Recent Advances in Laparoscopic Hysterectomy and Pelvic Floor Reconstruction

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What role could laparoscopy possibly play in treatment of uterine disorders and pelvic floor relaxation? The basic principle that laparoscopy is a mode of access, not a mode of treatment, must be emphasized. Statements such as "laparoscopic treatment of genuine stress urinary incontinence" are misleading because they imply that laparoscopy is a treatment modality, which it isn't. Laparoscopy provides only access to the anatomical area. Theoretically any procedure classically done at laparotomy, can be done under laparoscopic control. Is executing such procedures self gratification for the surgeon or a benefit for the patient? No doubt, procedures performed under laparoscopic control require more surgical skill. The benefits for the patient are reduced need for analgesia, which means that the procedure is significantly less painful, less postoperative ileus, reduced length of hospital stay, and finally, reduced cost to society through both direct and indirect savings. The fact that the procedure is less painful is reason enough to eliminate laparotomy in favor of laparoscopy: "Dolor per primam" is part of Hippocrates' oath.

Laparoscopic Hysterectomy

Laparoscopic hysterectomy, defined as removal of the uterus after laparoscopic ligation of its four major vascular pedicles, is an alternative to abdominal hysterectomy without the incision and with more precise attention to ureteral identification.[1,2,3,4] First performed in January, 1988,[5] laparoscopic hysterectomy (LH) stimulated general interest in the laparoscopic approach to hysterectomy, especially laparoscopic assisted vaginal hysterectomy (LAVH)in which the upper pedicles only are secured. LAVH has become an expensive procedure, and skilled vaginal surgeons will rarely find an indication for its use. LH remains a reasonable substitute for abdominal hysterectomy.

Definitions

There are a variety of procedures for which the laparoscope is useful as an aid to hysterectomy (Table 1). It is important that these different procedures be clearly delineated:

Diagnostic laparoscopy with vaginal hysterectomy is the use of the laparoscope for *diagnostic* purposes when indications for a vaginal approach are equivocal, to determine if *vaginal hysterectomy* is possible.[6] It also assures that vaginal cuff and pedicle hemostasis are complete and allows clot evacuation.

Laparoscopic assisted vaginal hysterectomy (LAVH) is a vaginal hysterectomy after laparoscopic adhesiolysis, endometriosis excision, or oophorectomy.[7,8,9] Unfortunately, this term is also used for stapling of the upper uterine blood supply of a relatively normal uterus. It must be emphasized that in most cases the easy part of both abdominal and vaginal hysterectomy is upper pedicle ligation.

Laparoscopic hysterectomy (LH) denotes laparoscopic ligation of the uterine arteries either by electrosurgery desiccation, suture ligature, or staples. All maneuvers after uterine vessel ligation can be done vaginally or laparoscopically, including anterior and posterior vaginal entry, cardinal and uterosacral ligaments division, uterine removal intact or by morcellation, and vaginal closure vertically or transversely. Laparoscopic ligation of the uterine vessels is the *sine qua non* for laparoscopic hysterectomy. Ureteral isolation has always been advised.

Total laparoscopic hysterectomy (TLH) *is a laparoscopic-assisted abdominal hysterectomy.* Laparoscopic dissection continues until the uterus lies free of all attachments in the peritoneal cavity. The uterus is removed through the vagina with morcellation if necessary. The vagina is closed with laparoscopically placed cuff suspension sutures.

Laparoscopic supracervical hysterectomy (LSH) has recently regained advocates after suggestions that total hysterectomy results in a decrease in libido.[10] The uterus is removed by morcellation from above or below.

Laparoscopic Hysterectomy Classification:

1. Diagnostic laparoscopy with vaginal hysterectomy
2. Laparoscopic assisted vaginal hysterectomy (LAVH)
3. Laparoscopic hysterectomy (LH)
4. Total laparoscopic hysterectomy (TLH)
5. Laparoscopic supracervical hysterectomy (LSH) - including CISH (Classical Interstitial Semm Hysterectomy)
6. Vaginal hysterectomy with laparoscopic vault suspension (LVS) or laparoscopic pelvic reconstruction (LPR)
7. Laparoscopic hysterectomy with lymphadenectomy
8. Laparoscopic hysterectomy with lymphadenectomy and omentectomy
9. Laparoscopic radical hysterectomy with lymphadenectomy

Table 1.

Kurt Semm's version of supracervical hysterectomy, called the CISH procedure (Classical Interstitial Semm Hysterectomy), leaves the cardinal ligaments intact while eliminating the columnar cells of the endocervical canal. After perforating the uterine fundus with a long sound-dilator, a calibrated uterine resection tool (CURT) that fits around this instrument is used to core out the endocervical canal. Thereafter, laparoscopic suture techniques are used to ligate the utero-ovarian ligaments. An Endoloop is placed around the uterine fundus to the level of the internal os of the cervix and tied. The uterus is divided at its junction with the cervix and removed by laparoscopic morcellation.

Laparoscopic pelvic reconstruction (LPR) with vaginal hysterectomy is useful when vaginal hysterectomy alone cannot accomplish appropriate repair for prolapse. Ureteral dissection and suture placement before the vaginal hysterectomy aid in high uterosacral ligament identification and plication near the sacrum. Levator muscle plication from below or above is often necessary. Retropubic colposuspension can also be done laparoscopically.

Indications

Indications for laparoscopic hysterectomy include benign pathology such as endometriosis, fibroids, adhesions, and adnexal masses usually requiring the selection of an abdominal approach to hysterectomy. It is also appropriate when vaginal hysterectomy is contraindicated because of a narrow pubic arch, a narrow vagina with no prolapse, or severe arthritis that prohibits placement of the patient in sufficient lithotomy position for vaginal exposure. Laparoscopic procedures in obese women allow the surgeon to make an incision above the panniculus and operate below it. Laparoscopic hysterectomy may also be considered for stage I endometrial, ovarian, and cervical cancer.[11,12,13] Pelvic reconstruction procedures including cuff suspension, retropubic colposuspension, and enterocele and rectocele repair may be accomplished through the laparoscope.

The most common indication for laparoscopic hysterectomy is a symptomatic fibroid uterus. Fibroids fixed in the pelvis or abdomen without descent are easier to mobilize laparoscopically. Morcellation is often necessary and is done vaginally using a scalpel rather than by cumbersome laparoscopic morcellators. Uterine size and weight measure-

ments are important to document the appropriateness of laparoscopic hysterectomy, since most small uteri can be removed vaginally. The normal uterus weighs 70-125 g. A 12-week gestational age uterus weighs 280-320 g, a 24-weeks uterus weighs 580-620 g, and a term uterus weighs 1,000-1,100 g.

Hysterectomy should not be done for stage IV endometriosis with extensive cul-de-sac involvement unless the surgeon has the ability and the time to resect all deep fibrotic endometriosis from the posterior vagina, uterosacral ligaments, and anterior rectum. Excision of the uterus using an intrafascial technique leaves the deep fibrotic endometriosis behind to cause future problems. It is much more difficult to remove deep fibrotic endometriosis when there is no uterus between the anterior rectum and the bladder; after hysterectomy, the endometriosis left in the anterior rectum and vaginal cuff frequently becomes densely adherent or invades into the bladder and one or both ureters. In many cases of stage IV endometriosis with extensive cul-de-sac obliteration, it is better to preserve the uterus to prevent future vaginal cuff, bladder, and ureteral problems.[14] Obviously, this approach will not be effective when uterine adenomyosis is present. In these cases, after excision of cul-de-sac endometriosis, persistent pain will lead ultimately to hysterectomy. Oophorectomy is not necessary at hysterectomy if the endometriosis is carefully removed. Surgical castration is rarely indicated in women under age 40 undergoing hysterectomy for endometriosis.

Hysterectomy is often done for abnormal uterine bleeding in women of reproductive age. A negative effect on quality of life should be documented. Hormone treatment is attempted before hysterectomy, and its failure, contraindication, or refusal is documented. The presence of anemia is recorded and correction attempted. If hysterectomy is chosen, a vaginal approach is usually appropriate. Laparoscopic hysterectomy is done when vaginal hysterectomy is not possible, including history of previous surgery, lack of prolapse (nulliparous or multiparous), or inexperience of the operator with the vaginal approach.

Contraindications

Laparoscopic hysterectomy is not advised for the diagnosis and treatment of a pelvic mass that is too large to fit intact into an impermeable sack. The largest available sack for removal of intraperitoneal masses is the LapSac (Cook Ob/Gyn, Spencer, IN), which measures 11 x 10 inches. While cyst aspiration is advocated by some investigators,[15] this author feels that postmenopausal cystic ovaries should not be subjected to fluid aspiration before oophorectomy because the inevitable spillage would change a stage Ia ovarian cancer to a stage Ic. Its effect on survival is unknown, but it may be detrimental. It must be emphasized that small gauge needles, placement through thickened portions of the ovary, and cyst aspiration devices with surrounding suction and endoloop placement (Cook) do not prevent spillage. Ovaries should be removed intact through a culdotomy incision.[16]

The medical status of the patient may prohibit surgery. Anemia, diabetes, lung disorders, cardiac disease, and bleeding diathesis must be evaluated prior to surgery. Age should rarely be a deterrent.

Cesarean hysterectomy is an absolute contraindication. Peripartum hysterectomy for placenta accreta, uterine atony, unspecified uterine bleeding, and uterine rupture are relative contraindications at present. Laparoscopic hysterectomy may be considered for patients needing a postpartum hysterectomy.

Another contraindication is stage III ovarian cancer which requires a large abdominal incision. Finally, inexperience of the surgeon is a contraindication to the laparoscopic approach.

Equipment

Expensive disposable instrument usage must be kept to a minimum. There is a French word, **bricolage**, which means making due with the material at hand. In the popular TV series "MacGyver", the power of bricolage is symbolized by the resourceful hero who saves the world with a minimum of raw materials and a couple of clever tricks. The gifted surgeon can take the least expensive available tools in the operating room and do better than others can using expensive disposable instruments. The artistic attitude which involves a healthy dose of bricolage frees the surgeon to see the possibilities of taking an ordinary instrument and making it extraordinary.

High flow CO_2 insufflation up to 10-15 L/min is necessary to compensate for the rapid loss of CO_2 during suctioning. The ability to maintain a relatively constant intra-abdominal pressure between 10 and 15 mm Hg during laparoscopic hysterectomy is essential. Gasless laparoscopy with abdominal wall retractors to minimize subcutaneous emphysema during retroperitoneal surgery may compromise peritoneal cavity operating space. A useful technique is to insert a Laparolift anterior abdominal wall retractor (Origin Medsystems, Menlo Park, CA) once the vagina is opened to maintain working space without CO_2 insufflation.

Operating room tables capable of 30° Trendelenburg's position are extremely valuable for laparoscopic hysterectomy. Unfortunately these tables are rare, and this author has much difficulty operating when only a limited degree of body tilt can be attained. For the past 16 years steep Trendelenburg's position (20°-40°), with shoulder braces and the arms at the patient's sides, has been used without adverse effects.

A uterine mobilizer (Valtchev, Conkin Surgical Instruments, Toronto, Canada or Blairden, Kansas City, KS) is inserted to antevert the uterus and delineate the posterior vagina.[17] When this device is in the anteverted position, the cervix sits on a wide acorn making the cervico-vaginal junction readily visible between the uterosacral ligaments when the cul-de-sac is inspected laparoscopically. A rectal probe (Reznik Instruments, Skokie, IL) is placed in the rectum to define the rectum and posterior vagina to excise endometriosis or to open the posterior vagina (culdotomy). Whenever rectal location is in doubt, it is identified by placing a probe.

Trocar sleeves are available in many sizes and shapes. For most cases, 5.5 mm cannulas are adequate.[18] Disposable stapling instruments are rarely used for large vessel hemostasis during laparoscopic hysterectomy, and, thus, 12/13 mm trocar sleeves are not necessary.

Bipolar forceps use high-frequency low-voltage cutting current (20-50 W) to coagulate vessels as large as the ovarian and uterine arteries. The Kleppinger bipolar forceps (Richard Wolf Medical, Inc.) 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.

Disposable stapling instruments are rarely used during laparoscopic hysterectomy because of their expense. Suture and/or bipolar desiccation work better.

Suturing

Suture application is made easy by not using needles. The vessel or pedicle to be ligated is isolated by dividing and separating surrounding peritoneum and connective tissue. The suture can then be placed around the pedicle with a grasping forceps, preferably one with a curved end. Suture tying is best accomplished by making the knots with the surgeon's hands outside the body (extracorporeal) and pushing or slipping the knot down to the pedicle.

An excellent technique for laparoscopic extracorporeal tying was developed in 1971 by Dr. H. Courtenay Clarke using a knot-pusher (Marlow Surgical, Willoughby, OH) to tie in a manner very similar to the way one would hand-tie suture at laparotomy.[19] This device is like an extension of the surgeon's fingers. The surgeon applies the suture around the skeletonized pedicle, pulls the loose end outside, and then, while holding both strands, makes a simple half-hitch; a surgeon's knot will not slide as well. 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 pedicle. The second throw is made in the same direction, i.e., a slip knot while exerting tension from above to further secure the tissue. A square knot is made with the third and fourth throws by pushing half-hitchs made in opposing fashion down to the knot to secure it firmly. To suture with a straight needle, the same technique is used.

Extracorporeal tying is facilitated by using a trocar sleeve without a trap to avoid difficulty slipping knots down to the tissue. A short trocar sleeve that doesn't protrude far into the peritoneal cavity, has a screw grid for retention, and has no trap, is ideal.[13] Both a reusable (Richard Wolf Medical, Inc.), and a disposable version (Apple Medical) 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 requires a technique to put them into the peritoneal cavity without a large incision, i.e., through a 5 mm lower quadrant incision.[20] The lower abdominal incisions placed lateral to the rectus muscle insure an obvious tract upon removing the trocar sleeve which 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 sleeve 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 about 2-3 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 reinserted over the driver. At this stage, the straight needle driver is replaced with a oblique curved needle driver (Cook OB/GYN, Spencer, IN), and the needle applied around vascular pedicles or through fascia. 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 pulled out of the peritoneal cavity; the knot is then tied with the Clarke knotpusher. 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.

The Endoloop is a pre-formed knotted loop designed to fit over vascular pedicles and then be tightened. Over the last 15 years, this author has used it for appendectomies and omentectomies, but never for oophorectomy. Bipolar desiccation or the suture ligature method just described works better.

TECHNIQUES

Preoperative Preparation

Laparoscopy is performed prior to ovulation if possible. Norethindrone acetate, 10 mg daily, or depoleuprolide (Depo-Lupron), 3.75 mg I.M. monthly, may be administered starting before or during menses until surgery for large myomas. GnRH analogs may reduce the total uterine and leiomyoma volumes, making laparoscopic or vaginal hysterectomy easier.[21,22] During treatment with depoleuprolide for 3 to 6 months, anemia secondary to hypermenorrhea resolves, and autologous blood donation can be considered prior to laparoscopic hysterectomy.

Patients are encouraged to hydrate and eat lightly for 24 hours before admission on the day of surgery. Magnesium citrate and a Fleet's enema are routinely administered the evening before surgery to evacuate the lower bowel. When extensive cul-de-sac involvement with endometriosis is suspected, a mechanical bowel prep is ordered (Polyethylene glycol-based isosmotic solution: Golytely or Colyte). Lower abdominal, pubic, and perineal hair is not shaved. A Foley catheter is inserted during surgery and removed the next morning. Antibiotics are administered before all cases.

Positioning of the Patient

Under general endotracheal anesthesia, surgery is performed in the lithotomy position with an orogastric tube inserted to minimize bowel distension. The patient is flat (0°) until after the umbilical trocar sleeve has been inserted and then placed in steep Trendelenburg's position (20°-30°). 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 always performed prior to prepping the patient. A Foley catheter is inserted when the bladder becomes distended. Self-retaining lateral vaginal wall retractors or Vienna retractors (Brisky-Navatril) are used when vaginal uterine extraction is anticipated. With large fibroids, the stirrups are replaced with candy-cane stirrups for the vaginal part in order to obtain better hip flexion so that vaginal sidewall retractors can be used.

Laparoscopy was never thought to be a sterile procedure before the incorporation of video, as the surgeon operated with his head in the surgical field, attached to the laparoscopic optic. It is not possible to sterilize skin. Since 1983, this author has maintained a policy of not sterilizing or draping the camera or laser arm. Infection has been rare. 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

loosely approximated 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.

Total Laparoscopic Hysterectomy Technique

Laparoscopic hysterectomy using suture ligation of the uterine vessels is my method of choice and will be described. Suturing adds safety, as the risk of ureteral injury is reduced and the risk of thermal damage is eliminated.

Incisions

Three laparoscopic puncture sites including the umbilicus are used: 10 or 12 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. This author's 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.

The intraumbilical incision overlies the area where skin, deep fascia, and parietal peritoneum of the anterior abdominal wall meet, permitting little opportunity for the parietal peritoneum to tent away from the Veress needle and primary trocar. This vertical midline incision is made initially with a #15 blade (never a #11) on the inferior wall of the umbilical fossa extending to and just beyond its bottom. In thin patients, this incision frequently traverses the deep fascia, but intraperitoneal injury is avoided by using the thumb to pull the umbilicus onto the surgeon's forefinger, a maneuver which controls the incision's depth. Following CO_2 insufflation to an intraabdominal pressure of 25-mm Hg, the trocar is seated vertically just inside the skin in the fascial dimple stuck to peritoneum prior to a 45° thrust. The result is a parietal peritoneal puncture directly beneath the umbilicus. The high pressure setting used during initial insertion of the trocar is lowered thereafter to diminish the development of vena caval compression and subcutaneous emphysema. A relatively constant 10-15 mm Hg intra-abdominal pressure is maintained during long laparoscopic procedures.

Special entry techniques are necessary in patients who have undergone multiple laparotomies, who have lower abdominal incisions traversing the umbilicus, or who have extensive adhesions either clinically or from a previous surgery. Open laparoscopy or microlaparotomy carry the same risk for bowel laceration if the bowel is fused to the umbilical undersurface. In these cases, Veress needle puncture is done in the left ninth intercostal space, anterior axillary line. Adhesions are rare in this area, and the peritoneum is tethered to the undersurface of the ribs, making subcutaneous insufflation unusual. A disposable Veress needle is grasped near its tip, like a dart, between thumb and forefinger. The needle tip is then inserted at right angles to the skin, but at a 45° angle to the horizontal anterior abdominal wall between the ninth and tenth ribs. A single pop is felt on penetration of the peritoneum. Pneumoperitoneum to a pressure of 20-25 mm Hg is obtained. A 5 or 10 mm trocar is then inserted at the left costal margin in the midclavicular line, giving a panoramic view of the entire peritoneal cavity.[1,23,24]

After reducing the intraabdominal pressure to 15-mm Hg, the lower quadrant trocar sleeves are placed just above the pubic hairline and lateral to the rectus abdominis muscle located by direct laparoscopic inspection of the anterior abdominal wall. When the anterior abdominal wall parietal peritoneum is thickened from previous surgery or obesity, the position of the muscle is judged by palpating and depressing the anterior abdominal wall with the back of the scalpel; the wall will appear thicker where rectus muscle is enclosed The incision made with a #11 blade should be lateral to this area near the anterior superior iliac spine.

Exploration

The upper abdomen is inspected, and the appendix is identified. If appendiceal pathology is present, i.e., dilatation, adhesions, or endometriosis, appendectomy is performed after ureteral isolation by mobilizing the appendix, desiccating its blood supply, and placing three Endoloops [Endoloop (chromic gut ligature), Ethicon, Somerville, NJ] at the appendiceal-cecal junction after desiccating the appendix just above this juncture. The appendix is left attached to the cecum; its stump is divided later in the procedure, after opening the cul-de-sac, so that removal from the peritoneal cavity is accomplished immediately after separation.

Ureteral dissection

Immediately after exploration of the upper abdomen and pelvis (Figure 1), each ureter is isolated deep in the pelvis, if possible. This is done early in the operation, before the pelvic sidewall peritoneum becomes edematous and/or opaque from irritation by the CO_2 pneumoperitoneum or aquadissection, and before ureteral peristalsis is inhibited by surgical stress, pressure, or the Trendelenburg's position. The ureter and its overlying peritoneum are

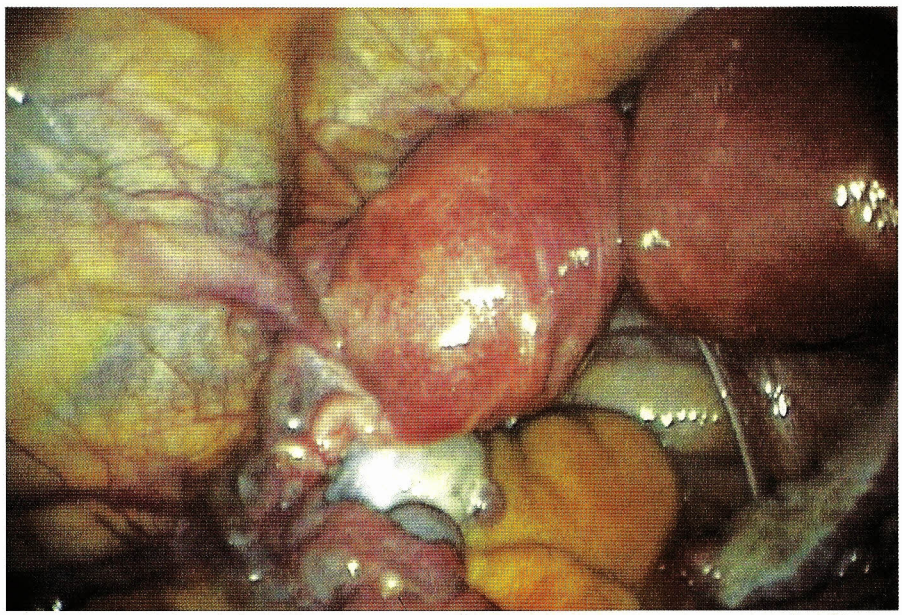

Figure 1. Double uterus (uterine didelphys is seen). Transplanted kidney is also visible on the left side of this slide.

grasped deep in the pelvis on the left below the lateral rectosigmoid attachments at the pelvic brim. An atraumatic grasping forceps is used from a right sided cannula to grab the ureter and its overlying peritoneum on the left pelvic sidewall below and caudad to the left ovary, lateral to the left uterosacral ligament. Scissors are used to divide the peritoneum overlying the ureter, and are inserted into the defect created and spread. Thereafter one blade of the scissors is placed on top of the ureter, the buried scissors blade is visualized through the peritoneum, and the peritoneum is divided. This is continued into the deep pelvis where the uterine vessels cross the ureter, lateral to the cardinal ligament insertion into the cervix. Connective tissue between the ureter and the vessels is separated with scissors. Bleeding is controlled with microbipolar forceps. Often, the uterine vessel ligation procedure below is accomplished at this time to diminish back bleeding from the upper pedicles.

In difficult cases involving a retroperitoneal ovary, a lateral approach is selected. The triangle of the pelvic sidewall is delineated by displacing the uterus to the contralateral side. The base of this triangle is formed by the round ligament, the lateral border by the external iliac artery, the medial border by the infundibulopelvic ligament, and the apex by where the infundibulopelvic ligament crosses the common iliac artery. The peritoneum in the middle of the triangle is incised with dissecting scissors and the broad ligament opened by bluntly separating the extraperitoneal areolar tissues. The infundibulopelvic ligament is pulled medially with grasping forceps to expose the ureter at the pelvic brim where it crosses the common or external iliac artery. It may be necessary to reflect the ureter off the medial leaf of the broad ligament for a short distance to aid in its identification, although this is not always required. The dissection of the apex is more difficult on the left side partly because the ureter is covered by the mesentery of the sigmoid colon, but mainly because it crosses the iliac vessels higher, and consequently lies more medial than the right ureter.

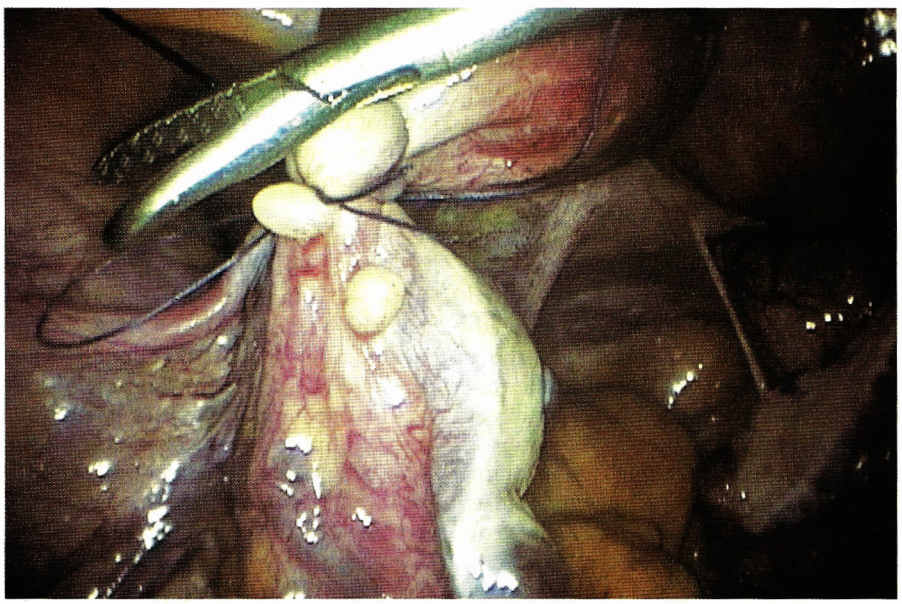

Figure 2. The left infundibulopelvic ligament is ligated with 2-0 Vicryl on stick ties. Two proximal and one distal suture is placed.

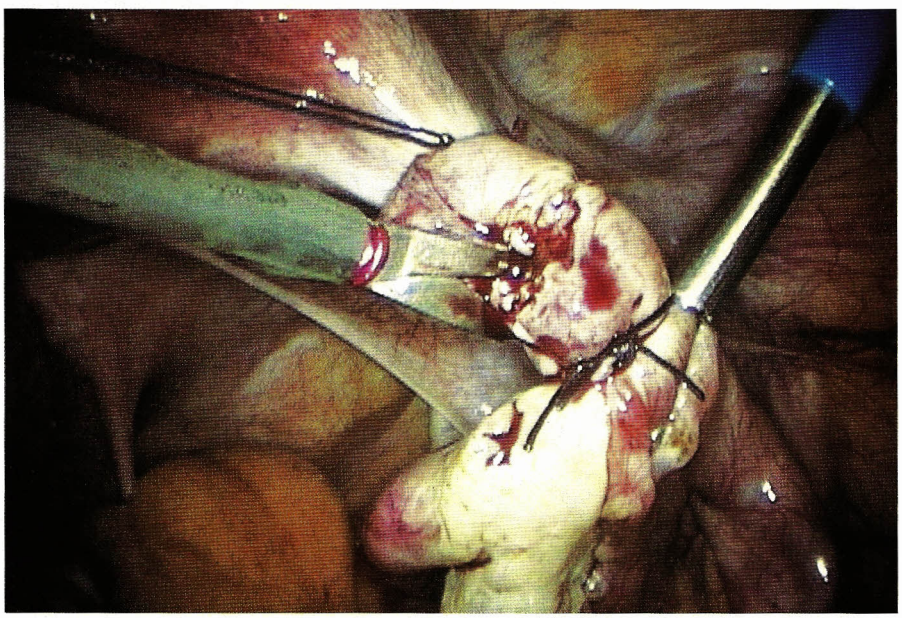

Figure 3. Similarly the right uteroovarian ligament is ligated and divided with scissors.

The dissection is carried bluntly underneath and caudad to the round ligament, until the obliterated hypogastric artery is identified extraperitoneally and traced retrogradely to the origin of the uterine artery. The pararectal space is opened by blunt dissection proximal and medial to the uterine vessels, which lie on top of the cardinal ligament. Once the pararectal space is opened, the ureter is easily identified on the medial leaf of the broad ligament, which forms the medial border of the pararectal space. The uterine artery and cardinal ligament at the distal (caudal) border of the space, and the internal iliac artery on its lateral border also become clearly visible. The uterine artery can easily be ligated at this time.

Bladder mobilization

The round ligaments are divided at their midportion using a spoon electrode (Electroscope) at 150 W cutting current with minimal bleeding. Persistent bleeding is controlled with monopolar fulguration (fulguration is the non-contact application of high voltage coagulation current) at 80 W coagulation current or bipolar desiccation at 30 W cutting current . Thereafter scissors or the same electrode are used to divide the vesicouterine peritoneal fold starting at the left side and continuing across the midline to the right round ligament. The bladder is mobilized off the uterus and upper vagina using scissors or the same spoon electrode until the anterior vagina is identified by elevating it from below with ring forceps.

Upper uterine blood supply

When ovarian preservation is desired, the utero-ovarian ligament and

fallopian tube pedicle are suture ligated adjacent to the uterus with 2/0-Vicryl. When ovarian preservation is not desired, the infundibulopelvic ligament vessels are ligated after skeletonization and then divided (Figures 2 and 3).

Uterine vessel ligation

The broad ligament on each side is skeletonized down to the uterine vessels. Each uterine vessel pedicle is suture ligated with 0-Vicryl on a CT-1 needle (27"). The needles are introduced into the peritoneal cavity (Figure 4) by pulling them through a 5 mm incision.[20] The curved needle is inserted on top of the unroofed ureter where it turns medially towards the previously mobilized bladder. A short rotary movement of the Cook oblique curved needle holder brings the needle around the uterine vessel pedicle. Sutures are tied extracorporeally using a Clarke knot pusher.[19] A single suture placed in this manner on each side serves as a "sentinel stitch," identifying and watching over the ureter for the rest of the case. In many cases, the uterine vessels are suture ligated as they ascend the sides of the uterus.

Circumferential culdotomy (Division of cervicovaginal attachments)

The cardinal ligaments on each side are divided with the CO_2 laser at high power (80 W) or with the spoon electrode at 150 W cutting current (Figure 5). Often, bipolar forceps are necessary to control bleeding. The vagina is entered posteriorly over the Valtchev retractor near the junction of cervix with vagina. A ring forceps inserted into the anterior vagina above the tenaculum on the anterior cervical lip identifies the anterior cervicovaginal junction, which is entered using the laser. Following the ring forceps or the aquapurator tip, and using them as backstops, the lateral vaginal fornices are divided. The uterus is morcellated if necessary and pulled out of the vagina. (Figures 6 and 7) Alternately, a 4 cm diameter vaginal delineator (Richard Wolf medical, Inc.) is used to outline circumferentially the cervicovaginal junction; it also serves as a backstop for laser work and prevents loss of pneumoperitoneum.

Laparoscopic vaginal vault closure and suspension with McCall culdoplasty

Vaginal repair is accomplished after filling the vagina with the vaginal delineator. The left uterosacral ligament and posterolateral vagina are first elevated. A suture is placed through this uterosacral ligament into the vagina, exits the vagina including posterior vaginal tissue near the midline on the left, reenters on the right, and finally, is used to fixate the right posterolateral vagina to the right uterosacral ligament. This suture is tied extracorporeally and gives excellent support to the vaginal cuff apex, elevating it superiorly and posteriorly toward the hollow of the sacrum. The rest of the vagina and overlying pubocervical fascia are closed vertically with a figure of 8 suture. In most cases the peritoneum is not closed.

Underwater examination

At the close of each operation, an underwater examination is used to detect bleeding from vessels and viscera tamponaded during the procedure by the increased intraperitoneal pressure of the CO_2 pneumoperitoneum. The CO_2 pneumoperitoneum is displaced with 2-5 L of Ringer's lactate solution, and the peritoneal cavity is vigorously irrigated and suctioned until the effluent is clear of blood products. Any further bleeding is controlled underwater using microbipolar forceps to coagulate through the electrolyte solution, and at least 2 L of lac-

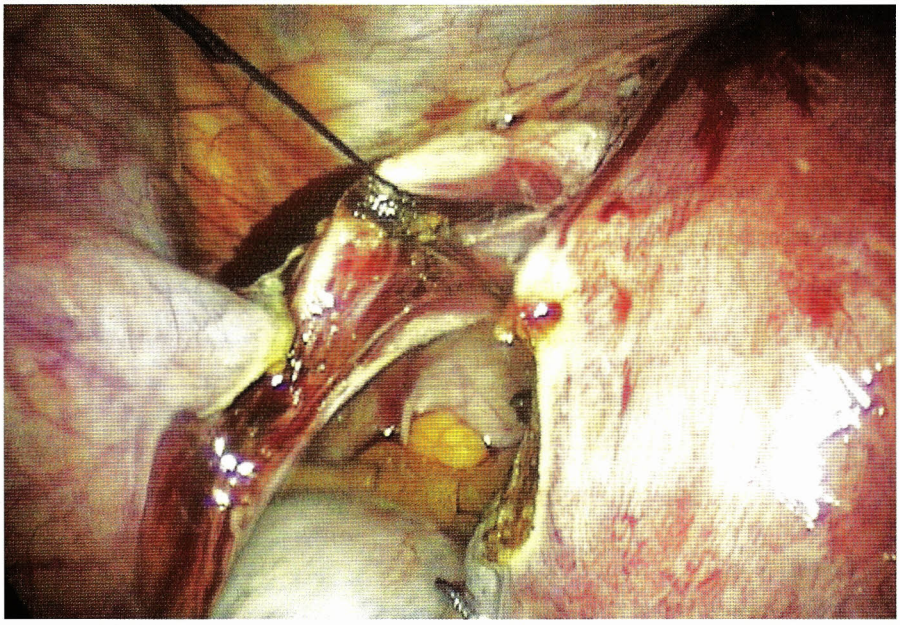

Figure 4. The left uterine artery is skeletonized and then suture ligated with 0 Vicryl.

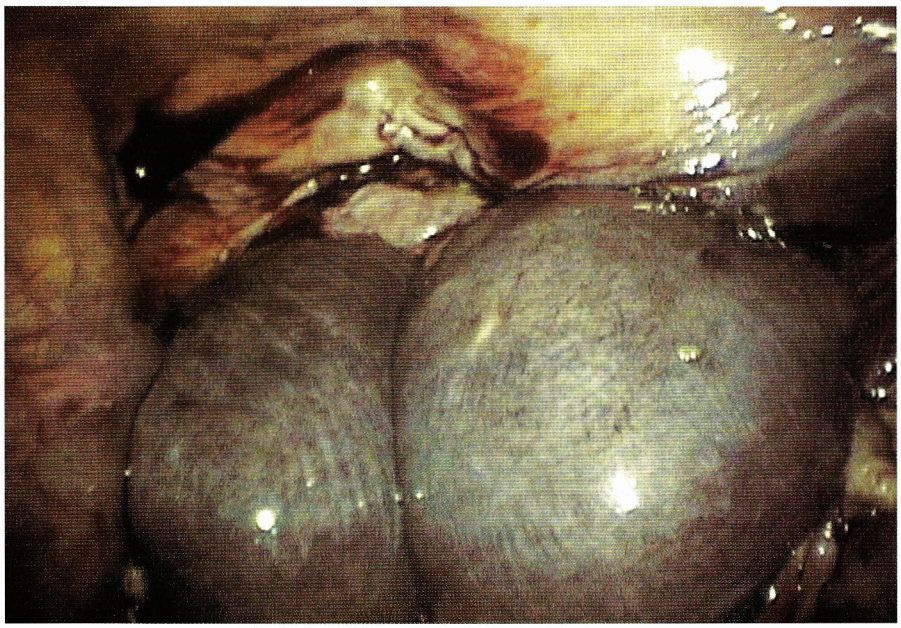

Figure 5. The devascularized uterus is evident after all of its blood supply has been ligated. Following separation from the vagina, it will be pulled out through it.

tated Ringer's solution are left in the peritoneal cavity.[25]

Postoperative considerations

Postoperatively, the vaginal cuff is checked for granulation tissue between six and 12 weeks, as sutures are usually absorbed by then. Patients usually experience some fatigue and discomfort for approximately three to six weeks after the operation, but may perform gentle exercise such as walking and return to routine activities between two and six weeks. Sexual activity may be resumed when the vaginal incision has healed, usually after six weeks.

Laparoscopic Hysterectomy Classifications

Diagnostic laparoscopy with vaginal hysterectomy (TVH)	16
Laparoscopic assisted vaginal hysterectomy (LAVH)	19
Laparoscopic hysterectomy (LH)	44
Total laparoscopic hysterectomy (TLH)	118
Laparoscopic supracervical hysterectomy (LSH)	3
TLH for pelvic reconstruction	5
Laparoscopic hysterectomy with lymphadenectomy	5
Laparoscopic hysterectomy w/ lymphadenectomy and omentectomy	4
Laparoscopic radical hysterectomy with lymphadenectomy	4
TOTAL	**218**

Table 2.

Indications for Laparoscopic Hysterectomy

Fibroid uterus	114
hypermenorrhea	52
hypermenorrhea and pain	29
pelvic mass without hypermenorrhea and pain	19
pelvic pain	11
early hydroureter	2
severe cervical dysplasia	1
Persistent symptomatic endometriosis	38
Hypermenorrhea	17
Pelvic pain and hypermenorrhea	13
Pelvic pain	12
Endometrial cancer	8
Ovarian cancer	4
Cervical cancer	4
Uterine prolapse	4
Adenomatous hyperplasia	3
Severe cervical dysplasia	1

Table 3.

COMPLICATIONS

Complications of laparoscopic hysterectomy are those of hysterectomy and laparoscopy in general: anesthetic accidents, respiratory compromise, thromboembolic phenomenon, urinary retention, injury to vessels, ureters, bladder, and bowel, and infections, especially of the vaginal cuff.[26] Complications unique to laparoscopy include large vessel injury and subcutaneous emphysema. Since the introduction of prophylactic antibiotics, vaginal cuff abscess, pelvic thrombophlebitis, septicemia, pelvic cellulitis, and adnexal abscesses are rare. Abdominal wound infection is rare, but the incidence of incisional hernias after operative laparoscopy is greatly increased 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.

Febrile morbidity with a vaginal approach is about half that of abdominal hysterectomy. Laparoscopic treatment with evacuation of all blood clots and the sealing of all blood vessels after the uterus is out should reduce the infection rate further. Morcellation during laparoscopic or vaginal hysterectomy results in a slightly increased risk of fever, especially if prophylactic antibiotics are not used. Disposable stapling instruments are rarely used for large vessel hemostasis during laparoscopic hysterectomy because of their expense and propensity for hematoma formation.

RESULTS

Between April 1983 and February 1994, 263 hysterectomies were performed. Of these, 218 women underwent a hysterectomy in association with laparoscopy (Table 2), 26 women had total vaginal hysterectomy and 19 women had total abdominal hysterectomy. No abdominal hysterectomies have been performed for benign conditions since July 1987.

Patient age ranged from 30-79 years with an average age of 46. Weight ranged from 48 to 113.5 kg. with an average of 65.3. Fifty-four women with fibroids were premedicated with Depot Lupron and 5 with Synarel. Autologous blood was given prophylactically in 52

women. Cefoxitin sodium or cefotaxime sodium was administered routinely in a single, 2 g dose intravenously at the start of the case.

Histologic diagnoses are listed in Table 4. Average weight of specimen was 236 g with a range of 18-1218 g. Fifteen specimens exceeded 500 g. Operating time ranged from 45 to 370 min with an average of 3 hours. Blood loss averaged 100 ml. Of 86 women who underwent oophorectomies, 54 had surgical castration and 32 had preservation of one ovary. Additional procedures included: vaginal suspension (150), cul-de-sac dissection (36), enterolysis (34), appendectomy (4), Burch procedure (4), excision of rectal nodule (3), rectocele/enterocele repair (3), repair of umbilical hernia (2), repair of inquinal hernia (2), repair of incisional hernia (2), low anterior rectal resection (1), vesicle neck suspension (1), and excision of breast papilloma (1). Length of stay ranged from 1 to 5 days with an average of 2 days.

Conversion to laparotomy was required in two cases: one after laparoscopic repair of four enterotomies; this patient had extensive adhesions from multiple prior surgeries and the other because of cul-de-sac obliteration with a large cervical fibroid in a 750 g uterus. Complications managed laparoscopically were laceration of the bladder (3), epigastric artery (2), and bowel (1). Ninth intercostal space insufflation was used in 10 cases; the Laprolift (Origin) was employed in 4 cases.

There was one rectovaginal fistula requiring colostomy after conservative management failed; this was reversed 3 months later. Three ureterovaginal fistulas occurred: one sealed after stent placement, but required later repair for stricture, another required reimplantation and the third healed after stent placement. Two delayed postoperative complications were amenable to laparoscopic repair: a peritoneo-vaginal fistula and an incisional hernia at the right lower quadrant 12-mm puncture site.

One woman had a pulmonary embolism 1 week post-surgery and required a 1-week hospital stay. One had pneumothorax that responded to thoracentesis. One was readmitted for partial small bowel obstruction that responded to IV hydration and bowel rest. One woman developed a vaginal cuff hematoma that resolved spontaneously. Two woman required unanticipated blood transfusion. Additionally, there were four cases of febrile morbidity, one urinary tract infection, and one woman had urinary retention requiring a catheter on discharge.

PELVIC FLOOR RECONSTRUCTION

Is there a need for abdominal access to the pelvic floor? Does the vagina provide sufficient access to the pelvic cavity to enable the surgeon to deal with all possible surgical situations? There is no satisfactory answer to these questions. The best surgical approach is the one providing good exposure and access to the anatomic area. Historically, vaginal procedures have been introduced to eliminate the need for abdominal incisions in order to reduce postoperative morbidity. However, visualization of some anatomical areas is easier and more complete when accessed from above. Morbidity from dissection of the abdominal wall can be reduced by the use of laparoscopic techniques.

Contraindications

Contraindications are divided into those related to laparoscopy, those related to the correction of pelvic floor relaxation, and the general contraindications to surgery (systemic conditions such as low cardiac output and severe emphysema).

In a patient with multiple previous surgeries in the pelvic area, it may be wise to access the space of Retzius by the preperitoneal route and the pelvic support structures by the vaginal route.

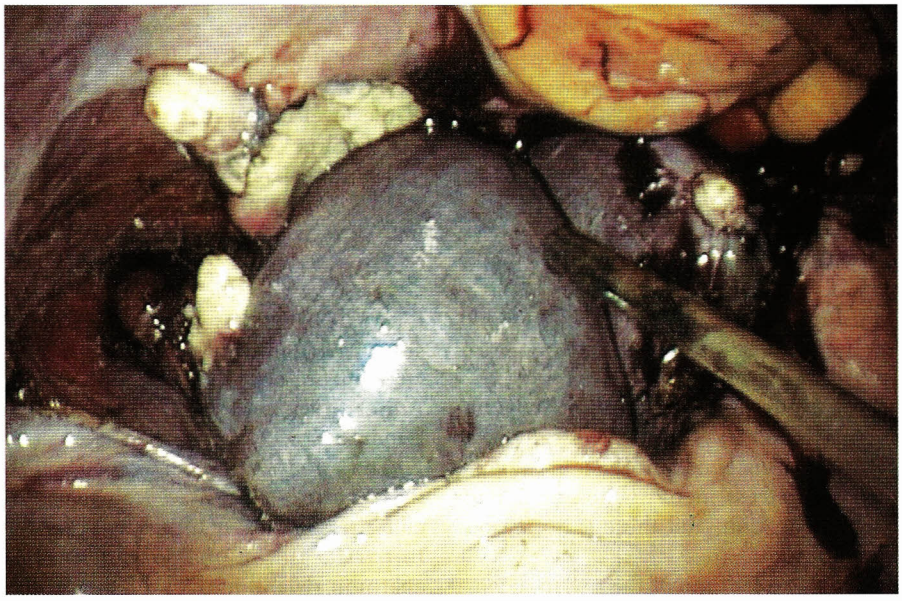

Figure 6. Uterus is pulled through vaginal culdotomy incision.

Figure 7. Specimen of double uterus evident.

Contraindications for the correction of genuine stress urinary incontinence include intrinsic urethral and/or bladder pathology, i.e., low pressure urethra and interstitial cystitis. These patients may have stress incontinence, but immobilization of the urethra will not result in cure.

Procedures

There are many different procedures which involve the pelvic floor. Clinical and laboratory investigations delineate the extent of pelvic floor relaxation and thereby dictate the extent of the surgery. Patients less than 40 years old are more likely to present with an isolated urethrocele; urethropexy is then the only procedure to be performed. The older patient is more likely to present with a complex combination of rectocele, enterocele, and cystocele. In such a case, the surgical procedure is more elaborate. It is technically easier to start the cystocele and/or rectocele operation by the vaginal route and to switch to abdominal access for the urethrocele and enterocele repair.

Whether or not the uterus should be removed as an integral part of the procedure is controversial. The procedure remains the same with or without the presence of the uterus. Anatomic structures are easier to identify, when the uterus is left in place. Intrinsically, the uterus is usually not involved in the etiology of stress incontinence or pelvic floor relaxation, and there is no reason to remove it.

The vaginal time of the pelvic reconstruction may encompass a vaginal hysterectomy, anterior and posterior repair. Emphasis is placed on correct performance of the posterior repair. The levator muscles are carefully identified and dissected. The muscle plates are approximated in front of the rectum, using several separate sutures, with minimal tension. The posterior repair can be reinforced by inserting materials which generate a layer of scar tissue. One method, published by Robert Zacharin[27] consists of using the resected portion of the vaginal wall. Instead of discarding the tissue, it can be used for interposition between the levator muscles and the vaginal wall. This devascularized tissue strengthens the vaginal wall, like Vicryl mesh, by promoting ingrowth of fibroblasts.

Once the vaginal part is completed, the legs of the patient are repositioned from hip flexion to extension. It is important that positioning of the patient be correct, prior to initiating the laparoscopic part of the operation. The patient should be supine with the upper leg in continuity with the trunk. The knees are flexed, to provide stability when the patient is tilted into the Trendelenburg position, and the legs are abducted for access to the vagina. A roll of towels is placed under the buttocks to optimize access to the cul-de-sac in preparation for the enterocele repair.

The surgeon stands on the left side of the patient if he/she is right handed. All further descriptions are written for a right handed operator.

A total of four trocars are used for the completion of enterocele repair and bladder neck suspension. The umbilical trocar provides access for the laparoscope. A 10 mm suprapubic trocar is used for introduction of suture material. Two 5 mm lateral trocars are placed at the level of the iliac crests, approximately three centimeters inward.

Pneumoperitoneum is established with CO_2 insufflation through the umbilicus with a Veress needle. In case of previous pelvic surgery, except for cesarean section, the insufflation is performed through a left paramedial incision. The umbilical trocar is inserted after pneumoperitoneum is established. Adhesiolysis and enterolysis may be required to access the cul-de-sac.

The enterocele repair is performed first because cul-de-sac access is difficult after bladder neck suspension, due to partial filling of the bladder. The anatomical landmarks are the cul-de-sac, the sacrouterine ligaments, the ureters and the vagina. A forceps introduced into the vagina and pushed upward will stretch the sacrouterine ligaments and highlight the edge of the "hernia", which now replaces the cul-de-sac. The peritoneum of the cul-de-sac may already be open or detached from the underlying tissue planes after posterior repair.

First the enterocele hernia sac is completely resected. The incision line follows the edge of the sacrouterine ligaments, which describe an inverted "U" or horseshoe shape. The peritoneum is completely dissected from the loose connective tissue, until it is attached to the anterior wall of the rectum only. This peritoneal flap is then excised from the rectum.

In patients who previously underwent a hysterectomy and in whom the bladder bulges over the vaginal vault, the bladder is dissected off the anterior wall of the vagina, to isolate the upper third of the vagina completely. The dissection of the vesicovaginal septum is important for access to the cardinal ligaments, which insert laterally onto the side walls of the middle third of the vagina.

The rectovaginal septum is then opened bluntly. Due to the previously executed posterior repair, the dissection of the rectovaginal space is rather easy. The stitches placed on the levator muscles can be identified. In addition it is possible to add a suture on the levator plate at this time, if visual inspection from the abdominal side reveals insufficient approximation of the crura. The graft of vaginal skin can be seen laying between the levator muscles and the posterior vaginal wall.

The first suture is applied posteriorly in front of the dorsal insertion of the sacrouterine ligaments. The needle is driven through the right ligament, incorporating as much fascial tissue as possible, and then several times through the edge of the peritoneal resection at the level of the anterior wall of the rectum. Finally the needle is passed through the left sacrouterine ligament and the suture tied with an extracorporeal knot. Care is taken not to strangle the rectum. Once the suture is tied, the position of the ureters is checked. Invariably there is some degree of medial displacement. A releasing incision can be made in the peritoneum between the ligament and the ureter. Once the posterior border of the hernia has been closed, the large defect in the pelvic floor between the sacrouterine ligaments, the anterior wall of the rectum, and the posterior wall of the vagina becomes apparent. The graft of vaginal skin is sutured to the sacrouterine ligament on both sides, as far back as the graft will reach. A forceps, introduced vaginally, gently pushes the vaginal cuff upward to evaluate how far it reaches without excess force. The needle is passed through the right sacrouterine ligament at the level where the vaginal cuff reaches. Then the needle catches the vaginal wall and the left ligament. When this suture is tied, the vagina lays upon the approximated levator muscles and becomes suspended to the sacrouterine ligaments. The vagina now occupies the space which was previously taken by the enterocele. This surgical procedure therefore recon-

structs the rectovaginal septum by reestablishing the anatomical relationship between vagina and rectum. Some degree of "overcorrection" may be unavoidable. Two or three more sutures are applied to completely close the defect.

One or two sutures placed in front of the new position of the vaginal cuff will provide some support for the bladder base. These sutures are placed immediately lateral to the vaginal wall, within the cardinal ligament complex and medial to the ureter. To further strengthen the vesicovaginal septum, a Vicryl mesh may be interpositioned between the vagina and the bladder, on top of the sutures connecting the cardinal ligaments. The peritoneum of the bladder flap is loosely draped over the enterocele repair to finish the procedure.

After completion of the enterocele repair, the urethropexy is performed, if necessary. The landmarks are the left umbilical ligament, which delineates the lateral border of the dissection and the lateral edge of the bladder on the left. The pubic bone can be identified as a ridge at the bottom of the triangular space defined by the umbilical ligaments and the bladder. Gentle probing with an ancillary instrument helps locate the pubic bone. The pubic bone represents the inferior border of the initial incision into the peritoneum, in order to avoid the superior vesical pedicle, which runs anterior to the round ligament but slightly below the level of the pubic bone. The superior vesical pedicle is not easily recognized, but the venous plexus is significant and will bleed profusely if accidentally incised. Avoiding this vascular structure is important because bleeding from it may obscure the tissue planes and increase the degree of difficulty of the procedure from the start. The Foley catheter is usually visible and helps in locating the bladder during the first procedures. Filling the bladder is sometimes helpful in a patient with multiple previous surgeries.

The initial peritoneal incision is made immediately medial to the left umbilical ligament, above the pubic bone. A left handed surgeon may choose to approach the space of Retzius from the right. The surgeon will strive to reach the pubic bone as quickly as possible. The distance between the peritoneum and the pubic bone is short, even in the obese patient. The surgeon must remain in a plane perpendicular to the pubic bone. There is a tendency to shift toward the midline too early, leading to bladder injury. Once the pubic bone is reached, the assistant will insert a blunt instrument into the incision and retract the bladder to the right. The space of Retzius is easily opened with minimal traction and some blunt dissection. The dissection continues until the entire space is opened and all anatomic structures can be identified on both sides. The urachus is seldom an obstacle to complete dissection of the field. The identifiable anatomic structures are: the urethra, the bladder neck, the anterior wall of the bladder, the vaginal wall, the obturator muscles, the pubourethral ligaments, the pubic bone with its symphysis and ligaments. Identification of Cooper's ligament as of today still represents a challenge. A wide dissection of the pubic bone will facilitate identification of this ligament.

Simultaneous vaginal examination during laparoscopic evaluation of the space of Retzius, greatly facilitates identification of the pubourethral ligament, which is located at the level of the undersurface of the symphysis.

The foundation of the procedure, currently being described, is the precise identification of the pubourethral ligament and incorporation of this ligament into the repair process (Figure 8). The essential principle, on which the procedure is based, is that the pubourethral

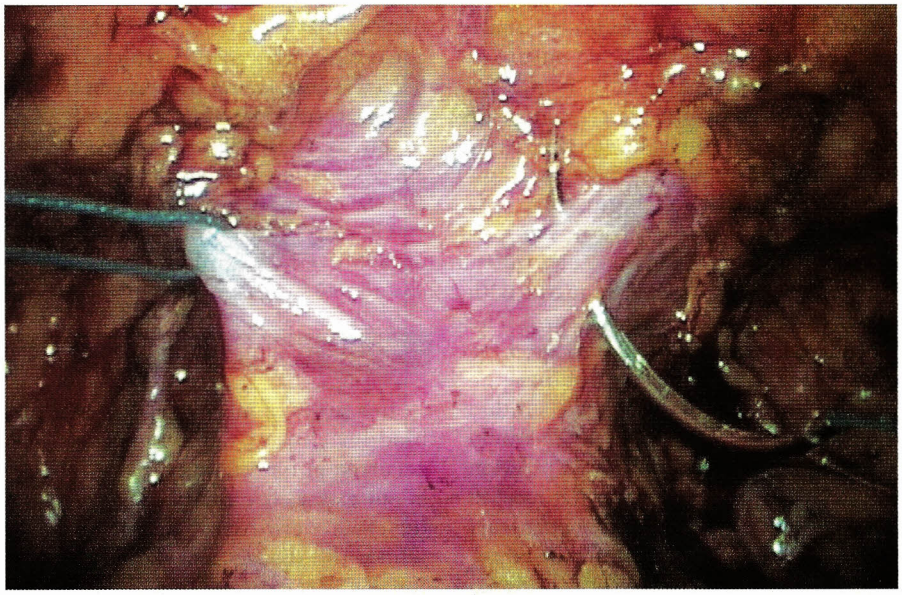

Figure 8. Posterior pubourethral ligaments on each side have been isolated. On the left, the suture has been placed. On the right, the needle carrying the suture is in the ligament.

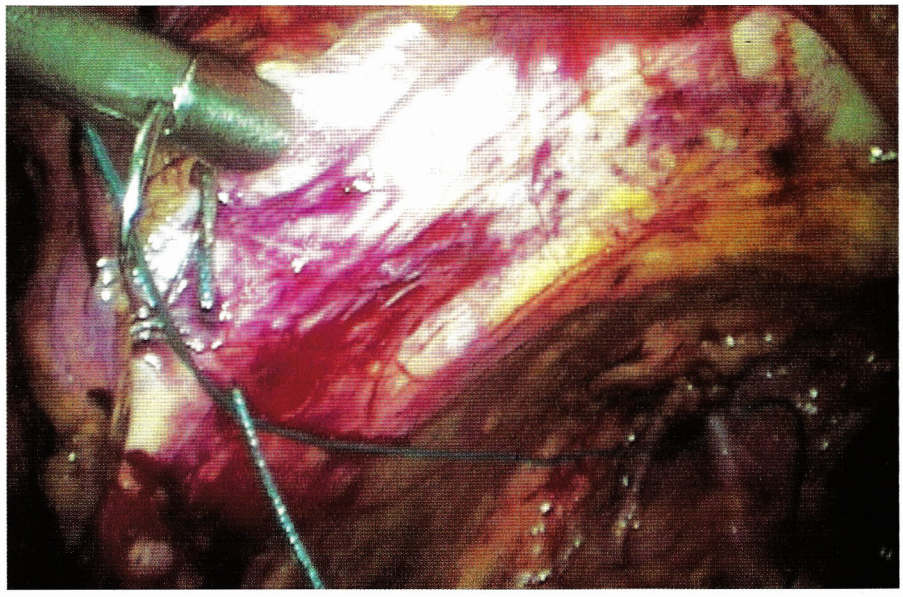

Figure 9. Suture placement into the left Coopers' ligament.

ligament is the key to urinary continence; laparoscopic urethropexy aims at shortening and strengthening this ligament to reduce mobility of the urethra.

The operator places his/her left hand in the patient's vagina to displace the bladder neck toward the left of the patient during application of the right sided suture. The vaginal wall is only elevated minimally, because otherwise the space between the vagina and the pubic bone is reduced to the extent that it becomes difficult to introduce the needle in the correct position.

The needle (Ethibond 2/0 - 36 inches) is introduced through the 10 mm trocar (suprapubic or paramedial). The needle holder is passed through the left lateral trocar, allowing optimal access to the space of Retzius. The needle is grasped and then guided into the space of Retzius. The right sided suture is placed first. The needle is passed through the paravaginal fascia, alongside the urethra from above the pubourethral ligament and into the pubourethral ligament (Figure 8). The needle is then passed through the ipsilateral Cooper's ligament (Figure 9). An extracorporeal knot is made with minimal traction on the suture. The objective of the suture is to shorten the ligament slightly and immobilize the urethra, but not to elevate the urethra into an unnatural position which would lead to chronic retention. Manipulation of the bladder neck with the left hand in the patient's vagina will allow the surgeon to evaluate the amount of elevation. Elevation of the urethra during actual suturing can then be done by an assistant if needed. The left sided suture is placed in a similar fashion.

For reinforcement, a strip of Vicryl mesh is sutured in place between the pubourethral ligament and Cooper's ligament on each side. The purpose of the mesh is to promote ingrowth of fibrocytes and hence to increase the amount of scarring.

Knotting is best performed using the extracorporeal technique. One or two extra throws will secure the extracorporeal knot. Tension on the suture is minimized by elevating the vaginal wall during tightening of the knot. The right sided suture is placed and tightened before insertion of the left sided one.

In some patients, once the space of Retzius is opened and dissected, it is obvious that the vagina is detached from the side wall, presenting a lateral defect. These lateral defects can be uni- or bi-lateral. The author recommends repairing these defects with sutures, approximating the lateral vaginal wall and the obturator muscle.

Closing the peritoneal incision can be achieved by applying one or two absorbable sutures.

COMPLICATIONS

In a series of more than 100 patients, bladder injury during dissection occurred in four instances, two early on in our experience and two later. The latter cases were repeat interventions in which the dissection of the space of Retzius was expectedly difficult. Three of these bladder lacerations were repaired under laparoscopic control. The first one, which occurred in the second patient undergoing the procedure, was repaired at laparotomy, because there was the additional difficulty of completing the actual procedure.

Inability to complete the procedure under laparoscopic control occurred in two instances, expectedly early in our experience.

Further complications such as bleeding, infection, injury to bowel or urinary structures other than the bladder did not occur, but are possible. Whether the incidence of this type complication will be higher in patients treated with the laparoscopic approach versus the alternative routes, remains to be seen.

The last category of complications which can be expected are those complications resulting from the treatment itself. The main complications are overcorrection with the need for long term catheterization and possibly continuous self catheterization and de novo bladder symptomatology of the urgency type. Overcorrection occurred in one patient. The incidence of de novo urinary complaints was estimated at 24% in a series of 42 patients.

Histologic diagnosis for laparoscopic hysterectomy

Uterine myoma	114
with adenomyosis	54
with endometriosis	20
with adenomyosis and endometriosis	10
Endometriosis	32
Adenomyosis	27
Adenomyosis and endometriosis	11
Adenocarcinoma	8
Ovarian cancer	4
Cervical cancer	4
Atypical adenomatous hyperplasia	3
CIN II	3
Benign pathology	12

Total number of women with endometriosis/adenomyosis = 154

Table 4.

OUTCOME

From June 1991 till December 1992, 42 patients were prospectively studied with a follow-up period of at least 18 months. One patient was lost to follow-up and another presented with recurrence of her symptoms in less than three months after the procedure. The remaining 40 patients are satisfied. Eight of them present with residual symptoms of stress, urgency or a combination of both. In some cases the residual urgency had been predicted by the preoperative cystometrogram.

Definite comments about the validity of the procedure await the five year follow-up evaluation. It can however be said that thus far the results are in line with what would be expected after a classical intervention.[28,29]

CONCLUSIONS

Laparoscopy is a valuable surgical tool for the performance of reconstructive surgery of the pelvic floor. Although preliminary, the results in the Vancaillie

series indicate that equivalence between the classical procedures and the laparoscopic interventions is likely.

Laparoscopic hysterectomy is a substitute for abdominal hysterectomy and not for vaginal hysterectomy. Most hysterectomies currently performed with an abdominal approach may be performed with laparoscopic dissection of part or all of the abdominal portion followed by vaginal removal, including fibroids of 1000 g. 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. Patient advantages are multiple and are related to avoidance of a pain producing abdominal incision. They include a reduced period of hospitalization and recuperation and an extremely low rate of cuff 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; it is rather a prudent surgical decision that will profoundly decrease patient risk.

The place of endometrial ablation as an alternative method to hysterectomy is controversial. Reich believes that endometrial ablation causes symptomatic adenomyosis in many patients similar to the fibrotic uterosacral ligament nodules seen with endometriosis. A recent report indicated that 20% of women required hysterectomy for pelvic pain two years after the ablation procedure.[30] In the future, rollerball ablation may be replaced by supracervical hysterectomy in patients with hypermenorrhea from a small uterus without prolapse.

The laparoscope can be used in combination with hysterectomy in a variety of ways with significant surgical and patient advantages. With few exceptions, laparoscopic hysterectomy can replace abdominal hysterectomy. Surgical outcome is the same. In experienced hands, the complication rate is low. Patient benefits are related to avoidance of an abdominal incision and include improved cosmetics and more rapid recovery. STI

REFERENCES

1. Reich H, McGlynn F, Sekel L. Total laparoscopic hysterectomy. Gynaecological Endoscopy. 1993;2:59-63.
2. Reich H. Laparoscopic hysterectomy. Surg Laparosc Endosc, 1992;2:85-8.
3. Liu CY. Laparoscopic hysterectomy: A review of 72 cases. J Reprod Med, 1992; 37:351-4.
4. Liu CY. Laparoscopic hysterectomy. Report of 215 cases. Gynaecol Endoscopy, 1992;1:73-77.
5. Reich H, DeCaprio J, McGlynn F. Laparoscopic hysterectomy. J Gynecol Surg, 1989;5:213-6.
6. Kovac SR, Cruikshank SH, Retto HF. Laparoscopy-assisted vaginal hysterectomy. J Gynecol Surg, 1990;6:185-9.
7. Summit RL, Stovall TG, Lipscomb GH, Ling FW. Randomized comparison of laparoscopy-assisted vaginal hysterectomy with standard vaginal hysterectomy in an outpatient setting. Obstet Gynecol, 1992; 80:895-901.
8. Minelli L, Angiolillo M, Caione C, Palmara V. Laparoscopically-assisted vaginal hysterectomy. Endoscopy, 1991;23:64-6.
9. Maher PJ, Wood EC, Hill DJ, Lolatgis NA. Laparoscopically assisted hysterectomy. Med J Aust, 1992;156:316-8
10. Lyons TL. Laparoscopic supracervical hysterectomy. In *Endoscopy in Gynecology* Proceedings of the World Congress of Gynecologic Endoscopy. AAGL 20th Annual Meeting, Las Vegas Nevada. Editors: RB Hunt, DC Martin. Port City Press, Baltimore, 1993, Chapter 18, 129-131.
11. Reich H. Laparoscopic extrafascial hysterectomy with bilateral salpingo-oophorectomy using stapling techniques for endometrial adenocarcinoma. AAGL 19th Annual Meeting Orlando Florida, November 14-18, 1990.
12. Reich H, McGlynn F, Wilkie W. Laparoscopic management of Stage I ovarian cancer. J Reprod Med, 1990;35:601-5.
13. Canis M, Mage G, Wattiez A, Pouly JL, et al. Does endoscopic surgery have a role in radical surgery of cancer of the cervix uteri? J Gynecol Obstet Biol Reprod, 1990;19:921.
14. Reich H, McGlynn F, Salvat J. Laparoscopic treatment of cul-de-sac obliteration secondary to retrocervical deep fibrotic endometriosis. J Reprod Med, 1991;36:516-22.
15. Parker WH, Berek JS. Management of selected cystic adnexal masses in postmenopausal women by operative laparoscopy: a pilot study. Am J Obstet Gynecol, 1990;163:1574-7.
16. Mann WJ, Reich H. Laparoscopic adnexectomy in postmenopausal women. J Reprod Med, 1992;37:254-6.
17. Valtchev KL, Papsin FR. A new uterine mobilizer for laparoscopy: Its use in 518 patients. Am J Obstet Gynecol, 1977;127:738-40.
18. Reich H, McGlynn F. Short self-retaining trocar sleeves. Am J Obstet Gynecol, 1990;162:453-4.
19. Clarke HC. Laparoscopy—New instruments for suturing and ligation. Fertil Steril, 1972;23:274-7.
20. Reich H, Clarke HC, Sekel L. A simple method for ligating in operative laparoscopy with straight and curved needles. Obstet Gynecol 1992;79:143-7.
21. Stovall TG, Ling FW, Henry LC, Woodruff MR. A randomized trial evaluating leuprolide acetate before hysterectomy as treatment for leiomyomas. Am J Obstet Gynecol, 1991;164: 1420-25.
22. Schlaff WD, Zerhouni EA, Huth JA, Chen J, Damewood MD, Rock, JA. A placebo-controlled trial of a depot gonadotropin-releasing hormone analogue (leuprolide) in the treatment of uterine leiomyomata. Obstet Gynecol, 1989;74: 856-62.
23. Reich H. Laparoscopic bowel injury. Surgical Laparoscopy & Endoscopy. 1992;2:1:74-78.
24. Hulka J, Reich H. Ninth intercostal space. *Textbook of Laparoscopy,* 2nd Ed., W.B. Saunders Company, 1994, p. 101.
25. Reich H. Aquadissection. Clinical Practice of Gynecology. 1990;2:159-185.
26. Woodland MB. Ureter injury during laparoscopy-assisted vaginal hysterectomy with the endoscopic linear stapler. Am J Obstet Gynecol 1992;167:756-7
27. Zacharin RF: The use of vaginal skin graft for the treatment of recurrent recto- and cystocele. Australian and New Zealand Journal of Obstetrics and Gynaecology 1992;32;146-9
28. Bergman A, Ballard CA, Koonings PP: Comparison of three different surgical procedures for genuine stress incontinence: prospective randomized study. Am J Obstet Gynecol 160:1102,1989
29. Bergman A, Koonings PP, Ballard CA: Primary stress urinary incontinence and pelvic relaxation: prospective randomized comparison of three different operations. Am J Obstet Gynecol 161:91,1989
30. McDonald, Russell. Audit applied to endometrial ablation. New Surgical Techniques in Gynaecology. Ed.: C. Sutton. Parthenon Publishing, Carnforth, Lancs, United Kingdom. 1992.