RECONSTRUCTIVE AND REPRODUCTIVE SURGERY IN GYNECOLOGY

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VOLUME 2: GYNECOLOGICAL SURGERY

EDITED BY

MALCOLM G. MUNRO • VICTOR GOMEL

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Volume Two: Gynecological Surgery

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Surgery for congenital anomalies

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Hysteroscopic, laparoscopic, laparotomic, and vaginal

JOSEPH S. SANFILIPPO, KATHRYN D. PETICCA, and FABIOLA BALMIR

Key points

- Surgical management of Müllerian anomalies has been revolutionized by imaging, and the development of hysteroscopic and laparoscopic surgical techniques that have rendered laparotomic management infrequent, and office hysteroscopic management of selected anomalies a reality.
- The CONUTA system of classification provides increased granularity allowing for more accurate descriptions of Müllerian anomalies affecting the uterine corpus, particularly when they affect the cervix and the vagina.
- For women with Mayer–Rokitansky–Kuster–Hauser syndrome (CONUTA U5-C4-V4) the success rate of the patient self-administered "Frank technique" is about 85%–90%.
- For those with vaginal agenesis for whom the Frank technique isn't feasible or successful, there exist other procedures, such as the Vecchietti and Davydov procedures that can be performed under laparoscopic guidance without the need for skin grafting.
- Isolated cervical agenesis (CONUTA U0-C4-V0 or V4) has been treated with procedures linking the corpus to the existing or artificially created vagina, but study sample sizes are small, and there is inadequate reporting of pregnancy outcomes to allow for meaningful counseling of patients.
- The unicornuate uterus and variants, CONUTA U4-C3 (rAFS Class IIb), are often associated with abnormalities of the urinary tract, such as unilateral renal agenesis, and can be treated with laparoscopically directed removal of the underdeveloped or obstructed uterine horn.
- Uterus didelphus, which is CONUTA U3b-C2 (rAFS Class III) and rAFS Class VI (there is no corresponding CONUTA designation) generally require no surgical or medical intervention to deal with symptoms or to improve pregnancy outcomes.
- The bicornuate uterus, CONUTA U3a-C0 (rAFS IV a/b), can be treated expectantly, or with Strassman metroplasty with hysterotomy and unification of the two endometrial cavities.
- The septate uterus, CONUTA U2-C0/1 (rAFS Va/b), can generally be treated with hysteroscopically directed transection of the septum.

INTRODUCTION

As described in Chapter 11, approximately 10% of females are born with a congenital anomaly of the reproductive tract, and while many do not benefit from interventions, a number will experience improved clinical outcomes with an appropriate surgical procedure.[1,2] From a historical perspective, the surgical management of anomalies involving the reproductive tract has, in many instances, changed dramatically because of advances in surgical technique and technology. As detailed in Chapter 11, the advent of minimally invasive surgical technological innovation has provided clinicians with a plethora of options for management.

Hysteroscopy is not only a means for assessment of the uterine cavity; it is also the method of access for reconstructive surgical intervention. Resectoscopes, radiofrequency needles (RFNs), and electromechanical morcellators complement more traditional operative instruments that include scissors and biopsy forceps placed through the operative channel. Indications for concurrent laparoscopy are variable and need to be considered on a case-by-case basis with knowledge that intraoperative sonographic monitoring is often at least as efficacious and, in most instances, readily available to the reproductive surgeon.

VAGINAL AND CERVICAL

Transverse vaginal septum (CONUTA V3)

The incidence of transverse vaginal septum is 1:80,000, with variable location and extent, occupying some portion of the lower, middle, and/or upper segments of the vagina.[3] The septa are more commonly perforate (61%), with resultant menses, but are frequently imperforate (39%), the latter being associated with amenorrhea and hematocolpos.[4]

As described in Chapter 11, evaluation of these patients requires a combination of physical examination, transperineal or transvaginal sonography, and, frequently, MRI. Examination of both the vagina and rectum allows for assessment of the caudal aspect of the

septum and for the presence of hematocolpos, should it exist, cephalad to the obstruction. However, MRI allows a more complete evaluation of the vaginal canal, including characterization of the position, length, and thickness of the septum, as these findings are important in designing the surgical approach. The septum may be present at a number of levels in the vagina; *viz.* low (14%), mid (40%), and high (46%).[5]

Surgical correction of the transverse vaginal septum is the management of choice. Ideally, we recommend performing resection surgery at the time of puberty to allow for improved healing of the vaginal epithelium in the presence of physiological levels of systemic estrogen. Following menarche, complete transverse septa are typically associated with distension of the upper vagina in the form of a hematocolpos, a circumstance that facilitates the surgical resection. The overall strategy for thin septa is resection with vaginal epithelial reapproximation. Another approach when there exists a thickened transverse septum or partial atresia of the vault is the modified Z-plasty technique described by Grünberger. Here, eight vaginal epithelial flaps are created and add vaginal vault length of up to 1 cm (Figure 29.1). This procedure also minimizes the risk of vaginal stenosis by postoperatively employing the use of a rigid plastic vaginal mold with concurrent use of estrogen cream.[6] Another consideration for patients with complete obstruction is the potential sequelae of retrograde menstruation that include endometriosis and associated adhesion formation secondary to inflammation. In such instances, simultaneous laparoscopy should be considered to manage the resulting adhesive disease. Relief of the outflow tract obstruction frequently results in complete reversal of even extensive endometriosis.[7]

The imperforate septum is generally approached vaginally. The procedure should be preceded by catheterization of the bladder with a Foley catheter. The surgeon must remain cognizant of both the bladder and the rectum during the resection. For thick transverse septa, the process is started by placing a large bore spinal needle through the septum to confirm and orient the presence and location of the hematocolpos with the aspiration of old, thickened blood. Resection of the septum is then undertaken, a process that can include use of a monopolar radiofrequency (RF) electrical needle or blade electrode used to incise through the center of the septum along the needle tract. This incision should be created with extreme care, avoiding posterior or anterior deviation toward the rectum or urethra. With such electrodes, a setting of 25–35 watts "cutting" current is generally effective for septum dissection. In cases of thin septa, resection should be done as widely as possible to reduce postoperative vaginal stenosis. Upon completion of the resection, it is important to perform a careful rectal examination to detect otherwise occult injury.

It is important to establish continuity of the vaginal epithelium across the area of resection. Consequently, once the septum is resected, the proximal and distal ends should be approximated with interrupted sutures with,

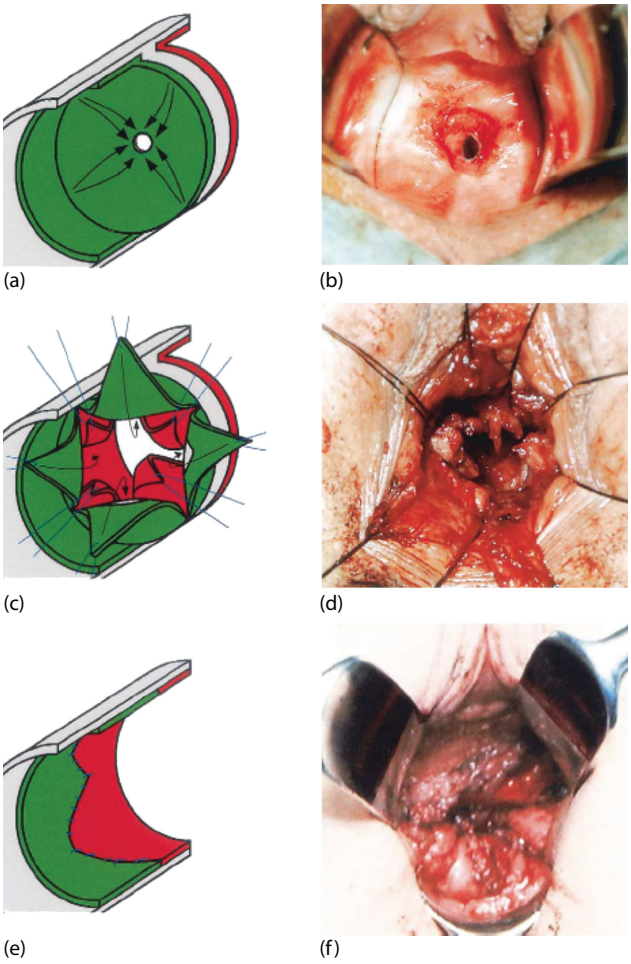

Figure 29.1 Grünberger Z-plasty technique for transverse vaginal septum (From Wierrani F, et al., *Fertil Steril*. 2003;79(3):608-12. With permission.)

for example, 2-0 or 3-0 polyglactin 910 positioned with a tapered (non-cutting) needle such as a SH, V20, CT-1, or GS-21 design (depending on the manufacturer), the former especially if there is space limitation within the vagina.

With thicker vaginal septa, if there is a significant gap, the vaginal epithelium can be addressed with the Z-plasty technique, which is performed to add length to the vagina and minimize the risk of vaginal stenosis. Where Z-plasty is not feasible, a split-thickness skin graft may be required with postoperative placement of a vaginal stent. The role for a postoperative acrylic vaginal stent when a skin graft is not used is controversial; there is no available quality evidence to provide guidance. Consequently, the use of a stent should be determined by the surgeon on a case-by-case basis if there is concern for contraction of the newly created space. Postoperatively, the maintenance of vaginal depth is important. If the patient is not sexually active, a vaginal stent should be considered. The vaginal stent can be placed either routinely each evening at bedtime or, at least, several times per week.

The abdominal perineal approach is rarely used. This technique can be considered if the transverse vaginal

septum is difficult to appreciate and there is no hematocolpos to allow for bulging of the septum. We recommend that during laparoscopy, a 5 mm colpotomy incision is created, followed by the placement of a suction irrigator tip through the incision allowing the compartment of the vagina to be distended. Concurrently, at the perineum, an incision is created vaginally over the bulge. Moreover, we find that the suction irrigator tip can also be used to apply pressure to the septum and locate the area of the septum for incision.

It would stand to reason that outcomes, in part, are predicated upon whether the septum is imperforate, i.e., associated with amenorrhea, or perforate and has an open area for egress of menstrual fluid. The imperforate septum can lead to a hematocolpos that, over time, can apply pressure on the septum, thereby causing thinning. The imperforate septum can also facilitate surgical interventions by allowing for bulging of the septum that facilitates dissection away from surrounding structures. The location and the thickness of the septum are also important prognostic variables. A high vaginal septum is technically more difficult to surgically correct. In general, complication rates are low.[4] The main long-term complication is vaginal stenosis, which may generally be managed by vaginal dilation. As previously mentioned, the risk of this adverse event can be minimized with postoperative use of a vaginal stent placed by the patient until she becomes sexually active.[8]

Longitudinal vaginal septum (CONUTA V1 and V2)

Since a longitudinal vaginal septum, CONUTA V1 or V2 from the ESHRE system, is often associated with other Müllerian anomalies, most commonly the didelphic and septate uteri (ASRM Class 3 and 5, respectively), this finding must prompt further workup for other abnormalities (see Chapter 11). This type of septum, when not associated with outflow tract obstruction, typically doesn't present until the patient attempts tampon insertion or becomes sexually active. The patient may bleed despite tampon insertion, and experience dyspareunia secondary to vaginal compromise. The septum can be complete, which is more often associated with uterus didelphys (AFS Class 3; CONUTA U3), or can be fenestrated.

Management is surgical transection, usually performed after menarche. Prior to surgery, it is important for the surgeon to perform a careful pelvic examination to evaluate the length of the septum and to confirm the presence and number of cervices. There are several techniques from which to select, with perhaps the most common and traditional being serial resection and suture ligation of segments using Haney- or Kelley-type clamps and a scalpel, scissors, or monopolar needle or blade electrode for transection.

Alternatively, and if possible, the entire length of the septum can be clamped with appropriate Peon or Kelly clamps and then transected with a monopolar blade or needle electrode; then the clamps can be sequentially removed and the incisions closed with a continuous, locking 2-0 polygalactin 210 suture.[9]

Additionally, Perez-Millcua *et al.* introduced the LigaSure™ (Medtronic/Covidien Minneapolis, MN) for vaginal septum transection starting at the most caudal portion of the septum and extending cephalad until the cervix or cervices are reached. As an RF bipolar vessel-sealing system the Ligasure has an advantageous small jaw that can be used to maneuver tight vaginal spaces. The thermal energy spread is 1–4 mm and is, therefore, less likely to cause adjacent bladder or rectal injury. While it is probably unnecessary, the edges of the resected area can then be oversewn with interrupted polyglactin 910 (or equivalent), and a vaginal mold can be considered for use immediately postoperatively to minimize stricture and scarring of the vagina (Video 29.1).[10]

There have also been reports of hysteroscopic techniques such as RF resectoscopy being used for transection of a vaginal septum in virginal girls and women who prefer to maintain an intact hymen. In this case, the vagina is distended with fluid media, and RF electrical energy through a cutting loop or needle-cutting electrode is then applied to the magnified fibrous layer of the septum. Ultrasound guidance is used simultaneously.

With each method, periodic rectal examination should be undertaken to ensure that the zone of dissection is kept away from the bowel. The resections (or transections) are ideally brought to the level of the cervix or cervices; care must be taken not to traumatize the cervix (or cervices) at the upper limits of resection.[8] In general, reapproximation of denuded vaginal epithelium is often necessary in the area of resection or transection. Absorbable sutures, e.g., 3-0 polyglactin 910, can be used to reapproximate the vaginal epithelium. Although post-operative stenosis or adhesion formation is a rare sequella of longitudinal septum resection, reassessment in two to four weeks is appropriate to evaluate the vagina and break down anteroposterior adhesions that may have formed.

MÜLLERIAN ANOMALIES AFFECTING THE UTERUS

rAFS Class I-hypoplasia/agenesis (CONUTA U5)

Mayer–Rokitansky–Kuster–Hauser (MRKH) syndrome (CONUTA U5b-C4-V4)

Psychologically, it is important that procedures designed to create a vagina be initiated at an appropriate age, considering several factors, including the patient's sexual orientation, her motivation for the surgery, and the availability of professional and family support. Consequently, psychosocial counseling before treatment intervention is appropriate.[11]

Non-operative techniques can be very successful and, consequently, should be considered the first line approach.[9] The original technique (Frank technique) employs the patient's use of graduated Lucite (vaginal) dilators of progressively increasing diameter to create a functional vagina (Figure 29.2).[12] The process begins at the vaginal dimple with the patient instructed about the proper orientation and angle of dilator placement to minimize the risk of trauma to the urethra. Success rates are in the realm of 85%–90% regarding satisfactory coitus.[9,13]

Figure 29.2 Vaginal obturators or dilators. These devices, of progressively increasing length and diameter, may be used by patients with vaginal agenesis to progressively create a functional vagina, starting with the smallest and progressing as appropriate to the largest size. They also can be of use for women with "vaginismus" to desensitize the muscles of the perineum and pelvic floor, and postoperatively following surgical vaginal reconstruction. This brand, from Vaginismus.com, comprises six dilators and a universal handle. The smallest, attached to the handle, is 0.6 inches (15 mm) wide and 3.48 inches (88 mm) long. The largest (far right) is 1.5 inches (38 mm) in diameter and 5.96 inches (151 mm) long.

The Ingram passive dilation technique uses a bicycle seat to secure the dilator in place while providing increasing pressure to create a functional vagina.[14] The goal of these techniques is the creation of a vagina more than 7 cm in length and the achievement of successful coitus. The available evidence suggests that this approach is associated with a success rate of 90%.[9,13,15,16]

One of the original surgical approaches to vaginal agenesis was the Wharton–Sheares–George technique, in which the surgeon identifies and then dilates the vestigial Müllerian ducts in the space between the two labia, just dorsal and lateral to the urethral meatus. Hegar or similar dilators are used, aligned with the axis of the urethra and then firmly pressed to form two parallel tunnels with a resulting intervening central septum. This surgically created septum is subsequently transected (as for a longitudinal vaginal septum) to form a blind pouch.[17] With the George modification, only a vaginal mold is inserted into the cavity and left for a week, when it is exchanged for a larger obturator. This device is then used by the patient day and night for three months after which time epithelialization has occurred to the point that intercourse is possible.[18]

A procedure designed to create a blind pouch between the bladder/urethra and rectum that is then lined with a split thickness skin graft was originally described by Abbe in 1898,[19] and then later revised by Macindoe and colleagues.[20,21] The Abbe–Macindoe procedure can be performed in a fashion like that of the Wharton procedure or by incising the perineum between urethra and rectum with subsequent development of the usually avascular rectovaginal space with a combination of blunt and sharp dissection (Figure 29.3). Then the vaginal stent or mold is covered with an inverted split-thickness graft typically taken from the skin of the buttocks or thigh. Unfortunately, the graft site can be a source of morbidity and provides a less than ideal cosmetic result. A number of options to the split thickness grafts have evolved including the use of amnion,[22] artificial dermis,[23] and in vitro cell culture; each of these tissue types was designed to develop into vaginal squamous epithelium. Long-term outcome studies are not available regarding the effectivity these options. With use of any of these techniques, a vaginal mold is continuously left in place for at least a week, but then, to preserve the vaginal length and caliber, is used in daily by the patient, until she is engaged in regular sexual intercourse.

There exist several other methods for creating a vagina that combine a laparoscopic and vaginal approach. The laparoscopic Vecchietti procedure is a modification of the original laparotomic approach[24] and uses a segmented acrylic mold placed in the vaginal dimple with sutures brought out through the abdominal wall in a way that allows for continuous traction.[25]

There are several variations in technique (Figure 29.4) (Video 29.2). For one, after emptying the bladder and establishing a pneumoperitoneum, the laparoscope is placed transumbilically and two ancillary cannulas are positioned in the left and right lower quadrant.[26] The peritoneum between the bladder and the uterine remnant is incised for about 5 mm with an appropriate instrument, most commonly laparoscopic scissors. One of the laparoscopic ports is replaced with a specially designed ligature carrier that is passed just subperitoneally and then caudally between the rectum and bladder, guided by a finger placed in the rectum. Cystoscopy and anoscopy/sigmoidoscopy are performed to ensure that the needle has not captured the lumen of either viscus. The needle is then used to penetrate the skin of the "pesudohymen" or vaginal dimple between the anus and urethra. Threads attached to the acrylic "olive" are threaded through the fenestration in the ligature carrier that is withdrawn, thereby pulling the threads into the peritoneal cavity and then subperitoneally and out through the abdominal wall where they are affixed to a traction device. Alternatively, the ligature carrier can be used via the vaginal dimple, placed under firm stretch in a cephalic direction in a fashion that allows, with laparoscopic assistance, puncture into the peritoneal cavity. The threads are then drawn through the subperitoneal space and subsequently externalized with the ligature carrier.[25] The suture threads are tightened 1–1.5 cm/d for seven to ten days. Subsequently, a vaginal dilator is used to complement coitus, all of which is focused on maintenance of adequate vaginal length and satisfactory intercourse. Success regarding coitus has been excellent and reported at over 90%.[26–28]

The Davydov procedure, originally performed laparotomically and described from Russia in 1969, creates the neovagina by lining the dissected vesicorectal space with peritoneum advanced from the adjacent peritoneal cavity.[29] The laparoscopic Davydov procedure (Figure 29.5)

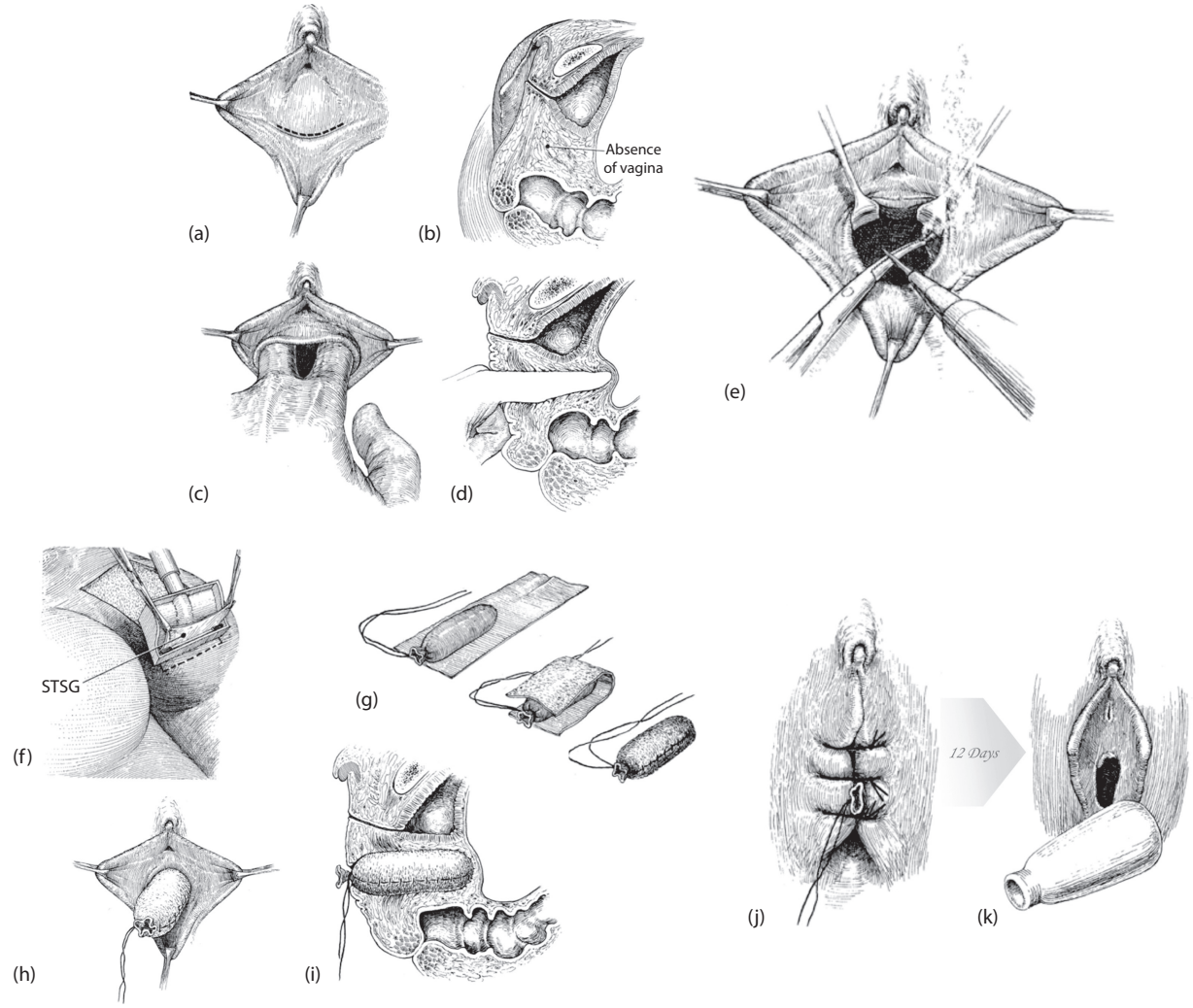

Figure 29.3 (a–k) Macindoe procedure. (Modified from www.atlasofpelvicsurgery.com. With permission.)

is simply a minimally invasive adaptation of the same procedure (Video 29.3).[30] With the bladder catheterized, the procedure is started laparoscopically by separating the urinary bladder from the rectum after forming a 4–5 cm transverse peritoneal incision between the two rudimentary uterine remnants, generally with laparoscopic scissors. With a finger in the rectum, the incision can be extended for about 1 cm between the bladder and rectum. From the perineum, the vesicorectal space is identified after making an "H"-shaped incision, and developed in a fashion similar to that used for the Wharton–Sheares–George technique with a large 27–28 Hegar dilator or with a combination of sharp and blunt dissection until the peritoneal edges are seen. The incised peritoneum is mobilized and drawn down caudally through this space and sutured to the edge of the "H" incision with interrupted 3-0 delayed absorbable monofilament sutures. After identifying the location of the ureters, a purse string or two "hemipursestring" sutures of a 2-0 delayed absorbable monofilament are positioned to include the lateral aspect of the mesorectum, the anterior rectal serosa, the peritoneum of the bladder dome, the round ligaments, the uteroovarian ligament, and lateral peritoneal leaf. This step can be accomplished either before or after the anastomosis of the peritoneum and the vestibule.[31] A vaginal stent (mold) is left in place for ten days followed by fitting with a permanent mold to complement maintenance of vaginal depth with intercourse.

The potential complications associated with these procedures include injury to bowel, bladder, and urethra as well as surgical bleeding. In addition, reduced vaginal length is likely to occur if there is lack of compliance with use of molds and/or coitus. Stricture and contracture secondary to scarring can occur as well as formation of granulation tissue and, if a split skin graft is used, hair growth in the vagina. Vesicovaginal, urethrovaginal, or rectovaginal fistula formation is also possible if there is injury to these adjacent structures. Vaginal vault prolapse is a potential problem after any intervention. However, overall, the incidence of such complications is low and in general less than 10%.[13,15,16]

Other methods of vaginoplasty are less popular and include use of bowel, sigmoid, jejunum, and ileum to line

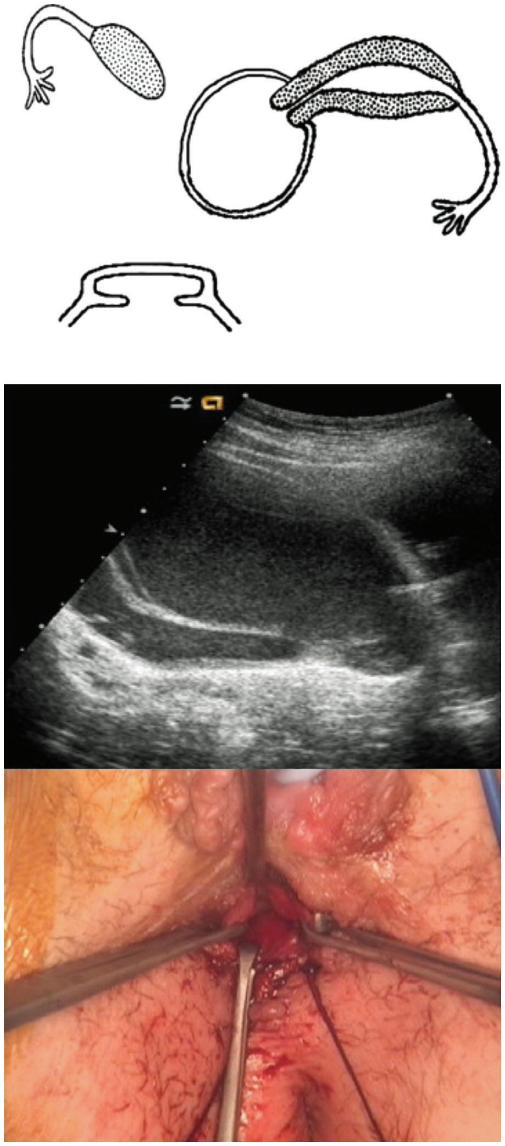

Figure 29.4 Isolated vaginal agenesis. (From Jessel RH, Laufer MR, *J Pediatr Adolesc Gynecol*. 2013;26(1):e21-3. With permission.)

the newly created vagina; however, foul-smelling mucus discharge and requirement for laparotomy make these approaches less desirable.[32]

Success rates are at least 74% when vaginoplasty techniques are viewed as a whole.[16] Functional success based on the validated Female Sexual Function Index reflects a range of 0 (poor) to 36 (extremely satisfied); this index provides scores of 25.2+/–3.7 for vaginal dilation and 27.9 +/–3.0 with vaginoplasty, compared to the general population of 30.2 +/–6.1.[13,14,16,33]

Instances of isolated agenesis of the lower vaginal tract may result from errors in the development of the sinovaginal bulbs and the vaginal plate. This can present as primary amenorrhea with findings of hematocolpos on imaging (Figure 29.6).[34] There may be a dimple present at the location of the vaginal introitus. Treatment for this is surgical and typically timed with adequate hematocolpos to distend the upper vaginal canal.

A transverse incision should be made at the perineum at the location of the vaginal dimple approximately 2 cm in length. Using a scalpel, the incision is continued until the bulging hematocolpos is reached. Care should be taken to remain in the same plane while creating the incision at the perineum to avoid injury to the urethra, bladder, or rectum. We recommend placement of a Foley catheter prior to incision to adequately show and palpate the location of the urethra throughout the procedure. A rectal exam should also be performed initially to palpate the hematocolpos location and then again at the end of the procedure to ascertain that no injury was incurred to the rectum. Once the hematocolpos has been reached and evacuated, vaginal epithelium can be seen. The vaginal epithelium should then be grasped with atraumatic clamps, such as an Alis clamp, at four corners and then pulled out to the level of the perineum to begin to create an introitus. The four corners of the vaginal epithelium can then be secured to the perineum using interrupted delayed absorbable sutures such as 2-0 polygalactin 910. Additional sutures may be added along the perimeter of the neointroitus.[34]

Figure 29.5 Surgical management of cervical agenesis. (From Fedele L, et al., *Fertil Steril*. 2008;89(1):212-16. With permission.)