Surgery for Neurogenic Lower Urinary Tract Dysfunction

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Most patients don’t need surgery

- The classical treatment for the neurogenic bladder consists of clean intermittent catheterization (CIC) programs and administration of anticholinergic drugs
- Approximately 90% of patients respond well to this type of therapeutic scheme

The primary aims for treatment

1. Protection of the upper urinary tract
2. Improvement of urinary continence
3. Restoration of the LUT function
4. Improvement of the patient’s QoL.

- Renal failure is the main mortality factor in SCI patients that survive the trauma
- The patient’s disability, cost-effectiveness, technical complexity and possible complications.

Classification

• Failure to storage:
  Overactive bladder
  Underactive urethra

• Failure to empty:
  Underactive bladder
  Overactive urethra
Surgical treatment

• Failure to empty
  • Underactive bladder: mitrofanoff
  • Overactive sphincter: Sphinctrotomy
    Balloon dilatation
    urolume

• Failure to store
  • Overactive bladder: Botox injection
    Bladder autoaugmentation
    Enterocystoplasty
    Urinary diversion
    Sacral neuromodulation
    Sacral rhizotomy
  • Underactive sphincter: Bulking agent
    Artificial sphincter
    Bladder neck reconstruction
    Sling procedure
Bladder Augmentation History

• The evolution of bladder augmentation is now well over 100 years old.
• Mikulicz in 1899 was the first to describe using a segment of ileum to perform an augmentation onto a coronally bisected human bladder.

• Clam enterocystoplasty described by Bramble: modified technique and involved the incorporation of a detubularised isolated bowel segment onto a near-complete sagittally bisected bladder.
The ideal bladder replacement:

- Good volume with low pressure storage
- Socially acceptable voluntary and complete efficient emptying
  either by valsalva or clean intermittent self catheterization (CISC)
- Allows continence between voids
- Protection of upper urinary tract (kidney and ureter)
- Avoidance of harmful long term sequelae and optimize quality of life
- Cost effective
Selection of bowel segment

- The most commonly used segment for augmentation is ileum¹
- Sigmoid augmentation has also been successful, although there are reports of increased rhythmic contractions when this segment is used²
- Gastric augmentation has the advantage of less mucous production and less changes in metabolic parameters.³

The clinical syndrome of hematuria/dysuria

Preparation

• The bladder plate needs to be widely opened to prevent an hourglass deformity when anastomosing the patch to the bladder
Detubularization

- Detubularization on the anti-mesenteric border provides a low-pressure reservoir and increases capacity when fashioned into either a U or W-shape.
- The success rate of enterocystoplasty is reported to be as high as 90%.

Complications

Long-term complications were found in 57.9%

- Recurrent infection
- Stone formation
- Perforation
- Diverticulum
- Possible malignant changes
- Metabolic abnormality
- Mucus production
- Impaired bowel function

A minimum of 10 years of follow-up. BJU Int 2012;109:1236-42.
Autoaugmentation

• Creating a large detrusor diverticulum via myomectomy to increase bladder capacity and reduce intravesicular pressure. Operative results often were not optimal in the past due to a bladder diverticulum either failing to form or being of inadequate capacity.

• The use of an inflatable silicon balloon placed in the bladder after autoaugmentation has been reported to improve the success rate.

• Results are not durable and further adjunct operations may be needed in up to 50% of cases.

Urinary diversion

• Continent diversion
• This should be the first choice for urinary diversion.
• Patients with limited dexterity may prefer a stoma instead of using the urethra for catheterization
• A continent stoma is created using various techniques.
• All of them have frequent complications, including leakage or stenosis
• The short term continence rates are > 80% and good protection of the upper urinary tract is achieved
• For cosmetic reasons, the umbilicus is often used for the stoma site
Incontinent diversion

• If catheterization is impossible, incontinent diversion with a urine-collecting device indicated
• It could be considered in patients who are wheelchair bound or bedridden with intractable and untreatable incontinence, in patients with lower urinary tract destruction
• When the upper urinary tract is severely compromised
• In patients who refuse other therapy
• An ileal segment is used for the deviation in most cases
Tissue engineering

- Scaffolds, probably of tissue-engineered material for bladder augmentation or substitution or alternative techniques, are promising future options.1

- Atala et al. reported recently on 3.8-year (mean) outcomes following bladder tissue reconstruction using autologous bioengineered bladder tissue in seven patients with myelomeningocele.

- Bladder tissue regeneration with a collagen scaffold in a diseased bladder model and in healthy bladder resulted in comparable functional and histological outcome, with a good quality of regenerated tissue involving all tissue layers. 2


Sacral Rhizotomy

- known as sacral deafferentation, has achieved some success in reducing detrusor overactivity
- It is used mostly as an adjuvant to sacral anterior root stimulation (SARS)
- SARS is aimed at producing detrusor contraction. The technique was developed by Brindley
- Only applicable to complete lesions above the implant location, because its stimulation amplitude is over the pain
- The urethral sphincter efferents are also stimulated, but because the striated muscle relaxes faster than the smooth muscle of the detrusor, so-called “post-stimulus voiding” occurs.
- This approach has been successful in highly selected patients
- By changing the stimulation parameters, this method can also induce defecation or erection.
Sphincter insufficiency (underactive urethra)

• The artificial Urinary sphincter is the preferred treatment for patients with NLUTD
• Placement of a bladder-neck sling or a mid urethral sling

Suitable only when:
1. The detrusor activity is stable
2. There is no significant associated vesico-ureteral reflux.

Increasing the bladder outlet resistance: has the inherent risk of causing high intravesical pressure during filling, which may become even higher during the voiding phase
Artificial urinary sphincter.

• This device has stood the test of time in patients with neuro-urological disorders

• The need for revisions has decreased significantly with new generations of devices allowing one to obtain an acceptable long-term outcome

• 74% continence rate in multi center study of 51 patients with an average follow-up time of 83 months (6-208).

Artificial urinary sphincter

- Adequate bladder capacity and compliance
- Urethral diverticula or strictures are contraindications to the artificial urinary sphincter.
- Sufficient learning capacity and hand strength/dexterity to operate the pump and its valve mechanisms

Complication

• Up to 35% of patients may require reoperation
• Urethral tissue atrophy
• Device infections
• Erosions
• Cuff migration
Urethral sling

• Various materials have been used for this procedure with enduring positive results.

• The procedure is established in women with the ability to self-catheterize.

• In men there are a growing number of reports suggesting that both autologous and synthetic slings may also be an alternative
Sling

• In female a fascial sling placed just distal to the bladder neck, with the concomitant creation of an abdominal stoma
• The sling can be placed abdominally if a concomitant augmentation is performed.
• human cadaveric fascia and xenotropic sling material
• sling suspension of the bladder neck in MMC girls leads to good results concerning urinary continence

Bulking agents

- Injection therapy may represent a useful option for short-term symptomatic relief
- Two or more injections required
- Not durable
Bladder neck and urethra reconstruction

• The classical Young-Dees-Leadbetter procedure for bladder neck reconstruction in children

• Kropp urethra lengthening improved by Salle are established methods to restore continence provided that intermittent catheterization is practiced and/or bladder augmentation is performed
Young-Dees Leadbetter bladder neck reconstruction.

- Augmentation cystoplasty is typically performed at the same setting with a catheterizable abdominal stoma thus avoiding any issues with catheterization.
BLADDER NECK CLOSURE

• Bladder neck closure is a last resort
• In combination with the creation of an abdominal stoma
• Can be difficult in patients with previous bladder neck surgery
• The key to a successful operation is:
  - Wide mobilization of the bladder neck
  - Interposition of healthy tissue between the closed bladder neck and urethral stump

Alexander Kavanagh, Kourosh Afshar, Heidi Scott and Andrew E. MacNeily* J Urology 2012
Procedures to Control Detrusor Emptying

• Appendico-vesicostomy
• The stoma can be brought to the umbilical area or to the right lower quadrant.
• Submucosal tunnel for supple small diameter conduit
• Rising intravesical pressure compresses the lumen
Complications

- Stomal stenosis: 10-20%
- Appendiceal perforation
- Stricture and necrosis
- Inaccessible bladder stones
- Incontinence
Alternatives

• Ureter
  Stomal stenosis higher than appendix
• Fallopian tube
  Problem stenosis
• Gastric tube
  Acid irritation of skin
• Tapered ileum
  Kinking if too long
Bladder-neck and urethral procedures for overactive sphincter

- Reduction of the bladder-outlet resistance to protect the upper urinary tract can be achieved by:
  - Sphincterotomy
  - Urethral stent
  - Chemical denervation of the sphincter using botulinum toxin A
Bladder Sphincter Procedures to Enhance Emptying

• Sphincterotomy
• Most appropriately reserved for quadriplegic males who are unable to perform self-intermittent catheterization.
• Short-term outcomes were very encouraging in terms of improved vesical drainage and reduction of urinary tract infections.
• Upper tract function preservation appears to be better when intervention is performed early.
• Reoperation rates can exceed 50.

Hemorrhage is a significant complication of sphincterotomy

Urethral Stents and Balloon Dilatation

• Therapeutic alternative to sphincterotomy
• Recurrent urinary tract infections may be a relative contraindication to this procedure
• Balloon dilatation of the external sphincter has also been studied and produces outcomes at 12 months that are comparable to sphincterotomy
• Urolume difficult to remove

Take-Home-Message

• Most patients don’t need surgery
• Surgery may involve bladder and outlet
• Intermittent catheterization essential
• Augmentation cystoplasty successful but high complication rate
• Tissue engineering is promising future option
• AUS is the gold standard procedure for underactive urethra
• Sphinctrectomy Most appropriately reserved for quadriplegic males with overactive sphincter
• Sacral rhizotomy and SARS only applicable to complete lesions above the implant location