Abdominal pain in pregnancy: diagnosis, surgery and anaesthesia

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INTRODUCTION

Abdominal pain and gastrointestinal symptoms are common in pregnancy. The expectant mother is likely to be more anxious about symptoms that she would tolerate when she was not pregnant. However, the converse may also be true and the woman and sometimes her medical advisors may fail to act on significant signs and symptoms, mistakenly attributing them to the pregnancy. The challenge for the clinician is to identify early potentially life-threatening conditions in mother and baby and, having identified them, to deal with them promptly and appropriately.

Surgical diseases that cause abdominal pain occur in approximately two in 1000 pregnancies.[1,2] Diagnosis of pain in pregnancy is rendered challenging by:

- the frequency of pain in pregnancy
- the changes in pregnancy that modify the responses to peritoneal irritation
- the presence of the uterus and its activity
- the consequent changes in position of the abdominal viscera.

A conservative approach to such patients has traditionally been adopted because of fears about the risks of surgery and anaesthesia to mother and fetus. Recent data suggest that the converse is true and that complications are more often related to disease severity and operative delay. Early intervention is therefore recommended.[3]

ABDOMINAL PAIN IN PREGNANCY

Abdominal pain in pregnancy may be pregnancy-related (*Table 1*), exacerbated by pregnancy (*Table 2*) or non-pregnancy-related (*Table 3*). It may also be extra-abdominal in origin (*Table 4*).

Table 1. Causes of abdominal pain in pregnancy

Early pregnancy	Later pregnancy
• Miscarriage	• Abruptio placentae
• Molar pregnancy	• Degeneration of a fibroid
• Ectopic pregnancy	• Liver pain associated with pre-eclampsia or the HELLP syndrome
• Accidents to ovarian cysts (torsion, haemorrhage, rupture)	• Rupture of the uterus associated with previous uterine surgery, particularly caesarean section
• Acute retention of urine associated with retroversion of the uterus, incarcerated fibroids or ovarian cysts	• Pressure from the enlarging uterus, polyhydramnios
• Degeneration of a fibroid	• Musculoskeletal pain, particularly symphysis diastasis
• Complications of invasive prenatal diagnosis	
• Stretching of the round ligaments or pre-existing lesions	

Table 2. Causes of abdominal pain exacerbated by pregnancy

- Heartburn from gastrointestinal reflux
- Gall-bladder disease
- Urinary tract problems (cystitis, pyelonephritis)
- Musculoskeletal pain, particularly from the spine, pelvis and the stretching of the abdominal muscles, particularly at their attachments to the ribs

DIAGNOSIS

History

Duration of pain

Acute onset suggests rupture or tearing of something. Possibilities include ruptured ectopic, perforated viscus, ruptured abscess, ruptured aneurysm or blood vessel (for example, rupture of the inferior epigastric or splenic artery) and ruptured uterus. Acute pain may also arise from abruption.

Table 3. Non-pregnancy-associated causes of abdominal pain

- Appendicitis
- Gall-bladder disease
- Pancreatitis
- Peptic ulcer (including the rare Meckel's)
- Inflammatory bowel disease, including gastrointestinal tract infections
- Renal calculi
- Rupture of aneurysms (splenic, renal, aortic)
- Rupture of the inferior epigastric artery
- Deep vein thrombosis
- Sickle cell crisis
- Porphyria
- Neoplasia
- Intestinal obstruction
- Trauma (including unreported violence)

Table 4. Extra-abdominal causes of abdominal pain

- Sickle-cell crisis
- Cardiac pain
- Lower lobe pneumonia
- Referred pleuritic pain from pulmonary embolism
- Psychological disturbance
- Drug abuse or withdrawal
- Pain that comes and goes with no diagnosis made

Pain that gets worse over a comparatively short time scale is more typical of:

- acute degeneration of a fibroid
- acute cholecystitis
- acute pancreatitis
- strangulated hernia
- urinary tract colic
- strangulation or infarction of the bowel.

A developing abruption may present with sudden or gradually increasing pain.

Vague pain is common but should not be ignored as it may be associated with appendicitis in its early stages, peptic ulcer and various urinary tract and gynaecological conditions.

Location of pain

Pain may begin in one area and move or be referred to another area; for example, the pain of appendicitis generally starts around the mid abdomen and subsequently shifts to the right iliac fossa. As pregnancy advances, the growing uterus displaces the appendix upwards and the pain becomes increasingly localised higher up in the right side of the abdomen. Later in pregnancy, the pain may be in the right upper quadrant. Pain in the groin may be referred from the upper urinary tract. Back pain may be present in patients with pancreatitis. Uterine pain is mediated through T10–L1; the dermatomes are located anteriorly from umbilicus to symphysis, to the iliac crests laterally and to the lumbar and sacral vertebrae posteriorly.

Quality of the pain

A burning quality is classically associated with peptic ulcer, whereas a tearing pain is generally associated with rupture of, for example, the uterus or an aneurysm. An intermittent pain is suggestive of colic, cramping suggests uterine pain.

Things that affect the pain

Food tends to relieve the pain of peptic ulcer, but may exacerbate cholecystitis. Opiates tend to relieve the pain of colic but not of strangulated bowel. Leaning forward may improve the pain of pancreatitis.

Associated symptoms

- **Vaginal bleeding** is associated with abruption or early labour. Vaginal discharge may be due to ruptured membranes, perhaps with associated chorioamnionitis.
- **Vomiting** occurs early with upper abdominal conditions such as acute gastritis or pancreatitis and with peritoneal irritation and perforation of a viscus. When there is large bowel or distal small bowel obstruction nausea usually precedes vomiting by some time.
- **Diarrhoea** suggests irritation of the bowel by an infective agent or an inflammatory bowel condition, whereas the non-passage of faeces or flatus suggests mechanical bowel obstruction or appendicitis.
- **Haematuria** suggests a urinary tract cause.

The medical history must be considered, with particular reference to previous surgical, gynaecological and obstetric operations. Specific enquiry should be made into a history of recent blunt abdominal trauma, as even trivial trauma to the abdomen can lead to delayed placental abruption. A history of violence by the partner may be difficult to elicit (particularly if he is present) but must always be considered.

Examination

The examination of the pregnant woman can be confounded by the physiological changes of pregnancy. There may be tachycardia, hyperventilation, relative hypotension and raised basal temperature. Initial assessment will include a general physical examination, including inspection of the sclera and tongue, noting any fetor of the breath.

Examination of the abdomen is complicated by the presence of the gravid uterus. It is helpful to try to differentiate between uterine pain and pain arising from outside the uterus. Alder's sign is elicited by initially placing the patient in the supine position and identifying the point of maximum tenderness. The patient is then placed in the left lateral position which displaces the uterus to the left. If the

site of maximum tenderness shifts with the uterus the pain is likely to be arising from the uterus. Rectal examination is not as helpful as it is in the non-pregnant patient.

INVESTIGATIONS

A sample of urine should be sent for microscopy and culture. Blood should be sent for haemoglobin and full blood count. The white cell count in pregnancy is an unreliable guide to the presence of intra-abdominal pathology unless it is very raised, as a mild leucocytosis is normal in pregnancy (the upper limit of normal is 15×10^9/l), as is a raised erythrocyte sedimentation rate. C-reactive protein is a useful marker of intra-abdominal pathology in pregnancy as its levels are unaffected by pregnancy itself. Urea, electrolytes, liver function tests and serum amylase estimations should also be requested, if appropriate. Assessment of coagulation and platelets is required if there is any suspicion of placental abruption, pre-eclampsia or HELLP syndrome.

SPECIAL INVESTIGATIONS

Ultrasound

Transabdominal ultrasound is helpful in establishing fetal size, liquor volume and the presence of fibroids; it may also assist in examining the placenta for evidence of developing abruption, although this technique is considered unreliable by many. Ultrasound is particularly helpful in trauma. The FAST test (focused abdominal sonography for trauma), which detects fluid around the liver, spleen, kidneys and in the pelvis, may be useful in detecting blood or other fluid in the peritoneal cavity. However, to be reliably detected, 500–800 ml of fluid need to be present. The liver, gall bladder and bile ducts may be visualised and the renal tract demonstrated. Ovarian cysts can be sought. Graded-compression scanning aids visualisation of abdominal morphology and ultrasound is invaluable in guiding invasive diagnostic procedures, such as fine needle peritoneal cytology.[4] Published data suggest that diagnostic accuracy is greater in the first and second trimesters.[5,6]

Radiology

Radiological investigations should not be withheld if they are expected to be useful. It will often be helpful to discuss which tests are likely to be helpful with radiological and surgical colleagues. It is prudent to shield the fetus if possible to restrict exposure to radiation. However, there is no evidence that exposure to radiation in the diagnostic range (i.e. less than 5 rads) is associated with an increased incidence of any significant congenital malformation,[7] but multiple exposure to radiation *in utero* has been associated in some studies with an increased risk of developing malignant disease in children (relative risk 1.4).[7]

Nuclear magnetic resonance imaging has a potential risk to the fetus related to the elevation of temperature in exposed regions and it is considered prudent to exclude the pregnant woman from such studies during the first few months of pregnancy.

MANAGEMENT OF SOME OF THE MORE COMMON SURGICAL CONDITIONS IN PREGNANCY

When considering a surgical diagnosis in the pregnant woman, early involvement of relevant surgical specialists, obstetric anaesthetist and high-dependency nursing care is advised. Delivery of a fetus at the same time as surgical treatment must be tailored to each patient after discussion between obstetricians and surgical colleagues, in order to optimise the outcome for both mother and baby.

Appendicitis

The incidence of appendicitis is approximately one in 1500 pregnancies.[8–10] Although appendicitis is more common in the first and second trimesters, perforation of the appendix is more common in the third trimester.[11] This may be attributed to the decreased sensitivity of the peritoneum in pregnancy, the relative immunosuppression of pregnancy, the shift in position of the appendix with advancing gestation, the inability of the omentum to localise the infection and the tendency towards delayed diagnosis. If the appendix is retrocaecal there may be irritation of the urinary tract causing pyuria, usually without bacteriuria.

It is well recognised that there is higher morbidity for both mother and baby from appendicitis in pregnancy and an increased negative laparotomy rate of between 20% and 35% is therefore acceptable in the pregnant patient.[8,9] Laparotomy is well tolerated and the morbidity and premature delivery rates are low.[12]

Abdominal pain in early pregnancy is often investigated with laparoscopy and appendicectomy may be carried out laparoscopically, avoiding the need for laparotomy. If the diagnosis of appendicitis is confirmed and laparotomy is deemed necessary, the incision can thus be kept to a minimum. However, if a preliminary laparoscopy is not performed and the diagnosis is in doubt a midline incision in early pregnancy is advisable as the rate of misdiagnosis is high. Later in pregnancy the position of the appendix shifts laterally and upwards and the laparotomy incision should be muscle-splitting and over the point of maximum tenderness.

Risk of premature labour

The main cause of fetal loss is premature labour, which is mainly associated with perforation and delay in operating.[13] The risk of premature labour associated with appendicectomy (12% risk)[1,2] appears to last for one week postoperatively.[14] Close observation postoperatively is recommended and early discharge discouraged.

The use of tocolytic agents is controversial, with conflicting data regarding severe maternal and fetal adverse effects.[15] Uterine activity can be masked by the use of postoperative analgesia and liberal use of cardiotocography is advised. Serial assessments of cervical length and dilatation may be helpful, preferably by ultrasound screening.

Cholecystitis

After appendicitis, the most common surgical condition encountered is cholecystitis, which occurs at a frequency of one to six per 10 000 pregnancies.[16] More than 90% of cases of acute cholecystitis are associated with gall stones and, although hormonal changes in pregnancy predispose to lithiasis, there does not appear to be an increase in frequency of cholecystitis compared with the non-pregnant population.[17]

The diagnosis of cholecystitis is similar to that in the non-pregnant patient. Anorexia, nausea and vomiting, associated with constant pain in the right hypochondrium and fever are classical features. In pregnancy, Murphy's sign is less common and a distended gall bladder is less likely to be palpable. Later in pregnancy, appendicitis can be difficult to differentiate from cholecystitis.

Serum transaminase and bilirubin may be raised, especially if there is a stone in the common bile duct, and there may be an associated leucocytosis. The serum amylase will be raised if there is an associated pancreatitis. Ultrasound identifies gall stones, oedema of the gall-bladder wall, the width of the common bile duct and associated fluid collections.

Traditionally, the management of cholecystitis in the non-pregnant patient has been conservative but it has now become much more active, with some authors suggesting surgery as first-line therapy.[17–19] This principle holds for pregnancy because maternal and fetal mortality rates are increased if the disease is allowed to progress. The high mortality and morbidity in earlier data reflect the advanced state of the disease when surgery was eventually carried out.

Acute pancreatitis in pregnancy is uncommon, but when it does occur it has a mortality rate of 10%.

Intestinal obstruction

The incidence of intestinal obstruction in pregnancy is increasing, with recent data suggesting a rate of one in 1500.[20] Increasing frequency of surgical intervention in women of childbearing age[21] leads to an increased incidence of adhesion formation, which is the most common cause of intestinal obstruction in pregnancy.[22]

The second most common cause of obstruction is volvulus, which has an increased incidence in pregnancy.[23] Bowel may be displaced by the gravid uterus, leading to compression and partial obstruction. Proximal distension then forms a loop of bowel which is at risk of torsion. Other causes of obstruction, such as intussusception, malignant disease and hernias, are much less common. Mortality and morbidity rates are increased in pregnancy and increase with gestation.[22] This reflects the difficulty in diagnosis and the tendency and temptation to treat conservatively in pregnancy.

The symptoms of absolute constipation, i.e. the non-passage of stool or flatus, vomiting and colicky abdominal pain are the same as in the non-pregnant patient. However, the fetus should be carefully assessed and may need to be delivered to facilitate definitive surgery.

Liver, splenic and aneurysmal rupture

The rupture of intra-abdominal aneurysms and of the liver and spleen are rare but slightly increased in pregnancy. Pre-eclampsia is associated with rupture of the liver. Splenic rupture may occur spontaneously in pregnancy and is more common in the second and third trimesters. Rupture of arterial aneurysms (e.g. splenic, renal and ovarian) has been reported.[24] The management of these conditions is resuscitative laparotomy through a large mid-line incision with relevant surgical procedure(s) to control the massive haemorrhage.

Ureteric obstruction

Although ureteric obstruction due to stones is relatively uncommon in pregnancy, as the ureters are generally dilated, external compression of the ureters by the gravid uterus or pelvic tumours may arise. The obstruction may be relieved either endoscopically using a stent or via a percutaneous nephrostomy.

LAPAROSCOPY

Until recently, the use of laparoscopic operative procedures for surgical disease in pregnancy was considered to be contraindicated.[25] However, over the last decade laparoscopic surgery has been increasingly used for cholecystectomy and appendicectomy and is now being used in pregnancy at an increasing rate, such that laparoscopic cholecystectomy can be performed in the third trimester. Trocar siting will need to be modified to avoid the gravid uterus.

Laparoscopic cholecystectomy is the most common general surgical laparoscopic procedure to be carried out in pregnancy, followed by appendicectomy. The literature contains several series reporting no adverse outcomes for mother or fetus.[26–31]

Concerns have been raised about the effect of carbon dioxide pneumoperitoneum on the fetus.[32] Animal studies have demonstrated fetal acidosis, tachycardia and hypercapnia.[33] However, no studies show that an increase in intra-abdominal pressure alone has any adverse effect on the fetus.[33] The potential long-term effects are unknown and await further investigation.

ANAESTHESIA

Approximately 2% of pregnant women require anaesthesia during pregnancy for surgery other than delivery. Anaesthetic considerations in pregnancy can be divided into two broad categories: the effects of anaesthesia on pregnancy and the effects of pregnancy on anaesthesia.

Almost all anaesthetic drugs have the potential to be teratogenic in some animal species, especially in early pregnancy. In later pregnancy anaesthetic drugs may affect the activity of the uterine muscle. However, there is little to suggest that the commonly used anaesthetic drugs are teratogenic in the human.[34] No increased rate of congenital abnormalities has been shown between surgical and control groups in pregnancy. Volatile agents causing vasodilatation

or myocardial depression with resulting hypotension can lead to fetal acidosis. Ketamine, vasopressors and increased adrenal activity (resulting from anxiety and stress) may result in uterine hypertonus and vasoconstriction. Neostigmine administration can lead to increased levels of acetylcholine with a resulting increase of uterine tone. Hyperventilation has been shown to decrease uterine blood flow. Caution should be observed in the use of non-steroidal anti-inflammatory drugs in later pregnancy in view of the risk of premature closure of the ductus arteriosus.

Anatomical changes that occur in pregnancy can affect the anaesthetic procedure. For instance, the breasts may increase considerably in size and, by falling cephalically, may make access for intubation difficult. The oedema that occurs in pre-eclampsia may also make intubation more challenging.

The physiological changes of pregnancy may require modification of anaesthetic management. In particular, abdominal distension and relaxation of the oesophageal sphincter increase the risk of gastric aspiration. Gastric pH falls in pregnancy, which increases the hazards of aspiration of acid contents into the lungs, with resulting inflammation (Mendelson's syndrome). Pre-operatively, H_2-receptor antagonists (ranitidine) or procholinergic drugs should be administered.

Pre-oxygenation is mandatory. Rapid sequence induction should therefore be carried out. Cricoid pressure should be applied and the patient should be intubated. Short-acting muscle relaxants should be used to facilitate this rapid intubation.

To avoid aortocaval compression the patient should be anaesthetised in a left lateral tilt position of at least 15 degrees.

The pregnant woman tolerates blood loss well but the fetus does not. A pregnant woman can lose up to one-third of her circulating blood volume before classical signs of shock develop, but blood is diverted away from the fetus with much smaller blood losses and the placental bed is very sensitive to catecholamines.

Regional anaesthetic techniques are often preferred in pregnancy to avoid the problems associated with intubation. However, regional anaesthesia interferes with sympathetic tone and therefore with the patient's response to blood loss. In addition, regional anaesthesia can be contraindicated if there is concomitant pre-eclampsia or any other condition leading to a coagulopathy.

Particular care should be taken to avoid hypoxic episodes during induction and recovery.

SUMMARY

Abdominal pain and surgical problems in pregnancy pose particular diagnostic and management challenges. Pregnancy modifies the abdomen's capacity to localise and limit intra-abdominal sepsis. It is important to recognise when there is a problem and to decide whether it is pregnancy-related. Surgical, medical, radiological and anaesthetic advice should come from experienced clinicians, and consultation requests should be made at consultant level. Surgery and anaesthesia are generally well tolerated in pregnancy, and intervention, if indicated, should not be delayed.

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