Reviews

MANAGEMENT OF PREGNANCY AFTER MAJOR URINARY RECONSTRUCTION

Jonathan S. Vordermark, MD, George E. Deshon, MD, and Robert E. Agee, MD

Major reconstructions of the urinary tract are being performed with increasing frequency. However, published experience concerning pregnancy after urinary reconstruction is limited. Complications in women who have undergone such complex procedures may endanger them or their fetuses and can disrupt the reconstruction or impair renal function. To counsel better those patients who have undergone urinary reconstruction and who desire to bear children, and to develop an approach to the management of their pregnancies, we reviewed the available literature. We found that the incidence of complications was low during pregnancy after a genitourinary reconstruction; the majority of women had an uneventful pregnancy and vaginal delivery. Close observation of renal function and prophylaxis against urinary tract infection during pregnancy are recommended. Elective cesarean is advised for women who have had a reconstruction of the bladder neck or urethra or who have received an artificial urinary sphincter. Urologists and gynecologists must continue to report the outcome of pregnancy in their patients who have undergone reconstruction so that we may develop meaningful data about the incidence of complications. ***(Obstet Gynecol 75:564, 1990)***

From the Urology Service, Department of Surgery, Letterman Army Medical Center, Presidio of San Francisco, California.

The views expressed in this article are those of the authors and do not reflect the official policy or position of the Department of the Army, the Department of Defense, or the United States Government.

A wide variety of procedures is now available to replace or restore functional integrity of the lower urinary tract or to provide a continent urinary reservoir. Many patients who have had a urinary diversion are also candidates for procedures to restore the continuity of their urinary tracts (undiversion). Those who have undergone such major reconstructions have experienced dramatic improvements in quality of life and preservation of renal function. Because many of these patients are of child-bearing age, it is only a matter of time until an obstetrician is faced with managing a pregnancy in a woman with a major reconstruction of the urinary tract.

Current Reconstructive Techniques

The creation of a reliable replacement for the urinary bladder has long been a goal of urologic surgeons. In 1950, Gilchrist et al[1] proposed a promising operation that used an isolated ileocecal segment to create a continent, catheterizable urinary diversion. The colonic portion served as the reservoir and the ileal limb was brought to the skin as a catheterizable stoma. Continence was provided by the ileocecal valve. This operation was never popular because of the low volume of the reservoir and the high incidence of incontinence and upper-tract deterioration from high-pressure contractions of the cecal segment. Bricker[2] introduced his technique of ileal urinary diversion in 1950, and the success of using isolated segments of bowel as a conduit drew attention away from efforts to develop a technique for construction of a continent reservoir. This trend was due in part to the ease and reliability with which an ileal diversion could be performed.

Because of a growing number of reports describing an unacceptably high incidence of late complications[3] after diversion with ileal and colonic conduits, the search for more physiologically and functionally acceptable alternatives was resumed in the late 1970s. The first such diversion to achieve clinical acceptance was proposed by Kock et al[4] in 1978. This procedure (Kock pouch) uses an 80-cm-long segment of ileum, the middle portion of which is detubularized and reconfigured to provide a low-pressure reservoir of adequate volume. The ends of the ileal segment are intussuscepted to form nipples. By maintaining an isoperistaltic orientation of the bowel, the proximal

nipple creates an antirefluxing ureteroenteric anastomosis. The distal nipple is brought to the skin as a continent, catheterizable stoma. Numerous other procedures have been described that are simpler and technically less demanding than the Kock pouch. These procedures may also use long segments of ileum and/or colon. Their success is based on the principle of using a detubularized and reconfigured segment of bowel to create a low-pressure reservoir.

A variety of methods to enlarge the small or spastic bladder have been developed. These procedures also use various segments of detubularized bowel or stomach, which are anastomosed to the bladder as a pouch to provide increased capacity and to lower intravesical pressure or to obliterate uninhibited or unstable bladder contractions. These operations may merely enlarge the bladder (augmentation cystoplasty) or replace the entire bladder (substitution cystoplasty).

Bowel segments may also be used to replace dysfunctional or absent ureters[5] or to provide catheterizable access to the bladder.[6] Even the appendix can be used as a catheterizable neourethra.[7] Reconstructions can also include an artificial urinary sphincter to achieve continence.[8,9]

Review of the Literature

Our review produced reports of 16 women who had a total of 18 pregnancies.[10–13] All had undergone an augmentation cystoplasty, 14 with an ileocystoplasty and two with a colocystoplasty. None of the women had a continent urinary diversion and none required an artificial urinary sphincter. Fifteen delivered healthy infants at or near term. Eight of these pregnancies were delivered by cesarean. There were no reported difficulties during cesarean and only one mention of dense intra-abdominal adhesions.

Two women experienced urinary retention during pregnancy,[10,11] and three developed progressive urinary incontinence that resolved after delivery.[12,13] Four of the pregnancies were complicated by recurrent urinary tract infections. One of these four women[11] developed a *Proteus* sp urinary tract infection during pregnancy and became progressively azotemic, with an increase in her serum creatinine from 1.0 to 1.9 mg/dL. Preterm labor developed at 30 weeks' gestation and, because of placenta previa, a cesarean was performed. The infant, who weighed 1220 g, died of respiratory failure.

Bowel Complications

No major bowel problems in women with augmentation cystoplasties were reported during their pregnancy or in the postpartum period, a surprising finding in light of the published experience for women with pregnancy after an ileostomy.[14–18] Although one series of women who became pregnant after ileostomy did not report any episodes of bowel obstruction,[16] the reported incidence of small-bowel obstruction in women who had an ileostomy for inflammatory bowel disease was as high as 43%.[15] Bowel obstruction may also occur postpartum.[15]

The women in the reports reviewed for this study had all undergone a relatively straightforward augmentation cystoplasty; none had had a complex undiversion or a continent diversion. It is not unreasonable to expect that patients with a more extensive reconstruction will have a higher risk for bowel obstruction during pregnancy than will women who have undergone an uncomplicated augmentation cystoplasty.

Patients with a continent diversion may also be at risk for stoma problems. Stomal obstruction and retraction, difficulties in fitting the stoma collection device, and prolapse of the stoma have been reported in the ileostomy patient.[14,18] In the series reported by Gopal et al,[18] stomal complications occurred in 22 of 66 women. Intussusception and volvulus of the terminal ileum at the site of ileostomy[15] have also been reported. Although not reported to date, difficulty with catheterization of the stoma during pregnancy is also a potential problem for the woman with a continent diversion.

Renal Complications

Urinary tract infection was described in four of the cases reviewed. Although infection could be linked loosely with preterm birth in only one case,[11] pyelonephritis has been associated with a significant rate of fetal wastage, preterm birth, and small-for-dates infants.[19–21] Because up to 80% of patients with a continent diversion or augmentation cystoplasty have intermittent or chronic bacteriuria,[22] it seems prudent to maintain these women on prophylactic antibiotic suppression for the duration of their pregnancy. No data are available that identify the optimal antibiotic for these patients. Antibacterial agents such as ampicillin and nitrofurantoin that have been demonstrated to be safe during pregnancy should be appropriate. Periodic surveillance with urine cultures would also be beneficial. Although no reports document the risk of infection during pregnancy for a patient with an artificial urinary sphincter, these women should probably also be maintained on antibiotic prophylaxis while pregnant.

Patients with moderate renal insufficiency (serum creatinine less than 2 mg/dL) are candidates for recon-

structions incorporating large segments of bowel. These patients are at risk for adverse metabolic sequelae, particularly hyperchloremic acidosis, which can worsen during pregnancy[23] because of mechanical factors produced by the expanding uterus, urinary stasis due to the physiologic hydronephrosis of pregnancy, or the inability of the compromised kidneys to increase their glomerular filtration rate to the level required during pregnancy. Although it is recognized that women with a serum creatinine higher than 1.5 mg/dL are at risk for deterioration of renal function during pregnancy,[24] it is not known whether pregnancy for a woman with a major reconstruction would pose risks to her renal function beyond those observed in individuals with renal insufficiency and an anatomically intact urinary tract. Only one patient in this review suffered deterioration of renal function during her pregnancy,[11] but the cause of this was not apparent.

The enlarging uterus may angulate or obstruct the ureters in a patient with a previous ureteral reimplantation,[25] requiring temporary urinary diversion with a ureteral stent or percutaneous nephrostomy. Careful monitoring of renal function and serial ultrasonography to detect hydronephrosis are therefore recommended throughout the pregnancy.

Complications Due to Primary Disease

The conditions that most commonly require a continent urinary diversion or augmentation cystoplasty in women of child-bearing age are exstrophy of the bladder and neuropathic bladder dysfunction due to spinal dysraphism. These entities may predispose the patient to problems with pregnancy and delivery that could jeopardize the urinary reconstruction. Although most women with bladder exstrophy deliver vaginally without difficulty, the incidence of abnormal fetal presentation is as high as 25%, a factor that predisposes these women to a high risk for cesarean.[26] Uterine prolapse during pregnancy is also common because of laxity of the pelvic floor, and can result in strangulation and erosion of the cervix and in preterm labor.[27] Prolapse of the pelvic viscera may also disrupt a bladder suspension and necessitate procedures to restore urinary continence or to correct uterine prolapse.[27]

Women with neural tube defects may experience difficulties with delivery because of bony abnormalities of the pelvic outlet or spasticity or contracture of the lower limbs.[28] Depending on the level of the neurologic lesion, patients with spinal cord injuries or spina bifida may not detect the onset of labor, especially preterm labor.[29] Paraplegia does not affect the ability of the uterus to contract normally,[20] but may preclude the coordinated muscle effort necessary for the final stages of labor.[26,29] These factors may necessitate cesarean delivery to protect the urinary reconstruction, especially if prolonged or difficult labor is anticipated.

Complications With Labor and Delivery

The need for cesarean for obstetric reasons should be anticipated. A detailed summary of the patient's surgical history should include a description of the anatomy of the reconstructed urinary tract. A urologist familiar with the anatomy of the patient's genitourinary tract should also be available at the time of cesarean.

A classical section using a midline uterine incision rather than a low transverse hysterotomy may be necessary if the lower portion of the uterus is obscured by adherent loops of bowel or by the reconstructed bladder.[11,27] When performing the cesarean, care must also be taken to avoid injury of the vascular pedicle to the cystoplasty. Parenthetically, the risk from minor invasive procedures, eg, amniocentesis, to the vascular pedicle of the bowel used in a urinary reconstruction has not been determined.[13,29]

Rupture of the augmented bladder is a potential risk for women allowed to deliver vaginally. Although not observed in pregnant women, spontaneous rupture of the augmented bladder has been reported.[30,31] This condition presents as sepsis or as an acute abdomen; a retrograde cystogram may fail to demonstrate the rupture. The only course is immediate operative exploration of any patient with an augmented bladder or a continent diversion who presents with an acute abdomen or sepsis without an obvious focus. Disruption of a reconstruction of the urethra, bladder neck, or vagina is also a risk of vaginal delivery. The safest method of managing delivery in these patients has not been resolved by experience. Because of the risk of damage to or disruption of the reconstruction by vaginal delivery, elective cesarean seems to be indicated for the woman who has undergone either a bladder neck or urethral reconstruction or placement of an artificial urinary sphincter.

A patient with diversion of the urine into the fecal stream (ureterosigmoidostomy) or the patient with tenuous fecal control or a neurologically compromised anal sphincter may be served best by cesarean if episiotomy or rectal laceration during delivery is likely.[26]

References

1. Gilchrist RK, Merricks JW, Hamlin HH. Construction of a substitute bladder and urethra. Surg Gynecol Obstet 1950;90:752–60.

2. Bricker EM. Bladder substitution after pelvic evisceration. Surg Clin North Am 1950;30:1511–21.
3. McDougal WS. The continent urinary diversion. J Urol 1987; 137:1214–5.
4. Kock NG, Nilson AE, Norlen L, Sundin T, Trasti H. Urinary diversion by a continent ileum reservoir. Scand J Urol Nephrol [Suppl] 1978;49:23–31.
5. Boxer RJ, Fritzsche P, Skinner DG, et al. Replacement of the ureter by small intestine. Clinical application and results of the ileal ureter in 89 patients. J Urol 1979;121:728–31.
6. Benchekroun A, Essakall N, Faik M, Marzouk M, Hachimi M, Abakka J. Continent urostomy with hydraulic ileal valve in 136 patients: 13 years of experience. J Urol 1989;142:46–51.
7. Duckett JW, Snyder HM III. Use of the Mitrofanoff principle in urinary reconstruction. Urol Clin North Am 1986;13:271–4.
8. Light JK, Scott FB. Total reconstruction of the lower urinary tract using bowel and the artificial urinary sphincter. J Urol 1984; 131:953–6.
9. Englemann UH, Felderman TP, Scott FB. Evaluation of the AMS 800 artificial urinary sphincter for continent urinary diversion using intestinal loops. Urology 1985;25:620–1.
10. Mori Y, Wakitani T. A spontaneous delivery at 36 week's gestation after ileocystoplasty. Mie Med J 1967;17:133–9.
11. Smith AM. Enterocystoplasty and pregnancy. Am J Obstet Gynecol 1973;117:527–9.
12. Bruce PT, Wheelaham JB, Buckham GJ. "Undiversion" with colocystoplasty for neurogenic bladder. A report of 2 cases. Br J Urol 1979;51:269–74.
13. Doyle BA, Smith SP, Stempel LE. Urinary undiversion and pregnancy. Am J Obstet Gynecol 1988;158:1131–2.
14. Scudamore HH, Rogers AG, Bargen JA, Banner EA. Pregnancy after ileostomy for chronic ulcerative colitis. Gasteroenterology 1957;32:295–303.
15. Priest FO, Gilchrist RK, Long JS. Pregnancy in the patient with ileostomy and colectomy. JAMA 1959;169:93–5.
16. DeDombal FT, Watts JM, Watkinson G, Goligher JC. Ulcerative colitis and pregnancy. Lancet 1965;ii:599–602.
17. Hudson CN. Ileostomy in pregnancy. Proc R Soc Med 1972; 65:281–3.
18. Gopal KA, Amshel AL, Shonberg IL, Levinson BA, Van Wert M, Van Wert J. Ostomy and pregnancy. Dis Colon Rectum 1985; 28:912–6.
19. Goeller H, Paelsack V. Pregnancy damage and birth complications in the children of paraplegic women. Paraplegia 1972;10: 213–7.
20. Robertson DNS. Pregnancy and labour in the paraplegic. Paraplegia 1972;10:209–12.
21. Barrett RJ, Peters WA. Pregnancy following urinary diversion. Obstet Gynecol 1983;62:582–6.
22. Montie JE, MacGregor PS, Fazio VW, Lavery I. Continent ileal urinary reservoir (Kock pouch). Urol Clin North Am 1986; 13:251–60.
23. Killam A, Grillo D, Summerson DJ. Pregnancy and delivery after ureterosigmoidostomy. Am J Obstet Gynecol 1967;97:278–9.
24. Hou SH, Grossman SD, Madias NE. Pregnancy in women with renal disease and moderate renal insufficiency. Am J Med 1985; 78:185–94.
25. Laverson PL, Hankins GDV, Quirk JG. Ureteral obstruction during pregnancy. J Urol 1984;131:327–9.
26. Stanton SL. Gynecologic complications of epispadias and bladder exstrophy. Am J Obstet Gynecol 1974;119:749–54.
27. Mariona FG, Evans TN. Pregnancy following repair of anal and vaginal atresia and bladder exstrophy. Obstet Gynecol 1982; 59:653–5.
28. Mann WJ, Jones DED. Pregnancy complicated by maternal neural tube defect and an ileal conduit: A case report. J Reprod Med 1976;17:339–41.
29. Daw E. Pregnancy problems in a paraplegic patient with an ileal conduit bladder. Practitioner 1973;211:781–4.
30. Rushton HG, Woodard JR, Parrott TS, Jeffs RD, Gearhart JP. Delayed bladder rupture following augmentation enterocystoplasty. J Urol 1980;140:344–6.
31. Scheiner JR, Kaplan GW. Spontaneous bladder rupture following enterocystoplasty. J Urol 1988;40:1157–8.

Address reprint requests to:
Medical Editing
HSHH-CI-ME
Department of Clinical Investigation
Letterman Army Medical Center
Presidio of San Francisco
San Francisco, CA 94129–6700

Received May 1, 1989.
Received in revised form September 11, 1989.
Accepted September 21, 1989.