

Open surgical procedures for VUR

Introduction

- VUR depends upon
 - Functional integrity of the ureter
 - Anatomic composition of the ureterovesical junction (UVJ)
 - Functional dynamics of the bladder.

Surgery aims to correct the anatomic composition

Indications of open surgery

Absolute indications for Surgery for vesicoureteral reflux

- Breakthrough UTIs despite prophylactic antibiotics or because of medical non-compliance.
 - Relative indications for VUR surgery include
- persistent grade IV or V reflux
- VUR associated with congenital abnormalities at the ureterovesical junction
- Renal growth retardation or the presence of new renal scars
- dilating reflux persisting in girls who have reached full somatic growth potentia

Surgical Principles of Reflux Correction

- Exclusion of causes of secondary VUR
- Adequate mobilization of the distal ureter without tension or damage to its delicate blood supply
- Creation of a submucosal tunnel that is generous in caliber and satisfies the 5 : 1 ratio of length to width recommended by Paquin (1959)
- Attention to the entry point of the ureter into the bladder (hiatus), the direction of the submucosal tunnel and the ureteromucosal anastomosis to prevent stenosis, angulation, or twisting of the ureter

- Attention to the muscular backing of the ureter to achieve an effective antireflux mechanism
- Gentle handling of the bladder to reduce postoperative hematuria and bladder spasms

Procedures classification

The surgical procedures can be classified on the basis of the approach to the ureter as

- *Intravesical*
- *Extravesical*
- *Combined.*

Furthermore, they can be classified on the basis of the position of the submucosal tunnel in relation to the original hiatus into

- *supra hiatal*
- *infra hiatal.*

Classification

Intravesical-

Politano-Leadbetter Technique -
Suprahiatal
Glenn-Anderson Technique-
intrahiatal
Cohen Cross-Trigonal Technique-
intrahiatal

Extravesical

Modified Lich-Gregoir/
detrusorrhaphy technique

Combined.

Paquin Technique - Suprahiatal

The surgical steps can be divided into major headings

1. pre op cystoscopy
2. initial steps- position and incision
3. approach to ureters-
4. mobilization of ureters
5. Creation of antireflux mechanism
6. Closure of bladder and incision
7. Post operative follow up

Open surgical procedures for VUR

1. Preop cystoscopy

- Cystoscopy before open surgery after anaesthesia
- Helpful in identifying subtle anomalies not detected on preoperative imaging
- particularly useful if an extravesical technique is employed.
- Preoperative cystoscopy may uncover inflammatory changes, trabeculation, duplication anomalies, or anatomic anomalies at the ureterovesical junction such as small ureterocele or diverticula.
- At the completion of cystoscopy the bladder is left half full if an intravesical technique is contemplated.
- If an extravesical technique will be used, a Foley catheter connected to a three-way adapter can be inserted to allow bladder distension to facilitate the dissection of the detrusor flaps.

2. Initial surgical steps

Position

Supine

The hips are abducted slightly to allow access to the urethra in girls if required; in boys the penis is prepped and draped in the field

Incision (for both intravesical and extravesical techniques)

- A Pfannenstiel skin incision, along a skin crease, is made about 2 cm above the symphysis pubis to the lateral edges of the rectus muscles.
- The anterior rectus fascia is opened in a transverse fashion and elevated superiorly to just below the umbilicus and inferiorly to the symphysis pubis.
- The pyramidis muscles attach between the pubic bone and the anterior rectus sheath. Thus they should not be separated from the rectus sheath.
- The bellies of the recti are then separated in the midline exposing the bladder.

3. Approach to ureters

Intravesical Procedures

- The peritoneum is gently swept off the dome of the bladder.
- The bladder is opened in the midline down to about 2 cm proximal to the bladder neck.
- Saline-soaked sponges are folded and gently packed into the dome of the bladder and also placed along the lateral edges of the bladder incision.

Extravesical techniques

- A Pfannensteil incision is used
- Obliterated umbilical artery is identified. The ureter crosses medial to the point of origin of the obliterated umbilical artery from the internal iliac artery. This is an excellent anatomic reference point for identification of the distal ureter.
- Dividing the obliterated umbilical artery facilitates dissection and mobilization of the ureter.
- The peritoneum is meticulously reflected off the anterior surface of the ureter

4. Mobilization of ureters

Intravesical Mobilization of the Ureter

- The ureter(s) is cannulated with a 3- or 5-Fr Silastic feeding tube that is sutured to the bladder mucosa at the inferior edge of the ureteral orifice with 5-0 Prolene.
- Using needlepoint cautery, a circumscribing incision is made in the bladder mucosa about 1 to 2 mm away from the ureteral orifice.
- With gentle traction on the feeding tube, the ureter can now be mobilized into the bladder.
- Mobilization of the ureter is best started at the 6 o'clock position by spreading the blades of the tenotomy scissors gently in a posterior direction initially.
- Once the correct plane is entered, the dissection is carried out circumferentially.
- The ureter is freed from its attachments to

Open surgical procedures for VUR

the bladder using a fine right-angle clamp and electrocautery. This is aided by gentle traction on the feeding tube.

- Dissection of the ureter is continued until it can reach the contralateral bladder wall without tension.

Extravesical mobilization of ureters

- A vessel loop is passed around the ureter and used as a handle.
- Dissection and mobilization of the ureter is carried distally to the point where it tunnels under the detrusor muscle.

5. Creation of antireflux mechanism

Intravesical techniques

Suprahiatal Tunnels

- Politano-Leadbetter Technique
 - The principle behind this technique, which was originally described by Politano and Leadbetter (1958), is to bring the ureter in through a new hiatus superior to the original insertion.
 - Retract the superior lip of the original hiatus and clear the back wall of the bladder bluntly under direct vision.
 - A right-angle clamp is then used to create a new hiatus through which the ureter enters the bladder.
 - The submucosal tunnel is created in the direction of the trigone, medial to the original orifice.
 - The ureter is pulled through the tunnel, and the feeding tube is removed
 - The ureter is spatulated ventrally (at the 6 o'clock position),
 - ureteral anastomosis is carried out with interrupted 5-0 polyglactin sutures .
 - The mucosa overlying the new hiatus is closed with a running 5-0 polyglactin suture.

Infrahiatal Tunnels

- Glenn-Anderson Technique
 - A submucosal tunnel is created toward the bladder neck
 - The detrusor edges are then

reapproximated distal to the ureter.

- Cohen Cross-Trigonal Technique
 - Tunnel directed across the trigone toward the contralateral bladder wall
 - As a result of its simplicity and reliable results Cohen's procedure has become the most commonly employed intravesical reimplant
 - The submucosal tunnel is developed using
 - The hiatus should easily accommodate the tips of a large right-angle clamp alongside the ureter to avoid obstruction of the ureter.
 - When only one ureter is reimplanted, the tunnel is directed superior to the contralateral ureteral orifice.
 - If both ureters are reimplanted, the tunnel for the more laterally displaced ureter is directed superior to the contralateral orifice.
 - The second tunnel is directed toward the inferior edge of the orifice of the laterally displaced ureter.
 - The ureter is spatulated and anastomosed to the bladder mucosa
 - The mucosa over the old hiatus is closed with 5-0 polyglactin sutures.
 - The ureter is catheterized with a 5-Fr feeding tube to ensure patency, although the continuous efflux of urine from the orifice provides the best assurance of patency.

Extravesical Procedures

- Lich and colleagues (1961) in the United States and Gregoir (1964) in Europe independently described the extravesical approach to ureteral reimplantation
- *Anatomical basis of extravesical procedure*
 - Main portion of the pelvic plexus is located approximately 1.5 cm to 2 cm dorsal and medial to the UVJ in adult cadavers.
 - Smaller branches travel along the medial aspect of the ureter, outside the thin layer of tissue (the

Open surgical procedures for VUR

- mesoureter) that surrounds the ureter.
- On the basis of their anatomic description, injury to the branches of the pelvic plexus is avoided if dissection of the distal ureter is carried out between the mesoureter and ureteral adventitia.
- Technique
- With the bladder in its normal anatomic position, the course of the ureter along the posterior wall of the bladder is identified and marked for a distance of 5 cm.
 - The bladder is reflected medially;
 - With the bladder retracted, the tunnel direction will appear to be pointing toward the anterior abdominal wall.
 - The detrusor is incised using low current electrical cautery to create the new submucosal tunnel.
 - When the last detrusor bundles have been divided, a uniform mucosal dome bulges out

 - The detrusor is dissected off the mucosa on either side of the incision, for a width slightly larger than the circumference of the ureter.
 - The detrusor fibers attached to the ureter are carefully divided, staying close to the ureter to avoid injury to any of the terminal nerve branches entering the bladder. The dissection is carried out along the lateral and medial attachments of the ureter but is not extended distally

 - Once creation of the submucosal tunnel is complete, the bladder is decompressed before reapproximation of the detrusor.
 - The ureter is positioned in the new tunnel, and the detrusor reapproximated using interrupted 3-0 polyglactin sutures.
 - The bladder is refilled and the retractor is removed.
 - The course of the ureter is reinspected to ensure absence of

any kinks in the retroperitoneum or any bulging of the mucosa at either end of the tunnel.

6. Closure of the bladder and drainage

Intravesical techniques

- The bladder is closed in two layers using a 3-0 polyglactin suture.
- A Foley catheter is used to drain the bladder for 48 hours;
- drains and stents are only employed for the more complex cases.

Extravesical technique

- Standard closure
- A Foley catheter is left for 24 to 48 hours.

Combined

Paquin Technique

- The new ureteral hiatus is created from outside the bladder, thus avoiding the difficulties associated with this maneuver in the Politano-Leadbetter technique.
- The ureter in the Paquin technique can be approached extravesically before opening the bladder. A right-angle clamp is applied at the ureterovesical junction, the ureter is divided, and a 3-0 polyglactin suture is used to suture ligate the original hiatus.
- The bladder is then opened in the midline, and a new hiatus is created, located cephalad to the prior position.
- The mucosa is dissected off the detrusor circumferentially at the new hiatus. The length of the submucosal tunnel is governed by the diameter of the ureter, and a 5 : 1 ratio is usually achievable.
- Once the tunnel is developed the remainder of the reimplants is similar to the Politano-Leadbetter procedure.

7. Postoperative evaluation

- Most agree that an ultrasound is necessary at 6 to 12 weeks postoperatively

Open surgical procedures for VUR

- Following ureteroneocystostomy, the presence of minimal ureteral dilatation and low-grade hydronephrosis on early postoperative ultrasound is not unusual
- On the other hand, persistence of this dilatation beyond 3 months or its progression should be further investigated
- Additionally, the development of new renal scars on late follow-up

ultrasound, a discrepancy in renal growth, or recurrent UTIs may warrant complete radiologic re-evaluation of the patient.

Complications

Early Complications

- Persistent Reflux
- Contralateral Reflux
- Obstruction

Long-Term Complications

- Obstruction
- Recurrent or Persistent Reflux

Table 1- Comparison of different techniques

	Advantages	Disadvantages
Politano-Leadbetter Technique- Intravesical suprahiatal	<ul style="list-style-type: none"> ○ Long tunnel can be created. ○ It creates a neo-orifice in an anatomically correct position, which is easily accessible for endourological manipulations 	<ul style="list-style-type: none"> ○ Kinking of ureters(hooked ureter) ○ Damage to structures posterior to bladder during tunneling
Glenn-Anderson Technique Intravesical Infra hiatal	<ul style="list-style-type: none"> ○ By using the same hiatus and advancing the ureter distally toward the bladder neck kinking of the ureter. 	<ul style="list-style-type: none"> ○ The distance from the hiatus to the bladder neck limits the length of the tunnel ○ With advancement of the ureter toward the bladder neck, the distal anastomosis of the ureter could be challenging
Cohen Cross-Trigonal Technique- Intravesical Infra hiatal	<ul style="list-style-type: none"> ○ overcomes the limitation of the tunnel length in the Glenn-Anderson technique ○ particularly suited for small bladders or thick-walled bladders (PUV or neuropathic) because the ureteral advancement across the back wall of the bladder rarely results in kinks or obstruction. ○ Procedure of choice in conjunction with bladder neck reconstructive procedures because the superior displacement of the ureters provides room for adequate elongation of the bladder neck. 	<ul style="list-style-type: none"> ○ Difficulty of retrograde catheterization of the superolaterally positioned ureteral orifice for radiographic studies, insertion of stents, and management of ureterolithiasis.
Lich and Gregoir- Extravesical	<ul style="list-style-type: none"> ○ Bladder is not opened; thus postoperative hematuria and bladder spasms are minimized. ○ Technique is simple to learn and is readily 	<ul style="list-style-type: none"> ○ Development of transient voiding inefficiency that is seen in up to 20% of children who undergo bilateral extravesical

Open surgical procedures for VUR

	taught	reimplants
Paquin – combined Intravesical Extravesical Suprahiatal	<ul style="list-style-type: none">○ New ureteral hiatus is created from outside the bladder, thus avoiding the difficulties associated with this maneuver in the Politano-Leadbetter technique.○ particularly suited for dilated ureters and complex and failed reimplants because of the versatility offered by the combined extravesical/intravesical approach to the ureter and the ability to achieve longer submucosal tunnel lengths.	<ul style="list-style-type: none">○ Extensive procedure- Need to open bladder and retroperitoneum