Perspectives
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Urinary Diversions: Perspectives on Nursing Care

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The indications for urinary diversion include bladder cancer, hostile neurogenic bladder, refractory interstitial or radiation cystitis, and congenital anomalies of the lower urinary tract. Bladder cancer is the most common indication for continent urinary diversion. These malignancies account for about 3% of all cancer deaths.[1] Superficial bladder tumors are managed by transurethral resection or laser ablation with or without intravesical chemotherapy, but more invasive tumors require radical cystectomy and urinary diversion.

Neurogenic bladder dysfunction occurs when trauma, infection, or disease alters neurological control of the lower urinary tract. The neurogenic bladder creates two primary problems from the urological perspective: voiding dysfunction (urinary incontinence or retention) and upper urinary tract distress, which is characterized by ureterohydronephrosis, vesi- coureteral reflux, febrile urinary tract infections, and renal insufficiency or failure.[2]

A hostile neurogenic bladder threatens the health of the kidneys that it serves. Several urodynamic conditions, including low bladder-wall compliance, obstruction, and detrusor

sphincter dyssynergia, are associated with this type of bladder dysfunction. When a patient has a hostile neurogenic bladder, bladder augmentation or urinary diversion are performed to reduce bladder filling and urine storage pressures and to alleviate subsequent upper urinary tract distress.[3]

Radiation cystitis is a chronic inflammation of the bladder, which is caused by exposure to external-beam or interstitial radiation therapy for pelvic cancer. In mild cases, radiation cystitis causes irritative voiding symptoms. They may be successfully managed by fluid and dietary changes, including the avoidance of bladder irritants, often combined with urinary analgesics, or antispasmodics. In more severe cases, hemorrhagic radiation cystitis may be improved, at least over a short-term period, by hyperbaric oxygen treatment.[4,5] Nevertheless, in some cases of radiation cystitis associated with low bladder-wall compliance and hemorrhagic cystitis, urinary diversion is done when more conservative therapies ineffectively control the bleeding, pain, and voiding dysfunction caused by significant radiation exposure.

Bladder Cancer is the most common indication for continent urinary diversion

Continent urinary diversion is also indicated as one portion of the extensive reconstructive surgery in children with classic exstrophy, epispadias, or cloacal exstrophy congenital defects.[7,8] Classic exstrophy in males is characterized by externalization of the bladder, pelvic diastasis, separation of the hemi-scrotum or labia, penile or clitoral defects, and significant urinary incontinence. Cloacal exstrophy occurs in females when the cloacal membrane fails to separate the vaginal, urethral, and anal orifices. While bladder neck reconstruction and bladder closure are adequate for most children who have these significant birth defects, continent urinary diversion is indicated in a minority who are not adequately managed by primary reconstruction.

Continent urinary reservoirs

A continent urinary diversion contains two essential elements: a urinary reservoir anastomosed to the ureters and a continent, catheterizable stoma attached to the abdominal wall. They are typically constructed from isolated segments of the bowel, although the fundus of the stomach has also been incorporated into the urinary reservoir.

Kock pouch

Continent urinary diversion requires construction of a urine reservoir that is attached to the ureters and some form of continence mechanism, which is incorporated into a stoma that is attached to the abdominal wall.[10] The Kock pouch: The first contemporary report of a continent urinary diversion incorporating these essential elements was published by Kock, who described a pouch that used detubularized small bowel.[11] The Kock pouch comprises three main segments: a proximal nipple mechanism made from approximately 17 cm of bowel; a reservoir that uses 78 cm of ileum; and a distal nipple, requiring another 17 cm, which is attached to the abdominal wall via a stoma. Continence is achieved by intussuscepting 17 cm of small bowel to form a segment that is at least 5 cm

long as well as two other segments; one is used for budded stomal construction; and the other is for anastomosis to the reservoir. Intussusception is maintained by extensive stapling, sutures, and a mesh of artificial material. A similar mechanism is constructed by converting a second 17-cm segment of small bowel into a non-refluxing mechanism for ureteral implantation.

The reservoir for the Kock pouch is constructed by detubularization of an isolated bowel segment.[12] This technique alters the geometry of the incorporated bowel and markedly diminishes its efficiency in propagating a peristaltic contraction. Were the bowel not detubularized, the increasing bolus of urine in the reservoir would stretch the multi-unit smooth muscle of the bowel wall, causing a powerful peristaltic contraction independent of nervous stimulation. We have observed such contractions during provocative urodynamic testing and found that they cause urine leakage from the stoma and an uncomfortable, cramping sensation within the abdomen.

Table 1. Reported continence after continent urinary diversion.

	Overall Continence Rate
Florida Pouch	97%
Indiana Pouch	68% %
Mainz Pouch	91%-97%
Miami Pouch	86%-99%

When constructing a reservoir for the Kock pouch, the 78 cm of bowel is placed in a U-shape on a sterile towel and isolated from the rest of the surgical field. The surgeon opens both halves of the bowel along the antimesenteric edge. The exposed mucosal edges are then anastomosed with running sutures to create a large, U-shaped reservoir as opposed to the characteristic tubular shape.

In experienced hands, the Kock pouch has been reported to achieve a daytime continence rate of 94% and a nocturnal continent rate of 84%.[13,14] However, this procedure has several disadvantages when compared to pouches that incorporate primarily large-bowel segments, and it has not gained widespread use by urological surgeons.

Metabolic complications associated with the Kock pouch include hypokalemia, hypomagnesia, and hyperammonemia leading to metabolic acidosis in 10% to 50% of patients.[15,16,17] Blood urea nitrogen and creatinine levels also rise, and some patients develop constitutional symptoms of renal insufficiency, including fatigue, anorexia, weight loss, and polydipsia. Chronic metabolic acidosis poses particularly problematic responses in children, leading to vitamin D resistance, hypocalcemia, hypercalciuria and bone demineralization. In addition to vitamin D resistance, many adults and children experience vitamin B12 deficiencies after the creation of a Kock pouch. Because the liver is able to store significant supplies of this vitamin, a deficiency may not be apparent until

two to five years after the procedure. Monthly intramuscular replacement may be required.[12,18]

Non-metabolic complications include urinary calculus formation within the ileal reservoir, uretero-ileal anastomotic stricture, and vesicoureteral reflux.[12] Because of the need for relatively extensive reconstruction and intussusception, problems with the proximal (antireflux) and distal (anti-incontinence) nipple valves are relatively common; 17% to 23% have been reported to require at least one surgical revision.[19]

Based on metabolic and mechanical complications, particularly those observed more than five years after pouch creation, as well as the complexity of this surgical procedure, most urologists prefer to create a continent diversion with the large bowel, which is usually isolated from its right segment.[9,16,19]

Other pouch techniques

Pouches incorporating the large bowel: Several procedures, including the Indiana, Florida, Miami, and Mainz pouches, incorporate segments of the right colon into the urinary reservoir, usually in combination with a segment of distal ileum.[20]

The Indiana pouch uses an isolated bowel segment, usually the ileum and ascending colon, which is made into a reservoir by detubularization. In this case, detubularization is achieved by transecting the bowel and folding it into an inverted U-shape. The ureters are then implanted into the side of the reservoir and a special nipple and valve is constructed to attach the reservoir to the skin. The ureters may be implanted in a refluxing or non-refluxing manner, since vesicoureteral reflux has not been proven deleterious to these high-volume, low-pressure reservoirs.

The anti-incontinence mechanism for the right colonic pouch was pioneered by a urologist at the University of Indiana.[21] It incorporates the ileocecal valve, which is reinforced by infolding the bowel wall, which extends to a budded stoma placed within the abdominal wall.

The candidate for continent urinary diversion with the right colon must be physically able to undergo a lengthy surgery. The patient's life expectancy in relation to quality of life also must be considered; persons with a life expectancy of less than one year are usually considered inappropriate for continent urinary diversion because of the prolonged time required to adjust to the surgery. The person must have adequate renal function, because the reservoirs have the potential to reabsorb fluids and urinary waste products. Generally, a serum creatinine level of 2.5 mg/dl or less is preferred. In most cases, the patient should have adequate gross and fine motor coordination to perform intermittent self-catheterization.[23] The person also must be able to follow directions and be willing to participate in the self-care skills demanded by the continent diversion.[24]

Contraindications for continent diversions that use the right colon include previous surgery with significant bowel resection resulting in malabsorption or chronic diarrhea,

patients with irritable bowel syndrome, ulcerative colitis, extensive diverticular disease, or bowel cancer. The presence of progressive neurological disorders involving the upper extremities is a possible contraindication, because the patient may be unable to self-catheterize. Other possible contrain-dications include morbid obesity and pelvic radiation, because of the increased risk of anastomotic leaks or poor wound healing.

Clearly, the major advantage of continent urinary diversion is the preservation of continence. Continence is initially attained during the day, but nocturnal continence remains more difficult to achieve, partly because bowel retains its ability to absorb water from the systemic circulation when the urine is hyperosmolar. Table 1 lists reported continence rates for the Indiana, Mainz, Miami, and Florida pouches.

Like the Kock pouch, these procedures are also associated with complications, including stomal incontinence, difficult catheterization, anastomotic leaks, pouchitis or pyelonephritis, obstruction, bacteriuria, urolithiasis, electrolyte imbalances, and alterations in bowel reabsorption.[3] In addition, rupture of the reservoir has been reported among patients who are not compliant with self-catheterization.[1]

Because of long-term problems associated with maintaining continence with surgically reconstructed bowel, Mitrofanoff described an alternative continent mechanism that incorporates the appendix.[25] This surgical technique uses three maneuvers to achieve continence: a small-caliber conduit (appendix or a segment ureter in selected cases) is mobilized that has sufficient length to extend to the abdominal wall to form a small stoma; an antirefluxing connection is established with the urinary reservoir, and a submucosal tunnel using a flap-valve mechanism is completed. As an alternative, the stoma can be placed at the umbilicus, providing a more cosmetic effect with the abdominal wall. When compared to a continent stoma formed with reconstructed bowel, the Mitrofanoff technique offers several distinct advantages.[26] It provides excellent diurnal and nocturnal continence (98%) and a straighter lumen between stoma and reservoir, facilitating self-catheterization. It also tends to produce less mucus than the stoma constructed from bowel and is less likely to require re-operation.

Orthotopic neobladder

In certain patients with a cancer-free trigone and urethra, and a competent, unobstructed sphincter, an orthotopic neobladder may be created as an alternative to urinary diversion. The neobladder is often preferred over even a continent urinary diversion, because it preserves micturition and avoids the need for an abdominal stoma.[24]

Cystectomy or cystoprostatectomy is completed prior to creation of the neobladder. Local lymph nodes may be scrutinized or removed for pathological analysis. Construction of the reservoir for an orthotopic neobladder is similar to construction of a reservoir for continent urinary diversion. It may be made from a 60- to 80-cm segment of small bowel, incorporating the ileocecal valve, which is detubularized to form a W-shaped reservoir; a 30-cm segment of terminal ileum and 25 to 30 cm of cecum and right colon; or a portion of the stomach.[27,28] The colon is cut along the antimesenteric border and folded to create

an S-shaped reservoir. An appendectomy is also performed.[29] The colon is then attached to the trigone and proximal urethra, following incision and eversion of a small segment of bowel. The reservoir may also be attached to the posterior periosteum of the symphysis using a technique similar to Marshall-Marchetti-Krantz urethral suspension. Contraindications for an orthotopic neobladder include bladder tumors that involve or extend into the trigone or proximal urethra, multifocal carcinoma in situ, positive prostatic biopsy, a locally advanced tumor, or lymph-node involvement.[30] Other contraindications include previous radiation therapy that is likely to interfere with wound healing or postoperative bowel function, pre-existing bowel disease, or renal insufficiency.[24]

Because the reservoir is attached to the urethra, patients maintain the ability to void by combining abdominal straining and pelvic floor muscle relaxation. Reported diurnal continence rates vary from 83% to 96% and nocturnal continence rates range from 34% to 71%.[30-32]

Metabolic complications may occur when ileum is used to create the urinary reservoir, including metabolic acidosis requiring alkalization in approximately 50% of patients. Long-term complications include vitamin B12 deficiency.27 Both ileal and ileocecal reservoirs are prone to urinary retention, which may be severe and lead to pouch rupture if bladder evacuation is not improved or intermittent catheterization begun. Other complications include stenosis of the cecal-urethral or ileo-urethral anastomosis, gastrointestinal fistula, ureteral fistula, and urinary calculi.[33]

Preoperative considerations

Preoperative educational needs depend on the type and extent of the planned surgical procedure. For the patient with cancer, preoperative educational counseling must reinforce flexibility, since the ability to complete a continent urinary diversion or neobladder may depend on intraoperative findings. In contrast, preoperative teaching can be more focused for the patient who has continent urinary diversion or neobladder construction because of a hostile neurogenic
bladder or severe cystitis. The nurse teaches the patient about the anticipated type of urinary diversion, self-care practices, number and type of postoperative drains, methods of pouching, control of urinary drainage, and minimization of odor.[34]

Intermittent catheterization education is begun for the patient who is scheduled for continent urinary diversion. The patient who will have a neobladder is advised that, while urethral voiding is expected to be preserved, strain voiding, i.e., increasing abdominal pressure while relaxing the pelvic floor muscles, will be necessary for micturition. An abdominal binder, with a Velcro® closure that can be secured at any point, may be applied to increase abdominal pressure.

Bowel preparation

Bowel preparation is completed preoperatively to prevent fecal contamination of the peritoneal cavity and to decompress the bowel.[35] Typical bowel preparation includes a low residue diet for 1 to 3 days prior to surgery, mechanical bowel cleansing using GoLYTELY® and marked reduction of bacterial flora via an antibiotic bowel preparation with neomycin or erythromycin.[1,10,3,23] Intravenous hydration may be required during the late stages of preparation owing to fluid and electrolyte losses from extensive bowel preparation. Parenteral tobramycin and vancomycin may be administered preoperatively to reduce the risk of postoperative wound infection involving anaerobic pathogens, such as the bacteroides.[36]

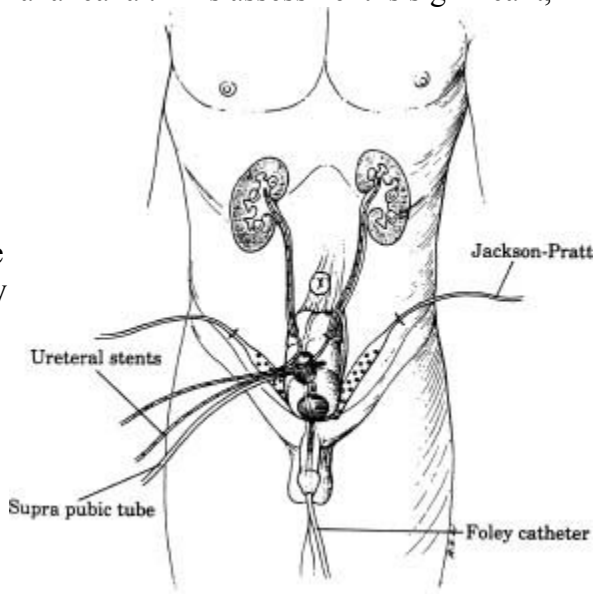
Physical and functional assessment

The preoperative nursing assessment is based on information from the patient's history and surgical plan. A general preoperative assessment is based on knowledge that the surgery will involve bladder reconstruction, the significant alteration of urinary function, and the removal of a segment of the large or small bowel from the gastrointestinal stream. The nurse particularly focuses on preoperative bowel elimination patterns, since bowel resection will produce a transient paralysis of peristalsis, which must be corrected during the early postoperative course. The urinary system is assessed for signs of infection, including gentle palpation of the costovertebral angle for evidence of pyelonephritis.

The patient's fluid status must be evaluated and closely followed, particularly if the person is elderly or has experienced nausea and vomiting during bowel preparation. A cardiovascular assessment includes blood-pressure measurement and auscultation for apparent abnormalities. The respiratory assessment includes auscultation for the quality of respirations and evidence of pneumonia, chronic obstructive pulmonary disorder (COPD), or other respiratory disorders likely to impact postoperative respiratory function.

A functional evaluation should be completed, because it will have a direct impact on postoperative education about self-management of the continent urinary diversion. For the patient with a paralyzing spinal disorder and limited upper-extremity dexterity, preoperative preparation may include consultation with an occupational therapist for detailed instructions on intermittent catheterization and fitting with assistive devices, such as a tenodesis brace or other prosthetic. The skin should be assessed for integrity and a pressure ulcer risk analysis should be completed.

For the patient who will have an orthotopic neobladder, neurological and musculoskeletal assessment should include the evaluation of pelvic floor muscle strength and function using a gloved finger placed in the vagina or anal canal. This assessment is significant, because it influences postoperative education about strain-voiding techniques.



Stoma site selection

The Wound Ostomy Continence (WOC) or Enterostomal Therapy (ET) nurse should be consulted to answer questions about surgery and postoperative care that are specific to urinary diversion and for stoma site selection.[24] For the patient who will have a diversion with a catheterizable, continent stoma, the WOC nurse helps to select a site that is accessible for catheter insertion and visual inspection. This site should not become lost in a skin crease or fold when the person assumes an upright position. It should allow for placement of a small dressing to protect the clothing from mucus discharge from the stoma, as needed. A commercially available secondary dressing holder with Velcro® closures may be applied to hold the primary dressing in place.

Postoperative considerations

Routine postoperative care

The patient is closely monitored by critical care nurses for two to five days postoperatively for cardiovascular and respiratory function, hemostasis, and fluid and electrolyte balance. A nasogastric (NG) tube is placed to decompress the stomach and bowel, to prevent vomiting, to protect the incision, and to administer medications to prevent stress ulcers. NG tube holders with a Velcro® type locking device are indicated because they reduce the irritation associated with tube manipulation or inadvertent dislodgement.[37]

Incentive spirometer, coughing, and deep-breathing exercises minimize postoperative respiratory complications. An abdominal binder may be worn to promote deep breathing. Sequential compression stockings are used to prevent venous stasis and thromboembolism. Ambulation should occur by postoperative day three or four. Early ambulation is strongly encouraged because of its preventive role in cardiovascular and respiratory complications and because of its facilitatory role in encouraging the return of bowel function.

The patient is assessed daily for evidence of peristalsis by auscultation. In addition, the patient is regularly assessed for the passage of flatus or a bowel movement (which is confined to passage of mucus material, often streaked with a small volume of blood).

Managing metabolic balance

Metabolic complications occur because urine is stored in a reservoir constructed from the gastrointestinal system. While the normal urinary bladder mucosa forms an effective barrier against the reabsorption of fluid or salts from stored urine, reservoirs constructed from ileum, colon or stomach both secrete and reabsorb a variety of ions and fluid, including sodium ions, which are exchanged for hydrogen ions, and bicarbonate, which is exchanged for chloride. In addition, an ileal or intestinal reservoir will reabsorb ammonium ions, causing an increase in serum urea and creatinine levels. These problems may occur at any time after surgical intervention, and many patients who have continent urinary diversion or neobladder construction will require systemic alkalization to prevent or alleviate bone demineralization caused by metabolic acidosis.[10,13,15,16]

Systemic alkalization is accomplished by dietary restriction of chloride intake. Sodium bicarbonate or Polycitra-K® (Baker Cummins) may be administered to supplement the body's store of these buffering substances.[38] Chlorpromazine (Thorazine) administered as 5 mg/kg/day or nicotinic acid 50 mg/kg/day may be administered to inhibit production of cyclic AMP-dependent acids from the urinary reservoir.[39,40]

In addition to a predisposition toward metabolic acidosis, loss of the ileocecal valve and ileal segments lessens the resorptive potential of the small bowel and reduces intestinal transit time. These changes predispose the person to diarrhea and malabsorption problems. Resection of significant amounts of ileum can lead to malabsorption of bile salts and vitamin B12, while resection of larger amounts of ileum (> 80 cm) is associated with malabsorption of fat and fat-soluble vitamins A, D, E, K.[10,23] The malabsorption of bile acid salts increases the synthesis of bile acids, which predisposes the patient to gallstones, kidney stones, and steatorrhea.[23]

Diversion-specific management

Continent diversion-specific management requires ongoing assessment of the stoma. Ureteral stents are used with continent urinary diversions to maintain ureteral patency. These stents may terminate into the urinary reservoir, a separate stab wound within the abdominal wall, or via the cutaneous stoma. The stents are essential to upper urinary tract drainage since urine flow never ceases following surgery. They are connected to a drainage bag immediately. Care is taken to see that they remain patent.

A suprapubic catheter may be placed into the urinary reservoir via a small stab wound in the abdomen. A second catheter is inserted through the stoma to facilitate drainage of urine not flushed by the stents. Use of Velcro®-type Foley catheter holders will help to stabilize drainage tubes and prevent accidental dislodgment. A Jackson-Pratt drain in the lower pelvic cavity and an indwelling catheter inserted through the urethra facilitates

drainage of pelvic fluid accumulation.[24] A Velcro® type drainage bulb holder also may be applied to reduce the likelihood of tube dislodgment.

Urinary extravasation

During the early postoperative period, the patient is at risk for urinary extravasation as the suture lines heal. Early signs of urinary or fecal leakage from anastomosis include an increased abdominal girth, fever, and drainage through the incision and around tubes or drains. The surgeon may choose to control the leakage by diverting the urine via nephrostomy tubes in order to allow the suture lines to heal. Leakage of urine at the anastomotic site or ureteral separation from the conduit may occur, causing the urine to seep into the peritoneal cavity.[3] Fecal anastomotic leaks occur uncommonly, but they cause peritonitis and usually require emergent surgical repair.[23] The symptoms associated with a fecal anastomotic leak are typically caused by peritonitis. They include fever, abdominal pain and rigidity, and absence of bowel sounds.[1]

Stoma viability

Stoma management during the postoperative hospital course is achieved by the combined efforts of WOC and unit-based nurses.[23] The stoma is inspected every hour for the first postoperative day for viability and to provide a baseline for assessment of subsequent deviations. If no problems occur during the early postoperative period, the interval between inspections is extended to every 4 hours, then every 8 hours prior to discharge from hospital.

The size, shape, and color are noted with each assessment.[3] It should be red, moist, and edematous during the initial postoperative period. Peristomal sutures that adhere to the skin and mucosal bowel edge are observed; slight bleeding when the site is cleansed is normal.[35] However, other changes may indicate complications, warranting prompt consultation with the WOC nurse or physician.[3] Any sign of darkness or duskiness raises a suspicion of an ischemic vascular supply.[1] An ischemic stoma usually appears pale, gray, and blanches when touched.[35] Fortunately, necrosis is limited to the mucosal stoma on the skin surface. It does not constitute a surgical emergency, as the upper portion will slough off, leaving a retracted or flush stoma. However, extensive necrosis occasionally occurs, demanding prompt surgical intervention. Stomal necrosis may result from poor surgical technique or an incorrectly sized or fitted appliance faceplate or related pouching appliance.[1]

Other complications include stomal herniation or retraction. Stenosis and retraction of the ostomy may result from scarring during maturation, use of an opening on the faceplate that is too large, epithelial hyperplasia, or thickening of the peristomal skin.[3] Stomal herniation may occur in any patient, but the risk is highest in obese patients or following a wound infection or subsequent radiotherapy.[41]

Maintenance of drainage tubes

The choice of drains and tubes varies according to the type of diversion or neobladder and the surgeon's judgment. In most cases, one or more ureteral stents are present. A catheter may be placed into the urinary reservoir through an abdominal stab wound or suprapubic wound. A urethral catheter may be in place if the patient has an orthotopic neobladder or if a continent urinary diversion was completed for an indication that did not mandate cystectomy (e.g., a neurogenic bladder).

Initially, patients may feel overwhelmed by the variety of tubes, stents, and pouch drains in place. They should be taught the purpose of each tube or drains and informed of the anticipated removal dates. With continent bladder reservoirs, initial teaching of appropriate hygiene and the "no-touch" technique for using an irrigating syringe should be illustrated with a model before self-demonstration. To increase patient confidence, the nurse should counsel the patient about the different holders that will be applied to secure and stabilize the various tubes.

During the immediate postoperative period, all catheters, stents, and drainage containers should be labeled and a closed, gravity drainage system for each device must be ensured. Clear identification of each tube is strongly recommended to prevent errors in irrigation and output calculations. The use of separate closed systems is encouraged because they minimize the risk of bacterial contamination and infection.[35]

When managing the patient with a continent urinary diversion or neobladder, it is essential to remember that urine flow never ceases. The nurse must ensure that the catheter and stents, if present, are draining urine freely at all times. Urine output is regularly monitored for amount, color, and clarity every hour for the first 24 hours then at least every 8 hours until hospital discharge. Pink or light red urine is initially observed, but the color will change from pink-tinged and clear to the characteristic yellowish hue by the third postoperative day.

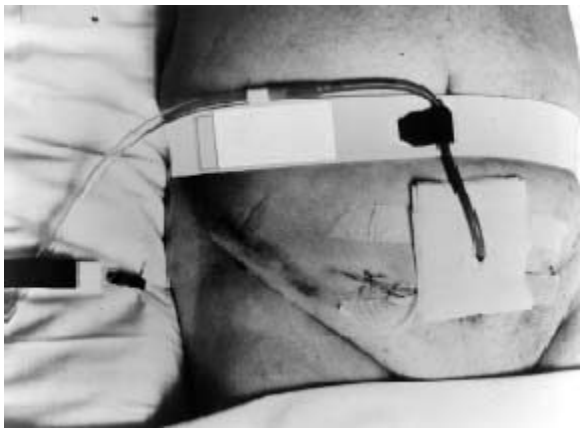
The urinary reservoir will manufacture large volumes of mucus, causing the urine to appear cloudy and filled with sediment.[35] Nevertheless, the nurse should regularly observe the urine for character, color, and the presence of blood. Bright red blood or clots in the urine must be reported promptly; they may indicate a loss of anastomotic integrity or infection causing hematuria.[35]

Urine output is monitored closely and the nurse irrigates the catheter at regular intervals, as directed, to maintain patency. A urine output less than 30 ml/hr or no output for more

than 15 minutes is reported promptly to the physician, since it indicates blockage of urine drainage or oliguria. Obstruction of drainage tubes must be managed promptly, since it can damage the newly created reservoir by creating stress against the fresh suture lines.

All catheters and stents should be secured with a Velcro®- type catheter holder to prevent occlusion from kinking or inadvertent dislodgement. Antegrade flow from all drainage tubes or stents is encouraged by positioning the drainage bag below the level of the kidneys to maximize the effect of gravity. In addition, gentle irrigation is completed regularly during the immediate postoperative period to prevent occlusion from mucus or small clots within drainage tubes.[1,42] The Penrose drain is also carefully monitored during the immediate postoperative period. It may produce a large amount of drainage, requiring transient containment via an ostomy appliance. This pouch should be emptied when it is one-third to one-half full or at least once daily. If drainage from the Penrose drain is minimal, a gauze dressing may suffice. The patient may shower and wash the area of Penrose drain with soap, allowing water to run over and clean the site.[42]

Unlike the continent urinary reservoir, a neobladder is drained by a large indwelling urethral catheter that is anchored in place with sutures to prevent migration or stress against fresh anastomotic suture lines. The catheter is gently irrigated to remove residual mucus every 4 to 6 hours.[23] It may be initially placed under slight traction using a Velcro®-type catheter holder with a locking device to prevent or minimize bleeding.[37]



Pain management

Pain management focuses on identification of the etiology of discomfort, correction of modifiable causes, and a combination of pharmacological and non-pharmacological interventions designed to alleviate the pain. Identification of the cause of discomfort is particularly significant, since a cramping pain and pressure localized to the abdomen may indicate distension of the urinary reservoir associated with urinary outflow obstruction, while continuous discomfort localized to the abdominal suture line is attributable to wound pain. Patients with defunctionalized bladders who have diversion for a neurogenic bladder or interstitial or parasitic cystitis may complain of suprapubic pain caused by a pyocystis or residual discomfort related to interstitial cystitis.[43]

Epidural analgesia is often preferred for pain management during the initial 4 to 5 postoperative days. We particularly prefer this method, because it provides superior pain relief when compared to patient-controlled pumps and because it promotes an early return of bowel function. Nevertheless, patient-controlled analgesia may also be used during this initial period. During this period, the patient's response to pain medications is closely observed and vital signs are monitored hourly. By the time the patient is tolerating clear

fluids and the nasogastric tube has been removed, oral narcotic analgesics are substituted for epidural or parenteral agents. An oral narcotic is administered as indicated throughout the remainder of the hospital course. Patients require narcotic analgesia for about 5 to 7 days after hospital discharge.

Since patients are usually preoccupied with postoperative pain, discomfort, and fatigue, they are typically unable to focus on discharge instructions until these symptoms subside.[42] Therefore, discharge teaching usually begins on postoperative day 4 to 5, when oral analgesics are begun and parenteral agents are discontinued.

Non-pharmacological pain management includes proper positioning and splinting of the abdomen when completing pulmonary toilet. Drainage tube occlusion must be promptly evaluated, since almost any distension of the reservoir produces discomfort and threatens anastomotic integrity. Irrigation of catheters and tubes should be gentle, and the nurse should be careful to secure catheters in a manner that protects underlying skin and avoids pressure injury.

We have found that a combination of early ambulation and epidural analgesia are ultimately beneficial to pain management, because these activities encourage the return of bowel function, thus allowing the earliest feasible removal of the nasogastric tube, which patients usually find uncomfortable.

Patient education during hospitalization

Patient education about bladder management after urinary diversion or orthotopic neobladder construction begins before surgery and is re-started as soon as possible after surgery. While education focuses on the patient, family members and other care providers are included, whenever feasible.

The patient is taught multiple measures for mucus management, including irrigation, which transiently removes mucus from the pouch. They also learn strategies that reduce the volume of mucus production and mucus viscosity. Patients should be taught to drink an adequate volume of fluids to dilute the mucus. This intake is based on the Recommended Daily Allowance (RDA) for fluids (30 ml/kg or 5 ounce/lb). Patients are also encouraged to drink 4 to 8 ounces of cranberry juice, which contains several substances, including benzoic and quinic acids, that are converted into hippuric acid, which thins the mucus within the pouch and makes catheterization easier.[44]

The patient with an orthotopic neobladder is taught that the reconstructed bladder will function differently than the native bladder. Following construction of a neobladder, micturition requires increasing pressure within the neobladder by abdominal straining, combined with striated sphincter (pelvic floor muscle) relaxation. In addition, voiding may be assisted by smooth muscle contraction within the reservoir wall.[45-47] Using this combination of techniques, residual volumes vary from 0 to 300 ml.[48-50] Only 3% to 6% will require ongoing intermittent catheterization.[51] However, the risk of markedly elevated residuals with inefficient voiding is significant, as illustrated by one case study

of a patient with an abdominal abscess after neobladder construction who was non-compliant with voiding instructions.[52]

Because of the risk of inefficient voiding and elevated residual volumes, patients are taught to void when the bladder feels full or to urinate by the clock (every 3 to 5 hours). They are also taught to identify, contract, and relax the pelvic floor muscles, preferably with biofeedback assistance. They are then taught to relax the pelvic floor muscles when urinating, since failure to do so has been associated with clinically significant urinary retention.[45,46,53] Patients use a combination of spontaneous voiding (whenever feasible) combined with abdominal straining to achieve maximal evacuation of urine. This combination is significant, since smooth muscle contractions within the reservoir wall often produce an initially good stream, but abdominal straining is necessary to achieve acceptably efficient micturition with low residual volumes.[45,54]

Follow-up and home care

Continent urinary diversion

Follow-up and home care of the patient with a continent urinary diversion differs from that recommended for the patient with an incontinent diversion. About 3 to 4 weeks postoperatively, a cystogram is obtained to ensure anatomic integrity of the reservoir and any remaining in- dwelling catheters are typically removed. This cystogram may be done under low and high pressures, but significant discomfort is not typically associated with this procedure.

Once anastomotic integrity is ensured, the patient with a continent urinary reservoir is taught self-catheterization. Catheterization proceeds on a progressive schedule designed to promote expansion of the urinary reservoir. Ultimately, most reservoirs hold 500 to 1000 ml.[12,20] With an intussuscepted continent stoma, the patient uses a relatively large catheter (16-18 French). He or she is taught to apply gentle pressure if resistance is met with catheterization and to gently rotate the catheter to identify the location of the central lumen. We have observed that most patients rapidly learn to identify the best angle for catheterization, and the nurse frequently benefits from asking the patient with a long-standing continent diversion to identify this angle before attempting catheter insertion.

In contrast, the patient with a Mitrofanoff procedure is typically taught to catheterize with a smaller-sized tube (10 to 14 French). Patients with a Mitrofanoff procedure typically find self-catheterization easier to do than those with a continent abdominal stoma constructed from intussuscepted bowel.

In addition to teaching the patient to self-catheterize, we have found it necessary to teach at least one family member or significant other to perform catheterization. This preventive education is invaluable should the patient be temporarily unable to complete this procedure. Teaching care providers or family members is also essential for handicapped patients who have continent urinary diversion, particularly when upper extremity function is impaired.

A stoma that is incorporated into a continent urinary diversion is not expected to leak urine, but it may produce mucus. Therefore, it may be covered with a gauze dressing between catheterizations to contain mucus discharge. The peristomal skin should be regularly observed for rashes and for integrity, but patients can be reassured that skin problems are rare. The use of a secondary wound dressing and holder is recommended when skin problems are present.

Long-term complications

All patients who have a urinary diversion or orthotopic neobladder are taught signs and symptoms of urinary tract infection (UTI). Patients with a continent urinary diversion or orthotopic neobladder may experience a febrile UTI, which may indicate pyelonephritis but more likely indicates pouchitis. This infection is characterized by abdominal discomfort that may or may not be localized to the urinary reservoir. Mucus production is likely to increase and blood-tinged urine may be present. Treatment of pouchitis or febrile UTI is based on sensitivity-guided culture results.

Patients are taught the importance of routine follow-up management, including regular monitoring of renal function and residual urine volumes. The routine monitoring of residual volumes and voiding efficiency is particularly significant for the patient with an orthotopic neobladder, since elevated residual volumes predispose the patient to complications, such as stones, infection, and compromised renal function.

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