LAPAROSCOPIC MYOMECTOMY

Harry Reich, MD, FACOG, FACS

A. INDICATIONS

Uterine leiomyomas are the most common solid pelvic tumor, occurring in 20% of women over age 35. Most are asymptomatic and can be followed with vaginal ultrasound to rule out ovarian neoplasms and rapid increases in fibroid size. Thus, surgery can usually be avoided. Hypermenorrhea is the major symptom in women with uterine leiomyomas who seek treatment. Other complaints include infertility and problems after conception including spontaneous abortion, pain from acute red degeneration during pregnancy, premature labor, fetal malposition, dysfunctional labor, obstruction of labor, retained placenta, and postpartum hemorrhage secondary to uterine atony. Fibroids require treatment when hypermenorrhea leads to anemia, pain develops from fibroid degeneration, pressure symptoms develop from large size, size increases rapidly, and when the clinician cannot properly palpate the ovaries, especially if ultrasound is not available.

Myomectomy by any route is a controversial subject. American College of Obstetricians and Gynecologists (ACOG) criteria for myomectomy are divided into two major indications: infertility patients (Table 1) and patients desiring to retain the uterus (Table 2). The accepted indications for myomectomy are secondary infertility with a past history of second trimester loss and preservation of fertility in women with either hypermenorrhea leading to anemia or a large lower abdominal mass. The performance of myomectomy in a woman undergoing laparoscopy for infertility raises the important question of whether the fibroids would interfere with her fertility or her capacity to bear a term pregnancy. Most leiomyomatas do not interfere with fertility or childbearing, and results of myomectomy to improve fertility are marginal. The benefits of myomectomy in an asymptomatic woman whose fibroid does not distort the uterine or tubal portion of her reproductive system even with a history of infertility cannot be documented by existing literature.

Laparoscopic or vaginal hysterectomy is the treatment of choice after completion of childbearing when hypermenorrhea leading to anemia or a symptomatic pelvic mass greater than 12 weeks gestational size is present. ACOG criteria for hysterectomy for leiomyomata are listed in Table 3. The benefits of hysterectomy include eliminating the risk of future leiomyomata regrowth, removing the cervix and endometrium to eliminate future carcinoma, and easing future estrogen replacement therapy without endometrial cavity monitoring. For these reasons, hysterectomy is the preferred management for symptomatic leiomyomata when reproduction is not an issue.

Extensive myomectomies by laparotomy or laparoscopy are not justified in patients who no longer wish to reproduce because the morbidity and mortality of myomectomy is comparable with that of hysterectomy in these situations. Except for infertility, the major indications for myomectomy and hysterectomy for fibroids are the same. It must be emphasized that multiple myomectomy is a more difficult and time-consuming procedure than hysterectomy and is associated with postoperative adhesions and the possibility of a subsequent procedure. Myomectomy by laparoscopy may be even more difficult and time consuming than an open procedure and can be associated with greater blood loss. With laparoscopy, however, the surgeon can do the same operation with less morbidity. When compared with vaginal hysterectomy, the laparoscopic advantages of a short hospital stay, rapid recovery, superior cosmetic result, and especially cost effectiveness are questionable.

The most common reason for laparoscopic myomectomy today is the patient's decision to avoid hysterectomy at all costs, including when it probably is indicated, i.e., a strong patient choice for uterine preservation. For those women who wish to have a myomectomy, and request it of their physician, he or she is obliged to review the risks and benefits of all options. If an abdominal incision is the major concern, these women often accept laparoscopic hysterectomy with morcellation and ovarian preservation as an alternative if counseled properly. In some women,

any type of hysterectomy is unacceptable, and the surgeon's decision to undertake these challenging myomectomy cases, despite attendant risks, is proportional to his or her developed surgical skills; only then is the issue of laparoscopic versus laparotomy myomectomy appropriate, depending on the particular expertise of the surgeon. The issue of insurance coverage may be critical in these decisions, as many insurance companies reimburse less for the more difficult to perform laparoscopic operation. If an abdominal myomectomy or hysterectomy is indicated and the patient chooses laparoscopic myomectomy, the insurance company may consider the surgery to be "cosmetic" (avoiding an abdominal scar), and the patient may have to cover a large portion of the cost. Medical insurance companies who do not discriminate against women should provide reasonable reimbursement to their participating physicians who perform this "patient choice" surgical procedure.

B. Myoma blood supply

Surgeons frequently talk about a vascular pedicle supplying a fibroid; there is no vascular pedicle. Fibroid blood supply comes from localized expansion of the normal subserosal vasculature of the uterus. The arterial pattern in a fibroid represents an expansion of the preexisting supply to that area of myometrium to accommodate the localized proliferation of smooth muscle. A number of small arteries, less tortuous than the adjacent radial arteries, penetrate the myoma anywhere on its circumference and those entering its inner aspect are seen to have reversed their normal centripetal course. This arterial density is without a regular pattern.

Distension of the uterine veins results in a vast network of distended channels. Uterine bleeding associated with fibroids results from dilatation and congestion of the venous plexuses of the myometrium and endometrium caused by the expanding tumors, rather than any intrinsic vascular patterns within the fibroids themselves. This widespread congestion of uterine veins caused by a localized obstruction was first noticed by Sampson and may be explained by compression of a segment of the arcuate venous plexus which drains a wide area of the uterus, coupled with the absence of valves in the uterine veins. The compression and dilatation of myometrial veins around the periphery of a fibroid is a constant feature; damage to these vessels occurs during myomectomy with resultant heavy bleeding.

C. Laparoscopic techniques for myomectomy

Enucleation of myomas can be a frustrating, time-consuming experience when attempted laparoscopically. Bleeding problems are common and difficult to resolve. Laparoscopic myomectomy requires a thorough knowledge of electrosurgical and laser techniques for dissection and hemostasis because lower uterine segment tourniquets are not available to reduce intraoperative blood loss.

Cutting current through a spoon electrode is used to cut and coagulate (desiccate); coagulation current is used to fulgurate. The tip of the spoon electrode is used to cut. The round body of the electrode is used to tamponade arteriolar bleeding vessels after which cutting current is applied to coagulate them. Diffuse venous bleeding can often be controlled with fulguration, the noncontact application of high-voltage coagulation current to the tissue through a 1 to 2 mm spark or arc. Cutting with coagulation is done with cutting current through the broad round spoon using power above 100 W. Persistent arterial bleeding from small or large vessels requires bipolar desiccation with cutting current. The argon beam coagulator can be used to provide more expensive fulguration than with an electrode alone; spray coagulation current at 80 watts will arc approximately 1 cm through the Argon gas with resultant charring and hemostasis.

Bipolar electrodes can only desiccate, and a cutting waveform is selected when using these forceps. Bipolar forceps use high-frequency low-voltage cutting current (20-50 W) to coagulate vessels as large as the ovarian and uterine arteries. (Reich H, 1987) The Kleppinger bipolar forceps are excellent for large vessel hemostasis. Specially insulated bipolar forceps are available that allow current to pass through their tips for precise hemostasis. Microbipolar forceps contain a channel for irrigation and a fixed distance between the electrodes. They are used to irrigate bleeding sites for vessel identification before coagulation and to prevent sticking of the

electrode to the eschar that is created. Irrigation is used during underwater examination to identify the bleeding vessel before coagulation by removing surrounding blood products.

An effect similar to a blended current is accomplished with conventional CO_2 laser through the operating channel of an operating laparoscope when used above 50 W as the large spot size with diameter from 2 to 4 mm obtained controls most arteriolar and venous bleeding. The argon, KTP-532, and neodymium:YAG fiber lasers have no advantage over electrosurgical electrodes for both cutting and coagulation and thus do not justify their extreme expense. Fibers cannot be maneuvered into places accessible with the carbon dioxide laser shot through the operating channel of an operating laparoscope perpendicular to the surgeon's field of vision. Less plume occurs with these lasers because the heat is dispersed into the tissue, causing greater tissue necrosis.

Suturing with large curved needles without a large incision is described in the section on uterine repair. Disposable stapling and suturing instruments rarely are used because of their expense. Conventional sutures and bipolar desiccation work better.

Vasoconstrictive agents (Vasopressin) are not injected into the myometrium or myoma during surgery because bleeding from the needle puncture sites often persists throughout the procedure, requiring later electrosurgical coagulation, and because delayed bleeding may occur in the myometrium. Vasopressin use is banned in France after fatalities occurred presumably from cardiac arrhythmias during cervical procedures and laparotomy myomectomy. Electrosurgical hemostasis often is supplemented by the placement of Surgicel (oxidized regenerated cellulose) inside the defect prior to suture repair. Bulldog clamps inserted through the 10-mm umbilical trocar sleeve are applied to the infundibulopelvic ligaments for hemostasis in selected cases. Autologous blood donation with transfusion during the case is considered.

Laparoscopic myomectomy requires special traction devices. (Reich H, 1989) Corkscrews are essential, including 5-mm corkscrews for laparoscopic traction and 11-mm corkscrews for extraction of the myoma through the cul-de-sac. Other available laparoscopic traumatic graspers are poor substitutes. Self-retaining lateral vaginal wall retractors or Vienna retractors (Brisky-Navatril) are used when vaginal fibroid extraction with hips extended is anticipated.

D. Preoperative Preparation

Laparoscopy is performed prior to ovulation if possible. Many methods are available to avoid operating on or injuring an ovary containing a corpus luteum. I prefer using low dose oral contraceptives or alternatively, Norethindrone acetate, 10 mg daily. I don't use gonadotropin-releasing hormone (GnRH) agonists [leuprolide acetate for depot suspension (Lupron Depot), 3.75 mg IM. Some others administer depoleuprolide acetate one month prior to the procedure, dependent only upon when the patient wants the surgery and not on where she is in her menstrual cycle. Autologous blood donation is considered, but rarely is necessary.

Pre- or postoperative ovarian suppression is not used for therapy for fibroids or endometriosis as both myoma size and endometriosis gland reduction is not significant, and does not make the surgery easier. In my clinical experience, depoleuprolide may make surgical procedures more difficult.

Patients are encouraged to hydrate on clear liquids the day prior to surgery. They are directed to be NPO after midnight on the day of surgery. Fleet Phospho-Soda (1.5 FL oz) is administered twice the day before surgery to evacuate the lower bowel. (C.B. Fleet Co., Lynchburg, Va.). Lower abdominal, pubic, and perineal hair is *not* shaved. Antibiotics are administered before surgery in all cases.

E. Positioning of the Patient

Surgery is done under general endotracheal anesthesia with orogastric tube suction to minimize bowel distension. The patient is flat (0^o) with arms at the sides until after the umbilical trocar sleeve is in place; then the patient is placed in a steep Trendelenburg's position (20^o -30^o). Lithotomy position with the hip extended (thigh parallel to abdomen) is obtained with Allen stirrups

(Edgewater Medical Systems, Mayfield Heights, OH) or knee braces, that are adjusted to the individual patient by the nursing staff before she is anesthetized. Anesthesia examination is done before prepping the patient. A Foley catheter is inserted during surgery when the bladder becomes distended and removed when the patient is awake and aware of it.

F. Incisions

Three laparoscopic puncture sites including the umbilicus are used: 10 mm umbilical, 5 mm right, and 5 mm left lower quadrant. I stand on the left side of the patient and use my dominant right hand to hold, manipulate, and focus the camera. My laparoscopic puncture sites have not evolved over the past 20 years as I do not feel that more and larger trocar sleeve incisions, used by many surgeons today, represent progress. The left lower quadrant puncture is the major portal for operative manipulation. The right trocar sleeve is used for retraction with atraumatic grasping forceps. Large masses are removed through the upper posterior vagina.

G. Myomectomy Technique

Solitary pedunculated myomas can be separated from the uterus by desiccating or ligating their pedicle with bipolar forceps or suture and dividing it with scissors. They are removed from the peritoneal cavity through a culdotomy incision. Adenomyosis may masquerade as an intramural myoma with bulging of the serosa. When encountered, the bulk of the lesion is removed with an electrosurgical wedge resection, hemostasis is obtained with fulguration, and the defect is closed with suture as described below (uterine repair).

Myomectomy, a gross procedure, is ideal for video observation. The myoma incision site is selected away from the adnexa, usually vertical and in the midline. If the myoma distorts or occludes a fallopian tube, the incision is made so that the myoma under traction can be pulled away medially from the tubal cornua and the dissection stays inside the pseudocapsule at all times; in some of these cases, a transverse incision can be considered if far from the tubal cornua because the vessels run radially. Similarly, broad ligament fibroids are pulled laterally away from the uterus and its vessels, and special attention is paid to the ureter throughout its course in the deep pelvis.

1. Eneucleation.

The serosa and surrounding myometrial shell are divided with a midline vertical incision using a spoon electrode at high power cutting current (100-200 W depending on the tissue effect of the available electrosurgical generator/electrode combination). The broad surface area of the spoon electrode cuts while coagulating without charring when used at low voltage (<600) cutting current. Persistent arterial bleeding from small or large compressed radial vessels requires bipolar desiccation with cutting current. Arteriolar bleeding is controlled with monopolar cutting current or bipolar desiccation, and venous oozing is controlled with coagulation current noncontact fulguration at 80-120 W or bipolar desiccation. The tip of the aquadissector is inserted between the fibroid and surrounding myometrial pseudocapsule to aquadissect tissue planes.(Figure 2) Thereafter, a 5-mm corkscrew (WISAP, Sauerlach, Germany) is screwed into the myoma and pulled outward to put it on traction during dissection from surrounding myometrium, so that the tip of the aquadissector can be inserted between the fibroid and surrounding myometrial pseudocapsule to continue to separate myoma from myometrium using fluid pressure and blunt dissection. A blunt probe also is frequently used to dissect and mobilize fibroids because it is much stronger than the aquadissector and less likely to bend or break. The exposed portion of the fibroid may be bivalved at any time using cutting current. Fibrous adherences between the fibroid and its myometrial shell are divided with monopolar electrosurgery or large spot-size CO_2 laser (50-100 W continuous) to control arteriolar and venous bleeding. Large pedicles, which are really dilated radial vessels, are desiccated with bipolar forceps; these appear to be located at the base of the myoma but many anomalous vessels usually are encountered and will retract into the myometrium if not immediately coagulated before being cut. Throughout

the procedure, the single channel aquadissector with solid distal tip is used to dissect the pseudocapsule cleavage planes, suction-retract both myometrium and myoma, and to suction smoke. Uterine lavage with indigo- carmine dye is done after myoma removal to rule out full thickness penetration into the endometrial cavity.

2. UTERINE REPAIR

After removal of the myoma, a myometrial defect of varying size results and bleeding occurs from vessel retraction into the myometrium. Myometrial bleeding is controlled with desiccation by using Kleppinger bipolar forceps or irrigating microbipolar forceps. Large Kleppinger bipolar forceps often are used through one trocar sleeve, and an irrigation source is used through the other sleeve to identify specific bleeding sites and to lessen the chance of eschar being pulled off of coagulated vessels. Monopolar high voltage coagulation current fulguration through a spatula or spoon electrode or argon beam coagulator also may be necessary to obtain hemostasis. Both of these fulguration sources result in carbonized eschar and shrinkage of the defect. A piece of Surgicel (oxidized regenerated cellulose) is packed into the defect which then is repaired with Ethicon 0-Vicryl suture on curved needles (CT-1 or CTX) to compress the full thickness of exposed myometrium.

Extracorporeal tying is facilitated by using a trocar sleeve without a trap to avoid difficulty in slipping knots down to the tissue. A short 5 mm trocar sleeve that doesn't protrude far into the peritoneal cavity, has a screw grid for retention, and has no trap, is ideal. (Reich H, McGlynn F) Both a reusable (Richard Wolf, Vernon Hills, IL) and a disposable version (Apple Medical, Bolton, MA) are available. The former is better for rapid instrument exchanges, but the Apple has a tight seal, preventing loss of pneumoperitoneum when pushing the knot down.

Suturing with large curved needles using 5-mm lower quadrant incisions requires a special technique to put them into the peritoneal cavity. (Reich H, Clarke HC, Sekel L) Lower abdominal incisions placed lateral to the rectus muscle ensure an obvious tract on removing the trocar sleeve that is very easy to reenter. To suture with a CT-1 or CTX needle, the trocar sleeve is taken out of the abdomen and loaded by introducing a straight needle driver through the trapless sleeve (Apple) to grasp the distal end of the suture, pulling the suture through the trocar sleeve, reinserting the instrument into the sleeve, and grasping the suture 2 cm from the needle. The needle driver is inserted into the peritoneal cavity through the original tract, as visualized on the monitor; the needle follows through the soft tissue and the trocar sleeve is pushed downward over the driver to reinsert it at its original position in the peritoneal cavity. At this stage, the straight needle driver is replaced with an oblique curved needle driver (Cook OB/GYN, Spencer, IN), and the needle is applied to approximate the full-thickness myometrium. Afterward, the needle is placed in the anterior abdominal wall parietal peritoneum for removal after the suture is tied. The suture is cut adjacent to the needle, and the cut end of the suture is pulled out of the peritoneal cavity; the knot then is tied with the Clarke-Reich knotpusher without loss of pneumoperitoneum because of the tight seal of the Apple trocar sleeve. The surgeon holding both strands makes a simple half-hitch. The Clarke knot-pusher is put on one strand of the suture just above the knot, the suture is held firm across the index finger, and the throw is pushed down to the tissue defect. The second throw is made in the same direction (i.e., a slip knot) while exerting tension from above to further secure the tissue. The knot is squared with the third and fourth throws by pushing half-hitchs made in opposing fashion down to the knot to secure it firmly. To retrieve the needle, the trocar sleeve is pulled out and the needle holder inside it drags the needle through the soft tissue. The trocar sleeve is replaced easily with or without another suture. Care is taken to avoid compressing polymeric braided or monofilament suture between the jaws of traumatic needle drivers or graspers as they are at risk of surface damage and later disruption. Though my experience with second laparoscopies after myomectomy is limited, adhesion formation to the operative site has been rare.

3. REMOVING LARGE MASSES FROM THE PERITONEAL CAVITY

Large masses should be removed through laparoscopic culdotomy incisions. Large puncture sites greater than 10-mm or incisions bordering on “minilaparotomy” should be replaced by a laparoscopic culdotomy, which can approach 4 cm in length. Many surgeons dilate 5-mm lower quadrant puncture sites to 11-mm or even 30-mm so that larger instruments, including morcellators, can be used to extract fibroids or the uterus after supracervical hysterectomy. These large puncture sites should be kept to a minimum because deep fascia never fully regains its previous strength after division. Primary repair of deep fascia and peritoneum at lower quadrant incisions often is not possible, and incisional hernias can occur at 10-mm or longer sites if they are not suture approximated.

Laparoscopic culdotomy techniques were developed to remove ovaries, cysts, and myomas from the peritoneal cavity while avoiding large lower quadrant incisions. Morcellation of myomas is too time consuming with instruments presently available except for the #10 blade on a long handle introduced through the 5-mm trocar incision, the Cook circular saw, and the Steiner Electromechanic Morcellator (Karl Storz, Tuttlingen, Germany).

Solid lesions greater than 3-cm in diameter are removed best through the cul-de-sac. A posterior **culdotomy** incision using CO2 laser or electrosurgery through the cul-de-sac of Douglas into the vagina is preferable to a **colpotomy** incision using scissors through the vagina and overlying peritoneum because better hemostasis is obtained. After scissors colpotomy, vaginal bleeding greater than 100-cc is usual before all cuff bleeding is stopped.

The anatomic relationship between the rectum and the posterior vagina must be confirmed before making the laparoscopic culdotomy incision to avoid cutting the rectum. A uterine manipulator (Valtchev, Conkin Surgical Instruments, Toronto, Canada or Pelosi, Apple Medical, Bolton, Ma) is inserted to antevert the uterus and delineate the posterior vagina. When these devices are in the anteverted position, the cervix sits on a wide acorn making the cervicovaginal junction readily visible between the uterosacral ligaments when a normal cul-de-sac is inspected laparoscopically. Alternatively, a curette is placed in the uterus for elevation and anteversion. A wet sponge in ring forceps is placed just behind the cervix to distend the top of the posterior vagina. A rectal probe (Reznik, Skokie, Il) confirms its position and aids in the dissection required should the rectum cover the posterior vagina.

Before the rectal probe is removed, it may be necessary to reflect the rectum off the posterior vaginal fornix if they are attached by fibrotic endometriosis or congenital adhesions. The peritoneum at the junction of the rectum and vagina is incised using either scissors with microbipolar backup, cutting current through a spoon or angled spatula electrode, or the laparoscopic CO_2 laser at 20 watts superpulse or ultrapulse. The plane between the rectum and the vagina is developed using the aquadissector and the rectum is pushed downward.

When the rectum has been separated off the posterior vaginal wall, the posterior vaginal fornix is distended by the wet sponge on ring forceps. A transverse culdotomy incision is made with a spoon or spatula electrode at 50 - 100 W of cutting current or the CO_2 laser at power of 50 - 100 W continuous without the bleeding that accompanies a vaginal colpotomy incision made with scissors. The sponge in the posterior vagina comes into view rapidly. Some difficulty maintaining adequate pneumoperitoneum may be encountered once the vagina is entered, but the sponge in contact with the incision usually is adequate for this purpose. The potential danger of grasping the bowel with a sharp forceps inserted through the vagina, however, may be created after losing sight of the lesion to be extracted from a sudden loss of pneumoperitoneum and field of view. After culdotomy a sponge, pack, or 30-mL Foley balloon is kept in close contact with the

vaginal incision to avoid the loss of pneumoperitoneum and to facilitate the extraction of large fibroids. In some cases this loss of pneumoperitoneum can be minimized by manual labial apposition.

A single-toothed tenaculum or 11-mm corkscrew is inserted through the vagina by maneuvering it around the sponge to minimize loss of pneumoperitoneum. The fibroid is grasped under direct laparoscopic vision. In some cases the fibroid can be pushed into the deep cul-de-sac and held there with a 5-mm lower quadrant grasping forceps while a second surgeon identifies it from below and applies the tenaculum. An 11-mm corkscrew device is screwed into the myoma vaginally through the culdotomy incision, and the myoma is put on traction at the incision and is morcellated further vaginally with scalpel as necessary until removal is completed.

Large masses can be removed through a small culdotomy incision by morcellation. These large masses include 10 to 15 cm fibroids to 1500 g, ovarian fibromas to 875 g, and large fibroid uteri during supracervical hysterectomy. Hysterectomies for large fibroids that can weigh over 1000 g are removed through the vaginal cuff in a similar manner. This can be a particularly time consuming portion of the procedure and can last over one hour. Vienna retractors (Brisky-Navatril) are used.

To gain an initial grip in the mass to be delivered, an 11-mm laparoscopic corkscrew (WISAP) is inserted into the mass through the vaginal cuff or culdotomy incision. A second 11-mm corkscrew then is inserted alongside the first one and, using a scalpel, the myoma is divided between the two corkscrew devices. The leading corkscrew device with surrounding tissue then is wedged free with scalpel from the larger body of the lesion. With traction around the second corkscrew an intramyoma coring technique is performed with the scalpel encircling the exposed myoma through 360^{o} to remove a large core of it. Much morcellation may be necessary but the surgeon's patience and hard work are rewarded by accomplishing removal of large-sized masses, sometimes exceeding 1000 g.

Difficulty in locating all of the myomas after excising them from the uterus is not uncommon during multiple myomectomy procedures. In most cases excised myomas are placed in the deep cul-de-sac for later removal through a laparoscopic culdotomy incision. On occasion myomas are placed in the right iliac fossa, especially if cecal adhesions are present, to prevent their egress into the upper abdomen. In cases in which all of the myomas cannot be located, copious irrigation with Ringer's lactate is performed with the patient in a reverse Trendelenburg's position. The area beneath the liver is searched by manipulating the laparoscope and the actively irrigating aquadissector tip in unison around the right lateral border of the liver and then beneath it into the subphrenic space. Foreign bodies in this area can then be visualized and grasped with biopsy forceps. Should the myoma be intertwined among loops of small bowel, the reverse Trendelenburg's position, copious irrigation, and gravity may return it into the cul-de-sac, where it can be grasped and delivered. When multiple small myomas are encountered, the culdotomy incision can be made early, the LapSac (Cook) introduced for fragment storage, and pneumoperitoneum maintained with a vaginal delineator (Wolf), a 30-mL Foley catheter in the vagina, or a vaginal pack.

After delivery of the "last" fibroid, the peritoneal cavity is inspected for additional lesions prior to closing the culdotomy. It is very frustrating to have to take down this closure to extract an additional fibroid.

After removal of the mass the incision is closed from below or laparoscopically with interrupted, figure of eight, or running 0-Vicryl suture. Vaginal suturing can be difficult because the vaginal incision becomes edematous frequently during the procedure making exposure inadequate. Thus, I usually elect to close the culdotomy incision from above using 1 to 3 curved needle sutures (Vicryl on a CT-2) tied extracorporeally with the Clarke-Reich knot pusher.

Morcellation of fibroids through anterior abdominal wall puncture sites is now possible. Professor Kurt Semm and WISAP have developed a manual circular saw to core out 2-cm cylinders of fibromyomatous tissue while the fibroid is still in or attached to the uterus. This device is inserted through a 2-cm lower abdominal trocar sleeve and depends on a corkscrew inside it to fixate the fibroid prior to twisting the circular saw into it. Loss of resistance during twisting indicates the base of the fibroid has been reached, after which the cylindrical specimen is pulled free by traction, the specimen is removed, and the instrument is reinserted. After the bulk of the lesion is removed in this fashion, a claw forceps is substituted for the corkscrew in the device for traction and the compressible, fenestrated, remaining tissue is removed from the uterus through the 2 cm cannula. These 2-cm puncture sites require direct peritoneal or fascial closure with skin hooks to prevent hernias.

The Steiner Electromechanic Morcellator (Karl Storz, Tuttlingen, Germany) is a 10-mm diameter motorized circular saw that uses claw forceps or a tenaculum to grasp the fibroid and pull it into contact with the fibroid. Large pieces of myomatous tissue are removed piecemeal until the myoma can be pulled out through the trocar incision. With practice this instrument can often be inserted through a stretched 5-mm incision without an accompanying trocar.

I have developed the poor man's morcellator, a #10 blade on a long handle introduced gently through the left 5-mm trocar incision after removing the trocar. With care the myoma can be bivalved with the blade. The surgeon's fingers in contact with the skin prevent loss of pneumoperitoneum.

4. Closure

At the close of each operation, an underwater examination is done to detect bleeding from vessels and viscera tamponaded during the procedure by the increased intraperitoneal pressure of the CO_2 pneumoperitoneum. Pneumoperitoneum is displaced with 3 to 5 L of Ringer's lactate solution, and the peritoneal cavity is irrigated and suctioned vigorously with this solution until the effluent is clear of blood products, usually after 5 to 10 L. Bleeding is controlled using microbipolar forceps to coagulate through the electrolyte solution.[11]

First, hemostasis is established with the patient in Trendelenburg's position. Next, hemostasis is secured per underwater exam with the patient supine and in reverse Trendelenburg using underwater microbipolar coagulation. Finally, hemostasis is documented with all instruments removed, including the uterine manipulator.

A final copious lavage with Ringer's lactate solution is undertaken and most clot is isolated, usually in the pararectosigmoid gutters, and aspirated; at least 2 L of lactated Ringer's solution are left in the peritoneal cavity to displace CO_2 and to separate operated-upon organs during the initial stages of reperitonealization in the hope of reducing the formation of fibrin adherences. No other antiadhesive agents are used. Drains, antibiotic solutions, or heparin are not used. The lactated Ringer's solution is absorbed in 2-3 days.

The absorption rate of fluid from the adult peritoneum cavity is 35 mL/hour. The typical volume of crystalloid that I use at the end of a case for hydroflotation is 2000 mL. Thus, the typical volume of crystalloid will be absorbed in 50 - 70 hours. The process of peritoneal repair, fibrin deposition, and adhesion formation extends beyond these times, lasting until 5 - 8 days after surgery.

Shoulder pain from carbon dioxide insufflation is less frequent following displacement of the carbon dioxide with 2 to 4 L of Ringer's lactate at the close of the procedure. Hyskon is not used because it pulls intravascular fluid into the peritoneal cavity.

The umbilical incision is closed with a single 4-0 Vicryl suture opposing deep fascia and skin dermis, with the knot buried beneath the fascia to prevent the suture from acting like

a wick to transmit bacteria into the soft tissue or peritoneal cavity. The lower quadrant incisions are approximated loosely with a Javid vascular clamp (V. Mueller, McGaw Park, IL) and covered with Collodion (AMEND, Irvington, NJ) to allow drainage of excess Ringer's lactate solution.

H. Postoperative considerations

Patients usually experience some fatigue and discomfort for approximately 1 to 2 weeks after the operation, but may perform gentle exercise such as walking and return to routine activities within 1 week. The vaginal incision is examined for granulation tissue between 6 and 12 weeks postoperatively because sutures usually are absorbed by then; any granulation tissue is coagulated with silver nitrate. The patient is instructed to refrain from sexual intercourse for 3 weeks.

I. Complications

Complications of laparoscopic myomectomy are the same as those of myomectomy and laparoscopy in general: anesthetic accidents, respiratory compromise, thromboembolic phenomenon, urinary retention, active bleeding, hematoma, infection, and injury to vessels, ureters, bladder, and bowel. Complications unique to laparoscopy include large vessel injury and subcutaneous emphysema. The incidence of incisional hernias after operative laparoscopy is increased greatly if 10-mm or larger trocars are placed at extraumbilical sites. These sites should be closed. If the incision is lateral to the rectus muscle, the deep fascia is elevated with skin hooks and suture repaired. If the incision is through the rectus muscle, the peritoneal defect is closed with a laparoscopically placed suture.

Although culdotomy surgery offers an opportunity for invasion by organisms already present in the genital tract, the use of an electrosurgical or laser incision, aspiration of all blood clots, and copious irrigation with over 2 L of irrigant left in the peritoneal cavity at the close of the procedure eliminate the environment necessary for proliferation of these organisms. Pelvic cellulitis and postoperative sepsis with laparoscopic culdotomy has not been reported using these techniques.

Failure to identify the rectum with a rectal probe can lead to rectal enterotomy, as can scalpel morcellation. In the bowel-prepped patient, injury to the anterior rectum can be repaired laparoscopically. My preferred technique is to insert a closed circular stapler [Proximate ILS Curved Intraluminal Stapler (Ethicon, Stealth)] into the lumen just past the or hole and open it 1-2 cm while holding it high to avoid the posterior rectal wall. The proximal anvil is positioned just beyond the hole which is invaginated into the opening and the device closed. Circumferential inspection is made to insure of the absence of encroachment of nearby organs and posterior rectum in the staple line and the lack of tension in the anastomosis. The instrument is fired, then removed through the anus. The surgeon must inspect and insure that a donut of tissue representing the excised hole is contained in the circular stapler. After closure, anastomotic inspection is done laparoscopically. Indigo carmine solution is injected through a Foley catheter with a 30 mL balloon into the rectum, and an underwater examination is done to check for any leaks, which then are reinforced. I have had no late sequelae following 30 rectal repair procedures.

J. RESULTS (23)

Laparoscopic myomectomy was done in 109 patients in the early 90's, and 65 patients were able to be contacted and interviewed. The patients averaged 37 years in age and included 27 pedunculated, 77 intramural, 9 full thickness (intramural & submucous), and 3 intraligamentous. The largest myoma removed weighed 1300 gms. Ten of the women received autologous transfusion after laparoscopic myomectomy; none required non-autologous transfusion.

Of these women, 62 were satisfied with their choice and result (95% satisfaction rate). Although 13 patients (20%) went on to have a hysterectomy, 11 of these were satisfied with their initial choice of uterine preservation. The results showed that patients are generally satisfied with their choice of laparoscopic myomectomy even if uterine conservation was only temporary.

Of the 65 women interviewed, 19 attempted pregnancy after laparoscopic myomectomy, 14 (73%) conceived, and 11 (57%) delivered viable term neonates. Four women delivered vaginally and 7 underwent Caesarean section for indications that included failure to progress during labor, breech presentation, hypertensive episode during labor, and twin gestation.

Leiomyosarcoma was diagnosed postoperatively in one 38-year old woman after myomectomy for infertility. Laparotomy hysterectomy with lymphadenectomy one month later by another surgeon did not reveal any residual tumor.

I have experienced no postoperative bleeding, hematoma, or infection. To my knowledge, there has been no late sequelae from these procedures including C-section dehiscence or adhesions at second look laparoscopy or laparotomy.

K. CONCLUSIONS

Laparoscopic myomectomy is a substitute for abdominal myomectomy in selected cases. There are many surgical advantages, particularly magnification of anatomy and pathology, easy access to the vagina and rectum, and the ability to achieve complete hemostasis and clot evacuation during underwater examination. In experienced hands the complication rate is low.

Patient advantages are multiple and are related to avoidance of a pain-producing abdominal incision. Advantages include reduced hospitalization and recuperation and an extremely low rate of infection and ileus. It must be emphasized that conversion to laparotomy when the surgeon becomes uncomfortable with the laparoscopic approach should never be considered a complication; rather it is a prudent surgical decision that decreases patient risk profoundly.

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TABLE 1

ACOG CRITERIA FOR MYOMECTOMY IN INFERTILITY PATIENTS

Procedure:

Myomectomy* (68.29) (CPT Codes 56309 [laparoscopy with removal of leiomyomata], 58140 [abdominal approach], or 58145 [vaginal approach]

Indication:

Leiomyomata (218.0-218.9) in infertility patients (628.3), as a probable factor in failure to conceive or in recurrent pregnancy loss (646.3)

Confirmation of Indication:

In the presence of failure to conceive or recurrent pregnancy loss:

1. Presence of leiomyomata of sufficient size or specific location to be a probable factor
2. No more likely explanation exists for failure to conceive or recurrent pregnancy loss

Actions Prior to Procedure:

1. Evaluate other causes of male and female infertility or recurrent pregnancy loss
2. Evaluate the endometrial cavity and fallopian tubes, eg, hysterosalpingogram
3. Document discussion that complexity of disease process may require hysterectomy

Unless otherwise stated, **each** numbered and lettered item **must** be present.

Evaluation of the quality of care provided with this procedure, when performed for the indication listed, will be possible through assessment of ongoing or repetitive patterns of care (“trending”).

Modified from American College of Obstetricians and Gynecologists. Quality assessment and improvement in obstetrics and gynecology. Washington, DC:ACOG, 1994

TABLE 2

ACOG CRITERIA FOR MYOMECTOMY IN PATIENTS DESIRING TO RETAIN UTERUS

Procedure:

Myomectomy* (68.29) (CPT Codes 56309 [laparoscopy with removal of leiomyomata], 58140 [abdominal approach], or 58145 [vaginal approach]

Indication:

Leiomyomata (218.0-218.9) for patients desiring to retain uterus

Confirmation of Indication:

Presence of 1 or 2

1. Asymptomatic leiomyomata of such size that they are palpable abdominally and are a concern to the patient
2. Ovulatory patients with leiomyomata as probable cause of excessive uterine bleeding

evidenced by either of the following:

a. Profuse bleeding with flooding or clots or repetitive periods lasting for more than 8 days

b. Anemia due to acute or chronic blood loss

Actions Prior to Procedure:

1. Confirm by cytologic study the absence of cervical malignancy

2. Eliminate anovulation and other causes of abnormal bleeding

3. When abnormal bleeding is present with ovulatory cycles, assess for submucous fibroid by dilation and curettage, hysteroscopy, or imaging technique

4. Assess surgical risk from anemia and need for treatment

5. Discuss with patient the advantages and disadvantages of myomectomy versus hysterectomy and document

Unless otherwise stated, **each** numbered and lettered item **must** be present.

Evaluation of the quality of care provided with this procedure, when performed for the indication listed, will be possible through assessment of ongoing or repetitive patterns of care ("trending").

Modified from American College of Obstetricians and Gynecologists. Quality assessment and improvement in obstetrics and gynecology. Washington, DC:ACOG, 1994

TABLE 3

ACOG CRITERIA FOR HYSTERECTOMY FOR LEIOMYOMATA

Procedure:

Hysterectomy, abdominal or vaginal*

Indication:

Leiomyomata

Confirmation of Indication:

Presence of 1 or 2 or 3

1. Asymptomatic leiomyomata of such size that they are palpable abdominally and are a concern to the patient

2. Excessive uterine bleeding evidenced by *either* of the following:

a. Profuse bleeding with flooding or clots or repetitive periods lasting more than 8 days

b. Anemia due to acute or chronic blood loss

3. Pelvic discomfort caused by myomata (a or b or c)

a. Acute and severe

b. Chronic lower abdominal or low back pressure

c. Bladder pressure with urinary frequency not due to urinary tract infection.

Actions Prior to Procedure:

1. Confirm the absence of cervical malignancy

2. Eliminate anovulation and other causes of abnormal bleeding

3. When abnormal bleeding is present, confirm the absence of endometrial malignancy

4. Assess surgical risk from anemia and need for treatment

5. Consider patient's medical and psychologic risks concerning hysterectomy

Contraindication:

1. Desire to maintain fertility, in which case myomectomy should be considered

2. Asymptomatic leiomyomata of size less than 12 weeks' gestation determined by physical examination or ultrasound examination

Unless otherwise stated, **each** numbered and lettered item (except contraindications) **must** be present.

Evaluation of the quality of care provided with this procedure, when performed for indications 2 and 3, will be possible through assessment of ongoing or repetitive patterns of care ("trending").

Modified from American College of Obstetricians and Gynecologists. Quality assessment and improvement in obstetrics and gynecology. Washington, DC:ACOG, 1994