

PRINCIPLES & PRACTICE
OF
UROLOGY
A comprehensive text

Volume-II

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Principles and Practice of Urology: A Comprehensive Text (Volume 2)

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This book is Dedicated

to

My Wife Dr. Khoorsheed Jahan Maula and my children Ishtiak Al Mamoon and Imtiaz Al Mamood who often missed me because of my pre-occupation with “Principles & Practice of Urology: A comprehensive text”.

PREFACE

Why another textbook on Urology? There is always a universal demand of appropriate good book in any subject. Despite the existence of numerous monographs on urology there remains a desperate need for a book emphasizing the scientific background and principles of patient care for the student trainees and reinforcing such concepts for the practicing urologists in the developing world.

Urology now a days is a subject of growing importance and the need for a comprehensive text on the basic principle of general urology was deeply felt by the author, by the trainees and students. All medical writings are practically rewritings plus the recent advances, but they are presented in a different format suitable for the specific class of readers or users. Despite many good books available, an appropriate book is needed in between the users and the advanced texts.

Principles & Practice of Urology is not intended to replace the existing textbook nor it can provide the minute details contained in scientific journals. Instead the author expects that the book will serve as a rapid review of clinically important informations for the postgraduate students, residents, trainees and practicing surgeons and urologists. It is also expected to provide much of the updated informations in an identifiable and understandable format.

The purpose of composing this text is to guide and assist the students, residents, trainee doctors of urology and this book may be used as a text or reference book by the senior students in medical colleges. A space is kept on the left side of the page for the reader to record his personal note. This book is expected to be helpful for the consultant general surgeon who is working in a hospital where there are no urologists.

I do solicit additional modification, correction and criticism which may be addressed to me.

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I am especially thankful to my two secretaries Mr. Noor Mohammad and Mr. Rony. Mr. Noor Mohammad should be credited for typing the whole manuscript and taking dictations mostly at odd times beyond his working hours. Mr. Rony, an excellent young man, covered the responsibilities of graphic designs and more importantly created the medical illustrations. Without their help this book would not be possible to complete in this format.

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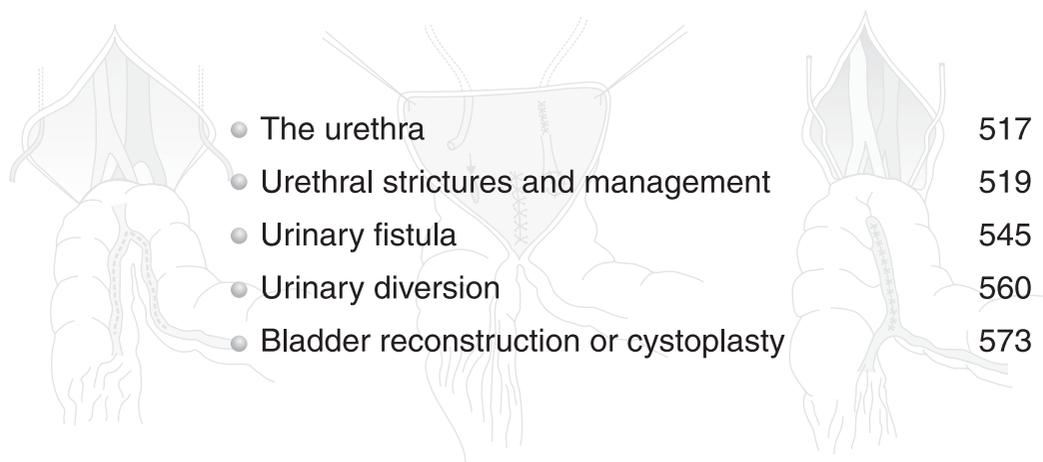
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Reconstructive Urology



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THE URETHRA

MALE URETHRA AND DISTAL SPHINCTER MECHANISM

The male urethra is divided into prostatic, membranous and spongy parts. It is lined by transitional epithelium proximally and by squamous epithelium near the external meatus (navicular fossa).

The prostatic urethra

The prostatic urethra is 3-4 cm long and receives the prostatic ducts on its posterior surface. A prominence on its posterior wall (the verumontanum) near the apex of the prostate provides an important landmark in trans-urethral prostatic surgery. Prostatic resection kept proximal to the verumontanum avoids injury to the sphincter mechanism in the adjacent membranous urethra. The ejaculatory ducts open on either side of the verumontanum and the utriculus masculinus opens on its apex.

The membranous urethra

The membranous urethra is the site of sphincteric activity in the male urethra. It is about 2 cm in length and extends from the apex of the prostate through the levator ani muscle to the bulb of the penis.

The spongy urethra

The spongy urethra is surrounded by the corpus spongiosum, part of the erectile tissue of the penis, which expands distally to form the glans penis. The spongy urethra receives the ducts of numerous glands, including those of the paired Cowper's glands. Its proximal part is surrounded by the bulbospongiosus muscle and is commonly known as the bulb of the urethra. Contraction of the bulbospongiosus muscle assists in emptying of the urethra at the end of voiding and aids emission of semen during ejaculation. Dorsal to the spongy urethra lie the paired corpora cavernosa, the main erectile structures of the penis, which pass from the ischiopubic rami and converge to lie side by side extending just beyond the corona of the glans penis.

Sphincteric activity

Sphincteric activity in the male urethra is traditionally attributed to a sphincter derived from fibres of the levator ani, which surrounds the membranous urethra as it penetrates the pelvic floor. Recent anatomical studies, however, have shown that, although fibres from the levator ani form a peri-urethral sling, this does not constitute a complete muscle ring.

The main contribution to the distal sphincter mechanism is from muscle within the urethral wall itself. In addition to an inner layer of smooth

muscle, the intrinsic urethral musculature has in outer circular layer of striated muscle fibres (the rhabdosphincter); these fibres are designed for prolonged tonic contraction (slow-twitch fibres). The rhabdosphincter is innervated by somatic nerves from S2 and S3.

Machanism of contenance

Although the peri-urethral sling of pelvic floor muscle is not capable of sustained contraction, it can contract rapidly to constrict the urethra for short periods (fast-twitch fibres). This may contribute to continence during the sudden rise in intravesical pressure seen, for example, with coughing or straining. The distal sphincter mechanism exerts a higher closure pressure than the bladder neck and is a more potent sphincter in terms of maintaining continence.

FEMALE URETHRA AND DISTAL SPHINCTER MECHANISM

The female urethra is approximately 4 cm long. It passes through the levator ani anterior to the vagina and its external meatus opens 2.5 cm behind the clitoris. It is lined by transitional epithelium proximally and by squamous epithelium nearer the external meatus. In some women, squamous epithelium extends along the entire length of the urethra to the bladder neck and sometimes even onto the trigone. Numerous mucus-secreting glands drain into the urethral lumen.

As in men, urethral closure in women is largely dependent on an intrinsic urethral sphincter. The urethral musculature consists of an inner longitudinal layer of smooth muscle and an outer, circular slow-twitch rhabdosphincter. The rhabdosphincter extends from bladder neck to external meatus but is most pronounced in the middle third of the urethra.

The muscle is thickest anteriorly and is thinner posteriorly where it is separated from the vagina by only a thin layer of fascia. The peri-urethral muscle sling (fast-twitch fibres) derived from the levator ani provides closure against sudden episodes of high bladder pressure, as it does in men, but the rhabdosphincter is the main protection against incontinence.

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URETHRAL STRICTURES AND MANAGEMENT

PRELUDE

Urethral stricture is one of the most important causes of bladder outflow obstruction, which may be resulted from verities of pathology e.g. inflammatory disease, injuries of urethra, neoplasm of urethra etc. In the old manuscripts the urethral stricture is well described. Indian surgeon Susruta described the use of green bamboo sticks for dilatation of urethra. Charles Bell in 1810 described the classification of stricture urethra as simple, dilatable, bridle, spasmodic and callus type. Remarkable contribution was made by Otis in 1872. He introduced his Otis urethrometer, and Otis urethrotome, the last equipment is still included in the modern urological armamentarium.

Definition

Abnormal narrowing of a segment of urethra may be referred as stricture urethra.

ETIOLOGY OF STRICTURE

Currently the traumatic strictures are more common and become the most important work load of the urological center in developing countries. Urethral injuries occurs as a results of road traffic accidents causing pelvic fracture distraction injuries of posterior urethra, or it may result from fall on astride injury of bulbar urethra resulting a bulbar stricture. Now a days more and more iatrogenic strictures are commonly found following prostatic and urethral surgery. Ischemic strictures are seen in



Fig. 11.01 : Pelvic fracture with distraction injury of urethra

meatus and in penoscrotal junction as a result of catheterization for longer time with a oversize catheter, particularly following a long surgery e.g. open heart surgery.

Etiology of stricture urethra	
<i>Type of stricture</i>	<i>Local site</i>
• Traumatic strictures	Posterior urethra
• Inflammatory strictures	Commonly anterior urethra
• Ischemic stricture	Meatus and penoscrotal junction
• Malignant stricture	Commonly posterior

Inflammatory urethral strictures may commonly occur from gonococcal infection of the urethra. These strictures were the most common strictures in the old age, now rarely seen in the modern urological practice.

Malignant strictures are the most difficult strictures, which may require mutilating radical surgery.

ASSESSMENT OF URETHRAL STRICTURES

Clinical assessment is important in the management of stricture urethra. Most patient presents with symptoms of obstructed voiding but in neglected cases they may present with features of chronic retention and sometimes uremia. Clinical examination may be unrewarding but it may discover a meatal stricture or stricture may be palpable if it is in anterior urethra. A full bladder may be palpable in neglected cases.

Assessment of stricture urethra
<ul style="list-style-type: none"> • History - LUTS obstructive symptoms • Clinical examination • Anterior urethral stricture may be palpable • Chronic retention – distended bladder • Uroflowmetry – low prolonged flow • Urethrogram – ascending and descending • Renal & Bladder Ultrasound scan. • Urethroscopy

Uroflowmetry may be the most important non-invasive investigations, which may show a low pick flow rate and obstructed voiding pattern. But it may result also from under activity of the bladder. The most definitive diagnosis of urethral strictures can be made by retrograde and anti-grade urethrogram and endoscopic examination. Ascending and descending urethrogram may present the accurate assessment of length of the stricture segment, which is very important information for urethral reconstruction. Endoscopy provides little information about the segment



Fig. 11.02 : Retrograde urethrogram showing pan-urethral stricture

of stricture. It is important to evaluate the status of potency before surgery and should be documented.

Pathogenesis of strictures of the bulbo-penile spongy urethra

The anterior urethra is surrounded by spongy tissue and natural healing by spongio-fibrosis leads to stricture formation. The spongy urethra has a peculiar tendency to restenose unless appropriate techniques are followed to prevent this. The posterior urethra is surrounded by sphincter muscles and damage to the distal sphincter mechanism is generally irreparable. A basic understanding of the pathogenesis of strictures, their development and the significance of spongio-fibrosis, is essential for successful urethral reconstruction. Partial loss of the uro-epithelial lining is the primary factor in the development of almost every spongy-urethral stricture, whether it is due to internal trauma, urethritis or external trauma.

Pathogenesis of stricture urethra
<ul style="list-style-type: none">● Loss of uroepithelial lining● Intermittent passage of urine in spongy tissue space● Spongiofibrosis● Reduction of diameters of urethra.

The loss of any proportion of the circumference of the epithelial lining generally results in a commensurate narrowing of the lumen during healing. This is due to the fact that the margins of the residual epithelium are approximated by the natural urethral closing pressure so that the defect forms a cleft which tends to heal rapidly by cross-adhesion and epithelial over bridging. The intermittent passage of urine opens these clefts and this repeated separation and re-exposure of urine to the vascular spongy tissue spaces leads to a gradual increase in the underlying spongio-fibrosis resulting stricture.

Attempts to promote uro-epithelialization of the denuded clefts by keeping them open for a prolonged period with an indwelling catheter are generally unsuccessful.

Surgical options for urethral strictures are	
• Urethral calibration	Self, assisted or by Urologist
• Urethrotomy	Otis urethrotomy. Optical internal urethrotomy Lasers urethrotomy
• Urethroplasty	Anastomotic urethroplasty Substitution urethroplasty

BASIC PRINCIPLES OF URETHRAL RECONSTRUCTION

It is important to recognize the four regions of the urethra and each require distinctly different considerations the glans-meatus, the penile, the bulbar and the sphincter-active posterior urethra. The three distinct procedure-principles for urethral reconstruction are:

Basic principles of urethral reconstruction
• Regeneration, Dilatation, OIU
• Excision and anastomosis (anastomosing urethroplasty)
• Substitution urethroplasty
Vascularized flaps : prepetual Island flap
Graft : buccal mucosa, bladder mucosa.

Regeneration procedures

Regeneration procedures depend upon the completion of part of the circumference of the urethral lining by the regenerative proliferation of the uroepithelium. The long-term success of urethral dilatation and of internal urethrotomy is entirely dependent upon this and the result depends upon whether epithelialization can occur before restenosis develops. The principle of the Dennis Brown buried-strip procedure is to induce apposition-regeneration and thus completion of the epithelial lining of the neourethra: however, although this is a fundamental principle as a back-up procedure in reconstructive surgery it is no longer advocated as a primary procedure for urethral reconstruction.

Excision and re-anastomosis of urethra

The only stricture-resolving procedure with an expected long-term success rate approaching 100% is excision and spatulated, tension free, circumferential anastomosis, unfortunately, owing to the extent of the spongio-fibrosis that is commonly associated with stricture of the bulbar urethra, other than those resulting from simple external trauma, few are

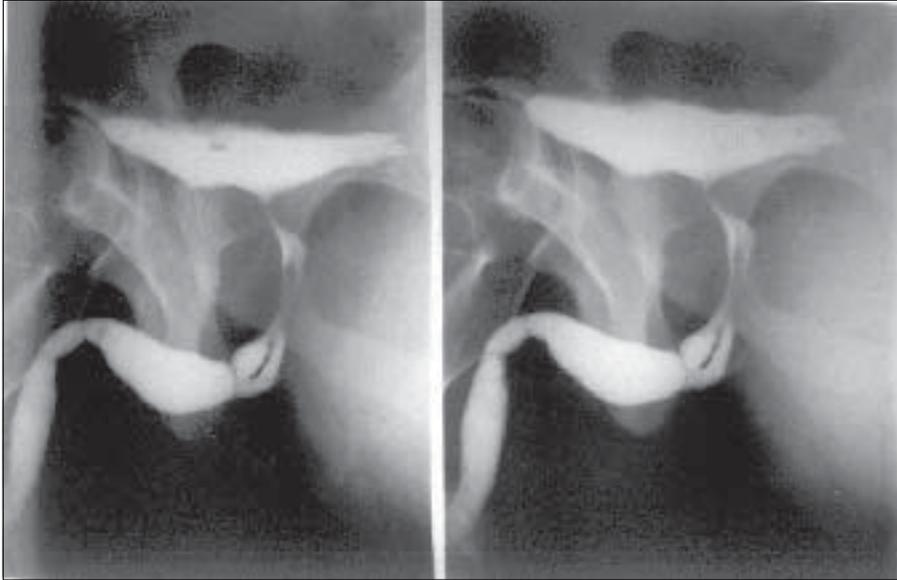


Fig. 11.03 : Urethral false passage following blind dilatation

appropriate for resolution in this way. However combination procedures have been developed to incorporate the advantages of partial circumferential restoration of urethral continuity by the formation of a redeployment fixed-flat roof-strip whenever possible.

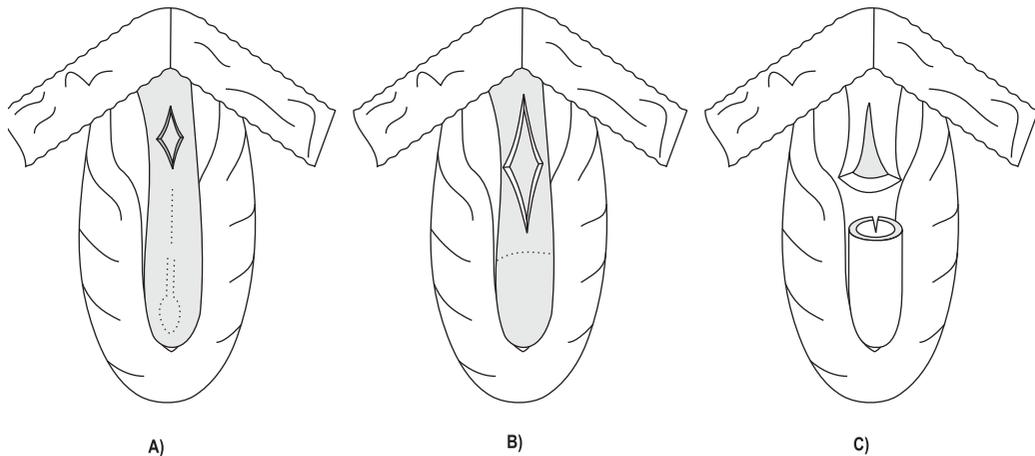


Fig. 11.04 : The technique of urethrotomy.
A) Distal ventral urethrotomy is made into normal urethra.
B) Urethrotomy is extended proximally to stricture segment where it is transected.
C) The proximal urethra is incised in its dorsal aspect and then spatulated.

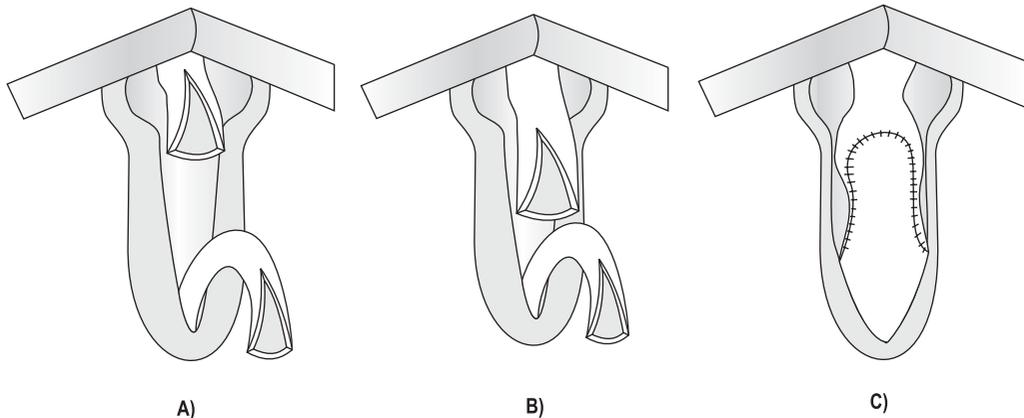


Fig. 11.05 : The technique of anastomosis

A + B) Spatulated ends are approximated by three epical structures

C) Remaining structures are placed in an equidistant manner and then all knots are applied

Substitution of urethra

All epithelial substitutes and all individual techniques for their use have inherent shortcomings with an inevitable incidence of failure. No substitute for the urethra is as good as the urethra itself; some are much better than others are, but all have inherent shortcomings and consequently a commensurate incidence of restenosis.

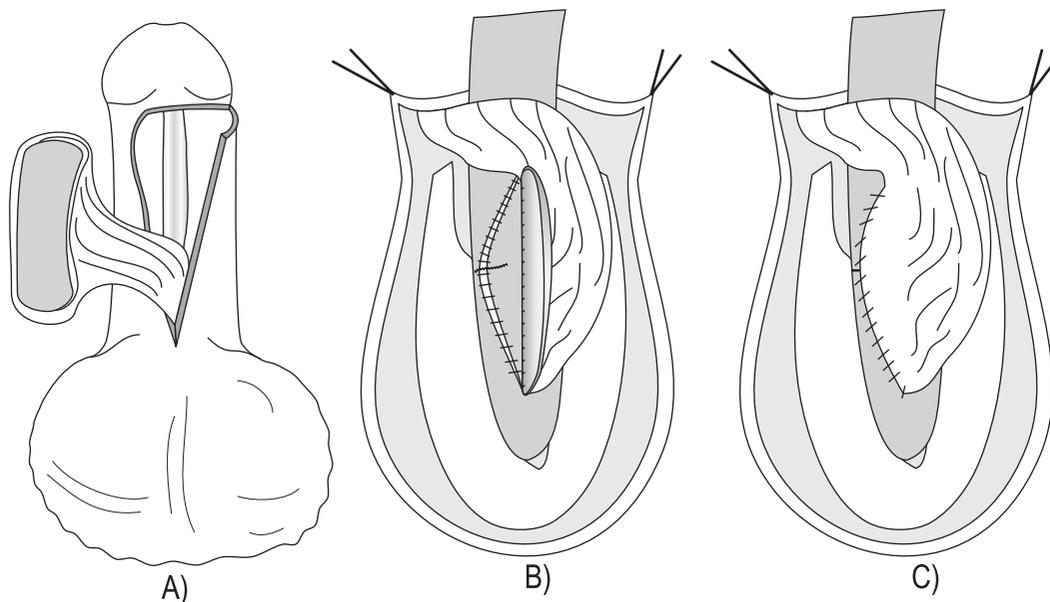


Fig. 11-06 : Technique of pedicle island penile flap.

(A,B, and C) Skin flap and pedicle are transferred back to stricturotomy and then approximated in roof-strip anastomosis. The skin flap edges are approximated to the urethrotomy with continuous sutures.

Self calibration of urethra

The aim of treatment is to keep the urethral caliber patent. This procedure can usually be done by the patient himself or assisted by an assistant. This technique is an inexpensive procedure. Usually for the adults the 18/16 Fr. Nelaton catheter is used for this purpose. Absolute sterility is not necessary. Safety of simple soap and water to clean the catheter is accepted. The procedure is entirely safe and keeps the patient stricture free as long as he continues the procedure and discontinuation may result the return of stricture.

Urethral dilatation

Urethral dilatation is the oldest and simplest form of treatment by which the vast majority of urethral strictures can be managed. The general principle of urethral dilatation is soft and gentle stretching of the scar without producing more scarring. It is better to dilate the stricture under surface anaesthesia instilled into the urethra and retained by a penile clamp. The stricture is then dilated until resistance is felt and this procedure is then repeated over multiple sessions. This treatment is very much cost effective but associated with dangers like creation of false passage.

Urethral Dilatation
<p><i>Advantage</i></p> <ul style="list-style-type: none">● Inexpensive procedure● Physiological approach● Can be done in compromised setting● Patient may be trained to do self dilatation● Complementary to OIU and urethroplasty <p><i>Disadvantage</i></p> <ul style="list-style-type: none">● Creation of false passage● Urosepsis● Life time procedure (No cure)

Despite the antibiotic prophylaxis fever, rigor and septicemia may occur in 15-30%. Bleeding, false passage, urinary retention, epididymitis, periurethral abscess and fistula formation occurs in 10-15% - depending on the number of times that dilatation is repeated.

Optical internal urethrotomy

Optical internal urethrotomy is the procedure, which opens the stricture by incising it transurethrally. In urethrotomy incision over healthy tissue

allows the scar to expand, where healing occurs by secondary intention. An obvious pre-requisite is that having incised the stricture the underlying corpus spongiosum is normal.

Optical Internal Urethrotomy
<p><i>Advantage</i></p> <ul style="list-style-type: none">• Urethrotomy carried out under vision• Safe procedure if a guide wire is used
<p><i>Disadvantage</i></p> <ul style="list-style-type: none">• Not curative• Length of stricture incision with each procedure converting a short stricture into a long segment stricture

Internal urethrotomy is most safely performed using a visual urethrotome so that the procedure can be conducted with a direct view. In many instances a general or regional anaesthetic is used but local anaesthetic is quite sufficient for most circumstances, as for dilatation. When the stricture is clearly in view, particularly if it is not possible to see through to normal urethra on the other side, a guidewire should be passed through



Fig. 11-07 : Visual urethrotomy equipments

to be sure of staying within the urethral lumen. It is all too easy to lose the urethral lumen by incising into a tight stricture without a clear view of the other side. Most urologists make the urethrotomy in the 12 o'clock position because this is the easiest place to cut using a standard visual internal urethrotome in the normal working position but some people have

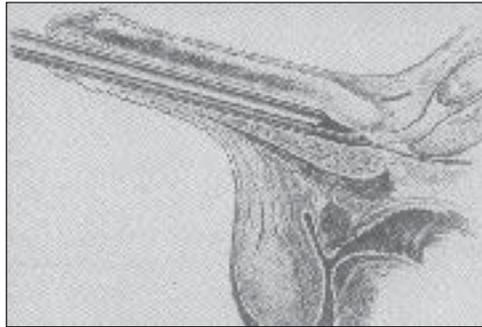


Fig. 11-08 : Visual urethrotomy in progress

advocated cutting at 3 o'clock, 6 o'clock or 9 o'clock to avoid cutting deeply into the corpus cavernosum in the 12 o'clock position.

Complication of OIU
<ul style="list-style-type: none">● Bleeding● Urosepsis● Venous leak – ED● Lengthening of stricture

With repeated OIU the segment of stricture enlarges because with each OIU few millimeter healthy urethra is divided proximally and distally resulting a longer incision then stricture segment which again heals by fibrosis.

After urethrotomy an indwelling catheter is left for a few days and although there is no consensus as to duration of catheterization. 2/3 days catheterization period preferred by most urologist. Antibiotic prophylaxis is commonly used. The complications of urethrotomy are much the same as the complications of dilatation except that after urethrotomy impotence can arise as a result of a corpus cavernosum spongiosum fistula as a consequence of a 12 o'clock incision – a complication that does not arise after dilatation.

The real problem of both urethrotomy and dilatation is that they are not curative in the majority of patients. The results can be approved by avoiding infection at the time of instrumentation. Even then the most enthusiastic endoscopist recognizes a recurrence rate of at least 50%. The most detailed recent study has reported a 68% recurrence rate after a single urethrotomy, although with a 58% recurrence rate in the bulbar urethra but an 84%