Vaginal Reconstruction Utilizing Sigmoid Colon: Complications and Long-Term Results

By J. Kellogg Parsons, Susan L. Gearhart, and John P. Gearhart
Baltimore, Maryland

Background/Purpose: The use of sigmoid colon segments to repair congenital deformities of the vagina is well established. There are little data, however, on complications or functional results in these patients. The purpose of this study was to evaluate complication rates and long-term patient outcomes in the use of sigmoid segments in vaginal reconstruction for congenital anomalies.

Methods: The authors identified 28 patients who underwent vaginal reconstruction with sigmoid colon segments between 1985 and 2000 at their institution. Patient charts were reviewed for surgical technique, complication rates, cosmetic results, functional results, and psychosocial development. Patients were recalled for physical examinations and personal interviews to assess current status.

Results: Of the 28 patients, 13 had male pseudohermaphroditism, 6 had Mayer-Rokitansky-Kuster-Hauser syndrome, 2 had true hermaphroditism, 2 had mixed gonadal dysgenesis, 2 had common urogenital sinus syndrome, 2 had adrenogenital syndrome, and 1 had penile agenesis. Mean patient age was 16 years (range, 6 to 21 years). Mean follow-up was 6.2 years (range, 2 months to 15 years). Postoperative complications included introital stenosis (4 patients), mucosal prolapse (4), partial small bowel obstruction (2), perineal wound hematoma (2), superficial wound infection (2), and vaginal prolapse (1). None of the complications have affected long-term patency or cosmesis of the neovagina, nor has mucous production significantly affected quality of life. Fourteen of 16 (88%) adult patients are heterosexually active, 1 is homosexually active, and 1 is asexual. Of the 14 heterosexually active patients, 11 (79%) are "very satisfied" with their psychosexual development and 3 are "comfortable." Four patients are married, and 1 has carried a child to term. All adult patients felt that the appropriate time to undergo surgery was in adolescence.

Conclusions: Reconstruction with sigmoid segments is an effective approach for many congenital conditions requiring vaginal reconstruction. Although surgical outcomes are not perfect, appropriately timed reconstructive vaginal surgery can provide most patients with an improved quality of life. For the best long-term results, a multidisciplinary team must be available from infancy to supply comprehensive support.

INDEX WORDS: Vagina, intersex, ambiguous genitalia, sigmoid.

THE SURGICAL MANAGEMENT of absence of the vagina in the pediatric population constitutes a significant technical challenge, the outcome of which affects both the physical and psychosocial health of the patient. Typically, congenital syndromes such as vaginal agenesis (Mullerian aplasia, commonly referred to as the Mayer-Rokitansky-Kuster-Hauser syndrome) and intersex conditions such as androgen insensitivity, adrenal hyperplasia, and gonadal dysgenesis are the most common indications for colpopoiesis in the pediatric patient. However, defects acquired from extensive resection of pelvic tumors also may require vaginal reconstruction. Initially, the most popular surgical approach to vaginoplasty was the skin graft—notably the split thickness free graft, or McIndoe procedure.[1] Typically performed after puberty, the McIndoe procedure and its many variations require frequent dilatation or the wearing of a vaginal mold for several months after the initial surgery. This demanding postoperative regimen, as well as relatively high rates of graft failure and stenosis,[2,3] have dampened enthusiasm for this technique. Other potential complications include local irritation caused by the incorporation of hair-bearing skin, inadequate vaginal length, and dyspareunia.[4] Adult patients frequently require extensive artificial lubrication or vaginal estrogen suppositories to moisten the neovagina before intercourse. In addition, there are several reports of squamous cell carcinomas occurring in split thickness skin graft neovaginas.[5,6]

An alternative reconstructive approach, first described by Baldwin,[7] is to utilize intestinal segments. Although the use of ileum and cecum has been described in both children and adults,[8,9] sigmoid colon is a particularly favorable choice, owing to its anatomic proximity and readily mobilized vascular pedicle. Various investigators

From the Division of Pediatric Urology, The James Buchanan Brady Urological Institute and the Department of Surgery, The Johns Hopkins Hospital, The Johns Hopkins University School of Medicine, Baltimore, MD.

Address reprint requests to John P. Gearhart, MD, Professor and Director, Pediatric Urology, Brady Urological Institute, 600 N Wolfe St, Marburg 146, Baltimore, MD 21287-2101.

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have reported the successful use of sigmoid colovaginoplasty in infants and children.[9-16] Still, there remain little published data on long-term outcomes in this population, particularly with respect to adult patients who underwent reconstruction as children or adolescents. Herein, we report our experience with the use of sigmoid colon for vaginal reconstruction in the young female subject. Surgical technique, complications, and long-term results are discussed, and psychosexual outcomes in adult patients are reviewed.

MATERIALS AND METHODS

We identified 28 patients who underwent vaginal reconstruction with sigmoid colon segments between 1985 and 2000 at a single institution. In 24 patients, total vaginal replacement was performed. In 2 of these patients who had undergone a prior McIndoe procedure and were unsatisfied with the results, the graft was resected before placement of the sigmoid neovagina. In 4 patients, the sigmoid segment was utilized as an interposition graft because the vagina came off at the bladder neck and would not reach the perineum after mobilization. Patient charts were reviewed for surgical technique, complication rates, cosmetic results, functional results, and psychosocial development. In addition, patients were recalled for physical examinations and underwent personal interviews to assess current status.

We have developed a multispecialty team approach to treating patients with congenital abnormalities of the genitourinary tract and perineum, including those who require vaginal reconstruction. In planning the surgical approach, careful history is taken, with particular attention paid to previous surgical procedures. Before surgery, patients undergo rigorous endocrinologic and psychological review, thorough radiologic examination, and endoscopic evaluation of the urethra and any vaginal remnants. Patients are given a mechanical and antibiotic bowel preparation on the night before surgery.

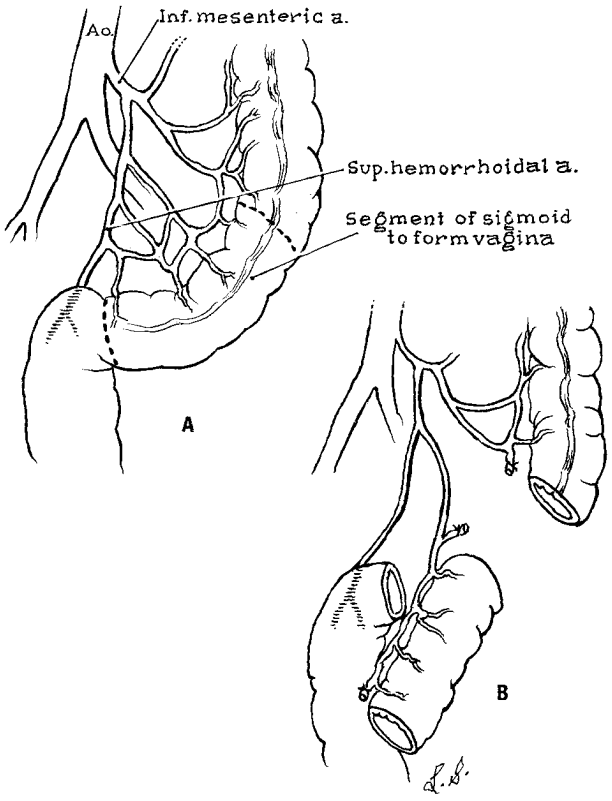

Fig 1. Mobilization and isolation of the sigmoid segment. (A) The descending colon is mobilized and a 10- to 15-cm portion of sigmoid is identified. (B) The sigmoid segment is isolated on its vascular pedicle in preparation for transposition to the perineum.

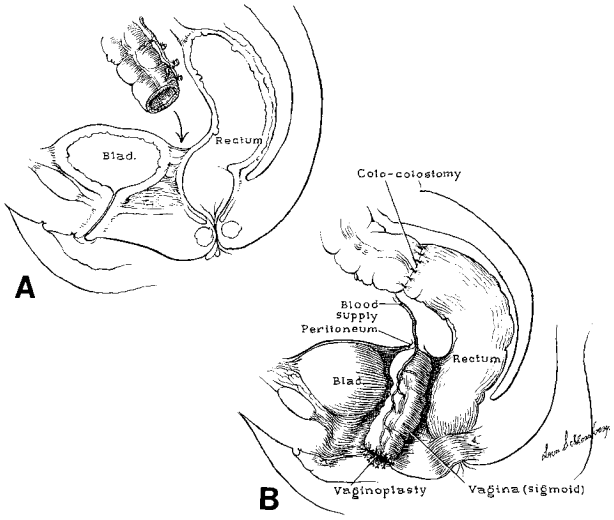

Fig 2. Placement of the sigmoid neovagina in the perineum. (A) After development of the surgical plane between the bladder and rectum, the mobilized sigmoid segment is brought down to lie in the pelvis without tension. (B) The colocutaneous anastomosis is performed, the proximal end of the sigmoid segment is closed (or, in the case of a transposition graft, the colovaginal anastomosis is performed), and colonic continuity is reestablished.

A simultaneous abdominal-perineal approach is used. Through a midline or Pfannensteil incision, the descending colon is mobilized from the splenic flexure down to, and including, the sigmoid colon. A 10- to 15-cm sigmoid segment is isolated on its vascular pedicle (Fig 1A and B). Simultaneously, through 2 U-shaped perineal incisions, a surgical plane is developed between the rectum and the urethra by a second operative team to shorten the operating time. (Alternatively, the sigmoid colon may be mobilized laparoscopically before making the perineal incision). A 14F Foley catheter is left indwelling in the urethra as the dissection progresses cephalad between the urethra and rectum. A rectal pack is not used routinely. Endoscopic instruments are kept at hand in case examination of the urethra or any vaginal remnant needs to be undertaken.

As the dissection proceeds from below in a cephalad manner, a Hagar sound is passed through the perineum, and the cul-de-sac is opened from above using the sound as a marker. The mobilized sigmoid segment then is brought down to the perineum without tension (Fig 2A and B). Depending on the vascular anatomy of the individual patient, either an isoperistaltic or peristaltic orientation is used. For those patients who require complete vaginal construction, a colocutaneous anastomosis is performed with interrupted 4-0 Vicryl/Dexon sutures, and the proximal end of the sigmoid neovagina is closed with 2 layers of interrupted 3-0 or 4-0 Vicryl/Dexon. For those patients with a high vagina requiring extension to the perineum, the sigmoid segment is interposed between the native vagina and the skin using interrupted 4-0 Vicryl/Dexon for both the colovaginal and colocutaneous anastomoses. Continuity of the colon is reestablished utilizing the GIA and TIA stapling devices. After the neovagina is sewn to the perineum, it is fixed to the sacral promontory with interrupted 3-0 silk and to the

pelvic floor with interrupted 3-0 silk to minimize postoperative prolapse. The neovagina is packed with antibiotic-soaked gauze, which is removed after 3 days. While in the hospital, patients are continued on intravenous antibiotics, and an indwelling Foley catheter is left in place for 5 days.

All patients are examined in the office 4 weeks after surgery, and most are vaginoscoped within 3 to 4 months after surgery. In those patients in whom the sigmoid is used as an interposition graft, vaginoscopy is performed routinely at 8 weeks postoperatively to check for narrowing of the bowel-vagina interface. If there is any suggestion of contraction of the colocutaneous or colovaginal anastomoses on examination, the patient is taken to the operating room for dilatation. Routine postoperative vaginal dilatation is not used.

RESULTS

Of the 28 patients, 13 had male pseudohermaphroditism, 6 had Mayer-Rokitansky-Kuster-Hauser syndrome, 2 had true hermaphroditism, 2 had mixed gonadal dysgenesis, 2 had common urogenital sinus syndrome, 2 had adrenogenital syndrome, and 1 had penile agenesis (Table 1). Mean patient age was 16 years (range, 6 to 21 years). In 2 (33%) of 6 patients with Mayer-Rokitansky-Kuster-Hauser syndrome, there was an adequate distal one third of the vagina present so that the sigmoid did not require anastomosis to the perineum.

The mean follow up for this series was 6.2 years (range, 2 months to 15 years). Overall, there was no postoperative mortality and minimal morbidity. Introital stenosis was noted in 4 (14%) patients on their first postoperative visit within 4 weeks after surgery. All 4 patients underwent dilatation of the colocutaneous junction under anesthesia and then were given a vaginal dilator and placed on a regular dilation protocol. All 4 responded well to this treatment and have had no subsequent recurrence of the stenosis. Two have become sexually active and have discontinued dilatation. Mucosal prolapse occurred in 4 (14%) patients within 4 weeks after surgery. This was managed in each case with local excision and fulguration of the prolapsed tissue and in each case has not recurred. One patient had significant, full-thickness prolapse of a large portion of the neovaginal segment, which required reexploration and fixation of the vagina to the pelvic floor. Other, less significant complications that developed during the immediate postoperative period included partial small bowel obstructions in 2 (7%) patients, each of which resolved after short-term nasogastric suction; perineal wound hematomas in 2 (7%) patients (both of whom had undergone prior McIndoe procedures), which were drained at the bedside without difficulty; and superficial wound infections in 2 (7%) patients, which responded to warm compresses and appropriate antibiotic therapy. At the latest follow-up, all patients had widely patent neovaginas. No evidence was seen of significant local irritation or abnormalities. Neovaginas were, for the most part, moist, yet none of the patients complained of excessive sigmoid mucous discharge.

Table 1. Etiologies of Vaginal Absence in the Study Population

Congenital Disorder	No. of Patients
Androgen insensitivity	13 (46%)
Mayer-Rokitanksy-Kuster-Hauser	6 (21%)
True hermaphroditism	2
Mixed gonadal dysgenesis	2
Common urogenital sinus	2
Congenital adrenal hyperplasia	2
Penile agenesis	1
Total	28

With respect to psychosexual outcomes in adult patients, 14 (88%) of 16 adult patients are heterosexually active, one is homosexually active, and one is asexual. The 12 younger patients are not yet sexually active. Of the 14 adult heterosexually active patients, 11 (79%) are "very satisfied" with their sexual development and function, and 3 (21%) are "comfortable." None of the patients reported significant dyspareunia. Four (29%) are married, and 1 patient with a history of congenital adrenal hyperplasia has carried a child to term that was delivered by cesarean section. All 16 adult patients felt that the appropriate time to undergo surgery was in adolescence.

DISCUSSION

To our knowledge, this is the largest series to date documenting long-term physical and psychosexual outcomes in patients undergoing sigmoid vaginoplasty for congenital absence of the vagina. Overall, long-term patency and function were high. The types and rates of complications encountered—namely, introital stenosis and prolapse—are comparable with those observed in prior series of intestinal neovaginas.[9,11] Notably, both patients who suffered postoperative perineal wound hematomas underwent excision of a prior McIndoe graft at the time of neovaginal construction. As a result, relatively more intraoperative bleeding was encountered. In the future, therefore, we recommend that perineal drains be placed in these patients at the time of surgery. Psychosexual evaluation indicated that most patients have thus far experienced satisfactory outcomes with respect to sexual development and function. Importantly, all of the patients in this series confirmed that the appropriate time to undergo surgery was in adolescence. Freundt et al[17] reported on psychosexual and psychosocial performance in adult patients with sigmoid neovaginas. This series included 8 patients with vaginal agenesis and 1 with androgen insensitivity. Psychosexual profiles, as determined by patient questionnaire, indicated that most of these patients achieved acceptable outcomes with respect to sexual relations, function, and satisfaction. However, the validity of these results is difficult to assess, because the investigators utilized the same questionnaire for transsexual patients—an entirely disparate

group of patients with profoundly different motivations for undergoing surgery. In a recent series, Wiesnewski et al[18] used an instrument that was designed specifically for use in patients with congenital abnormalities of the genitalia. In this series, long-term medical, surgical, and psychosexual outcomes for women with male pseudohermaphroditism (CAIS) were evaluated, and all patients felt that the proper timing of surgery was in adolescence, that psychological counseling was imperative, that they should be informed more about their condition at a younger age, and that complete patient confidentiality was essential. Select questions were utilized for the current study.

Although none of the patients experienced significant complications beyond the immediate postoperative period, there are several potential chronic complications of sigmoid neovaginas that merit discussion. Diversion colitis is a condition resulting from isolation of an intestinal segment from the fecal stream.[19] Clinically, it is characterized by pain, irritation, and bleeding. Endoscopy results may show erythema, edema, and friability of the mucosa, whereas histopathologic analysis typically shows ulceration, atrophy, and chronic inflammatory infiltrates with lymphoid hyperplasia.[20] The etiology of this condition is unknown. Diversion colitis has been observed in patients who underwent sigmoid vaginoplasty for vaginal agenesis.[21] None of our patients experienced this complication clinically. However, because we did not collect tissue for pathologic analysis, it is possible that at least some of our patients may have had subclinical signs of diversion colitis. Continued follow-up in this regard is required.

Although diversion colitis represents a pathologic entity that is induced by bowel segment isolation, it also is important to recognize that innate diseases of the GI tract may manifest in segregated loops of bowel. Ulcerative colitis, for example, has been reported in sigmoid neovaginas.[22,23] Similarly, patients with hereditary polyposis syndromes—familial polyposis, Gardner's syndrome, and nonpolypous hereditary colon cancer—have the potential to develop polyps in diverted colonic segments.[6] Intestinal neoplasia is a concern in sigmoid vaginoplasty patients. Although the reported rates are quite low (much lower than primary vaginal carcinoma, itself a rare disease), primary adenocarcinoma in neovaginas has been reported. Whether this represents a risk commensurate with that of any particular colonic segment independently developing adenocarcinoma, or whether it is perhaps related to the transplantation of colonic tissue to a new environment, remains unclear. Nevertheless, vigilance should be maintained as these patients grow older; in addition to standard endoscopy for colon cancer screening, vaginoscopy should be performed. Suspicious symptoms, such as bleeding or mass, necessitate prompt assessment.

With respect to ultimately improving outcomes in pediatric patients requiring vaginal reconstruction, technology holds much promise. Laparoscopy may reduce postoperative morbidity, pain, and length of stay while achieving the same operative results. Two groups have thus far reported the use of laparoscopy in sigmoid colpopoiesis.[24,25] We have utilized laparoscopy successfully in 3 cases (not included in this series) for mobilization of the sigmoid segment. Another promising endeavor is tissue engineering, which has the potential to create neovaginas without performing autotransplantation of intestinal segments.[26] Nevertheless, regardless of the method with which the vagina is reconstructed, we believe that to truly enhance psychosocial and surgical outcomes in these patients, a multidisciplinary team composed of surgeons, endocrinologists, and psychiatrists should be utilized as soon as the diagnosis is made. Such an approach allows the team to treat all aspects of a patient's condition in an integrated fashion, and thereby optimize psychosexual as well as physical results.

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