Optimizing pelvic surgery outcomes

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Perioperative problems can jeopardize the outcome of reconstructive procedures performed with the utmost technical skill. Since many of the factors behind such problems are within the surgeon's control, they must be kept in mind during surgical planning and postoperative care. The recent increase in use of biologic and synthetic grafts in reconstructive pelvic surgery has led to unique and specific healing abnormalities, many of which are preventable. This article reviews appropriate preoperative tissue preparation, intraoperative techniques to prevent postoperative healing difficulties, and management of graft-related healing abnormalities.

TISSUE PREPARATION

The problem of urogenital atrophy

Development of urogenital atrophy is an inevitable part of the aging process in women. Thought to be primarily a devascularization process, urogenital atrophy leads to thinning of the vaginal epithelium, mucosal dryness, increased sensitivity, and eventually an inflammatory infiltrate. There is a direct correlation between circulating estradiol levels and symptoms of urogenital atrophy.[1] Thus, the process of urogenital atrophy may begin even before the establishment of menopause. Symptomatic atrophy can also be seen in women of reproductive age with relative hypoestrogenism or decreased pelvic blood flow.

Posthysterectomy patients are particularly notable in this regard, owing to their reduced blood flow to the middle and upper vagina as a result of interruption of collateral blood flow from the uterine circulation. It is therefore not uncommon for these patients to have a pale and thin vaginal epithelium in the upper vagina and a well-estrogenized lower vagina. This is less commonly seen in women with an intact uterus, in whom apical vaginal blood flow is maintained.

Identifying urogenital atrophy

Surgeons cannot rely on symptoms alone to initiate therapy for urogenital atrophy. For unclear reasons, many women with significant atrophy are asymptomatic, even lacking signs and symptoms typically associated with atrophy, such as vaginal dryness and irritation.[2] For this reason, identification of urogenital atrophy during the physical examination is crucial for appropriate initiation of therapy. A pale, dry, and thin vaginal mucosa typically heralds urogenital atrophy. If the vagina is well vascularized but demonstrates lack of rugation only in specific areas, a subepithelial fascial tear should be suspected and is frequently found in patients with an enterocele.

The most objective means for identifying urogenital atrophy involves performing a vaginal wet prep, vaginal maturation index, or vaginal pH. These are simple, inexpensive tests that can be performed in the physician's office.

Vaginal wet prep. With this test, which is similar to an evaluation for vaginitis, urogenital atrophy is identified by a preponderance of intermediate and parabasal cells. These are small oval cells with large nuclei relative to the typical large squamous cells with pyknotic nuclei. In advanced stages of inflammatory atrophy, an abundant inflammatory infiltrate can be seen as well.

A vaginal maturation index is performed in a manner similar to a Papanicolaou smear. It is a quantitative test in which a pathologist counts the number of superficial, intermediate, and parabasal cells on the smear. An index can be calculated based on the relative presence of those cells. Various formulas are used for calculation of a maturation index. In vaginal atrophy, few, if any, superficial cells are noted, with more

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Disclosure: Dr. Davila reported that he has received grant/research support from American Medical Systems, Synovis Surgical Innovations, Adamed, and Tyco Healthcare/U.S. Surgical and that he is a consultant for and on the speakers' bureau of American Medical Systems.

than 50% of the cells being intermediate or parabasal.

Vaginal pH can also be very helpful. It is assessed with regular (fresh) litmus paper. Vaginal atrophy is associated with an increase in vaginal pH above 5.

These tests can all be used to identify atrophy as well as to quantify the degree of atrophy during treatment.

Treatment of urogenital atrophy

Appropriate preparation of epithelial tissues for reconstructive pelvic surgery can be crucial to reducing postoperative complications. This is especially true if synthetic grafts will be used in the reconstructive procedure. Any bacterial or monilial vaginal infection should be treated and resolved before surgical therapy. Any patient who previously wore a vaginal pessary should be monitored for the presence of ulceration, which should be completely healed before surgery. A pessary should be removed at least 1 week prior to a reconstructive procedure.

Tissues with significant urogenital atrophy should be pretreated with local estrogen. It is well recognized that low-dose local estrogen therapy can be administered such that it does not result in any significant systemic absorption.[3] Therefore, women with urogenital atrophy who have contraindications to estrogen therapy can be treated with local estrogen without prompting concerns over significant systemic absorption. If necessary, avoidance of such absorption can be documented by measuring the serum estradiol level before and after therapy. For appropriate preoperative tissue preparation, at our institution we recommend at least 6 weeks of local therapy in order to reverse the changes of atrophy and revascularize the vaginal epithelium. Local estrogen treatment options available in the United States are listed in Table 1.

Most patients who are referred with advanced degrees of prolapse have significant atrophy. At our institution, we recommend using local estrogen cream as the quickest means of achieving the desired mucosal changes. We prescribe 1 g of cream (Estrace or Premarin) for intravaginal application on 2 nonconsecutive nights per week. Patients are instructed to apply the cream upon lying down to prevent extrusion of the cream. Often patients need to be instructed by a nurse on how to insert the cream appropriately. We have found this method of administration to be much more effective for treating urogenital atrophy than introital digital administration, which can be used for treating urinary urgency and frequency.

Estradiol tablets (Vagifem) also can be used intravaginally. These cellulose-based tablets dissolve in the vagina and coat the vaginal surface. We have found that reversal of atrophic changes is slower with this form of therapy, although tablets may be more acceptable to patients since they are associated with less extrusion of cream and since their applicator is smaller and easier for most patients to use. Systemic absorption has been demonstrated with Vagifem, and since its dose is less adjustable, we recommend using cream in patients who strongly wish to avoid systemic absorption.

Use of a low-dose estrogen-containing ring (Estring) is also an option. Because the ring is left in the vagina for 3 months at a time, it is particularly useful for women wearing a pessary, as it can be inserted ahead of the pessary. However, lack of systemic absorption has also not been well documented with the ring.

TABLE 1
Delivery options for local estrogen therapy

Formulation	Dosage	Systemic absorption
Cream (Estrace, Premarin)	1 g 2 nights per week or 0.5 g every other night	None to minimal
Tablets (Vagifem)	1 tablet 2 nights per week	Minimal
Ring (Estring)	Change ring every 3 months	Minimal

INTRAOPERATIVE PREVENTION OF COMPLICATIONS

Our institution strictly follows a protocol aimed at preventing perioperative complications (Table 2).

Preoperative evaluation. The protocol begins with an appropriate preoperative evaluation from both the urogynecologic and medical standpoints. Urogynecologic evaluation involves a detailed pelvic examination as well as urodynamic testing, as indicated. All of our patients also obtain medical clearance from their internist to minimize problems related to any concomitant medical conditions.

Antibiotic prophylaxis. Preoperative use of prophylactic antibiotics administered intravenously is routine in pelvic surgery.

Prevention of thromboembolism. Intraoperative use of pulsatile antiembolism stockings is important, even for patients at low risk of embolism. The stockings should be applied and turned on before the start of surgery, as their mechanism of action involves release of thrombolytic substances in the vessel walls

TABLE 2
Perioperative care protocol

Preoperative evaluation
- Urogynecologic evaluation, including urodynamic studies
- Medical clearance

Prophylactic antibiotics preoperatively

Pulsatile antiembolism stockings

Allen stirrups

Regional anesthesia

Postoperative care
- Vaginal packing for 24 hours
- Early ambulation
- Laxatives/stool softeners
- Suprapubic catheter for bladder retraining
- Limit exertion (no lifting > 5 lbs for 6 weeks)

in addition to physical compression. In high-risk patients, including those with previous thrombosis or who have received prior anticoagulation therapy (eg, because of the presence of a cardiac valve), we use pulsatile antiembolism stockings as well as low-dose heparin or enoxaparin.

Patient positioning. Patient positioning is crucial to avoiding neuropathies involving the lower extremities and pelvis. We strongly recommend positionable stirrups, such as Allen stirrups, rather than "candy-cane" or low stirrups. Access to the pelvis by the surgeon and surgical assistants must be finely balanced with the need to prevent femoral and sciatic neuropathies. Allen stirrups allow for raising and lowering of the legs as necessary for complex reconstructive surgeries, which may include both an abdominal and a perineal approach. For patients with previous lower-extremity surgery or back pain, positioning while awake, prior to anesthesia, may reduce the risk of intraoperative positional complications.

Regional anesthesia. Since most reconstructive surgeries are now done via the vaginal or perineal route, we advocate the use of spinal or epidural anesthesia along with intravenous sedation. In elderly patients, this is associated with a marked reduction in the postoperative cognitive dysfunction that can be associated with general anesthesia.[4] We rarely need to convert a patient from regional anesthesia to general anesthesia.

Postoperative care. After the surgery, our protocol includes leaving the vaginal packing in for 24 hours. Once the packing is removed, ambulation and bladder trials are begun. We use patient-controlled narcotic analgesia pumps in the immediate postoperative phase along with intramuscular or intravenous ketorolac tromethamine. We then switch the patients to oral narcotics. If we are performing an abdominal sacrocolpopexy, we will initiate feeding very slowly, restricting dietary intake to clear liquids for the first 48 to 72 hours.

TREATMENT AND PREVENTION OF GRAFT-RELATED COMPLICATIONS

The expanded use of biologic and synthetic grafts in reconstructive surgery has brought about an entire new series of perioperative issues with which most surgeons are not yet familiar. Primary among them is selection of the appropriate graft material. While that topic is beyond the scope of this article, surgeons must avail themselves of published literature that describes the safety, tolerability, and longevity of a selected graft. Many theoretical benefits ascribed to a specific graft do not translate into clinical benefits. Because this is an evolving field, surgeons must peruse the recent literature for their resources.

Current understanding of the treatment of graft-related postoperative complications is improving. Healing difficulties should be tracked and recorded with various factors in mind (Table 3). The remaining discussion is best divided into complications associated with biologic grafts and those associated with synthetic grafts.

Complications associated with biologic grafts

Biologic grafts are less likely than synthetic grafts to lead to severe complications. They are less prone to erode into adjacent viscera or into the vagina. The primary concerns regarding their use involve immune reaction to the graft, infection, or the carrying of infectious particles from the donor.

To date, there has been no evidence of transmission of prions, viruses, or other organisms with a transplanted graft. Host reactivity to the graft can vary from a minimal inflammatory infiltrate to quite significant inflammation and development of granulation tissue. Some inflammatory reaction is necessary, as the use of a non–cross-linked graft requires that fibroblasts enter the graft substance in order to deposit a new layer of collagen. The concept of a biologic graft being a collagen matrix is dependent on the ability of host cells to penetrate the graft. As such, non–cross-linked grafts have recently achieved greater acceptance. Cross-linked grafts do not allow prompt penetration of the graft by host cells; rather,

TABLE 3
Relevant factors in graft-related healing assessment

- Timing relative to surgery
- Location of exposure (at incision vs other site)
- Presence of inflammatory changes (granulation vs no inflammation)
- Organ in which exposed (vagina vs viscera)

they tend to become encapsulated by host collagen deposition around the graft. This can be problematic if the graft shrinks over time, leaving unexposed areas adjacent to the graft.

The likelihood of significant immune reaction to currently available grafts is low. Careful technique in graft implantation, use of intravenous prophylactic antibiotics, and possibly soaking the graft in antibiotic solution have all been found to be useful in preventing graft infection. We will routinely place a circumferential suture around the anal opening (anal cerclage) to prevent fecal contamination of the graft.

The most common healing problem related to biologic grafts is separation of the suture line overlying a graft. This typically results from formation of a hematoma in the surgical area. Most biologic grafts behave much like the host biologic tissue, so there is no need to re-cover the graft with sutures; instead, the area should be allowed to heal by secondary intention.

If the reaction to an implanted graft includes significant granulation tissue, purulence, or both, infection must be suspected. A course of systemic or local vaginal antibiotics may be helpful. However, because of the decreased vascularity of the graft, it may be difficult to eradicate the infection and, in rare circumstances, some or all of the graft must be removed. We have not found this to be the case in our use of non–cross-linked biologic collagen matrices, including bovine pericardium or porcine dermis. Seromas have been noted to develop with small intestinal submucosa (SIS), although the mechanism behind their development is unclear. Most have been noted to occur in the subcutaneous fat layer along the anterior abdominal wall from suburethral sling procedures or other abdominal procedures. It has been suggested that the SIS ends of the graft be trimmed at the level of the fascia rather than at the skin to reduce the risk of seroma formation, but this has not been confirmed. The seromas appear to be sterile and resolve over time. A course of antibiotics is recommended, but if the seroma does not resolve within 4 to 6 weeks, exploration of the area should be considered and any exposed graft removed.

FIGURE. Posterior vaginal wall exposure along suture line.

Complications associated with synthetic grafts

The use of large-pore monofilament and multifilament polypropylene mesh materials has significantly reduced the incidence of complications related to synthetic grafts. In the past, synthetic grafts with small pores (ie, Gortex) or impregnated with a biologic material such as collagen (ie, ProteGen) have resulted in significant graft-related infections and subsequent rejection or graft removal.

Currently, most synthetic graft-related healing difficulties involve exposure of the ends of the graft through the vaginal epithelium (Figure). Early in the postoperative course, they tend to occur along the suture line. Later they can also present at a site remote from the suture line. Fortunately, most of these are simply exposures of the graft rather than true infectious or inflammatory erosions. If new composite grafts incorporating polypropylene and other materials become available, concerns about graft infection may resurface.

Treatment of an exposed edge of a polypropylene graft can be undertaken in the office or the operating room. If there is no granulation tissue and no purulent infiltrate, the graft's exposed edges should simply be trimmed and the rest of the graft buried. In the office setting, the exposed edges of the graft can be cut and local estrogen cream therapy initiated. Under most circumstances, with thickening of the vaginal epithe-

lium, the edges of the graft will be spontaneously covered. If a larger area of graft is exposed, placement of one or two interrupted sutures to reapproximate the vaginal epithelium may be necessary. If the exposure recurs, if there is significant epithelial induration around the graft, or if the area of exposed graft is quite large, treatment in the operating room may be necessary. In the operative setting, the vaginal epithelium can be undermined lateral to the area of exposed graft. At this point, the exposed mesh can be trimmed and the mobilized epithelial edges can be approximated with interrupted sutures. This will usually result in satisfactory healing. Local estrogen therapy can be started once the sutures are dissolved.

If the sutures used to implant the synthetic graft are not monofilament sutures, any inflammatory response may be due to the sutures rather than the graft. It is therefore important to differentiate between a reaction to a graft and a reaction to a suture. This is especially true if braided multifilament permanent sutures (eg, Ethibond sutures) are used.

Palpable graft edges without symptoms. It is not uncommon for an edge of polypropylene mesh to be palpable during a postoperative pelvic examination in an asymptomatic patient. Under these circumstances, we commonly choose to observe the patient over time. We have observed spontaneous regrowth of epithelium over the graft as well as continuous, unchanged exposure of the graft. In rare instances there is an increase in the size of the exposed graft. As long as these patients remain asymptomatic, it is appropriate to simply monitor them on a long-term basis.

Urethral and bladder erosion. Erosion of a graft into adjacent viscera is managed on the basis of the viscera involved. Erosion into the urethra or bladder, as long as it is not associated with significant granulation or inflammatory tissue, can be managed by simply trimming the exposed visible mesh. For urethral erosion, this can be done using a hysteroscope or a small nasal speculum to visualize the graft, place it under tension, and cut the exposed area. We have not found it necessary to open the urethra or perform any more radical procedures. Typically, the urethral mucosal defect will heal spontaneously. We consider it important to leave the rest of the sling graft alone in order to help maintain urethral support.

Fortunately, most patients remain continent after removal of the exposed urethral mesh.

Exposure of a mesh within the bladder lumen can likewise be handled in a fairly conservative fashion. As long as it can be clearly visualized, the exposed mesh can be trimmed using an operative cystoscope in an office setting. Another reported technique involves placement of a suprapubic laparoscopic 5-mm trocar into the bladder to provide traction for cutting of the exposed mesh; a laparoscopic grasper is then used to pull the mesh medially, and scissors placed through a cystoscopic port can be used to cut the exposed mesh.[5] This technique may be preferable since most tension-free retropubic sling grafts that erode into the bladder will do so in the lower third of the bladder, which can be difficult to visualize and reach with the rigid cystoscope in the office.

Rectal erosion. Fortunately, mesh erosions into the rectum are rare. If rectal perforation occurs, it should be identified intraoperatively. Rectal examination following mesh augmentation procedures is strongly recommended. We have not seen an erosion into the rectum that has occurred postoperatively. If an erosion is identified, the same principles should be followed as for treatment of bladder erosion. However, there is a high likelihood of an associated infection of the fibrous connective tissue around the graft, which may require excision of that section of the graft and infected tissue. Extreme care must be taken in managing that tissue and closure in order to prevent development of a rectovaginal fistula.

SUMMARY

Most perioperative complications related to graft use can be prevented by appropriate preoperative and postoperative tissue management. Intraoperative cystoscopy should be a routine part of most pelvic reconstructive procedures. A rectal examination should be performed at the end of each surgical procedure to document rectal integrity. Under most circumstances, graft erosions can be managed without the need to remove the entire graft or jeopardizing the surgical repair.

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