Care of patients undergoing laparoscopic cholecystectomy


### Summary

This article discusses laparoscopic cholecystectomy, or surgical removal of the gall bladder through a process also known as keyhole surgery. It explains the pre- and post-operative nursing care of patients undergoing this surgery. The anaesthetic considerations and operative technique are also described.

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### Aims and intended learning outcomes

This article aims to explore the nursing care of patients who require a laparoscopic cholecystectomy. Issues of pre- and post-operative nursing care as well as anaesthetic considerations and details about the operative technique are discussed. After reading this article you should be able to:

- Describe the anatomy and physiology of the biliary tract.
- Discuss the clinical presentation of gallstones.
- Appreciate the need for effective pre-operative assessment.
- Identify problems that can arise during the anaesthetic and surgical procedure.

### Introduction

Gallstones affect about 12% of men and 24% of women in the UK. Although many people have gallstones, only 10% have symptoms and require treatment (Nunes and Beckingham 2005). As a result about 40,000 cholecystectomies are performed each year. Only 10% of gallstones are radiopaque and visible on a plain abdominal X-ray (Sanders and Kingsnorth 2007).

A laparoscopic cholecystectomy is the surgical removal of the gall bladder and gallstones using laparoscopic technology in a process also known as keyhole or minimally invasive surgery. It is the gold standard treatment of choice for virtually all patients with symptomatic gall bladder stones (Nunes and Beckingham 2005).

It is important that surgical nurses have an understanding of gallstone disease and the surgical procedure, to ensure that patients are cared for not only empathetically but also safely and effectively.

### Anatomy and physiology

The gall bladder is a small muscular sac attached to the bile duct, beneath the liver. Its function is...
to store and concentrate a small amount of bile and release it into the intestines. Bile is made in the liver with about half a litre flowing down the bile duct each day to the duodenum. Bile consists of water, cholesterol, bile salts, fats and bilirubin—the waste product of degraded red blood cells (Kumar and Clark 2005).

Bile has two major functions in the body. First, it breaks down fats that are eaten so that the body can use them. Without adequate bile the body does not metabolise fats well and this can result in a deficiency of the fat-soluble vitamins A, D, E and K. This can also cause problems digesting essential fatty acids. Second, bile is a powerful antioxidant which helps to remove toxins from the liver. The liver filters toxins (bacteria, viruses, drugs or other foreign substances the body does not want) and excretes them in bile. Bile travels from the liver through the bile ducts and into the gall bladder, or directly into the small intestine, where it joins waste matter and leaves through the colon in faeces (Marieb 2003).

In an adult the gall bladder is about 8cm long and 4cm wide (Smith and Morton 2001). It can hold about 30-60ml of bile and is lined by a mucous membrane, which is thrown into numerous folds (rugae) when the gall bladder contracts. As the gall bladder fills with bile the folds flatten out. The anatomical arrangement of the liver, gall bladder and biliary tract is shown in Figure 1.

A healthy gall bladder empties when fatty food enters the duodenum, allowing a small amount of extra thick bile to travel down the bile duct to the duodenum, to help break down the fat eaten in the diet. The gall bladder also contracts between meals to deliver bile intermittently into the duodenum (Kumar and Clark 2005).

The main stimulus for gall bladder contraction is a high level of cholecystokinin (CCK) in the blood. This hormone is produced by the duodenal mucosa in response to fat accumulating in the duodenum, which stimulates the gall bladder to contract (Smith and Morton 2001). The release of bile and pancreatic juice is stimulated by the hormones secretin and CCK. They work together to encourage the pancreas to release a fluid rich in enzymes. Secretin affects the liver causing it to increase its output of bile and then CCK causes the gall bladder to contract. Bile is released into the bile duct, so that bile and pancreatic juice enter the small intestine simultaneously. The bile breaks down the large fat particles into smaller ones, providing a larger surface area for the pancreatic enzymes to work on (Marieb 2003).

**Gallstones**

Gallstones are hard crystals of bile that form when cholesterol and/or bile hardens in the gall bladder. Almost all stones contain cholesterol and are usually yellow in colour. In the UK these (yellow) stones account for approximately 80% of gallstones (Beckingham 2001). The formation of stones is also aided by a decrease in gall bladder motility. Bilirubin or pigment stones are dark and almost black in colour. They consist mainly of calcium bilirubinate and are more common in patients with haemolytic diseases, such as sickle
cell anaemia. Some gallstones are a mixture of bilirubin and cholesterol (Johnson 2001).

Gallstones can vary in size and consistency (Figure 2) and resemble grains of sand, dried peas or even avocado stones. They can be hard or soft depending on the varying amounts of cholesterol, bile pigment and other minerals found in the bile fluid.

**Risk groups for developing gallstones** Gallstone disease is becoming more common in the UK. It is the most common abdominal reason for admission to hospital (NHS Institute for Innovation and Improvement 2006). This is partly due to the ageing population, as well as the increase in obesity. Morbid obesity (body mass index greater than 40) increases the risk of individuals developing gallstones. There is evidence that patients who have lost weight rapidly after adhering to a strict diet or following weight loss surgery are also at risk of developing gallstones (Bateson 1999).

Factors that are known to increase cholesterol in the bile can increase the risk of gallstone formation. These factors include: being female, taking the oral contraceptive pill, hormone replacement therapy, cholesterol-lowering drugs, rapid weight loss and fasting, and diabetes. Low fibre, high cholesterol and starchy diets also tend to increase the risk of developing gallstones (Beckingham 2001). The risk factors associated with developing cholesterol gallstones are listed in Box 1.

**Clinical presentation of gallstones** Most gallstones do not cause any problems and can be found incidentally when the patient is being investigated for other medical conditions. Once gallstones become problematic, the patient often develops recurrent complications and over time these can become more severe (Kumar and Clark 2005). Gallstones are increasingly detected as an incidental finding at the time when the patient is having an abdominal X-ray or ultrasound scan. Once gallstones have become symptomatic there is a strong trend towards recurrent complications and an increase in their severity.

The most common presentation of a person with gallstones is that of pain under the ribs on the right side or even upper abdominal pain, with some pain experienced in the back near the right shoulder blade (Beckingham 2001).

Biliary colic is the term used for the pain associated with the temporary obstruction of the cystic or common bile duct (CBD) by a stone usually moving out of the gallbladder (Kumar and Clark 2005). Although it is known as ‘colic’ the pain does not fluctuate. The pain is severe, constant and persists from 15 minutes to 24 hours. Many individuals can relate the symptoms to over indulgence with food, particularly that with a high fat content. Biliary colic most commonly occurs in the evening and lasts through to the early hours of the morning. Nausea and vomiting frequently accompany the more severe episodes. The pain can subside spontaneously after a number of hours or it can require opiate analgesia. Pain accompanied by fever usually suggests acute cholecystitis (Beckingham 2001).

Acute cholecystitis is caused when an obstruction occurs at the cystic duct (Figure 3) (Kumar and Clark 2005). The obstruction results in an increase of gall bladder glandular secretion leading to gall bladder distension.

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**BOX 1**

**Risk factors associated with the formation of cholesterol gallstones**

- Increasing age.
- Female gender.
- Pregnancy – risk increases with the number of pregnancies.
- Obesity.
- Rapid weight loss.
- Diet high in animal fat.
- Drugs, for example the contraceptive pill.
- Bile salt loss occurring in ileal disease.
- Diabetes mellitus.
- Liver cirrhosis.
- Ethnic group.
- Cystic fibrosis.

(Beckingham 2001)
which, in turn, can compromise the vascular supply. An acute inflammatory response also develops secondary to the retained bile in the gall bladder. The initial presenting features of an episode of cholecystitis are similar to those of biliary colic (Johnson 2001). The pain increases in severity over several hours and is localised to the right upper quadrant. The pain is associated with tenderness and muscle guarding or rigidity. The gall bladder can occasionally become distended with pus. This is known as empyema of the gall bladder. On rare occasions acute gangrenous cholecystitis develops and this can perforate the gall bladder, leading to generalised peritonitis (Kumar and Clark 2005).

Patients with symptoms relating to gallstones should consider having their gall bladder and gallstones removed. Most gall bladders should be removed using laparoscopic surgery because it is considered the gold standard treatment (Nunes and Beckingham 2005).

A Cochrane review comparing laparoscopic with open cholecystectomy found no differences in complication rate, mortality or operative time (Johansson et al 2005). However, laparoscopic cholecystectomy when compared with the more traditional open cholecystectomy was associated with a shorter hospital stay and a quicker recovery time. This supports the recommendation that a laparoscopic cholecystectomy should be performed rather than an open cholecystectomy (Johansson et al 2005).

Time out 4

Discuss with colleagues the benefits of having a gall bladder removed using laparoscopic surgery.

A randomised clinical trial of day case versus inpatient overnight stay laparoscopic cholecystectomy found no difference in complication rate or patients’ acceptance, and that day case procedures cost the NHS less (Johansson et al 2006).

The NHS Institute for Innovation and Improvement (2006) showed that the average length of stay for a laparoscopic cholecystectomy is 2.6 days (ranging from 1.2-6.0 days). If this figure could be reduced by one day, there would be an annual saving for the NHS of approximately 35,400 bed days (£8 million, based on a bed day cost of £225). An NHS trust performing 300 elective laparoscopic cholecystectomies a year could expect to save about £100,000 a year by performing 40% as day cases and reducing length of stay for the remainder by one day.

Pre-operative assessment

Pre-operative assessment was developed in response to the need to treat patients undergoing elective surgery with increased efficiency (Beck 2007). As waiting times for elective surgery have decreased, effective pre-operative assessment is paramount to ensure that patients are fully prepared and delays or cancellations are kept to a minimum.

Comprehensive pre-operative assessment is the foundation of safe, effective surgery (Gudimetla and Smith 2006). In its definition of pre-operative assessment, the NHS Modernisation Agency says: ‘Pre-operative assessment establishes that the patient is fully informed and wishes to undergo the procedure. It ensures that the patient is fit for the surgery and the anaesthetic. It minimises the risk of late cancellations by ensuring that all essential resources and discharge requirements are identified’ (Operating Theatre and Pre-operative Assessment Programme National Team 2003).

It is the role of pre-assessment nurses to ensure that patients are well informed about the procedure. This helps patients deal with any specific anxiety and helps them feel more in control (Crawford 1999). Nurses should be properly prepared for their role in managing pre-operative anxiety so that they can act as an advocate for patients (Mitchell 2007a).

Good documentation also plays a pivotal role in effective pre-operative assessment, which with the increase in litigation, is paramount. Also, accurate documentation and effective communication at the pre-operative stage will ensure that the ward and theatre teams are able to plan and subsequently deliver individualised patient care.

Patients can have significant co-morbidity associated with gallstones, for example obesity or hypercholesterolaemia. They might have experienced complications associated with gallstone surgery, such as acute cholecystitis, cholangitis or pancreatitis. These co-morbidities can have significant influence on the conduct and risks of anaesthesia and should be discussed before surgery.

The aim of pre-operative assessment for patients awaiting a laparoscopic cholecystectomy is to ensure they have not developed any of the complications associated with gall bladder or gallstone disease, and that the operation remains a routine laparoscopic cholecystectomy (McWhinnie et al 2004). Operating on an acutely inflamed gall bladder carries a higher risk of conversion to open surgery, due to the difficulty in
identifying the common bile duct, cystic duct and cystic artery. In addition, an inflamed gall bladder might be more of a challenge to the surgeon, resulting in a prolonged operative procedure.

Time out 5
Consider the implications for patients having a general anaesthetic. Make a list of the pre-operative, peri-operative and post-operative disadvantages and discuss this with a more experienced colleague or an anaesthetist.

Anaesthesia

Laparoscopic cholecystectomy is usually performed under general anaesthesia. The use of spinal, epidural and local anaesthesia is not recommended because they are associated with pain and cardiac arrhythmias that necessitate the use of sedative drugs. An optimal anaesthetic technique should provide excellent peri-operative conditions while ensuring rapid recovery, a low incidence of adverse effects and an early return to daily activities (McWhinnie et al 2004).

A commonly used general anaesthetic technique involves induction with propofol, paralysis with a muscle relaxant and the introduction of an endotracheal tube or laryngeal mask (LMA), followed by intermittent positive pressure ventilation. Adequate muscle relaxation increases compliance of the abdomen, so allowing better inflation of the abdominal cavity, which assists surgical access. Controversy surrounds the use of a LMA for laparoscopic cholecystectomy. One trial has shown the LMA to be as effective as an endotracheal tube, providing comparable surgical conditions during a laparoscopic cholecystectomy (Maltby et al 2000).

Maintenance of anaesthesia can be provided by inhalational agents such as desflurane, sevoflurane or by propofol infusion. The use of nitrous oxide for laparoscopic surgery is often avoided as it has been found to increase the size of the pneumoperitoneum (air within the peritoneal cavity) and possibly increases the incidence of post-operative nausea and vomiting (Crozier 2004).

Laparoscopic operations carry a distinct risk of complications despite being minimally invasive (Table 1). Appropriate monitoring, large bore intravenous (IV) cannulae and access to facilities for central venous placement and resuscitation equipment are mandatory to detect and treat these complications — along with appropriate surgical skill and equipment.

Surgical intervention

Once anaesthesia has been established the operation can begin. It takes about 60-90 minutes depending on the difficulty of the procedure and whether the patient has had numerous episodes of acute cholecystitis or pancreatitis.

The patient is positioned supine in a slight to moderate reverse Trendelenburg position during a laparoscopic cholecystectomy (Figure 4). The entire operating table is tilted to 30-40° so that the head is higher than the feet and tilted so that the patient’s right side is uppermost. This allows the abdominal organs to fall away from the epigastric area, giving good access to the upper abdomen. Venous stasis can cause complications in patients in this position, which is why the prevention of deep vein thrombosis is an important consideration. The use of compression stockings and boots is suggested to improve venous return (Phillips et al 2008).

Time out 6
Reflect on any patients you have cared for who have undergone a laparoscopic cholecystectomy. Make notes about what happened during the operation, paying specific attention to patient preparation, the position of the patient on the theatre table and the monitoring used throughout the procedure.

Table 1

<table>
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<th>Complications of laparoscopic operations with relevance to anaesthesia</th>
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<td><strong>Cardiovascular</strong></td>
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It is important that the theatre team is aware of the position of the equipment and monitors, and how to use them correctly to promote a safe operating environment.

Carbon dioxide is used to insufflate (distend) the abdomen to allow visualisation of the anatomy and to avoid injury to the internal organs when inserting the trocars. It is important to maintain the carbon dioxide pneumoperitoneum at the lowest possible pressure – ideally less than 12mmHg. This avoids inferior vena cava compression leading to circulatory collapse and also prevents diaphragmatic splinting (pressure from underlying organs restricting the normal, effective movement of the diaphragm) that affects mechanical ventilation (McWhinnie et al 2004).

A rigid fibreoptic telescope is inserted through a trocar into the peritoneal cavity. Trocars are inserted through three or four incisions in the abdominal wall (Figure 5).

The location of the incisions will vary according to the size of the patient and the surgeon’s preference. A camera attached to the laparoscope allows the surgeon to view the instruments and the operative area. Viewing monitors are positioned at the side of the patient at the head of the operating table. The gall bladder is grasped through the lateral ports and held by the first assistant. After careful dissection the surgeon applies clips to the cystic artery and cystic duct. The gall bladder is then removed from the liver bed. It is usually withdrawn through the umbilical incision (Phillips 2007).

Intraperitoneal local anaesthetic can be administered after the procedure along with local infiltration to the wounds. Although laparoscopic cholecystectomy is a minimally invasive procedure, it is associated with intra-abdominal, incisional and shoulder pain after surgery (Ng and Smith 2002). Many clinical trials have been carried out to assess whether intraperitoneal instillation of local anaesthetic to the gall bladder bed and right subdiaphragmatic space has produced any effect.

Wills and Hunt (2000) found that in a number of clinical trials there was a significant reduction in overall pain for the patient. It would appear that for laparoscopic cholecystectomy, intraperitoneal local anaesthetic solutions produce modest analgesic effect, if also infiltrated into the incisions (Wills and Hunt 2000).

At the end of the procedure as much carbon dioxide as possible should be released from the abdomen. This is because post-operative shoulder tip pain is proportional to the size of the residual gas bubble under the diaphragm (Jackson et al 1996).

Complications with surgery

All surgical procedures are associated with complications and those specific to a laparoscopic cholecystectomy include: bile leakage, fluid collection in the abdomen, bleeding and bile duct injury. Bile leakage can occur because of leakage from the cystic duct or an accessory duct draining from the liver bed straight into the gallbladder. This can also occur during open surgery. Moreover, leakage can occur because removing the gall bladder can leave a raw surface of liver, exposing tiny ducts.

Bile duct injury is the most devastating of all complications and has been reported in 0.3-0.7% of cases from around the world (Keus et al 2006). Transection of the bile duct usually occurs as a result of failure to identify the anatomy exactly. Immediate reconstruction using a loop of small intestine is recommended and this should be done by a specialist liver surgeon (Connor and Garden 2006).
Post-operative care

Although different surgical procedures require specific and specialist nursing care, the principles of post-operative care remain the same. Patients need to be monitored closely after the operation. Initially the patient is transferred to the recovery area for a period of monitoring. Patients should stay here for about an hour or until their condition is stable. The nurse looking after the patient needs to monitor vital signs, pain, the level of post-operative nausea and vomiting (PONV), wound sites and, if there is one in place, the wound drain.

PONV is common after laparoscopic cholecystectomy because of peritoneal gas insufflation and manipulation of the bowel and the biliary tract (McWhinnie et al 2004). There are additional risk factors to consider including: female gender, previous PONV or motion sickness and the use of peri-operative opioids (Apfel et al 1999). Opioids are a common cause of PONV and so their use, even during laparoscopic cholecystectomy, should be kept to the required minimum. Anti-emetic prophylaxis should be encouraged.

Adequate hydration with at least one litre of IV fluid during the procedure is an important additional measure to reduce PONV (Yogendran et al 1995). PONV should be treated promptly, preferably using a different class of anti-emetic to that used for prophylaxis. PONV is common in the immediate recovery period and often persists for one to two days, but usually resolves thereafter. Pain following surgery is inevitable for many patients but each patient’s coping mechanism is different because gender, age, psychological and cultural factors determine the response to pain (Kitcatt 2003).

Pain is common after laparoscopic cholecystectomy, despite the use of prophylactic, multimodal analgesia (Khan et al 2002). Most patients are likely to require some form of opioid analgesia during their recovery and regular doses of oral analgesia before discharge. Pain tends to be moderately severe during the first couple of days, reducing in intensity after that, but it can still be sufficiently intense to prevent early discharge. ‘referred pain’ is post-operative pain experienced in a different region from where it originates. This can be the result of insufflations of carbon dioxide into the abdominal cavity or irritation of the diaphragm (Woelhck et al 2003). Referred pain following laparoscopic cholecystectomy is usually localised in the tip of the shoulder, usually on the right side, and/or in the back (Sarli et al 2000).

Non-steroidal anti-inflammatory drugs (NSAIDs) and other non-opioid analgesics reduce the intensity of post-operative pain but are usually inadequate as the sole analgesic. None of these drugs is effective in treating referred pain. Intrapерitoneal instillation of local anaesthetics can also be used for pain reduction in the immediate post-operative period, as well as infiltrating the trocar sites with local anaesthetic. The effects of these agents can last for up to eight hours (Raeder 2006).

Based on this the most effective analgesic regimen would consist of the pre-operative, prophylactic administration of a non-opioid analgesic, pre-operative infiltration of the skin incision sites with a local anaesthetic, the

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instillation of a local anaesthetic into the upper abdomen before abdominal closure and the post-operative administration of an opioid as rescue medication (Crozier 2004).

**Time out 9**

What post-operative advice would you give a patient before discharge?

It is vital before discharge that patients are provided with information about their anaesthetic regimen, wound care, returning to daily activities and dietary advice (Blay and Donohue 2006). Providing patients with practical discharge advice will improve their confidence in managing their care at home (Mitchell 2007b). They should also be warned of the possible complications and what to do if such an episode occurs. It is important that the patient continues to have support following discharge home, whether this is via a post-operative telephone call from the ward staff or from a nurse specialist attached to the surgical team with expert knowledge in the field. Post-operative telephone calls following surgery can help to reduce the patient’s level of anxiety and pain, while also reducing the need for contact with the primary healthcare team (Dewar et al 2003).

**Conclusion**

Gallstones are the most common abdominal-associated reason for hospital admission and account for a large proportion of healthcare expenditure. Laparoscopic cholecystectomy has become the gold standard treatment for patients with gallstones.

This article has focused on the care of patients undergoing a laparoscopic cholecystectomy. It has identified the key areas nurses need to understand when caring for these patients. As laparoscopic surgery develops, it is paramount that nurses working in a surgical unit can discuss with patients their proposed surgery and its outcomes, while promoting good care. Effective pre-operative assessment, good surgical technique and well managed post-operative care all contribute to a successful outcome for patients NS.

**Time out 10**

Now you might like to write a practice profile. Guidelines to help you are on page 52.

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**References**


