



Contents lists available at ScienceDirect

Gynecologic Oncology

journal homepage: www.elsevier.com/locate/ygyno

Review Article

Urinary diversion in the genitourinary cancer survivor

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HIGHLIGHTS

- This article reviews current usage of the urinary diversion in Gynecologic Oncology.
- We discuss differences between continent and non-continent diversions.
- We highlight indications and contraindications for each type of diversion.
- Long-term follow-up for diversions is emphasized, especially within the cancer survivor.

ARTICLE INFO

Article history:

Received 23 June 2017

Received in revised form 13 October 2017

Accepted 15 October 2017

Available online xxxx

Keywords:

Diversion

Conduit

Neobladder

Review

ABSTRACT

Urinary diversion has been in the scope of practice of Gynecologic Oncologists since the inception of the sub-specialty. However, many fewer urinary diversions are performed currently than in the past due to improved prevention of cervical cancer. The intent of this article is to provide a state of the art review for Gynecologic Oncologists. Surgeons performing these complex procedures must be knowledgeable about the differences between various types of continent and non-continent urinary diversions, and the principles of pre and post-operative care.

This includes the indications for surgery and pre-operative considerations, types of urinary diversion including continent and non-continent diversions, and the need for long-term follow-up with patients who undergo urinary diversion requiring lifelong follow up and testing for surveillance of the upper urinary tracts and to monitor for nutritional and metabolic alterations.

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Conflicts of interest	0
Disclosures	0
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1. Introduction

Urinary diversion has been utilized in urology, gynecology oncology and surgery for over 100 years. The primary goal of the urinary

diversion regardless of the indication is to protect the upper tracts and kidneys while allowing the patient to remove urine from the body. Such treatments have been in use as early as 1852, when Dr. Jon Simon performed the first reported ureterosigmoidostomy on a 13 year old boy with exstrophy [1]. By implanting the patient's ureters into the rectum, he successfully restored voluntary voiding until the boy succumbed to sepsis 12 months later. Since then, several other

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methods have been created and refined including continent and non-continent diversions.

The ileal conduit and orthotopic bladder were both described early in 1911 and 1888 respectively, but their success rates were ultimately limited by surgical techniques [2,3]. Ureterosigmoidostomy remained the most common form of diversion until the ileal conduit was refined by Eugene Bricker in 1950 [4]. Surgical ease and the rate of success improved through Bricker's method, which in turn allowed the conduit to remain the diversion of choice until the beginning in the 1980s. Orthotopic urinary reservoirs that allow voiding via the urethra were initially reported by Camey and Le Duc [5] and now are a common alternative to the ileal conduit in urological patients [6] and some gynecologic cases [7]. Continent ileo-colonic diversion was also reported in the gynecologic oncology literature in the late 1980s and was enthusiastically adopted by many centers in the US [8].

Despite the multiple options that patients and surgeons have for urinary diversion, there are still challenges one must expect that can affect long term success and quality of life. These include malabsorption of nutrients and metabolic imbalances [9] as well as the need to follow the upper tracts (kidneys) for late presenting obstruction and hydronephrosis. Each of these needs to be carefully considered by the clinician to provide the optimum level of care.

2. Urinary diversion in gynecologic oncology

Urinary diversion has been an integral part of exenterative surgery for recurrent cervical cancer and other gynecologic malignancies since the late 1940s. With appropriate selection of patients based on prognostic factors such as stage, disease-free-interval and advanced imaging studies such as CT/PET, as many as one-third to half of patients undergoing pelvic exenteration may be cured. In addition, a small fraction of patients who undergo radiation therapy for gynecologic malignancies develop fistulas or fibrotic/contracted bladders that subsequently require urinary diversion. This is becoming less common due to innovations in radiation treatment planning and delivery, such as intensity modulated radiation (IMRT), that minimize severe damage to normal tissues [10].

There has been considerable evolution of the approaches to urinary diversion in gynecologic oncology over the past 70 years. This has progressed from the wet colostomy, to incontinent diversions that require an external appliance and most recently to continent urinary diversions that are self-catheterized or allow voiding through the urethra. Each of these approaches has its pros and cons and it is important that gynecologic oncologists appreciate the many nuances related to pre-operative planning, surgical construction and ongoing management of urinary diversions.

Mastery of the knowledge base related to urinary diversions is becoming problematic as fewer urinary diversions are being performed by gynecologic oncologists. This decline is due to several factors. First, the incidence of cervical cancer, which historically has been the main indication for pelvic exenteration, has declined dramatically. There are only about 12,000 new cases of cervical cancer annually in the US. In our program over the past decade, only one-third of exenterations have been for cervical cancer. The majority have been comprised of vaginal, vulvar and endometrial cancers. Second, although a significant fraction of patients with cancer initially confined to the pelvis experience distant failure, persistent disease in the central pelvis that is amenable to resection with clear margins is less frequent. This is due to advances in radiation, including more effective delivery systems and the addition of radiosensitizing chemotherapy.

Few urinary diversions are performed now annually even in the largest gynecologic oncology programs. Growth in the number of cases has occurred in some programs due to the willingness to perform extended resections that encompass removal of pelvic sidewall disease or to perform intraoperative radiation therapy (IORT) in those with minimal sidewall disease. But, even in centers that employ these

extended indications, the numbers of exenterations and urinary diversions are small. The rarity and complexity of these procedures, which almost always involve radiated tissues with compromised healing potential, raises issues related to the quality of surgical care. Although all gynecologic oncology trainees should receive exposure to the principles and performance of these operations, patients may be best served by directing these cases to a subset of gynecologic oncologists in a program. This can enable a few clinicians to become more proficient, and likely yield better outcomes than if many surgeons do a small number of cases, which might translate to one case every few years.

In addition, as has occurred in our institution, it can be helpful to forge a close working relationship between Gynecologic Oncologists and Reconstructive Urologists who have considerable knowledge and experience. However, a shortage of trained reconstructive urologists with an emphasis on the care of the Genitourinary Cancer Survivor may presently limit the opportunity for such collaborations.

The intent of this article is to provide a state of the art review for gynecologic oncologists. We review the indications for urinary diversion, preoperative evaluation, types of urinary diversions including continent and non-continent diversions, and the need for long-term follow-up of these cancer survivors with lifelong surveillance of the upper tracts, metabolic status and nutritional status.

3. Indications & diversion types

A urinary diversion may either be used in conjunction with a cystectomy or utilized to divert urine away from the lower genitourinary tract while keeping a non-functional bladder in place after radiation. Indications can be split into two broad categories: malignant and benign. Outside of gynecologic oncology, bladder cancer is the predominant indication for a urinary diversion and most often is performed with a radical cystectomy to treat the cancer. Bladder cancer is the ninth most common malignancy, with an annual incidence of approximately 430,000 cases worldwide [11]. Cancer survival rates have steadily increased throughout the years, in turn requiring more focus on long-term quality of life goals for the patient with respect to the urinary diversion that is employed [12]. Common benign indications for a cystectomy with subsequent urinary diversion include neurogenic bladder, radiation damage to the lower tract, interstitial cystitis, vesicovaginal fistula and other forms of devastating urinary incontinence [13]. For the benign indications for urinary diversion, the surgeon has the option of leaving the bladder in place or removing it at the time of surgery. Whatever the indication we prefer to remove the bladder at the time of diversion even in benign cases in order to avoid subsequent complications such as pyocystitis, recurrent infections and possible secondary malignancies [14].

Several factors must be taken into account when considering the appropriate candidate for creation of a urinary diversion and with respect to the type of diversion offered (Table 1). Regardless of the type selected, patient education and participation in treatment decisions results in higher postoperative satisfaction [15]. Other parameters such as comorbidities, previous surgical and radiation history, obesity, baseline renal and hepatic function, sexual function, and ability to self-catheterize all have an impact on the choice of urinary diversion. In addition there are other parameters to consider based on whether a continent or noncontinent diversions is selected [9,16]. Obesity was a relative contraindication to urinary diversion several decades ago because of the degree of difficulty of this surgery. Although this usually is no longer the case, self-catheterization of continent stomas may be problematic with significant obesity. Surgeons who are contemplating a diversion that requires using the colon should order a colonoscopy prior to surgery when the patient is of the age needing screening. It is important to confirm that the tissue is healthy before repurposing it into a reservoir. If the colonoscopy should find polyps indicative of carcinoma or signs of irritable bowel syndrome, further workup of that section of bowel is needed before continuing with the diversion. A preoperative

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