

## Management procedure of each tube-related emergency

### *Difficult urinary catheterization*

Fully understand patients' basic condition, medical history (such as severe prostatic hyperplasia, urethral stricture, and trauma-induced urinary tract damage), and judge the filling degree of bladder by ultrasonography in emergency department to assist diagnosis and operation choice. Before the operation, inject 2% lidocaine into urethra to fully infiltrate and anaesthetize the urethral mucosa. Cover and fully lubricate the catheter sterile paraffin oil to make it smooth. Select an appropriate type of catheter according to the diameter of patient's external urethral orifice (usually ranging from 1/3 to 1/2 the diameter of the external urethral orifice) and the reason of urine retention. In general, the catheter made of silica gel (14–16 Fr) and emulsion (16–18 Fr) are commonly chosen for most patients, and the silica gel catheter is more suitable for those patients with severe prostatic hyperplasia or urethral stricture because the tough material can partly resist enlarged adenoma or narrow urethra. In case of failed insertion by common method, urethral dilatation by probe covered with sterile paraffin oil can be tried gently from small to large size gradually. After successfully retaining the last probe in the urethra for three minutes, repeat to try insertion. Generally, 18-Fr probe is enough for 14–16 Fr catheter, and 20-Fr probe for 16–18 Fr catheter. If still fail to insert the catheter yet, try probe and catheter integrative insertion (*Figure 1*). If all methods above do not work, suprapubic cystostomy is recommended (*Figure 2*) (12–14).

### *Bladder clot clogging*

Distinguish and confirm the cause of bladder clots clogging by medical history (such as history of hematuria, urological surgery, genitourinary cancer, and coagulation disorders) before operation. Routine blood test and urinary ultrasonography or CT scan can be utilized in emergency department to help judge the bleeding severity (such as active bleeding or the size of blood clot) and source of blood clot. For patients with mild bladder clots clogging, immediately insert or replace a three-way urinary catheter, and conduct continuous bladder irrigation with sterile saline. Adjust the speed of irrigation according to the color of outflow liquid to keep it clear. For patients with obvious pain, phloroglucinol, indomethacin, and some another similar drugs can be used to relieve analgesic and

spasmolytic effects. If an obvious blood clot blocks the urinary catheter, use a syringe to suck and wash quickly and repeatedly followed by continuous bladder irrigation. If the blood clot in the bladder is too big to suck it out, or combined with possible active bleeding judged by the color of outflow liquid or routine blood test, we suggest endoscope-assisted clots clearance and careful hemostasis, followed by continuous bladder irrigation (*Figure 3*).

### *Dislodgment or obstruction of nephrostomy/cystostomy tube*

Initially, fully understand patients' basic condition and medical history (such as diseases treated by nephrostomy/cystostomy, duration of nephrostomy/cystostomy, the time since poor drainage or dislodgment, symptoms and so on). Ask the emergency department clinicians for ultrasonography/X-ray/computed tomography (CT) scan to detect hydronephrosis, urine retention and the position of the nephrostomy/cystostomy tube. Then, identify the dislodgment or obstruction of nephrostomy/cystostomy tube. If imaging examinations show the tube out of renal collecting system/bladder or awareness of shortening of subcutaneous tube length by comparison with a new tube, it could be partial or complete dislodgement. If the tube locates in the right position of renal collecting system/bladder and difficult to flush with sterile saline, it could be obstruction by sediments. Note to exclude prerenal or renal anuria. If the nephrostomy/cystostomy tube is dislodged, try to directly insert a new tube of the same or smaller size (12 Fr minimum) (15). For nephrostomy tube insertion, the abdomen-elevated prone position is taken to keep the sinus tract straight, as is the standard position for percutaneous nephrostomy. For cystostomy tube insertion, patients take the supine position. The sinus tract orientation is estimated based on puncture site and imaging examinations. If direct insertion does not work, try to insert a tube after the sinus tract dilatation with the guidance of a stiff guidewire. Pull out the tube and insert a 6-Fr ureteral catheter carefully according to the estimated sinus tract orientation. Generally, urine will flow out when the ureteral catheter enters into renal collecting system/bladder. Remove the tip of ureteral catheter and the open-ended catheter is placed into the collecting system/bladder to guide the insertion of a stiff guidewire. Then, remove the ureteral catheter followed by sinus tract dilatation and tube insertion with the guidance of the stiff guidewire. If fail to insert a ureteral catheter into renal collecting system/bladder, percutaneous nephrostomy/cystostomy to insert a new tube is suggested

to perform with the guidance of ultrasonography (16,17). If the nephrostomy/cystostomy tube is obstructed, a new tube should be replaced immediately. Use sterile saline to irrigate the tube repeatedly to wash out crystals or pyuria in collecting system/bladder (*Figure 4*). Antibiotics are appropriately used based on the severity of urinary infection.

### ***Dislodgment or obstruction of single-J stent***

Initially, fully understand patients' basic condition and medical history (such as diseases treated by cutaneous ureterostomy, duration of cutaneous ureterostomy, the time since poor drainage or dislodgment, symptoms and so on). Ask the emergency department clinicians for ultrasonography/X-ray/CT to detect hydronephrosis and the position of the single-J stent. If imaging examinations show single-J stent out of renal collecting system or awareness of shortening of intraureteral stent length based on scales on the single-J stent, dislodgment of single-J stent can be identified. If the single-J stent is in the correct position but difficult to flush with sterile saline, it could be obstructed by sediments (18). Slight dislodgment can be solved by immediate re-insertion, while obvious or complete dislodgment can be solved by inserting a new single-J stent. A flexible-ended hydrophilic guidewire is recommended for the procedure. The guidewire slides into ureter till sense of slight resistance. Then pull out the original single-J stent. Cut off the tip of a new single-J stent and insert it with the guidance of the hydrophilic guidewire. If guidewire is obstructed in the middle of ureter and cannot reach renal pelvis, it may be attributed to stone formation around stents, false passages and stenosis by repeated replacements, local excessive curvature of ureter, and external compression (such as intestines, tumors). Try to insert and fix a bilateral open-ended ureteral catheter at the obstructed site and insert a hydrophilic guidewire into the ureteral catheter. Slide and rotate the hydrophilic guidewire to detect the ureteral lumen. Once the correct ureteral lumen is found, single-J stent can be successfully placed with the guidance of hydrophilic guidewire (18,19). If all methods above do not work, percutaneous nephrostomy is suggested to perform with the guidance of ultrasonography. If the single-J stent is obstructed, replace the single-J stent with a new one. Then use sterile saline to flush the single-J stent repeatedly to wash out crystals or pyuria in renal collecting system (*Figure 5*). Antibiotics are appropriately used based on the severity of urinary infection.

### ***Sickness caused by double-J stent retention***

Fully understand patients' condition (hematuria, frequency, backache or fever) and medical history (operation history, reason and time of double-J stent replacement) (20). For mild hematuria or urinary irritation symptoms, drink more water and take medicine of  $\alpha$ -receptor blocker or M-cholinergic receptor blocker, and susceptible antibiotics if urinary infection exists (21,22). Consider to remove double-J stent for persistent and severe hematuria. For backache caused by urine return to kidney through the double-J stent, urinate in time and avoid activity leading to urine reflux (23). For aggravated hydronephrosis or mild urinary infection, drinking more water, alkalizing urine and taking susceptible antibiotics. If pyonephrosis, fever, renal failure, or septic shock occur, it could be the complete obstruction of double-J stent. Percutaneous nephrostomy should be the first choice to relieve hydronephrosis. Choose to remove double-J stent if hydronephrosis or general health condition is not suitable for nephrostomy. Antibiotics are appropriately used based on the severity of infection.

### **References**

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