

# Urinary Diversion

Urinary Diversion means the removal of urine in a way other than natural (e.g. using anastomoses or catheters from individual sections of the urinary tract). It can be divided into **temporary** (acute or postoperative) and **permanent**. It can further be divided into external and internal (ending in the body), continent and incontinent, direct (mouth to the outside - ureterostomy) or indirect (catheters).

## Nephrostomy

Nephrostomy is used for **external drainage of the hollow system of the kidney. It is mostly an acute procedure** (subrenal obstruction - stone, tumor, stenosis of the pyeloureteral junction or ureter; obstructive pyelonephritis, especially if it progresses to sepsis). It is also indicated for some tumor processes, urinary fistulas or as a temporary solution during and after various procedures (antegrade endoscopic treatment of ureteral stenoses and insertion of stents).<sup>[1]</sup>

The procedure is preceded by an **internal preoperative examination** of the patient. Disposable sterile sets with instruments are prepared for the procedure itself (puncture needle with mandrel, X-ray contrast material, wire, dilators, nephrostomy drain, fixation aids, collection bag). It is most often performed under local anesthesia. The patient lies on his stomach or side. Needle puncture is performed in the **posterior axillary line** under ultrasound control. This is followed by injection of the hollow system with a contrast material and dilation of the percutaneous channel with the introduction of a definitive catheter on a wire (Seldinger method) under fluoroscopic control (C-arm). Subsequently, the catheter is fixed with two stitches to the skin (it is fixed inside the hollow system by the shape of the end - a pigtail or a balloon).<sup>[1]</sup>

The procedure is contraindicated in case of **inappropriate coagulation parameters, significant obesity or kidney tumor**. The most common complications include bleeding from the puncture channel, perforation of the hollow system, and urinary infection. Kinking or clogging of the catheter, which is manifested by a decrease in diuresis, pain and can even lead to urosepsis.<sup>[1]</sup>

## Ureteral stents

Stents are used both for derivation and as support after ureteral operations. One end of the stent opens into the bladder, the other is coiled in the pelvis. The shape of the stent prevents its dislocation (pigtail, double J stent, multicoil). Indications are mainly **obstruction of the ureter** (ureterolithiasis, strictures, tumors, pregnancy), temporarily in conditions after surgery (pyeloplasty, ureteroscopy) and iatrogenic damage to the ureter. Stents are inserted **anterogradely** through the nephrostomy or, more often, **retrogradely** during endoscopy. Using a cystoscope and a guide, the stent is introduced into the pelvis, where its position is verified fluoroscopy (stents may have X-ray contrast markers on them). In some cases, special stents are used - biodegradable, reinforced (for compressions caused by tumors), silicone (extending the exchange interval up to a year).<sup>[1]</sup>

## Catheterization of the bladder

### Catheterization with a catheter

**Catheterization of men, unlike women, falls exclusively in the hands of a doctor.** It belongs to basic medical skills. Most often, a Foley catheter 16-18 Ch is used for this procedure, ending with a fixation balloon (5-10 ml of physiological solution) for permanent catheterization. Before the procedure itself, it is important to apply a sufficient layer of **lubricating gel with an anesthetic effect** (Mesocain gel) to the catheter. However, many other catheters are available - with a straight or rounded end (Nélaton), curved end (Tiemann). Some catheters can be made of materials that adjust their stiffness according to the current temperature. In case of macroscopic hematuria, three-way catheter (Dufour) can be used, where one way serves for filling the balloon and the other 2 ways for lavage of the bladder (one for fluid instillation and the other for irrigation). Catheters are produced in different sizes (men, women, children). **More serious conditions and complications associated with catheterization belong in the hands of a urologist.** Indications are urinary retention due to various causes (subvesical obstruction, neurogenic bladder), instillation into the bladder (e.g. as part of chemotherapy), collection of an uncontaminated urine sample (bacteria, blood), accurate measurement of diuresis. They are contraindicated in the case of certain urethral strictures, **acute inflammation** in the area, trauma to the urethra <sup>[1]</sup>

**Intermittent auto-catheterization** - in some cases, intermittent auto-catheterization (intermittent self-catheterization) is more beneficial for the patient. This can be divided into **clean** or directly **sterile**. The advantage (apart from the possibility of self-intubation) of the method is that, compared to permanent catheterization, the catheter does not cause ischemia by pressing on the lumen of the urethra and thus limits the subsequent penetration of bacteria into the body. The catheter can be classically lubricated with gel or catheters with a hydrophilic surface layer can be used. After contact with water, the surface layer softens (becomes more slippery) within a minute and increases its surface up to 10x. Intermittent technique was pioneered by Guttman and Frankel during World War II. Lapidès (1972) argued for the expansion of pure intermittent auto-catheterization.. <sup>[2]</sup>

### Complications and care of catheters

Very frequent complications of inserted catheters include **bacteriuria and bacteremia together with chronic bacterial colonization of the lower urinary tract**. Any block in the outflow of urine (catheter kink, blockage) can lead to infectious conditions (in extreme cases, urosepsis). This condition must be quickly resolved by opening the passage of urine under simultaneous antibiotic therapy. Asymptomatic bacteriuria does not need to be treated during long-term catheterization. Antibacterial treatment is given only when changing the catheter or other instrumentation in the area of the urinary tract. Another complication is the **risk of trauma** and the subsequent formation of strictures, percutaneous fistulas or diverticula. For this reason, **epicystostomy** is preferred for long-term catheterization, which tends to be better tolerated. The frequency of catheter changes (urethral and suprapubic) is individual and depends on the physical parameters of the catheter (material, caliber) and the speed of salt formation on the surface. In most cases, the exchange is carried out after 4 weeks. <sup>[1][2]</sup>

## Epicystostomy

Epicystostomy drains urine with a suprapubic catheter. The procedure is performed on an outpatient basis, under local anesthesia about 3 cm above the upper edge of the symphysis at an angle of 80-90°. The basis of a safe execution is sufficient filling of the bladder, otherwise there is a risk of intestinal perforation. Insertion is checked sonographically. Indications are acute urinary retention (subvesical obstruction, neurogenic bladder, lower urinary tract injury). <sup>[1]</sup>

## Long-term diversion

After removing the bladder, it is necessary to solve the drainage of urine in order to protect the upper urinary tract while simultaneously achieving an acceptable quality of life. Depending on the method of execution, diversions can be divided into **incontinent** (supravesical diversion) and **continent** (substitution of the bladder).

### Incontinent urinary diversion

Incontinent urine diversion performs only a draining function. For its continuous course, it is necessary to use stoma devices. In palliative care, when the condition is no longer expected to improve, **cutaneous ureterostomy** is considered. In this case, the outlet of the ureters is surgically brought out through the wall of the abdominal cavity into a collection bag. However, its indication is rare today. The most common complication is stenosis of the stoma. <sup>[2][3]</sup>

### Uretero(ileo)stomy

**Uretero(ileo)stomy** was first described by Smith in 1887, but it is more widely known as **Bricker's operation** (1950). First, 15-20 cm of aboral ileum is excluded, where ureters are then implanted. A stoma is created in the right mesogastrium. It has been shown that there is no effect on reflux if the ureters are sutured separately or connected. The antireflux mechanism is the continuous flow of urine itself. Complications tend to be stenosis of the anastomosis of the ureters or at the site of their implantation. <sup>[3]</sup>

### Continent urinary diversion

Continent diversions of urine allow its collection and subsequent drainage at an appropriate moment.

#### Diversion controlled by the anal sphincter

**Ureterosigmoidostomy** is the oldest type of derivation (since 1852). Previously, this technique was burdened with high mortality and morbidity. Today it is performed as implantation of ureters into the sigmoid with an antireflux submucosal channel. The risk of ascending pyelonephritis is reduced by using a **sigma - rectum pouch (Mainz II)**. The large intestine is incised longitudinally (in the tenia) at the junction of the sigmoid and the rectus for a length of about 20 cm, and the ends are sewn together. A low-pressure reservoir is thus formed by the transverse suture of the intestine. The most common complications are ureteral stenosis, ascending pyelonephritis, and incontinence. <sup>[3]</sup>

#### Heterotopic neovesica

Different parts of the small and large intestine can be used to create it. The basic principles of pouch formation must be maintained - bowel detubulation, formation of a spherical low-pressure neovesicle and anti-reflux implantation of the ureter (e.g. technique according to Le Duc or Goodwin). The mechanism of urinary continence is ensured by the creation of a vascularized continent valve. Creation is considered in patients where it is not possible to create an **orthotopic** vesicle. Complications can be a stoma at the site of ureter implantation, stoma incontinence, and complications with the vascularization of the stoma by the patient. <sup>[3]</sup>

#### Orthotopic neovesica

There is a whole range of surgical techniques using different parts of the gastrointestinal tract (gastric neo-vesicle - **gastrocystoplasty**, ileal neo-vesicle - **ileocystoplasty**, ileocecal neo-vesicle, colon ascendens neo-vesicle, sigmoid neo-vesicle). In principle, it involves replacing the bladder by creating a high-capacity, low-pressure reservoir. The basic principles are similar to those of the heterotopic pouch (exclusion, detubulation, bowel reconfiguration, reflux technique of ureteral implantation). The outflow of urine is ensured by an anastomosis with

the urethra and the retained sphincter. In oncological patients, it is necessary to take into account the maintenance of oncological safety, i.e. the risk that the remaining urothelium may be a source of cancer progression. Complications are stenoses at the site of anastomoses and varying degrees of incontinence. <sup>[3]</sup>

## Links

### Source

1. HANUŠ, Tomáš a Petr MACEK. *Urologie pro mediky*. V Praze: Univerzita Karlova, nakladatelství Karolinum, 2015. ISBN 978-80-246-3008-3. Str. 248-251.
2. Presentace Poruchy mikce <https://portal.lf1.cuni.cz/clanek-996-vzdelavaci-program-urologie-1-lf-uk>
3. PDF článek z webu urologiepraxi.cz <https://www.urologiepraxi.cz/pdfs/uro/2001/04/06.pdf>