A COMPARATIVE STUDY OF LAPAROSCOPIC PORT SITE SKIN CLOSURE VERSUS SKIN ADHESIVES

A DISSERTATION SUBMITTED TO

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CERTIFICATE

This is to certify that the dissertation titled **"*A COMPARATIVE STUDY OF LAPAROSCOPIC PORT SITE SKIN CLOSURE VERSUS SKIN ADHESIVES*"** is the bonafide work done by ***Dr. PRASANNA S,*** Post Graduate student (2013 – 2016) in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfillment of the regulations of The Tamil Nadu Dr. M.G.R Medical University, Chennai for the award of M.S., Degree (General Surgery) Branch - I, Examination to be held in April 2016.

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I, **DR. PRASANNA S** solemnly declare that this dissertation titled ***"A COMPARATIVE STUDY OF LAPAROSCOPIC PORT SITE SKIN CLOSURE VERSUS SKIN ADHESIVES"*** is a bonafide work done by me in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under the guidance and supervision of my unit chief

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INTRODUCTION

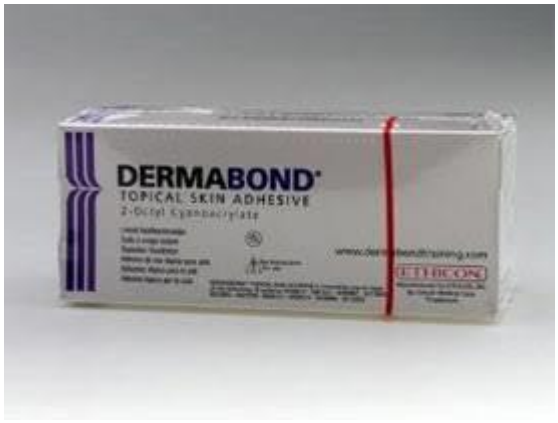
Minimally invasive techniques have grown leaps and bounds over the past decade. This occurred as a result of patient demands for less painful operations quicker postoperative recovery and technological development.

Any general surgical procedure can be done using laparoscopic procedures.

Surgeries in the chest, upper abdomen, and pelvis, especially those not requiring tissue removal, are ideally suited for laparoscopic techniques. Conversely, other procedures may have lesser known benefits when minimally invasive techniques are performed, especially when the specimen excised is large.

Traditionally, laparoscopic trocar sites were closed either

by subcuticular sutures or a simple skin suture depending on the surgeon.The other methods in which the port closure is being carried out are skin staples, surgical tape,full thickness cuticular sutures and skin adhesives. Cyano acrylates were actually used as tissue adhesives in operative set up. Easy appication, cost-effectiveness, cosmesis all make it a valuable asset in wound closure. Skin adhesives are being used extensively in the closure of extremity, head, and neck lacerations. Use of cyanoacrylates in otologic and ophthalmologic surgery are also being described.



Octylcyanoacrylate is a long- chain cyanoacrylate tissue adhesive. It is a combination of monomer and plasticizers which form a flexible bond with a breaking strength comparable to 5-0 monofilament suture. Multiple clinical applications for which it is commonly being used exist. However, no studies exist to compare its use in closing laparoscopic port sites.

AIMS AND OBJECTIVES

1. To establish the applicability of octylcyanoacrylate in laparoscopic surgery for swift closure of trocar sites by comparing it with conventional suturing.
2. To reduce the operating time and to reduce the economic strain with reference to repeated change of dressings and to produce cosmetically better wounds.

MATERIALS AND METHODS

PLACE OF STUDY

Department of General Surgery, Govt. Stanley Medical College &Hospital,Chennai

DURATION:

JAN 2015 TO SEP 2015

INCLUSION CRITERIA:

All Patients undergoing laparoscopic surgeries irrespective of age group both in the emergency and elective setup

EXCLUSION CRITERIA:

- Cases in which the laparoscopic procedure is converted to open technique
- Patients who are known to harbor atypical mycobacteriae
- Patients who are terminally ill
- Patients previously diagnosed with tuberculosis
- Patients diagnosed with AIDS, Hepatitis etc ;

METHODOLOGY

- All patients undergoing laparoscopic surgeries in our department during the period from January 2015 to September 2015 were included in the study
- After any laparoscopic surgery the 5 mm ports alone were not sutured instead a skin adhesive (octyl cyanoacrylate) was applied after approximating the wound edges. The port site is left open without applying

any dressing. The patients were followed in the 5 th and 14 thpostoperative days for any signs of inflammation like redness , induration, blisters, ugly scars etc; the results were compared with ports which were closed by conventional suturing by 2 –o vicryl simple intermittent sutures.

- The observations were recorded and tabulated.

REVIEW OF LITERATURE

Introduction

Tremendous growth in the use of minimally invasive techniques has occurredover the past decade. This was made possible by developments in technologyand was fuelled by patient demands for less painful operations and quicker postoperative recovery.

Almost all general surgical procedures can be performed using minimally invasive techniques. The greatest benefit is achieved in operations where the trauma of access exceeds that of the procedure. Procedures in the chest, upper abdomen, and pelvis, which do not require tissue removal , are ideally suited for minimally invasive techniques. Conversely, other proceduresmay have less obvious benefits when performed with minimally invasive techniques, especially if a large specimen is to be removed. To be a proficient *laparoscopist,* one must become familiar with a new set of techniques and instruments, as well as knowing when to apply them and when to convert toan open operation.

Patient Considerations

Patient Selection

As in all surgery, choosing the right operation for the patient is the first step. Since all laparoscopic surgery of the abdomen requires the use of general anesthesia, the ability to tolerate anesthesia is an absolute requirement. Patients with impaired exercise tolerance or a history of shortness of breath will need a preoperative consultation with a cardiologist or pulmonologist. Patients with severe carbon dioxideretention can be difficult to manage intraoperatively because the use of carbon dioxide for pneumoperitoneum exacerbates the condition. By increasing the minute ventilation and decreasing the CO_2pneumoperitoneum from 15 to 10 mmHg, one can control metabolic acidosis. Rarely, when these measures are ineffective at controlling hypercarbia, we have resorted to using nitrous oxide for peritoneal insufflation. While not suppressing combustion (as does carbon dioxide), nitrous oxide (N_2O) supports combustion no more than air and has been proven safe for laparoscopic use. A single blind randomized trial has demonstrated that N_2O pneumoperitoneum is associated with decreased

postoperative pain compared with carbon dioxide.

When deciding if a patient is a suitable candidate for a laparoscopic procedure, it is important to assess patient or procedure characteristics that will lengthen the operative time sufficiently to nullify the benefits of laparoscopy. If the laparoscopic operation takes substantially longer than the open equivalent or is more risky, then it is not prudent to proceed laparoscopically. A history of a prior open procedure or multiple open procedures can make access to the abdomen difficult and will be discussed in detail.

Adhesions and scarring in the surgical field from prior surgery can make laparoscopic surgery very difficult and may require use of many novel dissecting and coagulating tools. Operating on patients with severe obesity is challenging specifically because torque on transabdominal ports leads to surgeon fatigue and diminishes surgical dexterity. In addition, the long distance from the insufflated abdominal wall to the abdominal organs can make laparoscopic surgery a "far reach." Special long ports and instruments are available to overcome this difficulty.

Inability to obtain an adequate working space makes laparoscopic surgery impossible. This is encountered most commonly in patients with dilation of the intestine from bowel obstruction. Often, laparoscopic lysis of adhesions for distal bowel obstruction is not

technically feasible. Some patients with appendicitis will have sufficient small bowel dilation that laparoscopic access to the right iliac fossa is not possible.

Patient Positioning

We rely on gravity for retraction of the abdominal contents to provide exposure. Sometimes this requires steep positional changes, and care must be taken to prevent nerve complications or neuropathies after laparoscopic surgery as in open surgery. Patients must be positioned properly at the beginning of the procedure, making certain that all pressure points are padded. Perineal nerve injury is caused by lateral pressure at the knee and may occur when the table is "airplaned" to the side with a retractor holding the patient in place. Femoral and sciatic neuropathies are similar in that they are due to compression. Padding the retractor arms and securing the patient to the table can prevent these neuropathies.

It is best if the arms can be tucked for most laparoscopic procedures so that the surgeon may move freely up and down the table in order to line up instruments and the target tissue. This is most important for procedures in the pelvis, where the surgeon will want to stand adjacent to the contralateral thorax. However, even with upper abdominal laparoscopy, tucked arms allow more optimal positioning of instrument columns and monitors. If there is a need to extend the arms on arm boards, one must be very careful to avoid a brachial plexus injury that occurs when the arm is extended greater than 90 degrees at the shoulder. Usually, at the start of a procedure the arm positioning is safe but may change as the patient slides down on the table. For this reason, when reverse

Trendelenburg is expected, we place footplates at the feet. This prevents sliding on the table and does not cause any discomfort to the patient because it is much like standing. We secure the ankles as well to be sure they do not "twist" during the procedure. There are footplates available for split-leg tables that can be used when operating on the upper abdomen and steep reverse Trendelenburg is needed.

Patient Preparation

There may be an increased incidence of deep venous thrombosis after laparoscopic surgery that is due to pooling of blood in the venous system of the lower extremities. Venous return is impaired by compression of the iliac veins from the elevated intra-abdominal pressure exerted by the pneumoperitoneum. Additionally, the positional effects of placing the patient in a steep reverse Trendelenburg position lead to further distension of the venous system. All patients undergoing laparoscopic procedures in reverse Trendelenburg, even short procedures such as laparoscopic cholecystectomy, should have sequential compression devices placed before the procedure begins, although this does not improve femoral blood flow entirely. Patients at high risk for developing deep venous thrombosis should be treated with subcutaneous anticoagulants as either fractionated or unfractionated heparin.This includes patients undergoing lengthy procedures, obese patients, patients with a prior history of deep venous thrombosis or pulmonary embolism, and patients in whom ambulation after surgery will be delayed. Some authors recommend placement of vena caval filters in patients with a prior history of deep venous thrombosis who are undergoing lengthy laparoscopic

procedures.

Laparoscopic surgery is associated with a high incidence of postoperative nausea and vomiting. A recent review asserts that serotonin receptor antagonists such as ondansetron appear to be the most effective and should be considered for routine prophylaxis. Another prospective, blinded, randomized trial shows a decrease in the postoperative nausea and vomiting when low-dose steroids are given to all patients. There was no increased infection rate in the group that received steroids. Other preventive measures include ensuring adequate hydration and decompression of the stomach with an orogastric tube before the end of the procedure. Intravenous nonsteroidal anti-inflammatory drugs (NSAIDs) such as ketorolac provide superb pain relief and diminish the need for postoperative narcotics, which may help to prevent nausea and vomiting.

ABDOMINAL WALL ANATOMY

Basic anatomy and function related to pathology

The abdominal wall is a complex structure composed primarily of muscle, bone and fascia. Its major function is to protect the enclosed organs of the gastrointestinal and urogenital tracts but a secondary role is mobility, being able to flex, extend, rotate and vary its capacity. Flexibility requires elasticity and stretch which compromise abdominal wall strength. The roof of the abdomen is formed by the diaphragm separating the thoracic cavity above with negative pressure from the abdomen below with positive pressure. Weakness of the diaphragm can lead to much of the bowel being

drawn into the chest down this pressure gradient. The bony pelvis forms the floor of the cavity but a muscular central portion, the perineum, may also weaken and allow rectum, bladder and gynaecological organs to bulge downwards, a condition called prolapse. The overall design of the abdominal muscles is best seen on a transverse computed tomography (CT) scan through the midabdomen. Posteriorly the muscles are strong, further supported by the vertebral column, ribs and pelvis. Two regions called the posterior triangles represent areas of weakness which can lead to rare lumbar hernias. Laterally there are three thin muscle layers whose fibres criss-cross for strength and flexibility. Surgeons can make use of these layers, by making releasing incisions, separating the layers and then sliding one layer on another to increase girth and allow closure of defects in the centre of the abdomen, e.g. the 'Ramirez slide' used in large incisional hernia repair. Anteriorly the two powerful rectus abdominus muscles extend vertically from ribs to pelvis. Herniation through these strong muscles does not occur naturally but their central join, the linea alba, is an area of weakness resulting in epigastric and paraumbilical herniation. Divarification of the recti is the condition where the linea alba stretches laterally as the two rectus muscles separate. It occurs in the upper abdomen in middle-aged, overweight men but also as a result of birth trauma in the female when it occurs below the umbilicus.

Abdominal pressure

The positive pressure within the abdomen is used by a surgeon when drains are placed to allow blood, pus, bile, bowel content and urine to flow outwards down the pressure gradient. However, this constant pressure from within can also lead to the condition of

abdominal hernia where tissue, meant to be within the abdominal cavity, is forced outwards through defects in the muscular wall.

Laparoscopic access

There is a wide variety of ports, each with different characteristics, available on the market. The bladed trocars cut the abdominal wall fascia during entry. Because the nonbladed trocars do not cut the abdominal wall as much, they make smaller defects in the abdominal wall and may be less prone to hernia formation in the future. The most commonly used bladed ports have a shield that retracts as the blade is pushed through the fascia of the abdominal wall, and then it engages once inside the abdomen. When first introduced to the market, the shields were called safety shields, but they have lost that designation because the shield provides little protection. The nonbladed trocars come in many forms. One nonbladed trocar is used in the Step system a modified Veress needle that locks inside an expandable sheath. Once inside the abdomen, the Veress needle is removed, and a blunt port is passed into the sheath that guides the port by dilating radially. The Ethicon nonbladed trocar has a rough edge of plastic that is twisted and pushed through the layers of the abdominal wall. None of these technologies have proven safer than the more economical reusable nonshielded bladed trocar systems made by most instrument companies Important characteristics of a port need to be considered when choosing which port to use. The advantage of a port introduced with a nonbladed trocar is that the abdominal wall defect is smaller, which does not allow gas to leak from the abdomen during the procedure. Because the fascia is not cut,

there is a lower risk of port-site hernia, and the fascia of most 10-mm incisions does not have to be closed. Additionally, these ports tend not to slip out of the abdominal wall during manipulation. Other considerations when choosing a port are the size of the external component, the smoothness of entry and exit of the instruments and specimens, and whether an external reducer cap is needed.

Access or Placement of the First Port

No single access technique has emerged as the safest and best technique.The techniques for abdominal access include direct puncture and an open-access technique. The direct-puncture technique can performed either by direct trocar insertion without pneumoperitoneum or by first obtaining pneumoperitoneum using

a Veress needle and then inserting the first trocar directly. The latter technique is the performed most commonly in the United States. Each technique has a specific pattern of complications that must be considered when choosing among them.

The Veress needle access was first described in 1938. This technique involves direct insertion of a needle into the peritoneum after lifting the abdominal wall with towel clips or a firm grip. The optimal site for insertion of the Veress needle is through the central scar at the umbilicus. One can make either a vertical skin incision through the umbilicus, hiding the incision in the base, or a curvilinear incision in an infraumbilical or supraumbilical position. Nevertheless, insertion of the Veress needle should be aimed at the central scar, where the layers of the abdominal wall are fused. This does not mean, though, that the first port inserted must be at the umbilicus. Advocates state that the benefits of this technique are the ability to place the initial port anywhere on the abdomen, that it is relatively quick, and that the skin and fascial openings are smaller, which prevents CO_2 leakage during the procedure.

For safe Veress needle insertion, one first must be certain to check the stylet and needle patency, especially when reinserting it after an unsuccessful initial pass. The Veress needle is available either as a reusable or disposable product and comes in two sizes, both long and short. The spring mechanism that pushes the stylet out, thus protecting bowel from the needle, must be tested when using the reusable Veress needle.

The safest technique requires stabilizing the abdominal wall (we prefer penetrating towel clips in nonobese patients). It is important to have control over the force and depth of insertion of the needle. This is aided by placing either your wrist against the patient's abdomen or using the nondominant hand to support the hand wielding the needle. It is sometimes necessary to raise the operating table to achieve the proper control. One must be mindful of the fact that the most common catastrophic complication from Veress needle insertion is injury to major vessels. The trajectory of the needle should not be angled

After placement of the Veress needle, one should perform an aspiration test by connecting a syringe filled with saline to the top of the Veress needle and aspirate. Aspiration of air, blood, or bile signifies incorrect placement and should prompt serious concern for an unexpected injury. If there is no aspirate, saline should be injected and should flow easily. The saline should flow down the Veress needle into the peritoneal cavity without pressure, a qualitative measure. Removing the plunger from the syringe and watching the saline level drop briskly may achieve a quantitative assessment of patency. If the saline flows slowly or not at all, the needle is likely in the wrong position, i.e., up against an intra-abdominal organ, or it is in the preperitoneal space. Alternatively, the tip may be occluded with fat, or the system may have an "air lock." To test this, inject a little bit of fluid again gently, and retest by removing the plunger and allowing the saline to drop into the abdomen.

The Veress needle then is connected to the insufflation tubing. The expected initial

insufflation pressure, assuming proper placement, should be less than 6 mmHg. Abnormally high insufflation pressure is an indication that something is not right. Because the insufflator is usually set to allow a maximum pressure of 15 mmHg, a value greater than this suggests that the patient is not anesthetized adequately and is contracting his or her abdominal muscles. If the insufflator records a pressure of 15 mmHg, there are a few explanations. The most ominous cause would be incorrect placement into an intra-abdominal organ. More likely, the Veress needle tip may be against omentum or is in the preperitoneal space. The insufflation line may be occluded at the stopcock, or there may be a kink in the tubing.

Direct trocar insertion without first establishing pneumoperitoneum is not used as frequently because many surgeons think that it is dangerous given that the bladed trocar must be pushed into the abdomen with significant force to penetrate the abdominal wall. Surgeons unfamiliar with the technique worry about injury to bowel and vessels when using excessive force. There are, however, many surgeons who perform this technique with no increased complication rate, confirming its safety. Still other surgeons believe that the open-access technique that involves a "minilaparotomy" is the safest.

The open, or Hasson, technique was first described in 1974. A 1- to 2-cm skin incision is made at the umbilicus, and the soft tissue is divided to identify the abdominal wall. The fascia and muscles are opened with a knife, and the peritoneum is identified and grasped with Kocher or Allis clamps. A 0-0 absorbable suture is placed through the fascia, and the Hasson port is secured to the fascial

sutures. Later these sutures can be used to close the abdominal wall. The insufflation tubing is attached to the sideport of the trocar, and the abdomen is inflated rapidly to 15 mmHg.

Newer trocars, called *optical trocars*, allow visualization of the tip of the trocar as it passes through the layers of the abdominal wall . A straight-viewing 0-degree scope is placed inside a clear trocar that is available with and without a bladed tip. Safe introduction of an optical trocar is a skill that requires judgment and experience and can best be learned in patients with no prior surgery after insufflation is established. Success depends on the operator's ability to see each of the layers of tissue, although visualization does not imply safety. It is useful for the surgeon to have command of several access techniques because there is no single technique that is best for all circumstances.

Difficult Access

Access can be the most challenging aspect of the procedure in some patients no matter which technique is used. This is especially true in obese patients. First, the site of the central scar often is judged inaccurately because the umbilicus is in a

caudad position owing to the loose panniculus. Additionally, there is an increased distance between the skin and the abdominal wall fascia. The Veress needle may not penetrate the abdominal wall. If an open-access technique is chosen, it may be difficult to expose the abdominal wall through a small incision. Degenerated fascia in obese patients will make the abdominal wall bounce against the needle or finger, making its identification difficult. Raising the skin with penetrating towels clips does not facilitate this exposure and, in fact, distorts the anatomy, making it more difficult to identify the fascia. Sometimes a modified technique described by Vakili and Knight can be helpful. This is a combination of open and Veress techniques in which a small skin incision is made in obese patients. Kochers are used to hold the abdominal wall fascia up, and a Veress needle is passed through the abdominal wall.

Access is also difficult in patients who have had prior surgery through a midline incision. In these patients, it is unsafe to perform the Hasson technique through the midline site because of the potential for adhesions of bowel to the posterior surface of the abdominal wall. Injury can occur when dividing the fascia or when sweeping adhesions away with a finger. It is difficult to perform the open technique at sites other than the umbilicus because of the multiple layers of the abdominal wall. In these patients, we prefer to place the Veress needle in the next safest location, which is the left upper quadrant along the costal margin. One must be certain that the table is flat because the spleen and liver are injured more easily in patients in the reverse Trendelenburg position. One must be certain that the stomach is

decompressed with an orogastric tube before inserting the Veress needle in the left upper quadrant. Once insufflation is obtained, a port can be placed into the abdomen away from the previously operated field. We prefer entering with a 5-mm step port followed by a 30-degree 5-mm scope. Other surgeons recommend use of optical trocars in this situation

Port closure

Surgicell or other clot-promoting strips, or tissue glues may also be used laparoscopically to aid haemostasis. If at any stage bleeding is difficult to stem laparoscopically, then there should be no delay to convert to open in the interests of patient safety.

Devices such as the EndoClose may also be used to apply transabdominal sutures under direct laparoscopic view to close port sites that bleed.

Fascial Closure

Care should be taken to prevent port-site hernias, which occur in 0.65 to2.80% of laparoscopic gastrointestinal operations, because they can lead to bowel obstruction, incarceration, and/or Richter's hernias. All defects created with a 10-mm or greater bladed trocar should be closed, although this is not necessary when using some of the newer nonbladed trocars that create smaller fascial defects. Most

5-mm defects do not require fascial closure in adults, although there are reported cases of hernias at these sites. Because there is always a possibility of formation of a port-site hernia, the smallest possible port always should be used. When a port is manipulated excessively or has to be replaced multiple times, there may be a larger than expected fascial defect that may require closure. Additional recommendations are to place ports lateral to the rectus muscles when possible. At the conclusion of the procedure, removal of ports from the abdomen should be observed to be certain that omentum or abdominal contents are not brought up through the abdominal wall.

Fascial closure can prevent trocar-site hernia. A number of port-site closure devices have been developed because small laparoscopic incisions make it difficult to close the abdominal wall with round needles. The closure devices function like crochet needles, passing a suture through the abdominal wall on one side of the fascial incision. The suture end is released intra-abdominally under laparoscopic visualization, and the needle is removed. The needle is replaced (without suture) on the other side of the incision, and the free end is secured and pulled back out through the abdominal wall. A knot is then tied that closes the trocar site, as viewed laparoscopically

Trocar Injury

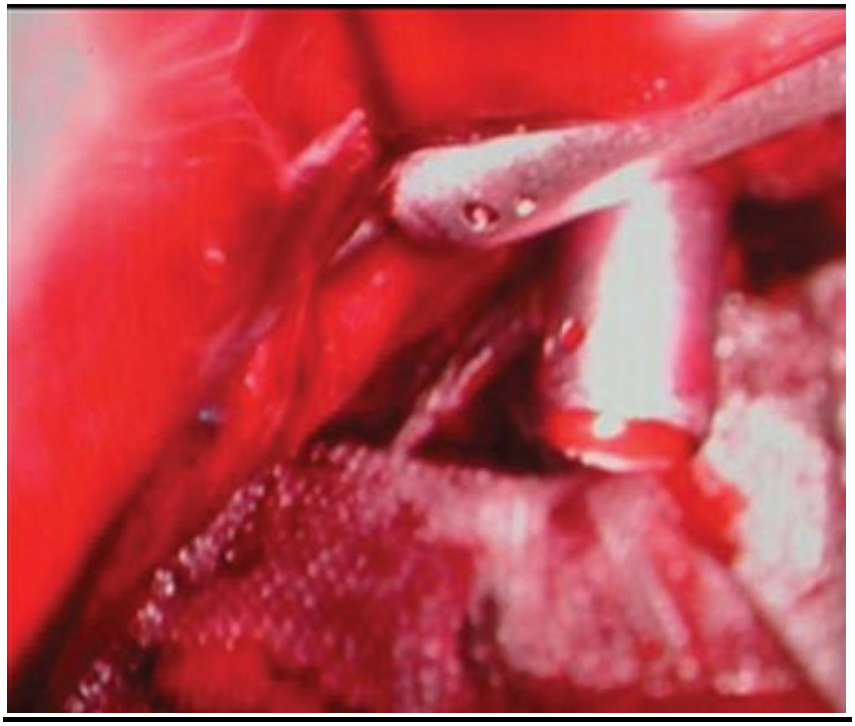
The overall risk of a trocar injury to intra-abdominal structures is estimated to be between 5 in 10,000 and 3 in 1,000. Almost all injuries occur during primary trocar

insertion. According to Chandler and colleagues, the most commonly injured organ is the small bowel (25.4%), followed by the iliac artery (18.5%), colon (12.2%), iliac vein (8.9%), mesenteric vessels (7.3%), and aorta (6.4%). All other organs were injured less than 5% of the time. The mortality from trocar injury is 13%, with 44% owing to major vessel injury, 26% to bowel injury with delayed diagnosis, and 20% to small bowel injury. Major vascular injuries are noticed immediately and require rapid conversion to laparotomy. They are managed by applying pressure when possible to allow the anesthesia team to maintain and correct volume and prepare for rapid blood loss. Then the surgeon gets control of inflow and outflow to permit repair of the injury. Unfortunately, many bowel injuries are not recognized at the time of the procedure, and nearly half are not noticed until more than 24 hours postoperatively. This obviously leads to severe sequelae and may be prevented by careful dissection and inspection at the conclusion of the procedure.

PORT SITE INFECTION

OMENTAL ENTRAPMENT

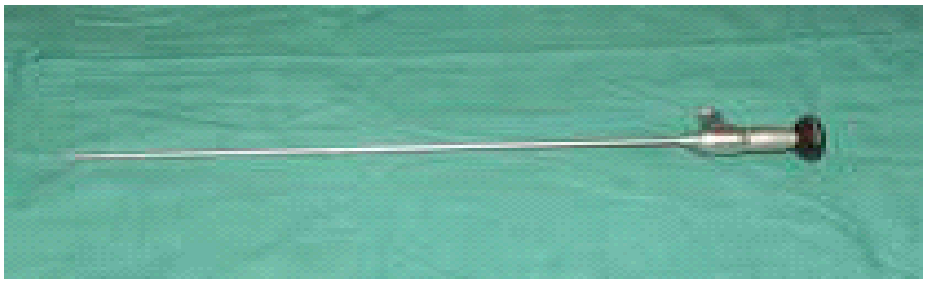
PORT SITE BLEEDING



Equipment

Telescope

Laparoscopic and thoracoscopic telescopes come in a variety of shapes and sizes, offering several different angles of view. The standard laparoscope consists of a metal shaft 24 cm in length containing a series of quartz-rod lenses that carry the image through the length of the scope to the eyepiece. The telescope also contains parallel optical fibers that transmit light into the abdomen from the light source via a cable attached to the side of the telescope. Telescopes offer either a straight-on view with the 0 degree or can be angled at 25 to 30 or 45- 50 degrees. The 30-degree telescope provides a total field of view of 152 degrees compared with the 0-degree telescope, which only provides a field of view of 76 degrees



The most commonly used telescope has a diameter of 10 mm and provides the greatest light and visual acuity. The next most commonly used telescope is the 5-mm laparoscope, which can be placed through one of the working ports for an alternative view. Smaller-diameter laparoscopes, down to a 1.1-mm scope, are available and are used mostly in children. They are not used commonly in adult patients because of an inability to direct enough light into the larger abdominal cavity. The camera is attached to the eyepiece of the laparoscope for processing.

Video Camera

The eyepiece of the telescope is attached to a high resolution camerawhich actually receives the image for projection on the monitor. The video image is transmitted via a cable to a video unit, where it is processed into either an analog or a digital form. Analog is an electrical signal with a continuously varying wave or shift of intensity or frequency of voltage. Digital is a data signal with information represented by ones and zeros and is interpreted by a computer. These are the methods by which the picture is transmitted to the video monitor. The camera and cable are designed so that they can be

sterilized in glutaraldehyde.

The camera iris directly controls the amount of light processed by opening the aperture of the camera. The gain controls the brightness of the image under conditions of low light by recruiting pixels to increase signal strength. Clearly, this step results in some loss of image resolution. This increases light but results in a grainy picture with poorer resolution. It also may create a loss of color accuracy owing to amplification of the noise-to-signal ratio.

Light Sources

High-intensity light is created with bulbs of mercury, halogen or xenon. The bulbs are available in different watts 150 and 300 and should be chosen based on the type of procedure being performed. Because light is absorbed by blood, any procedure in which bleeding is encountered may require more light. We use the stronger light sources for all advanced laparoscopy. Availability of light is a challenge in many bariatric procedures where the abdominal cavity is large. The light is carried to the fiberoptic bundles of the laparoscope via a fiberoptic cable. The current systems create even brightness across the field.

Insufflators

An insufflator delivers gas from a high-pressure cylinder to the patient at a high rate with low and accurately controlled pressure. Some insufflators have an internal filter that prevents contamination of the insufflator with the gas from the patient's abdomen and similarly filters any particulate matter that may be freed from the inside of an aging gas cylinder. Others require use with disposable insufflator tubing that has a filter on it. Some insufflators provide heated or humidified gas, but clinical benefit to these theoretically desirable features has not yet to be proven.

Video Monitors

High-resolution video monitors are used to display the image. Optimal monitor size varies but ranges from 19 to 21 in. Smaller monitors may be used if placed close to the operative field. Larger monitors provide little advantage outside of a display setting. Cathode-ray monitors (analog) are being replaced rapidly by flat-panel (digital) displays with excellent color and spatial resolution. These monitors may be positioned optimally when hung from the ceiling on light booms.

Instrumentation

The instruments used in laparoscopic surgery are similar to those of open surgery at the tips but are different in that they are attached to a long rod that can be placed through laparoscopic ports. Standard-length instruments possess a 30-cm-long

shaft, but longer instruments (up to 45 cm in length) have been developed for bariatric surgery. The handles come in many varieties and must be chosen based on comfort and ergonomics, as well as the need for a locking or nonlocking mechanism. The shaft of most hand instruments is 5 mm wide; however, some specialized dissectors are available only in a 10-mm width. Pediatric laparoscopy instrumentation is generally 2-3 mm in diameter

Bowel graspers come in a wide variety with different types of teeth .The most atraumatic grasper has small, smooth teeth like a Debakey forceps. This has the advantage of not tearing the tissues and can be used on almost all organs. We use the Hunter grasper (Jarit), which, like a Debakey, can be used to grasp bowel and also can be used to grasp a needle. An additional benefit is that the tip is blunt and not prone to causing tissue trauma. Another commonly used bowel grasper is the Glassman (Storz), which is atraumatic and is slightly longer than the standard-sized Hunter grasper. It is fenestrated and cannot be used to grasp a needle. For some tissues, these instruments do not "grip" well enough, and bigger teeth or a different tip, such as those of Allis and Babcock clamps, is preferred. We reserve these larger-teethed instruments only for organs that are being removed, such as the gallbladder, or for thicker tissue, such as the stomach. The rule is to be gentle because small injuries can take a relatively long time to fix laparoscopically.

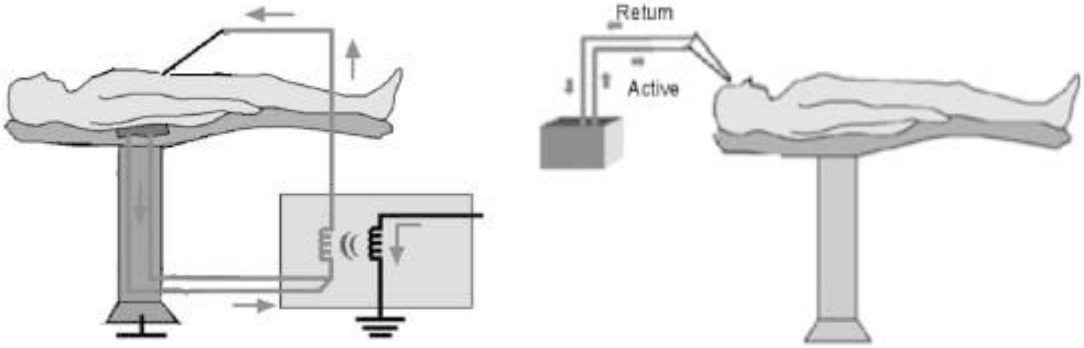
The most commonly used dissector is the Maryland dissector .It is useful for dissecting small ductal structures such as the cystic duct and can be used when dissecting vessels. Another use for the Maryland dissector is that it can be attached to monopolar cautery and used to grasp and cauterize a bleeding vessel (this should not be done with bowel graspers). The Maryland dissector should not be used to grasp delicate tissue because too much pressure is applied over a very small area, much like erroneously using a Kelly clamp for grasping tissue. Very delicate right-angle dissectors can be used for renal, adrenal, and splenic vessels and are less traumatic than the Maryland dissector because there are no ridges.

Scissors

Hemostasis

Hemostasis can be achieved using current from a monopolar electrosurgical generator applied to common instruments and controlled with a foot pedal. One of the most useful instruments for dissection is a disposable hook attached to the hand-held Bovie device for dissection (Valley Labs/Conmed and others). If a vessel has been transected and is bleeding but is too large to control with monopolar electrosurgery, a pretied lasso-like suture (Endo-loop, Ethicon Endosurgery) can be

helpful. Laparoscopic clips are handy for small identifiable vessels but should not be used when a vessel is not identified. The clip is only 7 mm in length and is not useful for vessels larger than this. When the vessel is not clearly identified but the bleeding site is, ultrasonic shears and some bipolar instruments such as the LigaSure device can be helpful. These instruments have the advantage of facilitating dissection while providing hemostasis for larger bleeding vessels



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Monopolar Electrosurgery

Although hemostasis is obtained using the same electrosurgical generator that is used in open surgery, there are hazards that are unique to minimally invasive surgery. The most frequently used method of delivering electrosurgery is monopolar. The desired surgical effect is hemostasis, and this is obtained by production of heat. Alternating current at 50,000 Hz (household current is 60 Hz) is generated and travels through an active electrode. The active electrode can be a Bovie tip in open surgery or, in laparoscopy, an instrument that is connected to the

generator by the monopolar cord. The current passes into the target tissue at sufficiently high current density to cause a great deal of heat. Depending on tissue heating, coagulation, fulguration, or vaporization of the tissue occurs. The circuit is completed by the return of the electrons broadly spread through the tissue (insufficiently dense to cause any adverse effect) back to the generator via the return electrode (grounding pad).

In open surgery, monopolar current sometimes is passed from the active electrode (Bovie tip) to the patient via another conductive instrument, the forceps. This is called *direct coupling.* In laparoscopy, it is not prudent to touch the active electrode (an activated instrument) on or near other conductive instruments within the abdominal cavity, i.e., the laparoscope or other working instruments. Direct coupling in minimally invasive surgery always should be avoided because injury may occur out of the surgeon's field of view. It is also not prudent to activate the generator in "midair" because the current may travel out of the surgeon's field of view to a crack in the insulation of a laparoscopic instrument. This results in transfer of current to a small area that generates heat and can produce an injury. All laparoscopic instruments should be checked for cracks in the insulation before being used.

Ultrasonic Shears

Before the introduction of ultrasonic shears, larger vessels had to be tied off individually. This was very tedious laparoscopically, especially with the division of

short gastric vessels during fundoplication. The development of the ultrasonic shears was revolutionary, allowing surgeons to divide larger vessels quickly and dissect simultaneously. Ultrasonic energy or sound waves are used to ablate, cauterize, and cut tissues. The ultrasonic vibration is amplified as it traverses the length of the titanium probe that is the active blade of the scalpel. Shearing forces separate tissue and heat the surrounding tissue, thereby coagulating and sealing blood vessels without burning. Damage to adjacent tissues is low, although the active blade can become quite hot, and burn injuries can occur.

Bipolar Electrosurgery

Bipolar electrosurgery coagulates tissue by passing a high-frequency, low-voltage electric current between two directly apposed electrodes. Laparoscopic general surgeons use it much less frequently because an additional maneuver must be made to divide the tissue. The LigaSure a newer bipolar device, coagulates larger vessels (up to 7 mm in diameter) and seals tissue and has a knife available for subsequent division of the tissue between the jaws of the forceps. The instrument makes a sound when the tissue within the jaw has been coagulated safely. The advantage is that division of larger vessels can be performed safely. Unfortunately, it is relatively slow to use as a dissecting instrument, and the tip is not very useful for dissection because it is straight and wide. It does not produce a large amount of heat, and damage to surrounding tissues is low.

The Physiologic Effects of Pneumoperitoneum

The pneumoperitoneum has many effects that are only partially known despite years of study in humans and in animal models. There are effects resulting from the pressure within the abdomen and effects resulting from the composition of the gas used, generally carbon dioxide.

The pressure within the abdomen from pneumoperitoneum decreases venous return by collapsing the intra-abdominal veins, especially in volume-depleted patients. This decrease in venous return may lead to decreased cardiac output. To compensate, there is an elevation in the heart rate, which increases myocardial oxygen demand. High-risk cardiopulmonary patients cannot always meet the demand and may not tolerate a laparoscopic procedure. In volume-expanded healthy patients with full intra-abdominal capacitance vessels (veins), the increased intra-abdominal pressure actually may serve as a pump that increases right atrial filling pressure.

Through a different mechanism associated with catecholamine release triggered by CO_2 pneumoperitoneum, heart rate rises along with systemic vascular resistance. This may lead to hypertension and impair visceral blood flow. It is not uncommon after the induction of pneumoperitoneum for the heart rate to rise along with the mean arterial pressure. This leads to a minimal effect in a young, healthy patient; however, in elderly, compromised patient, the strain on the heart can lead to hypotension, end-organ hypoperfusion, and ST-segment changes.

To minimize the cardiovascular effects of pneumoperitoneum, it is important that patients have adequate preoperative hydration. By insufflating the abdomen slowly, the vagal response to peritoneal stretching may be diminished and vagally mediated bradycardia avoided. Additionally, if cardiovascular effects are noted during insufflation or during the maintenance of pneumoperitoneum, the insufflation pressures should be lowered from the usual 15 to 12 mmHg, or pneumoperitoneum should be evacuated while the anesthesiologist sorts out the cardiovascular changes. Taking patients out of the steep reverse Trendelenburg position can help to increase venous return. Sometimes these effects can last for hours after desufflation.

The elevated intra-abdominal pressures restrict movement of the diaphragm, which reduces diaphragmatic excursion. This is represented as a decrease in functional residual capacity and pulmonary compliance and an increase in inspiratory pressure. Overall, there is no significant change in the physiologic dead space or shunt in patients without cardiovascular compromise. Bardoczky and colleagues studied seven healthy patients undergoing laparoscopy with CO_2 pneumoperitoneum. After the induction of pneumoperitoneum, peak airway and plateau airway pressures increased by 50% and 81%, respectively. Bronchopulmonary compliance decreased by 47% during the period of increased intra-abdominal pressure. After desufflation, peak and plateau pressures remained elevated by 36% and 27%, respectively, for 2 to 6 hours. Compliance remained at 86% of the preinsufflation value.

Urine output often is diminished during laparoscopic procedures and usually is the result of diminished renal blood flow owing to the cardiovascular effects of pneumoperitoneum and direct pressure on the renal veins. In addition to direct effects, elevated intra-abdominal pressure results in release of antidiuretic hormone (ADH) by the pituitary, resulting in oliguria that may last 30 -60 minutes after the pneumoperitoneum is released. Aggressive fluid hydration during pneumoperitoneum increases urine output. Positional changes can affect the collection of urine in the Foley catheter and must be taken into consideration if anuria is noted.

Carbon Dioxide Related Effects

Hypercapnia

Hypercapnia and acidosis are seen with pneumoperitoneum and are likely due to the absorption of carbon dioxide from the peritoneal cavity. In the ventilated patient, increasing respiratory rate or vital capacity must compensate for these changes. At extremes, increases in tidal volume may risk barotraumas, and increases in respiratory rates diminish time for gas mixing, increasing dead-space ventilation. A first steady state in $PaCO_2$ is reached around 15 to 30 minutes after introduction of the pneumoperitoneum. After this period, increases in $PaCO_2$ suggest that existing body buffers (>90% exist in bone) have been exhausted. Sudden increases may be related to port slippage and extraperitoneal or subcutaneous diffusion of carbon dioxide. This will resolve spontaneously once the

port is repositioned.

Hypercapnia and acidosis that are difficult to control may follow, especially in elderly patients, those undergoing long operations, and patients with pulmonary insufficiency. Our response to this is to desufflate the abdomen for 10 to 15 minutes. If reinsufflation results in recurrent hypercapnia, then we change insufflation gases (see above) or convert to an open operation. Acidosis can persist for hours after desufflation. Other complications of pneumoperitoneum that are less frequent but may be life threatening include CO_2 embolism and capnothorax.

Carbon Dioxide Embolus

The incidence of clinically significant CO_2 embolism is very low, although recent reports using more sensitive tests suggest that tiny bubbles of gas are present commonly in the right side of the heart during laparoscopic procedures. Clinically important CO_2 embolism may be noted by unexplained hypotension and hypoxia during the operation. There is a characteristic millwheel murmur that can be detected with auscultation of the chest. This is produced by contraction of the right ventricle against the blood-gas interface. Usually the anesthesiologist notes an exponential decrease in the end-tidal CO_2, which is consistent with complete right ventricular outflow obstruction. The mainstays of treatment are immediate evacuation of the pneumoperitoneum and placement of the patient in the left lateral decubitus, head down (Durant) position. This allows the CO_2 bubble to "float" to the apex of the right ventricle, where it is less likely to cause right ventricular

outflow tract obstruction. It is important to administer 100% oxygen and hyperventilate the patient during this period. Additionally, aspiration of gas through a central venous line may be performed.

Capnothorax/Pneumothorax

Capnothorax can be caused by carbon dioxide escaping into the chest through a defect in the diaphragm or tracking through fascial planes during dissection of the esophageal hiatus. It also can be due to opening of pleuroperitonealducts most commonly seen on the right side. Pleural tears during fundoplication can lead to pneumothorax, and additionally, the usual causes of pneumothorax, such as ruptured bullae, may be the etiology. The effects of carbon dioxide gas in the chest usually are noted as decreased O_2 saturation (a result of shunting induced by lung collapse), increased airway pressure, decreased pulmonary compliance, and increases in carbon dioxide and end-tidal CO_2. The treatment is to desufflate the abdomen and stop carbon dioxide administration, correct the hypoxemia by adjusting the ventilator, apply positive end-expiratory pressure (PEEP), if possible, and decrease the intra-abdominal pressure as much as possible. The recommendation is to avoid thoracentesis because this usually resolves with anesthetic management. We generally evacuate the capnothorax directly at the end of the procedure with a red rubber catheter placed across the diaphragm (through the pleural defect) and brought out a trocar site. The external end of the catheter is placed under water as the lung is inflated and then removed from the water when the bubbles stop. We do not obtain chest radiographs in the recovery room after

these maneuvers if there is no evidence of hypoxia on 2 L/min of O_2 flow. Patients should be maintained on supplemental oxygen to help facilitate absorption of the carbon dioxide from the pleural space.

BASIC LAPAROSCOPIC PROCEDURES

Diagnostic laparoscopy

Indications for emergency laparoscopy.

• Right iliac fossa pain (possibility of gynecologic

Pathology to be ruled out)

• Right upper quadrant pain

• Peritonitis

• Mesenteric ischemia

• Acalculous cholecystitis

• Small bowel obstruction

• Fever of unknown origin

• Gastrointestinal hemorrhage of unexplained etiology

• Blunt abdominal trauma

• Penetrating trauma(peritoneal and diaphragmatic injury to be sought)

Diagnostic Laparoscopy for Abdominal Pain

Emergency diagnostic laparoscopy is different from that of

a therapeutic laparoscopy for a known diagnosis (e.g., appendicitis or cholecystitis). All solid organs and the entire bowel should be manipulated for a thorough exploration.

It should never be considered a failure to resort to open surgery for completeexploration or definitive therapy since the patient's outcome is important.

Principles

1. The laparoscope should be inserted at the umbilicus except in cases where the pathology lies underneath the umbilicus. In cases of abdominal distension,the open insertion of a Hasson cannula is safer.

2. A 30-degree laparoscope and a 0-degree laparoscope should be available at all times. The 30-degree scope is highly useful to "see around corners" and to reach for the bowel or viscera from different angles for maneuvering and for dissection

3. During surgery surgeon stands opposite the side of expected pathology

4. A second, or third, trocar are inserted to manipulate, palpate, and move viscera for a thorough exploration.

5. If a pathology is recognised which warrants a therapeutic intervention (e.g., appendectomy, patch of perforated ulcer), it can be performed by conversionto laparotomy, or a laparoscopic surgery

Diagnostic Laparoscopy

The laparoscope is an essential tool and is very useful in the diagnosis of benignand malignant conditions in the abdominal cavity. Diagnostic laparoscopy should always be utilizedin conjunction with conventional imaging techniques such as computedtomography (CT), percutaneous ultrasound, magnetic resonance imaging (MRI),positron emission tomography (PET) and other radiologic and nuclear medicine studies. In cases of unexplained ascites it is very useful.

Indications for ElectiveDiagnostic Laparoscopy

Patients with an underlying primary or metastatic malignancy within the abdomen. Common lesions such as carcinoma ofthe esophagus, stomach, pancreas, and colorectum are reasons to consider diagnostic

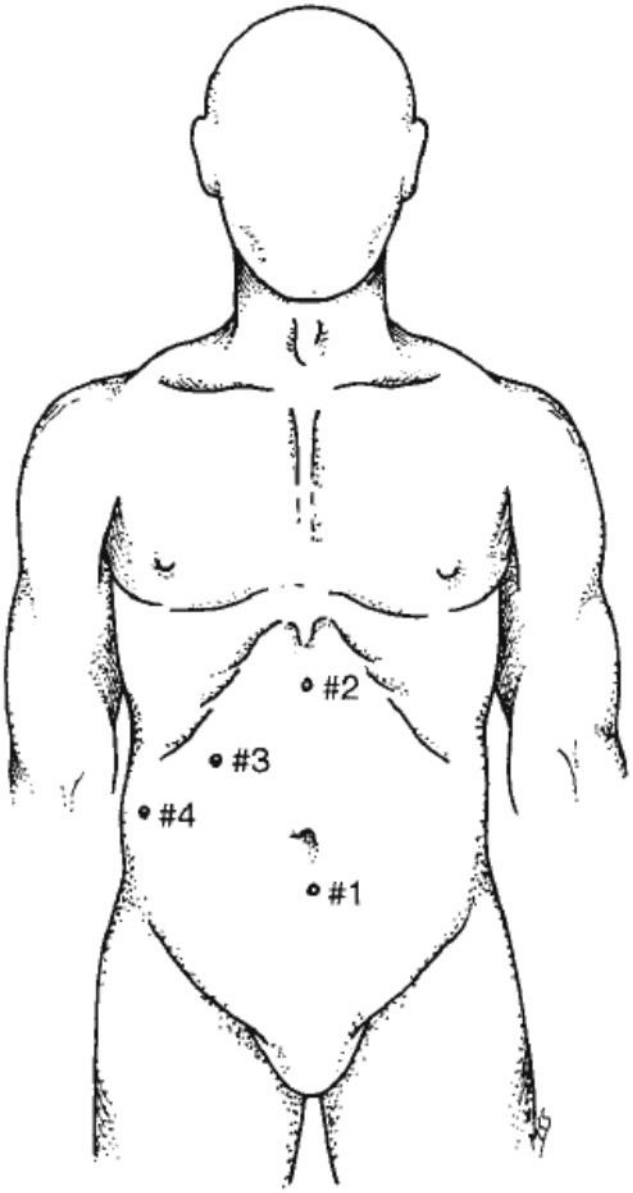
Laparoscopy for full preoperative assessment . The laparoscope is used for general inspection of the abdominalcavity and as a method of obtaining tissue from solid organs such as liver orlymph nodes . Imaging studies give only indirect evidence of underlyingdisease. So the laparoscope may be used getting biopsy,obtaining cytologic specimens along with peritoneal lavage, or fine-needleaspiration techniques. In some parts of the world, infectious diseases (such astuberculosis or

parasitic infestation) causing abdominal problems may be moreprevalent than cancer, and laparoscopic examination assists in the differentialdiagnosis of these entities. Diagnostic laparoscopy is beneficial for patientswith chronic abdominal pain who have had limited abdominal procedures in thepast. This is especially true in women who have undergone hysterectomy andpresent with chronic pelvic pain. These patients benefit from adhesiolysis

Laparoscopic Cholecystectomy

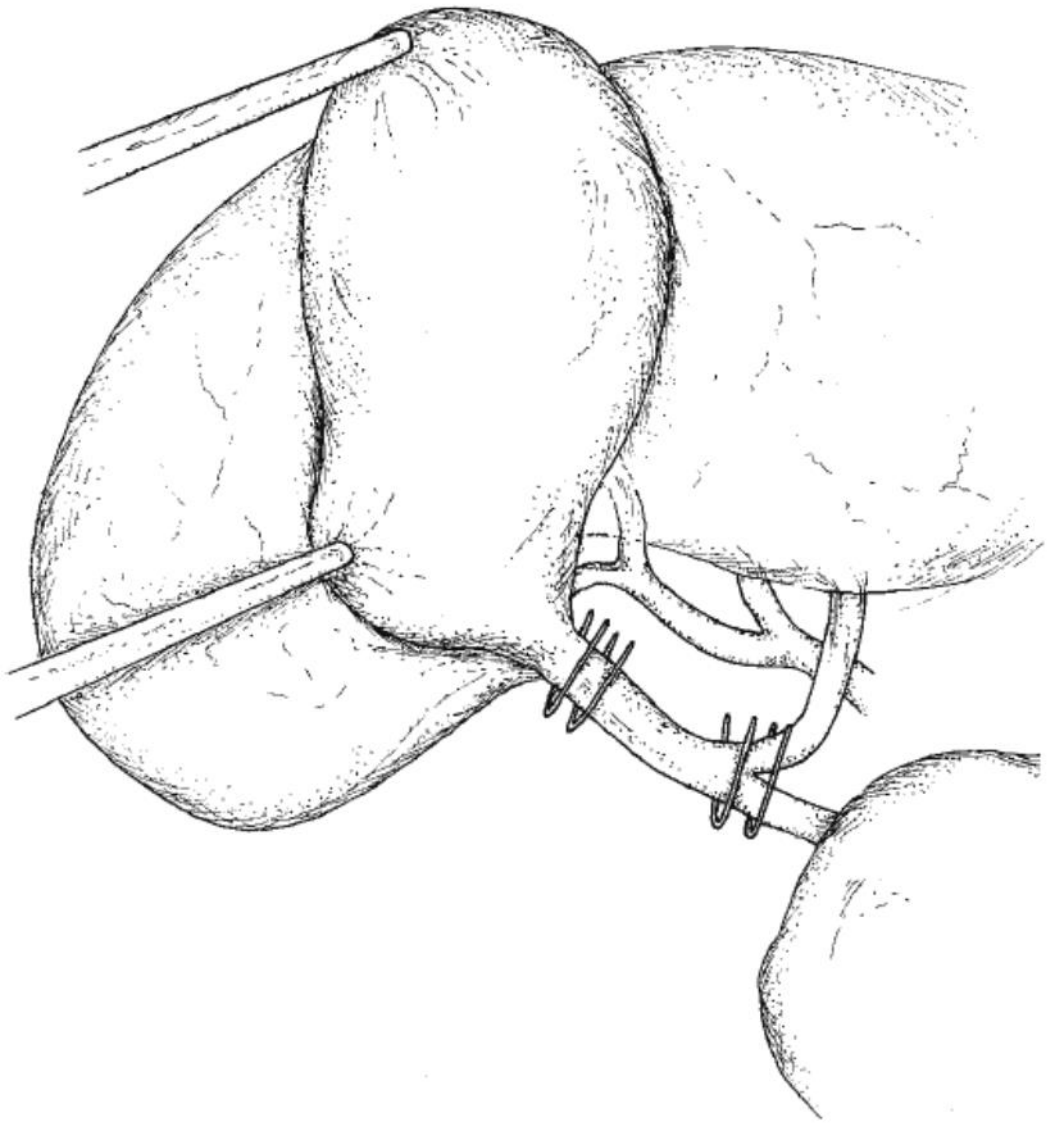
Following the advent of laparoscopic surgery, with its accompanying smaller incisions, less pain, and shorter hospitalization, surgeons have performed an increasing number of laparoscopic cholecystectomies. Most cholecystectomies are performed for biliary colic, but the operation can be performed safely in the setting of acute inflammation. Acute cholecystitis carries longer operative times and a higher conversion rate to the open procedure than when laparoscopic cholecystectomy is performed in the elective setting. General anesthesia with muscle relaxation is required when performing a laparoscopic cholecystectomy,. Therefore, one contraindication to the procedure is the inability to tolerate general anesthesia. Others include end-stage liver disease with portal hypertension, precluding safe portal dissection, and coagulopathy. Because most pneumoperitoneum laparoscopy is performed using CO2 and has a number of

adverse physiologic effects, severe chronic obstructive pulmonary disease, with poor ability for gas exchange, and congestive heart failure are considered relative contraindications. Patient preparation, induction of anesthesia, and sterile draping are performed as for an open cholecystectomy. Although use of a urinary catheter depends on the clinical setting, an orogastric tube is standard to decompress the stomach and help with exposure of the upper abdomen. Access to the peritoneal cavity and creation of pneumoperitoneum can be performed by the open or closed technique according to the expertise and discretion of the surgeon. The open technique involves making a small incision at the umbilicus, cutting down through the fascia of the abdominal wall, incising the peritoneum directly, and inserting a blunt trocar, known as a Hasson cannula. Alternatively, in the closed technique, an incision is made and a needle inserted into the peritoneal cavity to insufflate the abdomen prior to the placement of any trocars. Following the establishment of a CO2 pneumoperitoneum, a brief exploration is performed and additional 5-mm ports are placed in the right anterior axillary line, right midclavicular line, and subxiphoid location. The lateral port at the anterior axillary line is used to elevate the fundus of the gallbladder toward the right shoulder. This retraction provides exposure to the infundibulum and porta hepatis. The midclavicular trocar is used to grasp the gallbladder infundibulum, retracting it inferolaterally to open the triangle of Calot. By distracting Hartmann's pouch laterally, the cystic duct no longer lies almost parallel to the common hepatic duct.



The dissection is then carried along the infundibulum on the anterior and posterior surfaces to expose the base of the gallbladder. This dissection will eventually clear all fibrofatty tissue from the triangle of Calot. Inferolateral traction of the infundibulum then allows documentation of two structures entering the gallbladder, the cystic duct and cystic artery. A useful landmark for the cystic artery is the overlying lymph node, known as Calot's node. The view of the liver bed through

the space between cystic duct and cystic artery and above the cystic artery is known as the critical view of safety, and minimizes the risk of inadvertent iatrogenic bile duct injury . With sufficient dissection, clips are placed on the cystic artery and cystic duct.

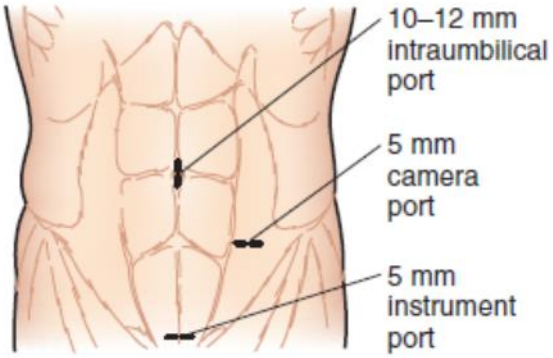


If a cholangiography is performed, the cystic duct is only clipped adjacent to the gallbladder and the cystic duct incised, although not transected. A cholangiographic

catheter is then fed through the incised duct and fluoroscopic images obtained with injection of contrast into the cystic duct and biliary tree. On obtaining a normal cholangiogram or when cholangiography is not performed, the cystic duct is doubly clipped on the common duct side and transected. The previously clipped artery is also transected and the gallbladder dissected off the liver bed using electrocautery. Because the venous drainage of the gallbladder is directly into the liver bed through venules, excellent hemostasis must be achieved during this dissection. The cystic duct and cystic artery clips are inspected just prior to completion of the dissection of the fundic attachments, because the superior traction of the fundus has provided exposure to the porta and triangle of Calot. The gallbladder is then brought out of the abdominal cavity through the umbilical port. In the setting of acute cholecystitis, or if during dissection the gallbladder was entered, a plastic bag should be used for retrieval. Any stones that are spilled during a cholecystectomy should also be retrieved Opinion is sharply divided regarding the performance of selective versus routine cholangiography, with supportive data for each approach. Routine cholangiography will identify unsuspected stones in less than 10% of patients and the natural history of these asymptomatic stones suggests that they will remain asymptomatic. Iatrogenic bile duct injury occurs less often when cholangiography is performed routinely. However, even when performed routinely, cholangiograms are frequently misinterpreted and thus do not adequately prevent an injury. In many cases of laparoscopic cholecystectomy performed for biliary colic, a cholangiogram will not alter management. Also, it increases the operative time and adds fluoroscopic exposure. Indications for cholangiography in the

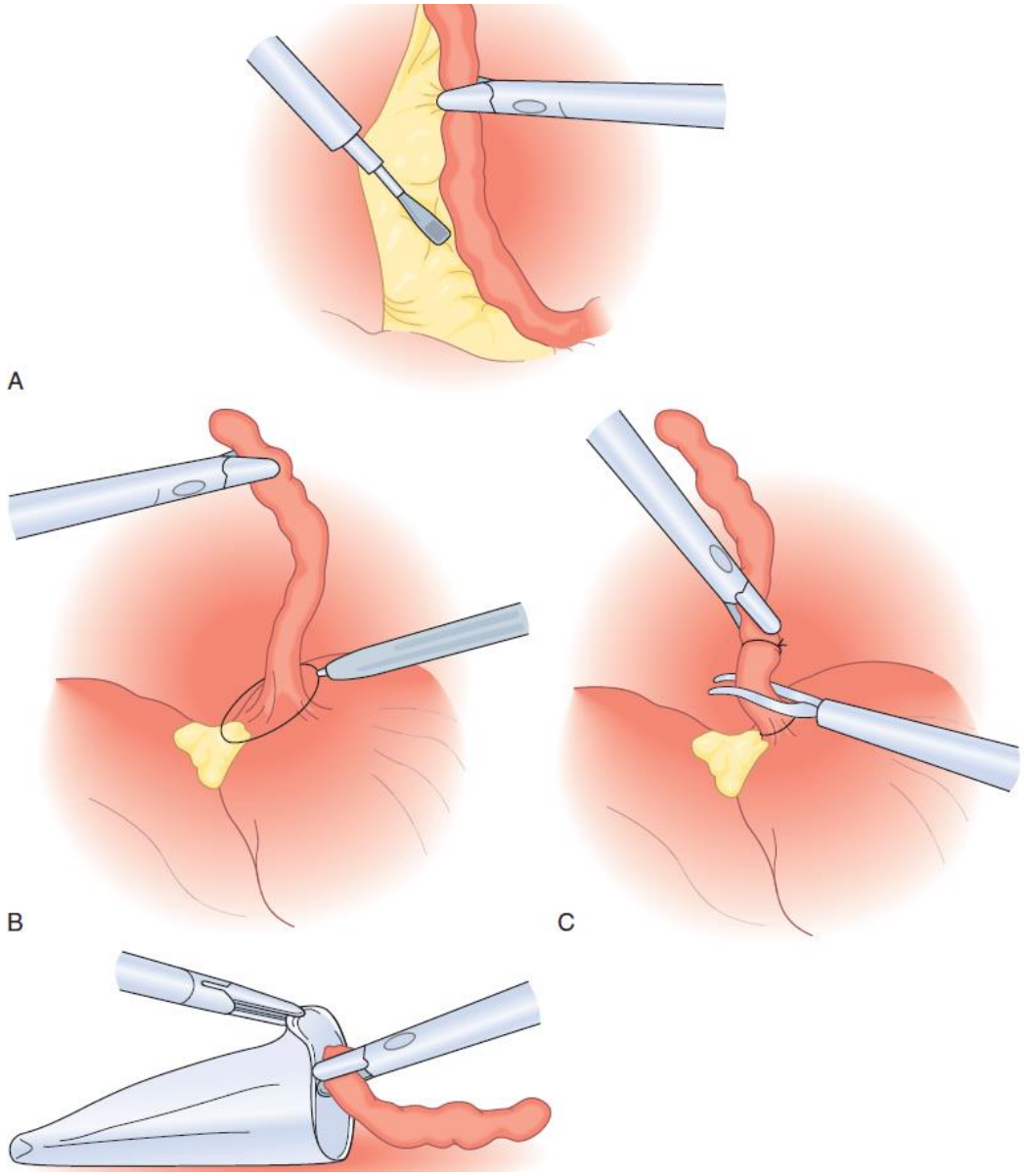
selective setting include unexplained pain at the time of cholecystectomy, any suspicion of current or previous choledocholithiasis without preoperative duct clearance, any question of anatomic delineation during cholecystectomy, elevated preoperative liver enzyme levels, dilated common bile duct in preoperative imaging, and suspicion of intraoperative biliary injury. Although just as accurate as cholangiography for the identification of choledocholithiasis, laparoscopic ultrasonography is highly operator- dependent, requires additional instrumentation, and is not widely available**.**

Laparoscopic Appendectomy



The first reported laparoscopic appendectomy was performed in 1983 by Semm; however, the laparoscopic approach did not come into widespread use until much later, following the success of laparoscopic cholecystectomy. This may be due to the small incision already commonly used with open appendectomy. Laparoscopic

appendectomy is performed under general anesthesia. An oro- or nasogastric tube and urinary catheter are placed. The patient should be placed supine with his or her left arm tucked and securely strapped to the operating table. Both surgeon and assistant should be standing on the patient's left facing the appendix. The laparoscopic screens should be positioned on the patient's right or at the foot of the bed. Standard laparoscopic appendectomy typically uses three ports. Typically, a 10- or 12-mm port is placed at the umbilicus, whereas two 5-mm ports are placed suprapubic and in the left lower quadrant. The patient should be placed in Trendelenburg and tilted to the left. The appendix should be identified similarly as in open surgery by tracking the taenialibera/coli to the appendiceal base. Through the suprapubic port, the appendix should be grasped securely and elevated to the 10 o'clock position. An "appendiceal critical view" should be obtained where the taenialibera is at the 3 o'clock position, the terminal ileum at the 6 o'clock positionand the retracted appendix at the 10 o'clock position to allow proper identification of the base of the appendix .Through the infraumbilical port, the mesentery should be gently dissected from the base of the appendix and a window created. Typically the base of the appendix is stapled, followed by stapling of the mesentery. Alternatively, the mesentery may be divided by an energy device or clipped and the base of the appendix secured with an Endoloop. The stump should be carefully examined to ensure hemostasis, complete transection, and ensure that no stump is left behind. The appendix is removed through the infraumbilical trocar in a retrieval bag.



Complications

1. **Bleeding**

While dissecting the meso appendix torrential bleeding may occur which can also be from omental vessels or retroperitoneum in a highly inflamed appendix.

2. **Leakage of appendiceal pus or fecalith**

This occurs when the appendix is tense and distended without perforation. So proper extraction through a specimen bag is more than sufficient.

3. **Incomplete appendectomy**

A very rare complication ,occurs when the appendix is tied too far from the caecum. In all cases it is essential that the base of appendix to be identified before carrying out appendicectomy. The diagnosis of appendicitis should always be borne in mind in cases, even though a laparoscopic or a open appendicectomy is carried out in such patients.

LAPAROSCOPIC HERNIA REPAIR

Transabdominal Preperitoneal Repair

This operation is performed under general anesthesia. The patient is positioned supine with arms tucked at the side to allow enough room for the surgeon to maneuver comfortably. Because a prosthesis is being used, many surgeons administer prophylactic antibiotics and/or use an iodophor-impregnated drape to reduce the risk of mesh contamination by the skin flora, though conclusive evidence of its efficacy is lacking. The scrotum is not prepared into the field unless manipulation is anticipated. A urinary catheter is not necessary if the patient voids immediately before entering the operating theater. Preoperative voiding is favored since there is a higher incidence of urinary tract infection with bladder catheterization.

A single video monitor is placed at the foot of the operating table, and the surgeon stands on the opposite side of the table from the hernia.

A three cannula technique is most commonly used: one 10-mm umbilical/infra-umbilical and two 5-mm placed on each side at the edge of the rectus sheath at the level of the umbilicus .A Hasson cannula is placed infraumbilically by means of the open method. The 5-mm trocar sleeves are then inserted under direct visualization. The patient is placed in the Trendelenburg position to allow the bowel to fall away from the pelvis, creating more room and providing better and safer access to the inguinal floor. An angled laparoscope greatly enhances visualization.

Once a diagnostic laparoscopy is completed, peritoneal anatomical landmarks are identified and both myopectineal orifices are inspected for additional hernias. The medial umbilical ligament can be divided if necessary but this can lead to bleeding if the umbilical vessels are patent. Fortunately, sufficient exposure can usually be obtained by dividing only the lateral side of the ligament.

The incision is continued laterally toward the anterior superior iliac spine, opening the peritoneum approximately 2 to 3 cm above the superior edge of the hernia defect. After the peritoneum has been incised, a dissection of relatively avascular preperitoneal space between the peritoneum and the transversalis fascia is commenced using posterior retraction and inferior blunt dissection. A thorough dissection with

removal of preperitoneal fat allows proper identification of anatomical structures and creates space for mesh placement Inadequate mobilization of the inferior peritoneal flap can result in mesh roll up when the peritoneum is closed, and has been linked to an increased chance of recurrence. The use of an endoscopic Kittner dissector with a two-handed blunt technique works well for mobilization of the inferior peritoneal flap and lessens the likelihood of peritoneal rents produced by sharp dissection. Although extensive use of electrocautery is not needed because of the avascular nature of the proper plane, it is important to have good hemostasis since proper laparoscopic illumination is hindered by blood.

After the inferior peritoneal flap has been created, the inferior epigastric vessels, the symphysis pubis and the lower portion of the rectus abdominis muscle are identified. Medial dissection is carried out to the contralateral pubic tubercle for sufficient overlap of the myopectineal orifice. Cooper's ligament is then dissected, which serves as the inferomedial fixation point for the mesh.

When dissecting inferior to the iliopubic tract, care should be taken to prevent injury to the femoral branch of the genitofemoral nerve and the lateral femoral cutaneous nerve, which lie lateral to the spermatic vessels and usually enter the lower extremity just below the iliopubic tract. As described previously, electrocautery is not recommended in this area. Additionally, the area between the vas deferens and the spermatic vessels should be avoided since the iliac vessels and femoral nerve can be

injured by staples or tacks used in this region. The dissection is completed by skeletonizing the cord structures with the least possible trauma to the vas deferens and the spermatic vessels.

For direct inguinal hernias that are located between the epigastric vessels and the pubic tubercle, the dissection is begun laterally, exposing the cord structures and the internal ring. The direct space is then dissected, reducing the sac and preperitoneal fat in the hernia orifice by gentle traction. This separates the peritoneal sac from the weakened transversalis fascia. The out-pouching of this fascia is called the pseudosac, which is allowed to retract back into the defect. It is thought that tacking or stapling a large pseudosac to Cooper's ligament may help to decrease the incidence of postoperative seroma.

A small indirect sac is easily mobilized from the cord structures and reduced back into the peritoneal cavity. However, if the indirect sac is large or extends into the scrotum, it should be divided as it may be difficult to mobilize without undue trauma to the cord structures. The division should start on the opposite side of the cord structures just distal to the internal ring. The proximal sac is then dissected away from the cord structures and closed with a pretied suture. The distal sac should be opened longitudinally on the side away from the cord, as far down the cord as is convenient. Downward traction of the cord allows the surgeon to remove the excess fatty tissue attached to the cord. Fatty tissue attached to the cord or round ligament is often referred to as a lipoma. A missed lipoma of the cord might be mistaken as a recurrence postoperatively ("pseudorecurrence") on clinical examination. In the

absence of a definite peritoneal hernia sac, cord lipomas should be treated as a hernia since they have been associated with symptoms similar to inguinal hernias.

A large flat piece of mesh (at least 15 x 10 cm) is introduced into the abdominal cavity through the 10-mm umbilical port. Special designed preformed mesh are preferred by some. The mesh is placed over the myopectineal orifice so that it completely covers the direct, indirect, and femoral spaces with a wide overlap, spanning the space between the opposite pubic tubercle medially to anterior superior iliac spine laterally. The mesh can either be laid over the cord structures or a slit can be made to accommodate the cord. The advantage of slitting the mesh is that there is less likelihood of migration or mesh roll-up related to the anchoring effect of placing it around the cord. The disadvantage is that the size of the prosthesis is smaller and there have been reports of recurrences through such slits, presumably because the tails of the slit were not adequately approximated around the cord.

The next decision deals with fixation of the prosthesis. The large prosthesis used for LIH allows the intra-abdominal pressure to act uniformly over a large area, keeping it securely in place. For this reason, some surgeons avoid using fixation all together. This has the added advantage of preventing damage to nervous and vascular structures by staples and tacks. Most surgeons, however, have enough concern about mesh migration, roll-up, and shrinkage to use an anchoring system. Disposable instruments that apply staples, helical tacks, anchors, and other mechanical fastening agents are commercially available and were discussed above. The choice is left to the surgeon. Staples along the superior border should be placed horizontally in the same direction

as the ilioinguinal or iliohypogastric nerves to minimize the chance of injury to these deeper structures. Since the lateral cutaneous nerve of the thigh and the femoral branch of the genitofemoral nerve run vertically, staples on the lateral side of the prosthesis should be placed vertically. Staples along the inferolateral border of the mesh can lead to injury of these nerves and therefore should not be used here. The mesh is secured medially to the tissue adjacent to the opposite pubic tubercle, continuing fixation to the area of the ipsilateral tubercle and then Cooper's ligament. Staples and tacks should not be placed directly in the periosteum of the tubercle or Cooper's ligament as this could lead to chronic postoperative pain. Palpating the head of the anchoring device through the abdominal wall with the nondominant hand before deploying the fixator is a useful maneuver. The redundant inferior border of the mesh should be trimmed to avoid roll-up when the peritoneum is closed. Biological adhesives such as fibrin glue can also be used to fix the mesh and avoid possible damage to underlying structures. Currently, studies in humans using such adhesives are being conducted in Europe for open hernia repairs. These biodegradable adhesives have been used in laparoscopic hernia studies involving pigs with good results.

The final step in the hernia repair is to cover the prosthesis to separate it from intra-abdominal viscera. The peritoneal flap is closed over the mesh using staples, tacks or absorbable running sutures. Decreasing the pneumoperitoneum may aid the closure. The goal should be to cover the prosthesis, isolating it from the bowel to prevent adhesions. Forceful linear re-approximation of the peritoneum should generally be avoided because undue tension can result in gaps in the peritoneal closure through

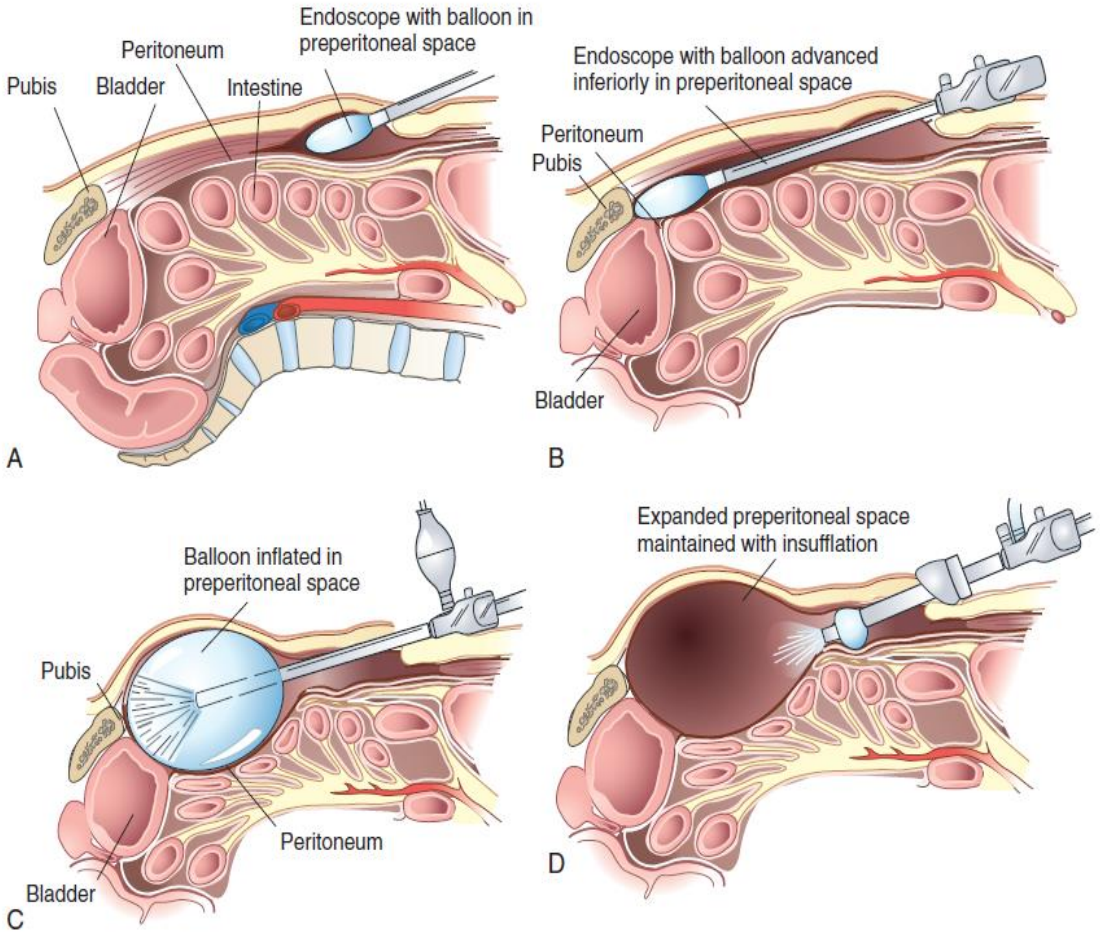
which bowel can find its way causing an obstruction. Similarly, excessive tension can also result in a tenting effect leading to roll-up of the inferior edge of the prosthesis and a hernia recurrence. We do not hesitate to leave some transversalis fascia exposed as long as the mesh is covered. Another option, in cases where there is not enough peritoneal flap available, is to mobilize the omentum and secure it with staples or tacks to cover the exposed mesh. Before completing the closure, 30 mL of diluted bupivacaine anesthetic solution is placed in the preperitoneal space. It has been shown to reduce postoperative pain. A technique for needle injection of local anesthetic in the preperitoneal space prior to the start of the dissection rather than at the end is felt by proponents to facilitate flap mobilization by separating the peritoneum from transversalis fascia.

For bilateral hernias, the preperitoneal space over the symphysis pubis (retroperitoneal space of Retzius) is dissected so that a large common space is created between both sides. This is usually done through two separate peritoneal incisions, preserving the space between the medial umbilical ligaments. Two separate incisions as opposed to one long incision prevent inadvertent division of a patent urachus or damage to the bladder. A large prosthesis (approximately 30 x 12 cm can be secured from one anterior superior iliac spine to the other to reinforce the myopectineal orifices, in a manner not dissimilar to the Great Replacement of the Visceral Sac popularized by Stoppa in France and Wantz in the United States. Alternatively, two smaller pieces can be used which makes prosthesis manipulation simpler.

Recurrent hernias are approached according to the methods of the previous repair(s). If the failed operation(s) was preperitoneal, then a conventional anterior operation is recommended. Vice versa, LIH should be chosen when the preperitoneal space has not been dissected and the earlier repair(s) was performed conventionally in the inguinal canal. The previously dissected field is thus avoided. Using the laparoscope for the repair of recurrent inguinal hernias allows complete visualization of the myopectineal orifice for the accurate identification of the nature of the recurrence, whether a result of a missed hernia (femoral or pantaloon) or inadequate mesh coverage. A large prosthesis can then be tailored to adequately cover the defect. Occasionally, the surgeon is faced with a patient who has already had both spaces dissected. If laparoscopic repair is planned, the patient should be referred to a specialized center because re-exploration of the preperitoneal space should be left to experienced surgeons. It is difficult to identify the structures in the preperitoneal space in these cases and injury to the bladder and other preperitoneal structures is common. The previously inserted mesh does not need to be removed unless it is infected. If the peritoneum covering the mesh is scarred to the point that it becomes fragmented during the dissection, a nonadherent material such as ePTFE, dual mesh, or a biological substitute should be considered for the prosthesis .

Totally Extraperitoneal Repair

The rationale for the TEP procedure is to eliminate the possibility of complications such as visceral damage, adhesive intestinal obstruction, and ventral herniation by not entering the peritoneal cavity. The operating room set-up and positioning for TEP are no different than for TAPP.



A similar skin incision as for the Hasson cannula (10 mm) at the umbilicus is made but this is then extended through the anterior rectus sheath on the ipsilateral side lateral to the midline. The muscle is retracted laterally to expose the posterior rectus sheath. Blunt dissection with a finger or a rigid laparoscope aimed toward the pubic symphysis creates a space anterior to the posterior rectus sheath. The dissection can also be accomplished under direct vision by pushing a transparent balloon-tipped cannula into the space, directed toward the side of the hernia. A laparoscope is then placed in the cannula and the balloon is inflated to create extraperitoneal space for two more ports. Side-to-side movement and inflating/deflating the balloon several times facilitates the creation of this space. The pressure resulting from balloon inflation aids in hemostasis. A disadvantage of the balloon technique is a higher incidence of dissection anterior to the inferior epispastic vessels causing them to be reduced with the peritoneal flap. This can complicate exposure.

After adequate extraperitoneal room is created, a laparoscopic Hasson cannula is placed and pneumoretroperitoneum is achieved. Two additional cannulae (5 mm) are placed in the midline under direct vision: the first cannula is several centimeters above the pubic symphysis and the second is midway between the first and the umbilical cannula . An alternative is to place the cannulae on either side of the umbilicus. With either method, it is best to place them by blunt dissection with a hemostat under direct

vision rather than depending exclusively on the trocar to prevent inadvertent penetration through the narrow preperitoneal space into the abdominal cavity. Once the accessory cannulae are in place, the dissection of the preperitoneal space is completed. Although the orientation is somewhat different in TEP, the remainder of the operation is carried out in a similar fashion to TAPP. Inadvertent rents in the peritoneum should be closed to facilitate maintenance of the pneumoretroperitoneum and to avoid contact of mesh with abdominal organs. Similarly, when the hernia sac is divided, the proximal portion of the sac should be closed. Carbon dioxide can escape into the peritoneal cavity during the procedure creating a competing pneumoperitoneum. If exposure is compromised, a 5-mm cannula or a Veress needle can be placed into the peritoneal cavity to reduce the pressure. We prefer the former because of our practice of routinely performing a diagnostic laparoscopy at the end to assess for unsuspected peritoneal defects.

TAPP versus TEP

There are two major criticisms of the TAPP procedure. The first is the need to enter the peritoneal cavity, resulting in the possibility of a laparoscopic accident such as injury to an intra-abdominal organ, intestinal obstruction secondary to adhesive complications, or ventral herniation. The second is the need to close the peritoneum over the prosthesis, which is time consuming and has been associated with bowel obstruction caused by herniation through gaps in the closure. The TEP operation was developed to address these concerns. The procedure is more demanding than the TAPP because of the limited working space. Most authorities believe that the

laparoscopic surgeon should be comfortable with the TAPP herniorrhaphy before progressing to the TEP. Inadvertent breaches of the peritoneum are common, especially in patients with thin peritoneum or those that have scar tissue associated with previous lower abdominal surgery. The peritoneal lacerations can be difficult to recognize because they are not in the visual field of the limited working space. The consequences of these unrecognized peritoneal holes are as yet unclear. Intestinal obstruction secondary to bowel finding its way into the preperitoneal space and a death from delayed recognition of an intestinal injury have been reported.

Intraperitoneal Onlay Mesh Repair

This procedure was developed to avoid the complex preperitoneal dissection used in TAPP and TEP. The theory is that the same repair should be accomplished if the prosthesis is fastened directly to the peritoneum (one thin layer beneath the preperitoneal space) using the exact same landmarks as for the preperitoneal repairs. The initial laparoscopy and port placement are the same as in the TAPP repair. A large piece of prosthetic material is introduced into the peritoneal cavity and secured using tacks, staples, or sutures. Incising the peritoneum over Cooper's ligament to aid in fixation to that structure is preferred by some surgeons. Several reports have shown reasonably good results, while others have suggested a higher incidence of postoperative pain and higher recurrence rates. Because of the risk of complications associated with direct contact of the mesh with intra-abdominal viscera, the IPOM should still be considered a procedure of last resort and best reserved for patients who have contraindication to a preperitoneal dissection, e.g., previous preperitoneal repair,

radiation to pelvis, and retropubic surgery. The development of a mesh covered by material completely effective in eliminating the risk of intestinal adhesions or fistula formation while maintaining the properties that result in a strong synthetic mesh repair could make this operation a much more attractive option. There is minimal experience reported to date with expanded polytetrafluoroethylene (ePTFE) or the newer biological prosthesis. Further developments in synthetic nonadhesive prosthetic material or bioprosthetics may increase the applicability of this technique.

Postoperative Care

Postoperative follow-up and care for laparoscopic inguinal herniorrhaphy is similar to the open method. Patients are discharged to home the day of surgery if there is no urinary retention, nausea or vomiting, and pain is well controlled. They are encouraged not to lift over 15 pounds for one week as part of their pain management recommendations. After this, they are allowed to return to work and normal activity as dictated by pain tolerance. No specific restrictions are made thereafter. Patients return for follow-up at 1 week, 6 weeks, and then as needed.

Laparoscopic Repair of Ventral Hernia

A fascial defect through the anterior abdominal wall with protrusion of an intra-abdominal organ(s) is referred to as a ventral hernia. They are most commonly secondary to fascial defects at sites of previous surgical incision (incisional hernia). Primary ventral hernias are also possible, not infrequently developing at sites of

potential weakness in the abdominal wall namely the umbilicus, epigastrium (linea alba) or linea semi-lunaris (Spigelian).

Incisional Hernia

Etiology

Between 2% and 11% of patients undergoing laparotomy develop incisional hernias with a dramatic increase if the postoperative course was complicated by wound infection. Smoking, uncontrolled diabetes, malnutrition, use of steroids, obesity, old age and antimetabolite agents among others have been implicated in an increased incidence of incisional hernias. Disease states which increase intra-abdominal pressures such as cirrhosis with ascites, obstructive uropathy, constipation, and chronic cough also predispose to incisional hernia occurrence. Additionally, incision site and the method of closure of the original wound are clearly important. Finally, basic defects in collagen metabolism are just now being defined and will probably greatly increase our knowledge of incisional hernia causation. Klinge and associates have shown that there is a decreasing collagen type I to III ratio in scar tissue with increasing number of recurrences.

Clinical Presentation and Diagnosis

Ventral hernias usually present with a reducible abdominal bulge and cough impulse with or without pain. Occasionally the first presentation may be severe pain caused by incarceration. This is especially true for primary ventral hernias. The diagnosis is not always obvious, especially in obese individuals. When the diagnosis is not clear,

ultrasonography, computerized axial tomography (CAT) or MRI may be helpful. The diagnostic test of choice depends upon local expertise.

Indications for Repair

There is no consensus of opinion on the role of routine ventral herniorrhaphy for the nonincarcerated, asymptomatic incisional hernia. Some surgeons feel that routine repair should be recommended for otherwise fit patients to prevent the serious complication of strangulation. Others think that the incidence is low enough that it is safe to observe a completely asymptomatic hernia. Specific risk factors that predispose to strangulation are yet to be identified.

Laparoscopic Repair

Primary surgical repair of incisional hernias have dismal outcomes as they are commonly associated with a recurrence rate of 50% or even greater. Flament and Stoppa in France, and Wantz in the Unites States described the use of a large prosthetic mesh, which is placed between the rectus muscle and posterior rectus sheath. The prosthesis is secured to the full musculofascial thickness of the abdominal wall on either side of a hernia defect using a suture passer. This approach has a very low recurrence rate (3%), however, it is achieved at the expense of significantly higher morbidity because of the extensive abdominal wall dissection required to create the space for the prosthesis. The result is increased pain and significant seroma (20%) and wound infection rates. The basic principal of the repair is to use a large prosthetic mesh with 3 to 4 cm fascial overlap circumferentially.

Laparoscopic ventral hernia repair was described by Leblanc in 1993. Just as the IPOM procedure was designed to avoid the extensive dissection of the preperitoneal space required for the TAPP and the TEP inguinal herniorrhaphies, the laparoscopic ventral hernia repair mimics the conventional retrorectus ventral herniorrhaphy but avoids the extensive dissection required to place the prosthesis in the abdominal wall. A large prosthesis, widely overlapping the fascial defect, is placed directly onto the peritoneum after reduction of the hernia. A suture passer is used to secure the prosthesis to the abdominal wall.

Contraindications

Laparoscopic repair can be applied to nearly all ventral hernias. However, there are a few situations where one should be cautious before proceeding with laparoscopy. These include an extensive abdominal operative history making a "frozen abdomen" possible, previous peritoneal dialysis, cirrhosis, and significant cardiopulmonary comorbidities that can lead to hemodynamic and/or respiratory compromise secondary to pneumoperitoneum. Another relative contraindication is a large ventral hernia with "loss of domain" of the abdomen, in which the viscera protrude outside the confines of the abdominal cavity to the extent that replacement followed by hernia repair might cause respiratory embarrassment and/or an abdominal compartment syndrome.

Special attention should be given to the condition of the skin, especially for large incarcerated umbilical hernias and incisional hernias in obese people. Macerated skin and even chronic ulcers are not infrequent and should be addressed prior to implanting

prosthetic material for hernia repair. Caution must be used when considering the use of prosthetic material in the pediatric age group because of concerns about the relationship of the implant to surrounding tissue as the patient grows. It is considered contraindicated by many.

The repair is completed with a fastening device applied every centimeter to fix the edges to the abdominal wall, preventing roll-up .This is very important as it stops viscera from slipping between the mesh and the abdominal wall. It helps to manually deform the abdominal wall with the non-dominant hand during fixation so that the fastening device can be applied perpendicular to the abdominal wall

The procedure is completed by removing all laparoscopic cannulae and closing the fascia of any cannula site greater than 5 mm. The skin is closed with absorbable subcuticular stitches.

Umbilical Hernias

Umbilical hernias in adults are acquired. Laparoscopic repair should be considered in patients with large defects, who are obese, or have a recurrent hernia. The laparoscopic technique is similar to that described for incisional and epigastric hernias.

Postoperative Care

Patients are transferred to a surgical ward and started on a clear liquid diet. Oral pain medication is usually sufficient for smaller hernias but parenteral analgesia will be required for most. Depending on extent of the adhesiolysis, a paralytic ileus might develop but it quickly resolves. Early ambulation and discharge from the hospital is the norm. No postoperative antibiotics are needed and patients are seen in follow-up in 10 to 14 days.

In all of these commonly performed laparoscopic procedures the port sites are closed with subcuticular sutures or skin staples extensively . A lot of studies suggest the enhanced advantageous options cyanoacrylate offers for port closure. In study conducted byWatanapa and Tangjaroen the incidence of port site hernias were studied. Some studies used steristrips for port closure .

OBSERVATION AND RESULTS

- The study was conducted in the department of General surgery , Stanley medical college and hospital for the past 9 months. Patients who fulfilled the inclusion criteria were included in the study after getting informed consent.
- Total number of patients included in the study – 50
- The number of patients where octyl cyanoacrylate was used for 5mm port closure – 25.
- In the control group 2- 0 vicryl was used for conventional suturing
- The skin adhesive was applied after approximating the wound edges. Care should be taken not to apply the adhesive in between the wound edges. No dressing is done for these port sites and is left open.
- A total of 50 port sites were closed with skin adhesives and another 50 port sites were closed with 2- 0 vicryl
- The time taken for applying the skin adhesive is recorded. The port site was examined post operatively for 2 wks to look for any signs of inflammation ,wound dehiscence,wound discharge. etc; The same details collected for the control group and the results tabulated.

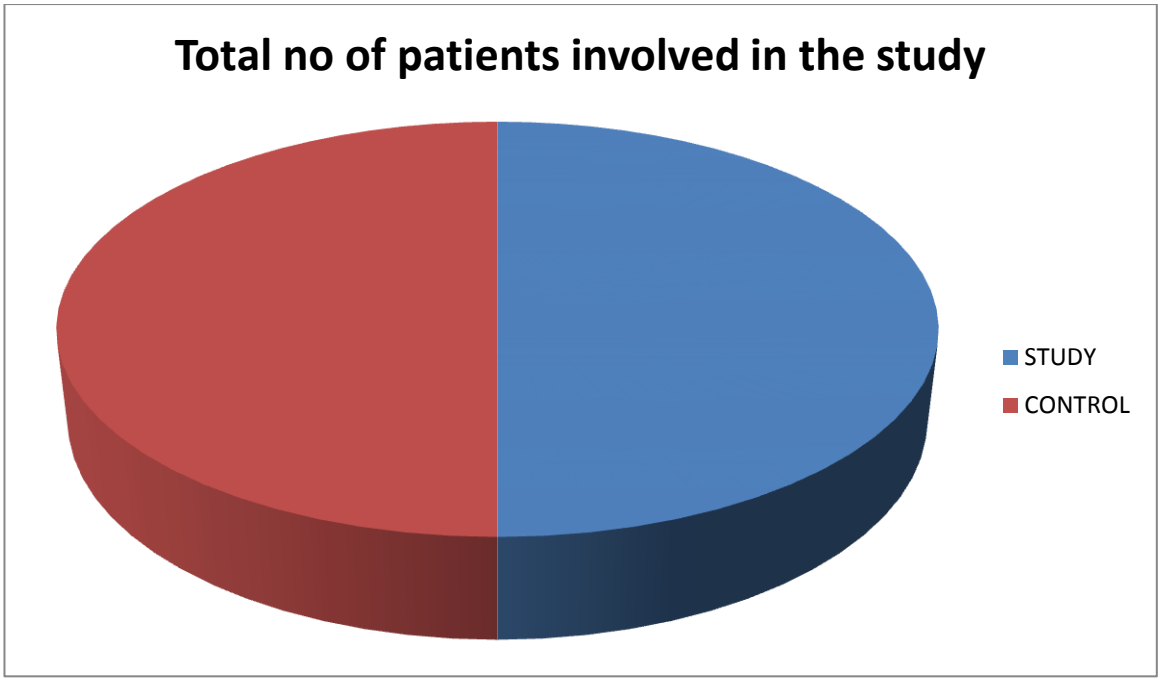


Table 1 Average time taken for port closure

	STUDY GROUP(octyl cyanoacrylate)	CONTROL GROUP(conventional suturing)
Time taken in seconds	5	15

Table 2 Total no of surgeries

Surgery	No of cases
Laparoscopic appendicectomy	14
Laparoscopic cholecystectomy	12
Laparoscopic hernioplasty(TAPP)	8
Laparoscopic hernioplasty(TEP)	1
Diagnostic laparoscopy	10
Laparoscopic ovarian cystectomy	5

Table 3 Total wound length

	STUDY GROUP	CONTROL GROUP
LENGTH in cms	25	25

Table 4 Complications(blisters, wound dehiscence, wound infection)

STUDY GROUP	CONTROL GROUP
1	6

STATISTICAL ANALYSIS

Inputs

Time taken for closure versus wound status day 14

	Wound status day 14		
	Healthy (%)	Unhealthy N (%)	TOTAL
< 5 Sec	21(46.7%)	0(0%)	21
>5 sec	24(53.3%)	5(100%)	29
TOTAL	45	5	50

PEARSON CHI SQUARE(4.023) df (1)

P value (0.045)

Time taken versus day 5

	Healthy	**Unhealthy**	**Total**
< 5sec	**21(47.7%)**	**0(0%)**	**21**
>5 sec	**23(52.3%)**	**6(100%)**	**29**
	44	**6**	**50**

Pearson chi square (4.937) ;df (1)

P value (0.026)

Port closure versus wound status day 14

	Healthy	Unhealthy	Total
Octyl cyanoacrylate	25(55.6%)	0	25
Conventional suturing	20(44.4%)	5(100%)	25
	45	5	50

Chi square (5.556) ;df (1) P VALUE (0.018)

T test

Time taken for port closure versus wound status day 5

	Wound status	Mean +/- SD	PVALUE
Time taken	HEALTHY	Mean 9.41 sec +/ - 5.078 sec	0.040
	Unhealthy	Mean 13.67+/-3.777	

T (2.473) ;df (7.713)

P value (0.040)

Time taken for wound closure versus wound status day 14

	Wound status	Mean +/- SD	P value
Time taken	Healthy	9.36+/- 5.068	0.001
	Unhealthy	15.00+/-0.707	

t (48.337) ; df(48) ;

P Value (0.001)

SUMMARY

- Total no. of patients enrolled in the study period – 50
- No. of patients where skin adhesive was used- 25
- No of patients where conventional suturing method was used – 25
- The skin adhesive which was used did not produce any wound infection , ugly scars or wound dehiscence . They were cosmetically better. The operating time was also significantly reduced when compared with the control group.
- Analysing the above results with chi square, the association between the above mentioned variables is proved with the calculated P value and the test is statistically significant.
- By t test the mean of healthy wounds at day 5 is 9.41 +/- 5.078 .

  The mean of unhealthy wound status at day 5 is 13.67+/- 3.777.

  The mean of healthy wound status on day 14 is 9.36+/- 5.068.

  The mean of unhealthy wound status on day 14 is 15.00 +/- 0.707. The time taken for port closure is taken into account while calculating the means. In other words the ports closed within an average time of 5 seconds were always healthy signifying that the ports closed with octyl cyanoacrylate showed lesser chances of infection and the operating time was reduced significantly.

CONCLUSION

- The use of cyanoacrylate for skin closure in laparoscopicskin incisions is effective, cosmetically better and economical.It is much quicker to close these port sites with octylcyanoacrylate than by sutures.
- The technique for closure is easy to learn and not technically demanding. This leads to shorter overall operating times, lower cost, and greater efficiency in wound closure. Even if the adhesive used gets in between the wound edges it gets extruded just like any foreign body. Nevertheless , the skin adhesive is always used after approximating the wound edges.
- Low wound complication arose possibly due to bacteriostatic properties of tissue adhesives. Both n-2-butylcyanoacrylate and 2-octylcyanoacrylate demonstrate antimicrobial effects against gram-positive organisms

BIBLIOGRAPHY

1. Coover HN, Joyner FB, Sheerer NH, Wicker TH. Chemistry and performance of cyanoacrylate adhesive. *Special Technical Papers*. 1959;5:413-417.

2. Quinn JV, Drzewiecki AE, Li MM, et al. A randomized, controlled trial comparing a tissue adhesive with suturing in repair of pediatric facial lacerations. *Ann Emerg Med*. 1993;22:1130-1135.

3. Osmond MH, Klassen TP, Quinn JV. Economic evaluation comparing a tissue adhesive with suturing in the repair of pediatric facial lacerations. *J Pediatr*. 1995;126:892-895.

4. Ronis ML, Harwick JD, Fung R, Dellavecchia M. Review of cyanoacrylate glues with emphasis on their otorhinolaryngologic applications. *Laryngoscope*. 1984;94:210-213.

5. Tse DT, Panje WR, Anderson RL. Cyanoacrylate adhesive used to stop CSF leaks during orbital surgery. *Arch Ophthalmol*. 1984;102:1337-1339.

6. Kohli N, Jacobs PA, Sze EHM, et al. Open compared with laparoscopic approach to Burch colposuspension: a cost analysis. *Obst Gynecol*. 1997;90:411-415.

7. Galil KA, Schofield ID, Wright GZ. Effect of n-2-butyl cyanoacrylate (histoacryl blue) on the healing of skin wounds. *J Can Dent Assoc*. 1984;50;565-569.

8. Ellis DAF, Shaikh A. The ideal tissue adhesive in facial plastic

and reconstructive surgery. *J Otolarygol*. 1990;19:68-72.

9. Keng TM, Bucknall TE. A clinical trial of histoacryl in skin closure of groin wounds. *Med J Malaysia*. 1989;44:122-128.

10. Mizrahi S, Bickel A, Ben-Layish E. Use of tissue adhesives in the repair of lacerations in children. *J Pediatr Surg*. 1988;23:312-313.

11. Applebaum JS, Zalut T, Applebaum D. The use of tissue adhesion for traumatic laceration repair in the emergency department. *Ann Emerg Med*. 1993;22:1190-1192.

12. Kamer FM, Joseph JH. Histoacryl: its use in aesthetic facial plastic surgery. *Arch Otolaryngol Head Neck Surg*. 1989;115:193-197.

13. Halopuro S, Rintala A, Salo H, Ritsila V. Tissue adhesive versus sutures in closure of incision wounds. *Ann ChirGynaecol*. 1976;65:308-312.

14. Morton RJ, Gibson MF, Sloan JP. The use of histoacryl tissue adhesive for the primary closure of scalp wounds. *Arch Emerg Med*. 1988;5:110-112.

15. Kung H. Evaluation of the Undesirable Side Effects of the Surgical Use of Histoacryl Glue With Special Regard to Possible Carcinogenicity. Basel, Switzerland: RCC Institute for Contract Research in Toxicology and Ecology; March 1986. Project 064315.

16. Quinn J, Wells G, Sutcliffe T, et al. A randomized trial comparing octylcyanoacrylate tissue adhesive and sutures in the management of lacerations. *Ann Emerg Med*. 1993;22:1130-1135.

17. Toriumi DM, O'Grady K, Desai D, Bagal A. Use of octyl-2-cyanaoacrylate for skin closure in facial plastic surgery. *Plastic Recon Surg*. 1998;102:2209-2219.

18. Quinn JV, Osmond MH, Yurack JA, Moir PJ. N-2-butylcyanoacrylate: risk of bacterial contamination and its antimicrobial effects. *J Emerg Med*. 1995;13:581-585.

19. Noordzij JP, Foresman PA, Rodeheaver GT, Quinn JV, Edlich RF. Tissue adhesive wound repair revisited. *J Emerg Med*. 1994;12:645-649.

ANNEXURES

MASTER CHART

NAME	AGE	SEX	IP NO	DIAGNOSIS	PROCEDURE	PORT CLOSURE	DOS	POD 5	POD 14	time taken for port closure(sec)
MAHALAKSHMI	22	FEMALE	1522341	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	13.5.15	no discharge	healthy	5
KALPANA	27	FEMALE	1523421	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	13.5.15	no discharge	healthy	4
SARATHKUMAR	14	MALE	1533461	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	17.3.15	no discharge	healthy	5
LAKSHMI	36	FEMALE	1532874	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	5.6.15	no discharge	healthy	5
KARUPPAN	58	MALE	1513933	CARCINOMA STOMACH	DIAGNOSTIC STAGING LAPAROSCOPY	CONVENTIONAL SUTURING	11.4.15	no discharge	healthy	15
YAMUNA	40	FEMALE	1511446	GALL BLADDER POLYP	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	3.3.15	no discharge	seroma	16
ARCHANA	21	FEMALE	1512149	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	7.3.15	no discharge	healthy	5
VAISHALI	11	FEMALE	1513349	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	7.3.15	no discharge	healthy	5
ESTHER	39	FEMALE	1511402	LEFT OVARIAN CYST	LAPAROSCOPIC OVARIAN CYSTECTOMY	CONVENTIONAL SUTURING	17.3.15	no discharge	healthy	14
SARATHKUMAR	13	MALE	1514650	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	7.3.15	no discharge	wound dehiscence	14
VEERAMMAL	33	FEMALE	1525070	RIGHT OVARIAN CYST	LAPAROSCOPIC OVARIAN CYSTECTOMY	CONVENTIONAL SUTURING	16.5.15	wound infection	scar	15
MOLIN	18	FEMALE	108119	LEFT OVARIAN CYST	LAPAROSCOPIC OVARIAN CYSTECTOMY	OCTYL CYANOACRYLATE	20.5.15	no discharge	no dischargе	6
BHARATHI	34	FEMALE	1533714	PELVIC INFLAMMATORY DISEASE	DIAGNOSTIC LAPAROSCOPY	OCTYL CYANOACRYLATE	20.5.15	blister	healthy	6
SHANTHI	36	FEMALE	1534065	OVARIAN MALIGNANCY	DIAGNOSTIC STAGING LAPAROSCOPY	CONVENTIONAL SUTURING	14.7.15	wound infection	ugly scar	15
GOPAL	65	MALE	1535629	METASTATIC CARCINOMA STOMACH	DIAGNOSTIC STAGING LAPAROSCOPY	OCTYL CYANOACRYLATE	14.7.15	no discharge	healthy	6
HARISH	22	MALE	1538813	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	11.7.15	no discharge	healthy	5
MEERA	50	FEMALE	1535606	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	7.7.15	wound infection	healthy	15
DIVYANATHAN	58	MALE	1534002	METASTATIC CARCINOMA STOMACH	DIAGNOSTIC STAGING LAPAROSCOPY	CONVENTIONAL SUTURING	7.7.15	no discharge	healthy	15
CHELLAPPA	55	MALE	1535378	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	OCTYL CYANOACRYLATE	3.7.15	no discharge	healthy	5
MURUGESAN	62	MALE	1532566	CHOLELITHIASIS WITH	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL	30.6.15	no disch	healthy	16

				PARAUMBILICAL HERNIA	WITH OPEN MESH REPAIR	SUTURING		arge		
RANI	65	FEMALE	1531079	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	27.6.15	wound infection		15
SIVAKAMI	40	FEMALE	1527357	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	16.6.15	no discharge	healthy	5
KARTHIKEYAN	45	MALE	1530656	RIGHT PRIMARY LATERAL INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	OCTYL CYANOACRYLATE	16.6.15	no discharge	healthy	4
INDRANI	37	FEMALE	1551664	CARCINOMA STOMACH	DIAGNOSTIC STAGING LAPAROSCOPY	OCTYL CYANOACRYLATE	14.9.15	no discharge	healthy	5
RAJA	50	MALE	1552153	LEFT LATERAL INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	OCTYL CYANOACRYLATE	14.9.15	no discharge	healthy	5
SHAILAJA KUMARI	32	FEMALE	1552151	RIGHT OVARIAN CYST	LAPAROSCOPIC OVARIAN CYSTECTOMY	CONVENTIONAL SUTURING	21.9.15	wound infection	healthy	16
PARTHIBAN	45	MALE	1524911	LEFT PRIMARY LATERAL INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	CONVENTIONAL SUTURING	16.5.15	no discharge	healthy	15
KIRUBHA	48	FEMALE	1517341	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	21.4.15	no discharge	healthy	14
RAMYA	15	FEMALE	1516704	ABDOMINAL TUBERCULOSIS	DIAGNOSTIC LAPAROSCOPY	OCTYL CYANOACRYLATE	18.4.15	no discharge	healthy	5
ABDUL AZEEZ	38	MALE	1512307	BILATERAL PRIMARY INDIRECT INGUINAL HERNIA	BILATERAL LAPAROSCOPIC HERNIOPLASTY	CONVENTIONAL SUTURING	14.3.15	no discharge	healthy	15
MUNIYAMMAL	40	FEMALE	152643	ACUTE ON RECURRENT APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	26.5.15	no discharge	healthy	15
VEERASAMY	65	MALE	1527404	LEFT PRIMARY INDIRECT INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	CONVENTIONAL SUTURING	1.6.15	no discharge	healthy	14
SIVASHANKAR	36	MALE	1530190	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	9.6.15	no discharge	healthy	14
BRINDHAVATHY	53	FEMALE	1529448	CARCINOMA STOMACH	DIAGNOSTIC LAPAROSCOPY	CONVENTIONAL SUTURING	9.6.15	no discharge	healthy	17
ASHWINI	21	FEMALE	1545395	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	4.4.15	no discharge	healthy	14
VISHAL	14	MALE	1548938	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	7.4.15	no discharge	healthy	15
RITHIKA	13	FEMALE	1547450	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	11.4.15	no discharge	healthy	15
DAWOOD	20	MALE	1547382	RIGHT PRIMARY INDIRECT INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	CONVENTIONAL SUTURING	10.2.15	no discharge	healthy	14
THULASIDHASAN	17	MALE	1545885	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	7.2.15	no discharge	healthy	16

BLESSY	12	FEMALE	1544524	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	CONVENTIONAL SUTURING	7.2.15	no discharge	healthy	15
SEKHAR	50	MALE	1540156	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	CONVENTIONAL SUTURING	10.2.15	no discharge	healthy	14
INDHU	38	FEMALE	1527389	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	OCTYL CYANOACRYLATE	21.5.15	no discharge	healthy	5
VEERAMMAL	33	FEMALE	1525070	RIGHT OVARIAN CYST	LAPAROSCOPIC OVARIAN CYSTECTOMY	OCTYL CYANOACRYLATE	16.5.15	no discharge	healthy	4
GOVINDARAJ	55	MALE	1510061	CARCINOMA HEAD OF PANCREAS	DIAGNOSTIC LAPAROSCOPY	OCTYL CYANOACRYLATE	4.4.15	no discharge	healthy	6
SURESH	33	MALE	1508546	RIGHT PRIMARY INDIRECT INGUINAL HERNIA	LAPAROSCOPIC HERNIOPLASTY	OCTYL CYANOACRYLATE	16.2.15	no discharge	healthy	4
RAFI	40	MALE	1506401	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	OCTYL CYANOACRYLATE	10.2.15	no discharge	healthy	5
UMA	28	FEMALE	1504439	ACUTE APPENDICITIS	LAPAROSCOPIC APPENDICECTOMY	OCTYL CYANOACRYLATE	20.1.15	no discharge	healthy	4
NASREEN	18	FEMALE	1501604	CHRONIC ABDOMINAL PAIN	DIAGNOSTIC LAPAROSCOPY	OCTYL CYANOACRYLATE	20.1.15	no discharge	healthy	5
RAJAMMAL	44	FEMALE	150068	CHOLELITHIASIS	LAPAROSCOPIC CHOLECYSTECTOMY	OCTYL CYANOACRYLATE	6.1.15	no discharge	healthy	4
SUGUNA	22	FEMALE	150096	RIGHT ILIAC FOSSA PAIN	DIAGNOSTIC LAPAROSCOPY	OCTYL CYANOACRYLATE	6.1.15	no discharge	healthy	5

Patient Information Module

You are being invited to be a subject in this study.

Before you participate in this study, I am giving you the following details about this trial, which includes the aims, methodology, intervention, possible side effects, if any and outcomes:

All patients undergoing laparoscopic surgeries will be included in this study. A detailed clinical history will be taken following a standardized proforma. A detailed clinical examination will be made and relevant basic investigations will be done at the time of admission.Effect of 5mm port closure with octyl cyanoacrylate on wound status and shorter operating time will be evaluated. The results arising from this study will be analyzed and used for academic purposes. You will be given clear instructions at every step and you are free to ask/ clarify any doubts. Your identity will remain confidential. You are free to withdraw from this trial at any point of time, without any prior notice &/ or without any medical or legal implications.

I request you to volunteer for this study.

Thanking You,

Investigator's Sign Patient's Sign

(Dr.S.PRASANNA) (Name:)

PROFORMA

A comparative study of port site skin closure versus skin adhesives

Investigator: **Dr.PRASANNA. S**, PG 2nd year – MS (General Surgery)

Guide: **Prof. Dr. D. NAGARAJAN,** Chief, Unit S3

- NAME : SL. NO:
- AGE /SEX:
- ADDRESS WITH CONTACT NUMBER:
- IP NO:
- DATE OF ADMISSION:
- DATE OF SURGERY:

HISTORY OF PRESENTING ILLNESS:

PAST HISTORY:

WHETHER A KNOWN CASE OF DM/ HYPERTENSION/

ASTHMA/ TB/EPILEPSY/CARDIAC ILLNESS

H/O SIMILAR EPISODES IN THE PAST, IF ANY:

CLINICAL EXAMINATION:

GENERAL EXAMINATION: TEMP: P.R: B.P: R.R

SYSTEMIC EXAMINATION:

CVS

RS

PER ABDOMEN:

CLINICAL DIAGNOSIS:

Investigations:

HEMAT	
HB	
PCV	
RBC	
TC	
DC	
PLT	
ESR	
RBS	
B.UREA	
S.CREAT	
S.Na+	
S.K+	
S.Cl-	
S.HCO3-	

CHEST X RAY:

ABD X RAY:

USG ABD:

PATIENT CLINICAL COURSE:

OUTCOME OF TREATMENT:

Informed Consent

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign Investigator's Sign

(Dr.S.PRASANNA)

அரசு ஸ்டான்லி மருத்துவக் கல்லூரி, சென்னை - 600 001.

பங்கு பெறுபவரின் ஒப்பம்

ஆராய்ச்சியின் தலைப்பு :தோல் ஒட்டிகள் எதிராக குடற்பகுதியின் துறைமுக மூடல் ஒரு ஒப்புமை ஆய்வு

ஆராய்ச்சி நடைபெறும் இடம் : அரசு ஸ்டான்லி மருத்துவக் கல்லூரி,

சென்னை - 1.

பங்கு பெறுபவரின்
பெயரும் முகவரியும் :

நான், ... இந்த ஆராய்ச்சியின் விவரங்களை எனது சொந்த மொழியில் கூற அறிந்து கொண்டேன்.
இந்த ஆராய்ச்சியின் முழுவிவரங்களையும் நான் அறிந்து கொண்டேன். இந்த ஆராய்ச்சியில் நான் பங்குபெறும் போது எனக்கு ஏற்படும் நன்மை தீமைகளை முழுவதுமாக அறிந்து கொண்டேன்.
இந்த ஆராய்ச்சியின் போது எப்போது வேண்டுமானாலும் நான் விலகிக்கொள்ளலாம் என்பதையும், அதனால் எனக்கு கிடைக்கும் மருத்துவத்தில் எந்தவித மாற்றமோ பாதிப்போ இருக்காது என்றும் அறிவேன். இந்த ஆராய்ச்சியில் நான் பங்குபெறுவதற்காக நான் எந்தவித சன்மானமும் (பணமாகவோ, பொருளாகவோ) வாங்கமாட்டேன். இந்த ஆராய்ச்சியின் முடிவுகளை, என் அடையாளங்களை குறிப்பிடாமல் மருத்துவ இதழ்களில் வெளியிட எனக்கு எந்த ஆட்சேபனையும் இல்லை. இந்த ஆரய்ச்சியில் என் பங்கு என்ன என்பதை அறிவேன். இந்த ஆராய்ச்சிக்கு எனது முழுஒத்துழைப்பையும் தருவேன் என்று உறுதி அளிக்கிறேன்.

பங்கு பெறுபவரின் பெயரும் முகவரியும்:

பங்கு பெறுபவரின் கையொப்பம் / விரல்ரேகை :

தேதி:

சாட்சி:

(சாட்சியின் பெயர், முகவரி, கையொப்பத்துடன்)

ஆராய்ச்சி செய்பவரின் பெயரும் கையொப்பமும் :

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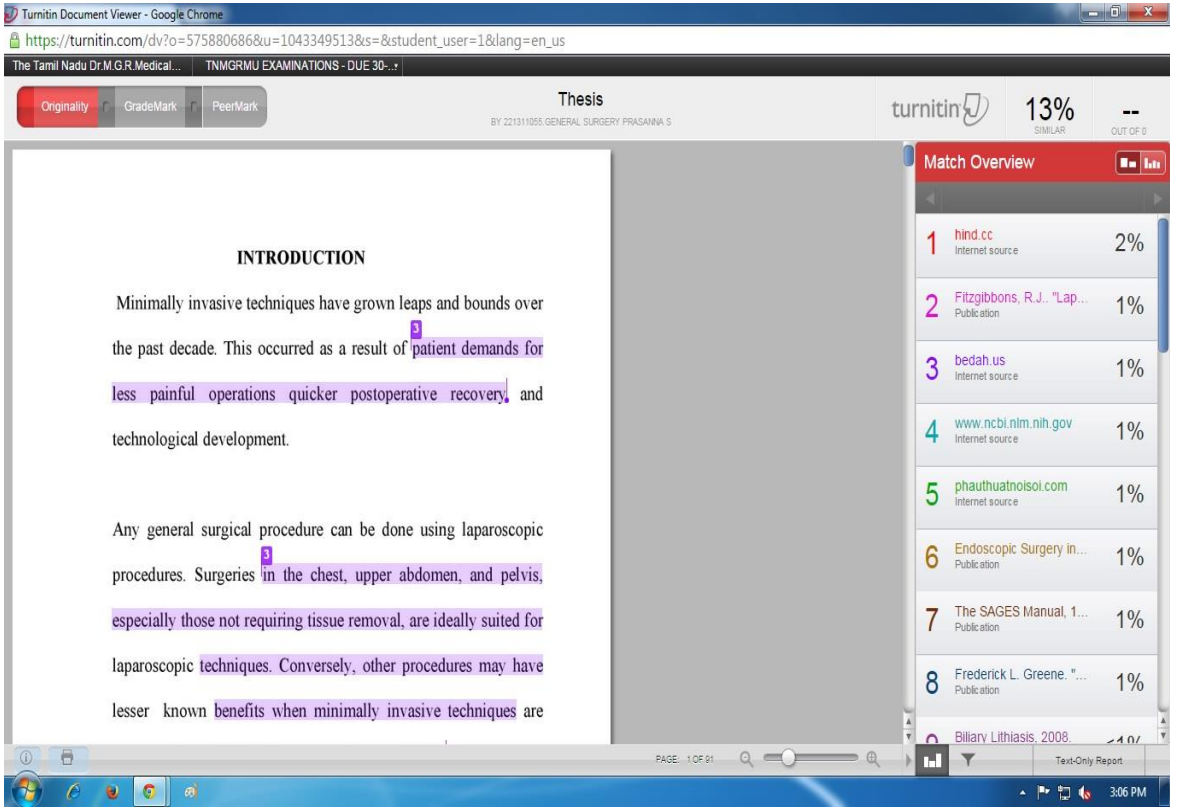
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INTRODUCTION
Minimally invasive techniques have grown leaps and bounds over the past decade. This occurred as a result of patient demands for less painful operations quicker postoperative recovery, and technological development.
Any general surgical procedure can be done using laparoscopic procedures. Surgeries in the chest, upper abdomen, and pelvis, especially those not requiring tissue removal, are ideally suited for laparoscopic techniques. Conversely, other procedures may have lesser known benefits when minimally invasive techniques are
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INSTITUTIONAL ETHICAL COMMITTEE,
STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : A comparative study of Laparoscopic port site skin closure versus skin adhesives.

Principal Investigator : Dr. Prasanna.S

Designation : PG M S (General Surgery)

Department : Department of General Surgery
Government Stanley Medical College,
Chennai-01

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 13.01.2015 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate from the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

MEMBER SECRETARY,
IEC, SMC, CHENNAI

ABSTRACT

A COMPARATIVE STUDY OF LAPAROSCOPIC PORT SITE SKIN CLOSURE VERSUS SKIN ADHESIVES

INTRODUCTION

Minimally invasive techniques have grown leaps and bounds over the past decade. This occurred as a result of patient demands for less painful operations quicker postoperative recovery and technological development.

Any general surgical procedure can be done using laparoscopic procedures. Surgeries in the chest, upper abdomen, and pelvis, especially those not requiring tissue removal, are ideally suited for laparoscopic techniques. Conversely, other procedures may have lesser known benefits when minimally invasive techniques are performed, especially when the specimen excised is large.

Traditionally, laparoscopic trocar sites were closed either

by subcuticular sutures or a simple skin suture depending on the surgeon. The other methods in which the port closure is being carried out are skin staples, surgical tape,full thickness cuticular sutures and skin adhesives. Cyano acrylates were actually used as tissue adhesives in operative set up. Easy appication, cost-effectiveness, cosmesis all make it a valuable asset in wound closure. Skin

adhesives are being used extensively in the closure of extremity, head, and neck lacerations. Use of cyanoacrylates in otologic and ophthalmologic surgery are also being described.

Octylcyanoacrylate is a long- chain cyanoacrylate tissue adhesive. It is a combination of monomer and plasticizers which form a flexible bond with a breaking strength comparable to 5-0 monofilament suture. Multiple clinical applications for which it is commonly being used exist. However, no studies exist to compare its use in closing laparoscopic port sites.

AIMS AND OBJECTIVES

1. To establish the applicability of octyl cyanoacrylate in laparoscopic surgery for swift closure of trocar sites by comparing it with conventional suturing.
2. To reduce the operating time and to reduce the economic strain with reference to repeated change of dressings and to produce cosmetically better wounds.

MATERIALS AND METHODS

PLACE OF STUDY

Department of General Surgery, Govt. Stanley Medical College & Hospital,Chennai

DURATION:

JAN 2015 TO SEP 2015

TYPE OF STUDY

Prospective study

SAMPLE SIZE – 50

INCLUSION CRITERIA:

All Patients undergoing laparoscopic surgeries irrespective of age group both in the emergency and elective setup

EXCLUSION CRITERIA:

- Cases in which the laparoscopic procedure is converted to open technique
- Patients who are known to harbor atypical mycobacteriae
- Patients who are terminally ill
- Patients previously diagnosed with tuberculosis
- Patients diagnosed with AIDS, Hepatitis etc ;

METHODOLOGY

- All patients undergoing laparoscopic surgeries in our department during the period from January 2015 to September 2015 were included in the study
- After any laparoscopic surgery the 5 mm ports alone were not sutured instead a skin adhesive (octyl cyanoacrylate) was applied after approximating the wound edges. The port site is left open without applying any dressing. The patients were followed in the 5 th and 14 th

postoperative days for any signs of inflammation like redness , induration, blisters, scars etc; the results were compared with ports which were closed by conventional suturing by 2 –o vicryl simple intermittent sutures.

- The observations were recorded and tabulated.

CONCLUSION

- The use of cyanoacrylate for skin closure in laparoscopic skin incisions is effective, cosmetically better and economical.It is much quicker to close these port sites with octylcyanoacrylate than by sutures.
- The technique for closure is easy to learn and not technically demanding. This leads to shorter overall operating times, lower cost, and greater efficiency in wound closure. Even if the adhesive used gets in between the wound edges it gets extruded just like any foreign body. Nevertheless , the skin adhesive is always used after approximating the wound edges.
- Low wound complication arose possibly due to bacteriostatic properties of tissue adhesives. Both n-2-butylcyanoacrylate and 2-octylcyanoacrylate demonstrate antimicrobial effects against gram-positive organisms

KEY WORDS: Laparoscopy , 5mm port closure, octyl cyanoacrylate**.**