Complications of Microlaparoscopy and Awake Laparoscopy

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ABSTRACT

Complications of laparoscopy are categorized into trocar insertion complications, complications resulting from image quality, and complications resulting from instrumentation. Microlaparoscopy also has similar complications and additional complications when being performed in the awake patient. Each of these complications is reviewed as they apply to microlaparoscopy. The results reveal that the seriousness of the complication is directly dependent on the size of the perforation. Therefore, surgeons’ reluctance to downsize the instruments used is increasing the laparoscopy complication rate. Using smaller-diameter trocars and instruments reduces laparoscopic complication rates.

Key Words: Awake laparoscopy, Microlaparoscopy, Laparoscope.

INTRODUCTION

The premise of smaller is better has its merits. Moving from a trocar size of 10 mm to trocar sizes of 2 or 3 mm has advantages. Palter demonstrated a decrease in incisional pain, postoperative recovery time, and improved cosmetics. Kavic, on the other hand, demonstrated a decrease in trocar site hernias as a result of the smaller diameter access. Microlaparoscopy has not been without its complications. The objective of this discussion is to review the complications associated with microlaparoscopy and awake laparoscopy and to provide suggestions on how to avoid them.

TROCAR INSERTION COMPLICATIONS

Preperitoneal Insertion

The ability to separate the peritoneal layer from the abdominal wall increases and the distance from the umbilicus increases. Tenting occurs when the trocar is advanced into the preperitoneal spaces. Upon the delivery of the gas, the peritoneum is dissected away from the abdominal wall. In an anesthetized patient, this often goes unnoticed until the laparoscope is inserted. In a patient undergoing awake laparoscopy, this is perceived by the patient as acute onset of intense abdominal pain, resulting in conversion to a general anesthetic for the laparoscopy. This complication can be prevented in 2 ways. In an awake laparoscopy, the trocar is not advanced but rather is held steady and the patient is asked to distend his or her abdomen, and as a result, the muscles and peritoneum are pushed over the stationary trocar. The second tip to prevent this complication is to look with the scope to confirm that you are in the peritoneal cavity before inflation with the gas is begun.

Trocar Injury to the Bladder

Large-diameter trocar injuries to the bladder normally require a surgical repair by suturing the bladder in 2 layers followed by drainage of the bladder with a catheter for 5 days. Should a small diameter trocar accidentally perforate the bladder, a more conservative approach can be taken. The 2- or 3-mm trocar injury to the bladder caused by the microlaparoscopic trocar is often less in
diameter than standard suprapubic drains that are used in the management of bladder surgery. Ensuring that the bladder is empty prior to starting the laparoscopy is by far the best way to prevent this complication. Having the patient void preoperatively does not ensure complete drainage of the bladder. Nervousness of the patient because of the impending surgery or the intravenous (IV) fluids given preoperatively may result in a larger amount of urine in the bladder than one may expect despite the fact that the patient just voided. The only sure way to ensure that the bladder is empty is to catheterize the patient just as the laparoscopy is starting.

**Trocar Injury to the Bowel**

The true incidence of laparoscopic bowel perforation secondary to Veress needle insertion is unknown. Although the incidence of bowel perforations in laparoscopic cases has been estimated at 0.14%, the inadvertent perforation by the Veress needle often goes unnoticed. This low incidence of bowel perforation complication forms the basis of a more conservative approach to bowel perforation by 2- or 3-mm trocars. Should a perforation occur, observe for bleeding and control as necessary. Then, look to see whether spillage has occurred of any bowel contents. If no bleeding or spillage is observed, note the area, then continue the planned operation and look back at the end of the procedure and check again for bleeding or spillage. If none is observed, the option to leave a drain may be exercised. Should drainage be observed, then assess the extent of the perforation. If a tear rather than a simple perforation is seen, then proceed as you would with a large trocar perforation. If a simple direct perforation is seen then usually only 1 or 2 laparoscopic sutures are all that is needed to close the defect. Proper drainage and postoperative antibiotics and monitoring should follow.

**COMPLICATIONS RELATED TO IMAGE QUALITY**

**Not Full Screen**

Most laparoscopists are used to the full screen image on the monitors when they are operating. Most microlaparoscopes only give a restricted round screen image that makes the surgeon uncomfortable. This can be overcome in 2 ways. The first is to use a camera that has an image enlargement capability to produce a full screen and eliminate the black areas. This has its drawback in reducing the light transmission. The other way is to move to a larger scope, such as a 4-mm scope, that produces a large screen image and increases the light transmission.

**Poor Light**

The main reason that 10-mm laparoscopes were adopted initially was the need to provide the necessary light bundles to obtain adequate light transmission. The focal distance of these large 10-mm scopes is extensive and exceeds 10 cm. This results in the laparoscopist operating from a distance and having a wide view. As the scope is reduced in size, fewer light bundles are contained to transmit the light. This results in a darker image if one stays at the same distance away from the organ viewed. Because the focal distance of the scope is also reduced, this adds to the poor light and image. The way to overcome this problem is to understand that you have to move the scope closer to the operating field, and therefore the light and picture quality improve.

**White Out**

The downside of moving too close to a structure is that the light is reflected off the structure, the aperture of the camera cannot compensate fast enough, the screen therefore goes white, and the picture quality and fine detail are lost. This complication is known as white out. It can be corrected by use of a larger scope or a single-chip rather than a triple-chip camera.

**COMPLICATIONS RELATED TO INSTRUMENTATION**

**Lack of 1 to 1 Correlation**

Laparoscopists using larger diameter instruments are expecting that movement of the distal or handle of the instrument will result in equal movement of the instrument in the operating field. As the diameter of the instrument is reduced, the 1 to 1 correlation is lost as the instrument bends. This makes the surgeon feel clumsy and can be frustrating. The smallest diameter of instrument that maintains this 1 to 1 correlation is 3 mm. The other way of getting around this problem is to move the trocar and the instrument together as a unit or use shorter instruments.

**Lack of Grasping Ability**

The technique used in macrolaparoscopy is to keep the
laparoscope stationary for the most part and move the structures of organs with the instruments out of the way to obtain the view required. This technique just does not work in microlaparoscopy because of the difference in the focal length of the scope and the grasping ability of the small jaws or the flexibility of the instruments. One must utilize the advantages of the smaller diameter and the shorter focal length and go around the structures to obtain the view required. This technique is especially important in the awake patient because grasping the tube for example can be painful to the patient.

**COMPLICATION OF SHOULDER PAIN**

Laparoscopy was first recorded in 1871 and since that time a need has existed to create a space within the peritoneal cavity to view the abdominal organs. Early users of laparoscopy had no resources other than room air to develop this space. Concerns over the risks, including air embolism and possible combustion during the use of electrocautery, led to the search for a different distention medium. Nitric oxide, helium, and carbon dioxide were initially tested, and over the years carbon dioxide became the distention medium of choice. It is absorbed quickly, does not support combustion, and reduces the risk of air embolism. The main drawback to the use of carbon dioxide is the 80% incidence of shoulder pain associated with its use. This shoulder tip pain was viewed as an expectable trade off, when comparing its benefits with those of other gases. The cause of the shoulder pain was largely unexplained. Theories arose to try to explain the phenomenon. The most widely accepted theory presumes that the carbon dioxide reacts with the water present in the peritoneal fluid and forms carbonic acid, which in turn was thought to be an irritant and stimulated the diaphragmatic nerve resulting in the pain. More recently, researchers began looking at the change of temperature as the gas expands from the compressed cylinder to the abdominal cavity. A temperature of 21° Celsius has been recorded when gas exits the Veress needle versus the 37° Celsius temperature of the peritoneal cavity. The third idea about the cause of shoulder pain focused on the drying affect of the carbon dioxide on the peritoneal cell. The gas escaping from the Veress needle is of very low humidity (.0002%). The low humidity results in mesothelial integrity being temporarily lost, and the basal lamina to be bare. This phenomenon may lead to cellular death, resulting in chemical irritation.

These scientifically based studies established the foundation for clinical trials. Ott, et al began looking at the effect of heating and humidifying the carbon dioxide gas prior to instillation into the peritoneal cavity on core body temperature. They reported that core body temperature was maintained during prolonged laparoscopic procedures and recorded a decrease in postoperative pain and length of stay. Korell et al. using visual analog pain scales, also observed a reduction in postoperative pain with heated and humidified gas over raw gas.

In recent years, with the development of smaller instrumentation, awake laparoscopy under IV conscious sedation, patient assisted laparoscopy, and pain mapping have led to a resurgence in the performance of laparoscopy without the use of a general anesthetic. Shoulder pain resulting from the gas limited the amount of the gas used to less than 700 cc. Volumes over that amount result in increased analgesic requirements to deal with the higher incidence of shoulder pain that shortens or preempts the surgery. The need for reducing the shoulder pain has been exemplified.

Studies have shown that heating and humidifying the gas results in: (1) increased volumes of gas being infused, resulting in a better view; (2) increased visual and operative fields; (3) decreased incidence of shoulder pain by 80%; (4) decreased need for analgesic, both intraoperatively and postoperatively; (5) decreased conversion rate to a general anesthetic; and (6) decreased duration of shoulder pain should it occur.

**PAIN DURING THE AWAKE LAPAROSCOPY**

**Pain at the Injection Site**

Applying EMLA cream 1 to 2 hours before the intended surgery will prevent the initial needle pain as well a 27-gauge sized needle. Furthermore, Xylocaine dissolved in carbon dioxide gas will reduce the “burning sensation” of the injection deeper in the abdominal wall. One other thing to remember is that a larger volume of a more dilute concentration provides better analgesic effects than does a small volume of more concentrated Xylocaine. The other point to raise is to use common sense to prevent oversedation. That is to say, do we give Fentanyl or Propofol to a patient for a Pap smear or a para-cervical block? How about for the insertion of a 16-
gauge IV line or a subclavian line?

**Pain During Laparoscopy**

The main premise to understand during awake laparoscopy is that once pain is evoked it is hard to differentiate, and this shortens the length of the procedure. Therefore, it is best to see and touch what is normal first, then move slowly to the area of pathology. In doing so, try not to grasp or poke at structures. Instead, try to deflect or go around structures to get an adequate view. Touch very lightly, start some distance away from the pathology, and note the first change in sensation or pain. Remember, the object is to find out where the pain is, not how much it hurts!

**Hyperesthesia**

The patient saying, “everything hurts,” better known as hyperesthesia, is the result of oversedation, especially when Midazolam is used. Oversedation prevents the patient from processing the sensory input properly and results in “everything hurts.” To prevent this, allow the patient some time for the pain to settle without giving more sedation. Getting the patient to refocus and regain his or her composure results in a more cooperative patient and better results.

**Complication Specific to Awake Laparoscopy**

Anxiety is by far the greatest complication of awake laparoscopy. Anxiety is not only a complication experienced by the patient, but the surgeon also can have anxious moments. If the surgeon expresses any degree of anxiety about the procedure, this is immediately picked up and exemplified by the patient. Therefore, making microlaparoscopy as similar as possible to macrolaparoscopy is key to reducing the surgeon’s anxiety. Having a full screen view on the monitor, adequate light, adequate abdominal distention, and all the instruments present for the procedure will reduce anxiety for the surgeon, which in turn reduces anxiety in the patient. To reduce patient anxiety, prevention is the key. The following are suggestions for the prevention of patient anxiety.

*Discussion in the office:* As with any surgery, an adequate, full explanation of the procedure is of utmost importance. With awake patients, it is not only important to explain the details of the surgical technique but also the events surrounding the surgery. For example, what happens when they get to the hospital, the preoperative ward, and the events that will occur when the patient enters the operating room. Try to make it so that there are no surprises. Motivation is key to the success of awake laparoscopy and to reducing anxiety. To help motivate a patient, use logic. Can we see pain? If I had 2 pimples on my forehead, could you tell me just by looking which one is painful and which one is not? If I sedate you, how can I tell what is painful? You are the only one in the room who knows where the pain is. Show me. The two of us can do a better job than either one of us by ourselves.

*Patient arrival at the hospital:* Having the hospital staff well-informed of the procedure is key to reducing anxiety. A staff member who makes a simple comment like “you are brave” or “I wouldn’t do this” is extremely anxiety provoking and can lead to cancellation of the procedure. Having the operating room staff introduce themselves and explain their role and answer questions about the procedure goes a long way in reducing anxiety. Being prepared in the operating room with all the instruments present, checked, and set out prior to bringing the patient into the room reduces the impression that something is wrong. The patient needs the confidence that everything is going smoothly.

*Once the patient is in the room:* Silence to a patient is very anxiety provoking. Therefore, it is essential that all the conversation be directed to the patient. Having one person always talking to patients while they are positioned and prepped for surgery keeps their minds occupied. Keeping patients warm by minimizing the time they are exposed, warming the preparatory solution, and using warm blankets on the upper body maintains the patient’s temperature. Distraction can be used to your advantage. Cooling the speculum and having the patient concentrate on the coolness goes a long way in reducing the embarrassment of a patient being examined with so many people around and the pain of a paracervical block.

*During the procedure:* Ensure the drapes and the patient’s positioning will allow her to see you and the monitor at all times. Let the patient be in control and allow her to tell you when to proceed and when to stop. Explain as you go, and make it interesting by using lay terms. Lighten up a bit, and do not make it sound too serious. Inject some humor, when appropriate, to break...
the tension. Most important is for the surgeon to avoid the use of anxiety-provoking words, such as “needle, scalpel, or this may hurt.” To get around this, use sign language to communicate to the scrub nurse or just point to the instruments, or better yet have all the instruments set out on a Mayo stand so as to be self-service.

Complications occur in all forms of surgery including microlaparoscopy and awake laparoscopy. The best way to avoid complications is to be aware of them and the steps necessary to avoid them. Promoting awareness of complications is the objective of this review. It was also our objective to point out that the mere fact of moving to a microlaparoscopic approach in itself can minimize complications, especially bowel and bladder perforations. The smaller the problem, the easier it is to fix.

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