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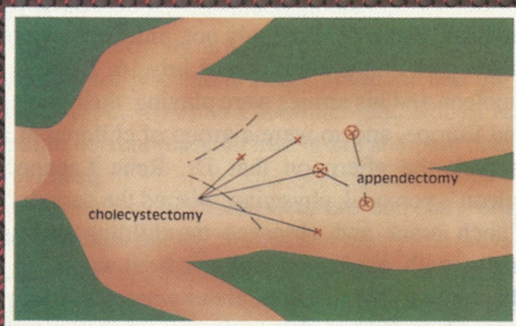

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Laparoscopic cholecystectomy

By Sharon Gabriel, R.N., B.Sc.N.

Laparoscopy has been a diagnostic and treatment technique successfully used by gynecologists for more than 30 years.[6,9] With recent technical advances in equipment, general surgeons have developed laparoscopic techniques for the diagnosis and treatment of appendicitis and gall bladder disease.[1] Laparoscopic cholecystectomy was introduced at Mt. Sinai Hospital in Toronto in July, 1990, the first time this type of surgery was performed in Toronto.

Traditional cholecystectomy

Traditional cholecystectomy is major abdominal surgery. Postoperatively, the patient requires medication for the treatment of pain, potentially suffers from ileus, is hospitalized for up to seven days, and has a six week recuperation at home. This traditional gall bladder procedure has the risks of major surgery, anaesthesia and involves a considerable investment for the patient in terms of time and loss of income. For the hospital, there is the equal commitment of time and money.

Laparoscopic cholecystectomy, a surgical procedure reported in the United States by Dr. Reddick, et al in 1989,[7] is reducing the time of hospitalization between 24-48 hours, with a recovery period of two weeks.[2,4,5,7,9] There is considerably less pain with the laparoscopic procedure due to the small incisions (1 to 3 cm in size) and a decreased potential for ileus. Left shoulder pain, a common complaint of patients undergoing laparoscopic procedures, can be controlled through oral medication and heat applied to the shoulder.[4] Cosmetically, the small incisions are much more pleasing to the patient than the traditional longer abdominal incision.[5]

Anatomy and physiology

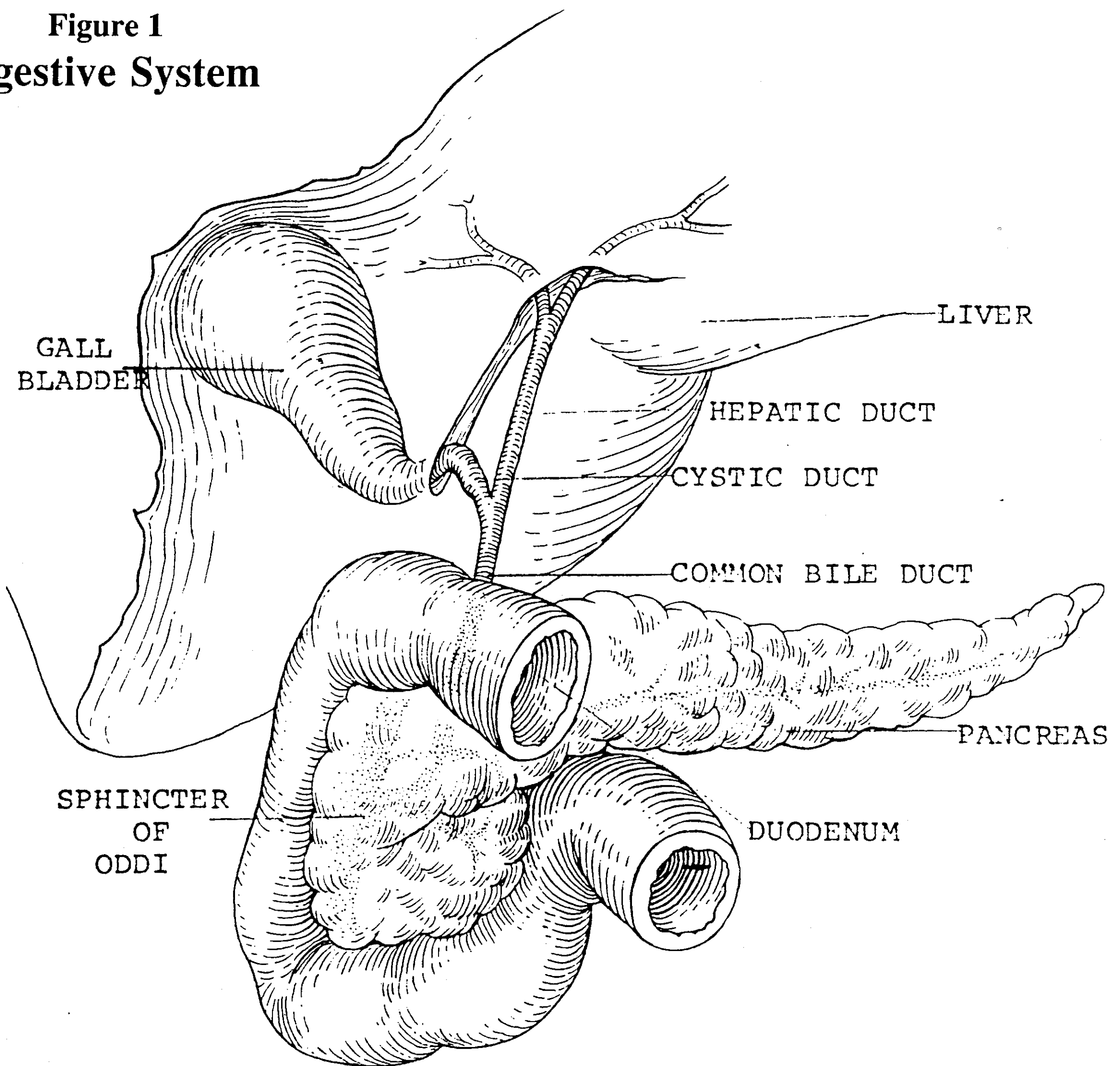
The gall bladder is a small muscular sac attached to the underside of the right lobe of the liver. It is a storehouse for bile, secreted in the liver and transported via the hepatic duct. Bile, essential to the metabolism of carbohydrates, proteins and fats, is released from the gall bladder when food is ingested. The gall bladder contracts and secretes bile through the cystic duct into the common bile duct and reaches the duodenum via the sphincter of Oddi.[3] **(See Figure 1 following page)**

Abstract

Traditional gall bladder surgery results in an abdominal incision requiring management of pain, possible ileus, a hospital stay of 5 to 7 days, and a six week recovery period. This type of surgery carries with it the risks of both surgery and anaesthesia and can have a high monetary cost for both the patient and the hospital. Laparoscopic cholecystectomy results in four, 1 to 3 cm incisions, that appear to produce less pain and no ileus. Hospitalization is 24 to 48 hours and complete recovery and return to work can occur within two weeks. This surgery is a safe and economical alternative to traditional surgical methods.

Indications for cholecystectomy, the removal of the gall bladder, are the formation of stones (cholelithiasis) and the symptoms of acute or chronic infection (cholecystitis). Cholelithiasis, the production of stones, can obstruct the common bile duct, resulting in jaundice. Patients with cholecystitis may present with symptoms of an acute infection, requiring immediate surgical intervention or chronic infection, resulting in surgery when symptoms improve.[3]

Figure 1
Digestive System



Preoperative assessment

Candidates for this procedure are selected according to strict criteria. Patients should be relatively healthy and a candidate for general anesthesia. Contraindications are obesity, evidence of acute cholecystitis, or the presence of multiple stones and jaundice. Previous abdominal surgery is also a contraindication due the possibility of adhesions.[4] Only 30% of the patients requiring a cholecystectomy are eligible for laparoscopic cholecystectomy.

Preoperative tests for laparoscopic surgery are similar to those required for traditional cholecystectomy. A full blood work up is required including a complete blood count, prothrombin time and partial thrombplastin time, electrolytes, random glucose, creatinine, conjugated and unconjugated bilirubin. Gamma Glutanyl Transferase (GGT), Alkaline Phosphates (ALP), Aspartate Transaminase (AST) and Alanine Transaminase (ALT) are done to test liver function and the possibility of a stone obstructing the common bile duct.

A preoperative ultra sound of the gall bladder is essential to assess the size of the gall bladder, the presence of stones, and the size of the common bile duct. An enlarged duct may indicate an obstruction, a contraindication for laparoscopic surgery.[4,5] A cross and type for the two units of blood, routine urinalysis, chest x-ray and electrocardiogram complete the preoperative investigation.

Preoperative teaching is essential. For Mount Sinai Hospital this is a new procedure, and informed consent includes the possibility of the surgery being converted to the traditional laparotomy.

Patients must be educated to understand that postoperative symptoms will be less severe and of a different type, i.e., less abdominal pain but more shoulder pain. Deep breathing and coughing is important as is early mobilization. Due to the decrease in pain, this is easier for patients to achieve.

The surgeon, first introducing the procedure, inserviced the nurses on the surgical unit receiving the patient. Recently, I have been approached by other units, including recovery room, to set up multiple inservices so that everyone can become familiar with "bandaid gall bladder surgery."

Operating room preparation

Preopertively, the circulating nurse must check the equipment required for this surgery in order to promote patient safety and avoid intraoperative delays due to equipment failure. The equipment consists of two television screens, a camera that attaches to the telescope, an insufflator, a light source and an electrosurgical unit.

At Mount Sinai, we use a specially designed insufflator that has two delivery modes - one litre per minute and automatic. The carbon dioxide tank must be full, as up to 175 litres may be used at one time. There is no reserve or internal tank on this insufflator. Light is provided by a Xenon light source, which must be checked for bulb potency. These bulbs are very costly and should be changed by biomedical engineering. The integrity of the camera lens must be checked and the camera is white balanced for color clarity. Two televisions are necessary and are positioned in such a way that both the surgeon and first assistant have a clear view of a television screen. **(See Figure 2)**

At Mount Sinai Hospital, the insufflator, camara, one television monitor and electrical surgical unit (ESU) are positioned behind the primary surgeon, in full view of the first assistant. The first assistant can visualize not only the monitor, but also the insufflator and ESU settings. It may be necessary to have adaptors available for the ESU to facilitate the use of a cauterizing instrument.[4]

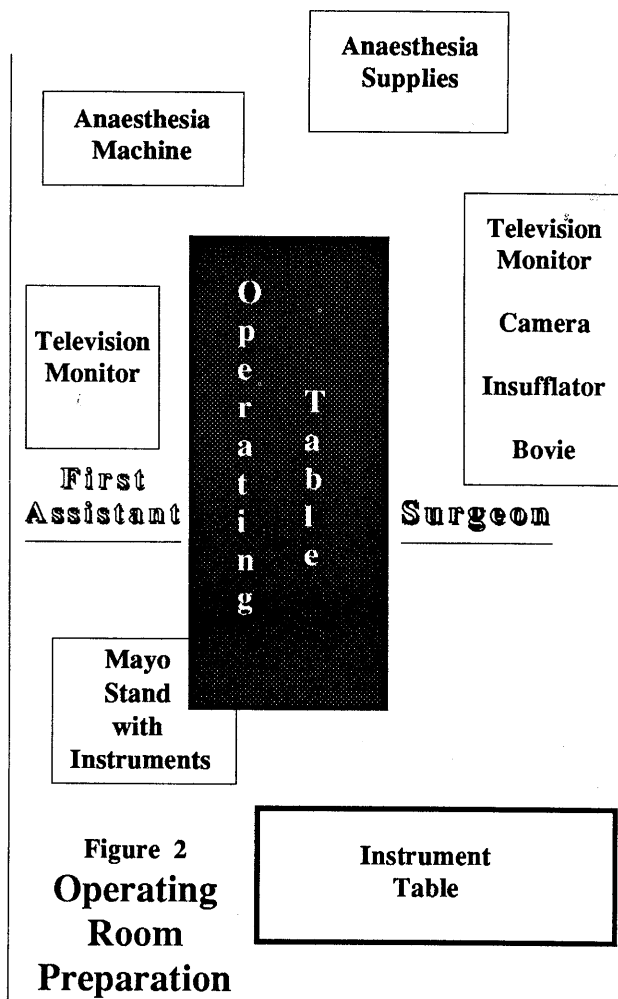


Figure 2
Operating Room Preparation

Intraoperative procedure

Anaesthesia monitoring includes EKG, blood pressure, and O_2 saturation. The patient is anesthetized, intubated, and the endotracheal tube secured. A nasogastric tube is inserted to decompress the stomach. A catheter is inserted to empty the bladder and an electrosurgical grounding pad is applied.

The patient is placed in the supine position. A sand bag is placed under the left scapula, which rolls the liver to the right side and exposes the gall bladder. The patient's skin is prepared with betadine, painted nipples to thigh, table edge to table edge. Draping must be adequate to permit performance of a traditional cholecystectomy in case the laparoscopic procedure must be abandoned.[4,5]

The telescope head is draped in a sterile covering

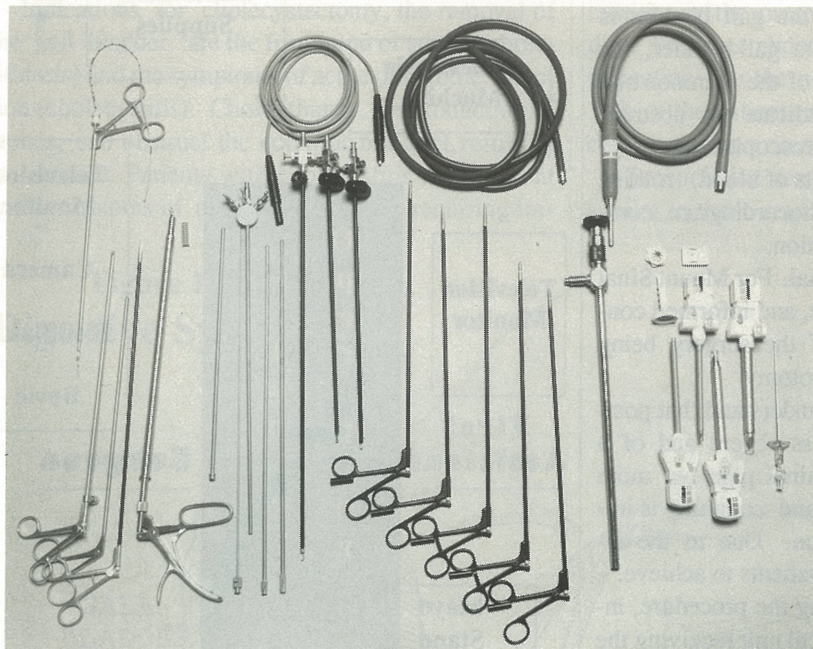


Figure 3 - Instrumentation for laparoscopic cholecystectomy. Verres needle is shown at the far right. The next four instruments are trocars.

late the gall bladder. A sleeve, with the appearance of a screw, helps to hold these trocars in place and prevent slippage during instrument manipulation.

Mount Sinai Hospital is currently using disposable Verres needles and trocars. They are believed to provide a constant degree of sharpness. The trocar has a safety sheathe that protects the tip from puncturing nearby organs. The surgeon identifies, dissects and isolates the cystic duct and artery. The duct and artery are ligated with a clip.

An alternative method[5] of ligation is the use of endoloops. The gall bladder is separated from the liver bed using the ESU in the blend mode.

so that the circulating nurse may apply the camera head. The light cable is attached to the telescope. Connecting tubing is attached to the insufflator and left for later attachment to a trocar. Electrosurgical cables, one adapted for the cholecystectomy equipment and one for a hand-held cautery, are secured to the draping. Suction tubing and irrigation tubing usually go to the head of the bed.

Instrumentation

The surgeon begins by inserting a Verres needle in a one cm stab hole below the umbilicus. (See Figure 3) A drop test is performed to assess that the needle is in the abdomen.[6] The peritoneum is filled with carbon dioxide at the rate of one litre per minute up to six litres. The needle is removed and a 10 mm trocar is introduced. The telescope with the attached camara head is introduced via the trocar and used to inspect the abdomen.

Insufflation is maintained by switching the machine to automatic which maintains the abdominal pressure at 12 to 14 mm Hg. An 11 mm trocar is inserted under visualization in the mid line, two finger breadths below the xyphoid. This portal is used for the dissecting and cauterizing equipment. Two 5 mm trocars are introduced in the mid clavicular area and anterior axillary line through which graspers can retract, expose, and manipu-

Before the final separation of the gall bladder from the liver, the liver bed is inspected for bleeding. Copious amounts of normal saline, delivered under pressure, are used to irrigate the abdomen. If the gall bladder proves to be large, an aspiration needle may be introduced to decompress the gall bladder. The gall bladder is then separated from the liver bed and removed via the umbilical incision. The gall bladder is held by grasping forceps while the telescope is removed and reintroduced in the upper incision. A grasper in the umbilical incision brings the gall bladder to the abdominal wall where it is easiest to remove through the single layer of fascia. If stones are too large to permit removal of the gall bladder sac, the incision may be extended 2 cm and stone forceps used to crush the stone and remove fragments.[4,5,6,7]

The abdomen is inspected for haemostasis. The carbon dioxide is permitted to escape, the sheathes are removed, and the incision is closed with 2-0 Prolene for peritoneum and fascia and 4-0 Dexon in a subcuticular fashion for skin. The four small incisions are dressed with 1/4" Steristripes.

Documentation is conducted in the usual manner. Names of the surgeon, assistants, anaesthetists and nurses, as well as the names of other people present in the OR for observation are recorded. The serial number of the ESU is recorded as well as positioning, prepping solution, and comments. The pa-

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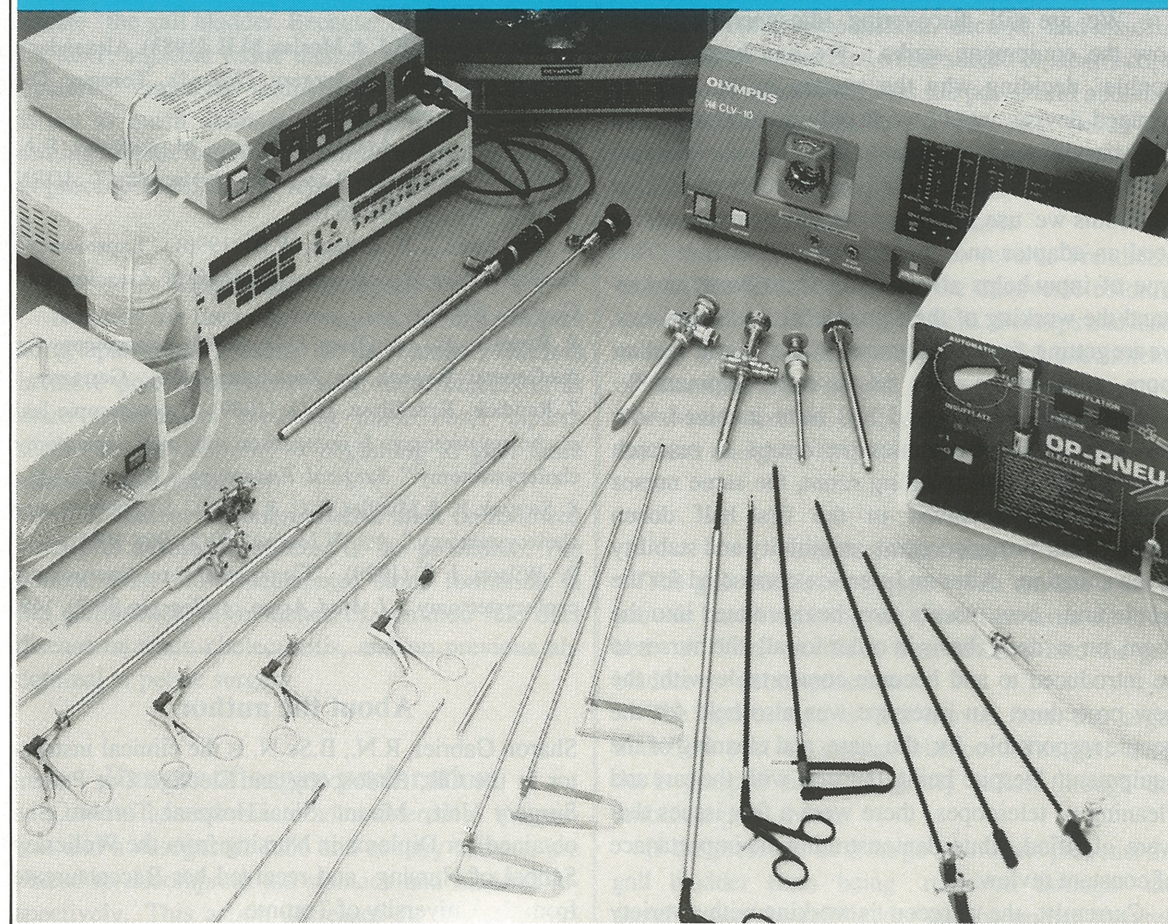

tient is then transferred to the post anaesthetic unit.

Recovery from anaesthesia is the same as for the traditional cholecystectomy. The signs and symptoms observed are the same for any abdominal surgery. The patient is returned to the surgical unit.

Currently, if the patient is the first surgical candidate of the day, the patient is permitted clear fluids in the late afternoon and ready for discharge the following day by early afternoon.

Nursing implications

New procedures are a difficult time of adjustment for both surgeons and nurses. The similarity between gynecological laparoscopy and laparoscopic cholecystectomy makes instruments and equipment somewhat similar. The support and continued presence of detail representatives of various companies has helped the learning process of both physicians and nurses. After eight of these procedures and a technical inservice, the nursing staff is now totally responsible for equipment set-up and instruments. However, the sales representatives are only a phone call away.

We are still discovering idiosyncrasies about how the equipment works. We had been having trouble deciding why the cautery cable, a single pronged devise, would work only in certain rooms. One circulating nurse new to this procedure pointed out that there were two different models of ESU in the rooms we use. For one unit, she pointed out, we need an adaptor and, for another, we do not. This type of input helps all the nurses to better understand the working of the equipment. In this process, we are getting faster and more efficient, and feeling more comfortable with set-up and equipment.[8]

As clinical instructor, I had been involved with the first cholecystectomies performed in research labs. Once in the operating room, the same nurses were initially involved in the first half dozen cases. This provided some continuity and stability to the situation. After an inservice conducted for the whole unit, new nurses are being rotated into the room on a daily basis in order for all the nurses to be introduced to and become comfortable with, the new procedure. An inservice was also held for the people responsible for the care and cleaning of the equipment. Despite being familiar with the care and cleaning of telescopes, there were a few issues that were clarified, thus demonstrating the importanace of constant review.

Currently, the surgeon is working with a variety of instrumentation, which can change from case to case as availability changes. This equipment is currently so in demand that there is a six month to one year back order situation. The disposable equipment is also in great demand and becoming available from a variety of sources.

Conclusion

Laparoscopic cholecystectomy is a viable option to traditional cholecystectomy for a select population. The decrease in post operative pain and ileus, and decrease in hospitalization and recovery time make it an attractive alternative both to patients and to hospitals in these times of limited resources. ■

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About the author

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Laser laparoscopic cholecystectomy

In the "traditional" removal of a diseased gallbladder (cholecystectomy), the required main incision (a right upper quadrant incision) requires that the patient, because of the pain associated, not move or breathe deeply after the procedure. This could complicate the recovery process if infection or respiratory problems become evident.

The CO_2, contact Nd:YAG, argon, and frequency-doubled YAG lasers have been used to excise the gall bladder. Because of the precision of the laser, adjacent tissue damage is minimized. Postoperative drains are removed earlier because there is not as much drainage resulting from the laser's sealing effects. Recovery is similar to the conventional procedures except for reports of quicker recovery.

Laser laparoscopy

Recently the laser has been used through an operating laparoscope to excise the gall bladder. This less invasive procedure is becoming more successful as more refinements are being made. Laser laparoscopic cholecystectomy is beginning to gain more attention and popularity.

The patient selection criteria must be followed strictly to ensure the success of the procedure. The patient must show documented stone formation in the gallbladder, no evidence of common bile duct disease or acute cholecystitis, and no previous abdominal or pelvic surgery.

Danger of organ perforation

General anaesthesia is administered to the patient and a nasogastric tube and urinary catheter are placed to decompress the stomach and bladder, respectively. This action decreases the chance of organ perforation during the laparoscopic procedure.

The patient is placed in the Trendelenburg position (head down) to allow the organs to move towards the chest. A small umbilical incision is made and an insufflation needle inserted to fill the abdominal cavity with CO_2 gas. The needle is removed when the insufflation appears to be adequate. A trocar and sheath are inserted and the trocar removed to allow introduction of the laparoscope through the sheath. The light cord, video camera, suction, and insufflation hose are connected to the sheath or laparoscope.

The physician examines the pelvis and abdomen and identifies landmarks for reference. Other stab wounds are made at strategically placed positions to allow for the passage of other necessary instrumentation during the procedure.

The patient is then placed in reverse Trendelenburg (feet down) to allow the transverse colon to move away from the surgical field. Forceps and laser energy are used to dissect any peritoneal attachments or adhesions from around the cystic duct or artery. These structures are doubly ligated and divided with the laser energy.

Laser dissection

The gall bladder is grasped with tension used to provide traction during the dissection from the liver bed. A long needle is then inserted into the gall bladder for decompression.

The laparoscope is then moved from the larger umbilical port to another side port. The gall bladder is grasped and then gently pulled through the umbilical port sheath.

If the presence of a large gall-stone prevents the gall bladder from being removed through the sheath, then the gallbladder can be pulled through