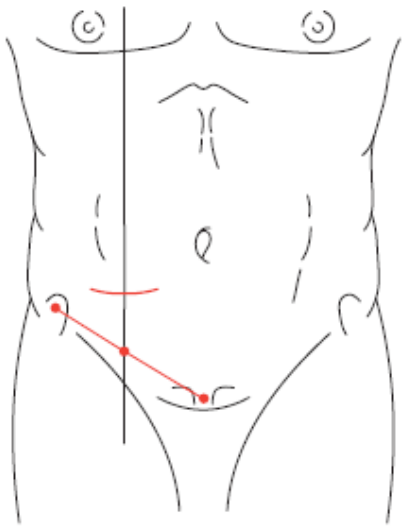

Figure 67.13 Transverse or skin crease (Lanz) incision for appendicitis, 2 cm below the umbilicus, centred on the mid-clavicular–midinguinal line (courtesy of Mr M. Earley, FRSCI, Dublin, Ireland).

When the diagnosis is in doubt, particularly in the presence of intestinal obstruction, ***a lower midline abdominal incision*** is to be preferred over a right lower paramedian incision. The latter, although widely practised in the past, is difficult to extend, more difficult to close and provides less good access to the pelvis and peritoneal cavity.
Rutherford Morrison's incision is useful if the appendix is paracaecal or retrocaecal and fixed. It is essentially an oblique muscle-cutting incision with its lower end over McBurney's point and extending obliquely upwards and laterally as necessary. All layers are divided in the line of the incision.

Appendix abscess
Failure of resolution of an appendix mass or continued spiking pyrexia usually indicates that there is pus within the phlegmonous appendix mass. Ultrasound or abdominal CT scan may identify an area suitable for insertion of a percutaneous drain. Should this prove unsuccessful, laparotomy through a midline incision is indicated.

Pelvic abscess
Pelvic abscess formation is an occasional complication of appendicitis and can occur irrespective of the position of the appendix within the peritoneal cavity. The most common presentation is a spiking pyrexia several days following appendicitis; indeed the patient may have already been discharged from hospital. Pelvic pressure or discomfort associated with loose stool or tenesmus is common. Rectal examination reveals a buggy mass in the pelvis, anterior to the rectum, at the level of the peritoneal reflection. Pelvic ultrasound or CT scan will confirm. Treatment is transrectal drainage under general anaesthetic.

Management of an appendix mass

If an appendix mass is present and the condition of the patient is satisfactory, the standard treatment is the conservative Ochsner Sherren regimen. This strategy is based on the premise that the inflammatory process is already localised and that inadvertent surgery is difficult and may be dangerous. It may be impossible to find the appendix and, occasionally, a faecal fistula may form. For these reasons it is wise to observe a nonoperative programme, but to be prepared to operate should clinical deterioration occur.

Careful record of the patient's condition and the extent of the mass should be made, and the abdomen regularly re-examined. It is helpful to mark the limits of mass on the abdominal wall using a skin pencil. A nasogastric tube should be passed and intravenous fluid and antibiotic therapy instigated.

Temperature and pulse rate should be recorded 4-hourly and a fluid balance record maintained. Clinical deterioration or evidence of peritonitis is indication for early laparotomy. Clinical improvement is usually evident within 24—48 hours at which time the nasogastric tube can be removed and oral fluids introduced. Failure of the mass to resolve should raise suspicion of a carcinoma or Crohn's disease. Using this regime approximately 90 per cent of cases resolve without incident. It is advisable to remove the appendix usually after an interval of 6—8 weeks.

Note

Criteria for stopping conservative treatment of an appendix mass

- A rising pulse rate
- Increasing or spreading abdominal pain
- Increasing size of the mass

Postoperative complications

Postoperative complications following appendicectomy are relatively uncommon and reflect the degree of peritonitis that was present at the time of operation and intercurrent diseases that may predispose to complications.

1) Wound infection

This is the most common postoperative complication which occurs in 5—10 per cent of all cases. This usually presents with pain and erythema of the wound on the fourth or fifth postoperative day, often soon after hospital discharge. Treatment is by wound drainage and antibiotics when required. The organisms responsible are usually a mixture of Gram-negative bacilli and anaerobic bacteria, predominantly bacteroides species and anaerobic streptococci.

2) Intra-abdominal abscess

Intra-abdominal abscess has become a relatively rare complication after appendicectomy with the use of perioperative antibiotics. Postoperative spiking fever, malaise and anorexia, developing 5—7 days after operation, suggest an intraperi-toneal collection. Interloop, paracolic, pelvic and subphrenic sites should be considered. Abdominal ultrasonography and CT scanning greatly facilitate diagnosis and allow percuta-neous drainage. Laparotomy should be considered in patients suspected to have intrabdominal

sepsis in whom imaging fails to show a collection, particularly those with continuing ileus.

3) Ileus
A period of adynamic ileus is to be expected after appen-dicectomy, and may last for a number of days following removal of a gangrenous appendix. Ileus persisting for more than 4—5 days, particularly in the presence of a fever, is indicative of continuing intra-abdominal sepsis and should prompt further investigation.

4) Respiratory
In the absence of concurrent pulmonary disease, respiratory complications are rare following appendicectomy. Adequate postoperative analgesia and physiotherapy, when appropriate, reduce the incidence.

5) Venous thrombosis and embolism
These are rare after appendicectomy except in the elderly and women taking the oral contraceptive pill. Appropriate prophylactic measures should be taken in such cases.

6) Portal pyaemia (Pylephlebitis)
Pylephlebitis is a rare but very serious complication of gangrenous appendicitis associated with high fever, rigors and jaundice. It is due to septicaemia in the portal venous system and may leads to the development of intrahepatic abscesses (often multiple). Treatment is with systemic antibiotics and percutaneous drainage of hepatic abscesses as appropriate.

7) Faecal fistula
Leakage from the appendicular stump rarely occurs, but may follow if the encircling stitch has been put in too deeply or if the caecal wall was involved by oedema or inflammation. Occasionally, a fistula may result following appendicectomy in Crohn's disease.

8) Adhesive intestinal obstruction
Adhesive intestinal obstruction is the most common late complication of appendicectomy. At operation often a single band adhesion is responsible. Occasionally, chronic pain in the right iliac fossa is attributed to adhesion formation after appendicectomy. In such cases laparoscopy is of value in confirming the presence of adhesions and allowing division.

9) Right inguinal hernia
This is said to be more common following a grid-iron incision for appendicitis due to injury to the iliohypogastric nerve.

Less common pathological conditions

Mucocele of the appendix
Mucocele of the appendix may occur when the proximal end of the lumen slowly becomes completely occluded, usually by a fibrous stricture, and the pent up secretion remains sterile. The appendix is greatly enlarged and

sometimes it contains several millilitres of mucus.The symptoms produced are those of mild subacute appendicitis unless infection supervenes, when the mucocele is converted into an empyema.Rupture of a mucocele of the appendix is a cause of pseudomyxoma peritonei. Occasionally, the mucocele is caused by a mucus secreting adenocarcinoma, in which case a right hemicolectomy is the correct treatment.

Neoplasms of the appendix

Carcinoid tumour (syn. argentaffinoma)

Carcinoid tumours arise in argentaffln tissue (Kultschitzsky cells of the crypts of Lieberkuhn) and are most commonly found in the vermiform appendix. Carcinoid tumour is found once in every 300—400 appendices subjected to histological examination and is 10 times more common than any other neoplasm of the appendix. In many instances the appendix had been removed because of symptoms of subacute or recurrent appendicitis. The tumour can occur in any part of the appendix, but it frequently does so in the distal third. The neoplasm feels moderately hard, and on sectioning the appendix it can be seen as a yellow tumour between the intact mucosa and the peritoneum. Microscopically, the tumour cells are small, arranged in small nests within the muscle and have a characteristic pattern using immunohistochemical stain for Chromogranin B. Unlike carcinoid tumours arising in other parts of the intestinal tract, carcinoid tumour of the appendix rarely gives rise to metastases. Appendicectomy has been shown to be sufficient treatment, unless the caecal wall is involved, the tumour is 2 cm or more in size, or involved lymph nodes are found, otherwise right hemicolectomy is indicated.

Primary adenocarcinoma

Primary adenocarcinoma of the appendix is extremely rare. It is usually of the colonic type and should be treated by right hemicolectomy (as a second-stage procedure if the condition is not recognised at the first operation).