

## Traumatic Urethral Injuries (PFUI) and Urethral Strictures:

Is there a best management plan?

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## Pelvic Fracture Urethral Injuries (PFUI)

Pelvic Fracture; Urologic Triad

- Gross Hematuria
- Blood at Meatus
- Inability to Void

If you have any **one of the three** findings  
**25%** with Lower Urinary Tract Injury

Husmann Unpublished Observations, 2014



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## Incidence of GU Injury with Pelvic Fracture With one of urologic triad findings:

- Rule of 20 & 5
  - 20% will have a **bladder injury only**
  - 5% will have a urethral injury
    - 20% have a **concurrent bladder injury**
    - 5% have a **bladder neck injury**
  - 5% of pelvic fractures are **compound- open**
    - Rectal, vaginal or skin lacerations with connection to pelvic fracture
    - 20% will have a **urethral injury**



Montgomery & Husmann 2016

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## Mortality Pelvic Fracture

- Related to the type of pelvic fracture
- Risk is highest for compound (open) fracture
  - 50% in 1980's decreased to 5% in 2010
- Death
  - 2/3<sup>rd</sup> exsanguination
    - Interventional radiology - angioembolization
  - 1/3<sup>rd</sup> infection
    - Proximal fecal and **urinary diversion**

Groetz et al 2005, Govert et al 2012



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## Management of PFUI Historical Perspective 1930-1970's

- Sutured Repair of the Urethral Injury –
  - Associated with increased blood loss
  - Infected Hematoma
  - Increased Risk of Erectile Dysfunction
  - Increased Risk of Urinary Incontinence

Still Indicated for concurrent Bladder Neck Laceration (BNL) and PFUI

Mitchell 1968, Colfield and Weems 1977  
Martinez et al 2010, Gomez et al 2014,  
Barrett et al 2014



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## Management of Urethral Injuries Urethral Realignment Historical

- Initially described in 1932
- Interlocking sounds, sound to finger. endoscopic realignment
- Fell out of favor in 1970 – 1980's
  - ED in 3% with staged repair versus 33% with realignment – **10 fold increase**
  - Urinary Incontinence staged repair 2-3% vs 4-6% with realignment – **2 fold increase**

Mitchell 1968, Moorehouse 1969 & 1972



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## Management of Urethral Injuries Historical Delayed Reconstruction (1970-1985)

- Initial placement of SP tube delayed reconstruction in 3 months
- Obliterative urethral stricture in ~ 90% of patients
- Expertise needed in repair

Gomez et al 2014, Barret et al 2014



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## Primary Suprapubic Tube Delayed Repair Versus Endoscopic Realignment

- Erectile Dysfunction
  - No difference - median incidence ~40%
- Urinary Incontinence
  - No difference - directly related to BNL and/or sacral nerve damage ~ 5 %
- Incidence of complications **related to primary traumatic injury** not method of repair

Webster et al 1983, Husmann et al 1990, Follis et al 1992,  
Koraitim 1996, Ku et al 2002, Mouraviev et al 2005

Hadjizacharia et al 2008, Chang et al 2011, Barrett et al 2014



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## Primary Suprapubic Tube Delayed Repair Versus Endoscopic Realignment

PST (median F/U 10 yrs)

N= 84 pts

- Obliterative Stx ~ 90%
  - Subsequent End to End success 85-90%
- Partial Stx – 5%
  - Rx with intermittent DVIU/dilation
- No Rx or 1 Stx Rx – 5%

ER (median F/U 10 yrs)

N=65 pts

- ER Obliterative Stx ~ 60%
  - Subsequent End to End success 85-90%
- Partial Stx - 30%
  - Rx with intermittent DVIU/dilation
- No Rx or 1 Stx Rx – 10%

Husmann et al 1990, 2016



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## Is There an Advantage to Endoscopic Realignment of PFUI?

- Reduction in **obliterative stx** by 30%
- However in this 30% - **two-thirds (20%)** of pts need to maintain patency by **repetitive DVIU/urethral dilation, daily catheterization**
- True success ( $\leq 1$  Rx) in **10%**
- In contrast, SP tube alone, **5%** of pts need to maintain patency by **repetitive DVIU/urethral dilation, daily catheterization**
- True success ( $\leq 1$  Rx) in **5%**



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## What do we recommend for PFUI?

- If patient is stable, brief trial of endoscopic realignment
- If unstable or fail to **realign in 10 min**, primary SP tube.
- If BNL & PFUI delayed repair
  - 2-14 days post traumatic injury
  - BNL **repaired** continence = 0% (0/19)
    - Pelvic abscess = 0% (0/19)
  - BNL **not repaired** continence = 0% (0/8)
    - Pelvic abscess = 62% (5/8)



Routh et al 2007, Montgomery & Husmann 2016

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## Urethral stricture; Incidence and current treatment practice

- National Insurance Data Banks
- Information acquired by surveys of members of the AUA (35% response rate).
- Practice logs submitted to the American Board of Urology for certification and recertification, in 2012.



Ferguson, 2011, Burks 2012, Wong 2012

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## Urethral Stricture; Incidence and current treatment practice

- Urethral stricture Incidence
  - 0.5% of men > 20 yrs of age.
- 96% of urologist had Rx'd urethral stx disease at the time of certification-recertification
  - 94% of strictures Rx with DVIU/dilation
  - 6% with formal urethroplasty



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## Urethral stricture; Incidence and current treatment practice

Multiple states with **no pts undergoing open urethroplasties** :

Alabama, Kansas, Maine, North and South Dakota, Pennsylvania, Vermont and West Virginia



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## Urethral stricture; Incidence and current treatment practice

- Initial certifying urologists
  - 12% had done a urethroplasty
- Recertifying urologists
  - 4% had done a urethroplasty
- Combining the certifying and recertify urologist's
  - 6% had done  $\geq 5$  urethroplasty per yr
  - 1%  $\geq 12$  urethroplasty per yr



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## My Fathers Wisdom Right tool for the right job!

- If all you have in your tool box is a hammer then?
- Regardless if it is a screw or a nail, you will drive it home with the hammer!



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## DVIU vs Urethroplasty

- Why the reliance on DVIU?
  - Patient choice?
  - Ease of the procedure for surgeon?
  - Surgeon unfamiliar with open urethroplasty?
  - DVIU
    - Good results?
  - Open urethroplasty
    - Poor results ?
    - Increased complications ?



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## Success of Urethral Dilation & DVIU: Histology of Wound Healing

- Wound healing with no epithelial approximation
- Heals by two processes
  - **Epithelium growing** from wound margins
  - **Wound contraction** closing the defect
    - Narrowing the area the epithelial cells need to close
  - **Scarring-Stricture occurs** when wound contraction is needed to cause epithelial approximation



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## Success of Urethral Dilation & DVIU: Histology of Wound Healing

- Successful prevention of urethral stricture dependent on two factors
  - Epithelial growth > wound contraction
  - No additional damage to the corporal spongiosum



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## Healing of Urethra: Post Urethral Dilation & DVIU

- Indwelling cath:
  - Prevents extravasation of urine into spongiosa and scar extension
    - No additional damage to spongiosum
  - Holds incision open to combat wound contracture
    - encourage epithelium contact
    - does foreign body decrease epithelial growth?



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## Healing of Urethra: Post Urethral Dilation & DVIU

- Does the length the catheter is left in situ make a difference?
  - 4 days -3 weeks; similar outcomes
  - >3 weeks **increased risk meatal stenosis**
- Does catheter size make a difference?
  - 16F – 22F similar outcomes
  - > 22F **increased risk of meatal stenosis**

Barbagli 2012



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## Success of Urethral Dilation : Urethral Wound Healing

- Urethral dilation **disrupts** the annular **scar** tissue in **multiple planes** with unknown **depth of injury**
  - Depth of corporal injury increases stricture
  - Dilation **>24F** associated with **increased corporal bleeding**, risk of **increased stricture**

Van Leeuwen 2011, Ferguson 2011



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## Success of Urethral Dilatation & DVIU: Urethral Wound Healing

- DVIU
  - Single linear longitudinal incision controlled plane – 12 o'clock
  - Two incisions at 4 & 8 o'clock
  - Small circumferential radial cuts- feathering

Van Leeuwen 2011, Ferguson 2011



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## DVIU

- Single incision at 12 o'clock
  - Thinnest area of spongiosa less injury
  - Incision may extend into cavernosum resulting in cavernosal- spongiosa shunt
    - Erectile Dysfunction 3-5%
- Incision at 4 and 8 o'clock
  - MRI with increased spongiosa bleeding
  - Documented to lengthen scar in >80%

Husmann 2008, Husmann & Rathbun 2012



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## Exactly how good is DVIU?



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### Data Presented: Prospective database 1986 - Date

- Management of urethral stricture
- One surgeon
- All patients followed up at 3- 6 month intervals for 2 yrs after Rx
  - Flow rate with US residual
  - RGUG & cystoscopy: obtained for recurrent symptoms or abnormal uroflow
- Success determined at 2 yrs
  - Flow rate  $\geq 15$  cc/sec peak/150ml voided
  - Asymptomatic



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## Is there a role for DVIU?

DVIU only for:

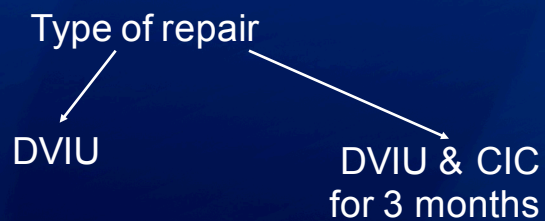
- bulbar urethral strictures
- <1 cm in length
- estimated diameter of  $\geq 5$  French size
- DVIU performed at 12 o'clock
- 16F catheter left in place 4-7 days



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## Material and Methods

- 1986-2014
- CIC success measured after stopping CIC



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## 2 yr - Successful Rx DVIU vs DVIU & CIC N= 77 pts

DVIU : 22% (9/40 pts)

DVIU + CIC : 21% (8/37 pts)

No difference between  
using DVIU alone versus DVIU plus CIC

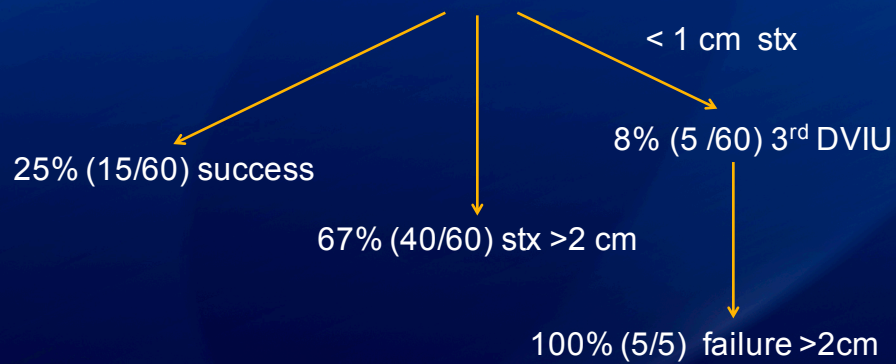


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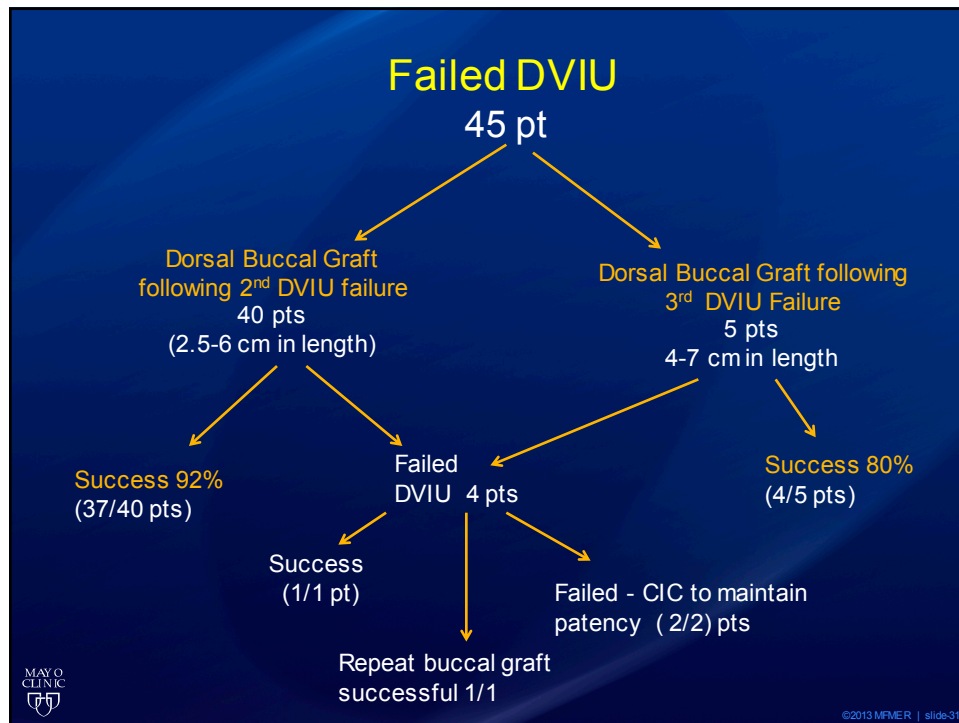
## Failure of 1<sup>st</sup> DVIU

Repeat (2<sup>nd</sup>) DVIU

60 pts



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### Lessons Learned for DVIU Location, Length and Diameter

Location = bulbar urethra  
 Length < 1 cm , Diameter ≥5F

- Overall success : 42% (32/77 pts)
  - 1<sup>st</sup> DVIU - 22% (17/77 pts)
  - 2<sup>nd</sup> DVIU - 25% (15/60 pts)
- 2<sup>nd</sup> DVIU made 67% ( 40/60 pts) worse
- 3<sup>rd</sup> DVIU - absolutely no benefit

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## DVIU (Measures to improve?)

### Incidentally

- injections of steroids, interferon, botulinum toxin, collagenase
- Laser vs cold knife
- All give similar results

Barbagli 2012



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## Is DVIU better than urethral dilation?

Results are similar between the two methods

Steinkamp 1997, Heyns 1998



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## Current Rx Urethral Stricture Selective - Stair Step Approach

### Bulbar urethra

- < 1cm , ≥5F consider = DVIU X1  
—20% success
- Recurrent Stx; reassess < 1cm = repeat DVIU  
—20% success
- Urethral Stx >1 cm or recurs after 2<sup>nd</sup> DVIU  
—Open urethroplasty ~ 90% success
- Data suggest DVIU results **identical for dilation**



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## Selective- Stair Step Approach To Urethroplasty

- < 1cm < 5F diameter -**bulbar in location**
  - End to end ; 90% success
- 1-5 cm (**all penile < 1cm**)
  - Onlay/Inlay Graft vs Flap; ~ 85% success
- >5cm
  - Staged buccal graft (80% completed in 2 ops)
  - CIC to maintain patency
  - Perineal urethrostomy



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## Surgical Success for Urethroplasty

Dependent upon training

- Success matching published results requires approximately 45-60 cases as baseline
- Proficiency and maintenance of excellent results requires approximately 12-15 cases per yr.
- **1% of urologists in US**



Santucci 2009, Mundy 2009, Andrich 2010, Van Leewuen, 2011

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## Graft versus Flap

- Flap
  - Pro- carries its own blood supply
  - Con- limited amount non hair bearing skin
- Graft
  - Pro- more volume available
  - Con- Reliant on graft bed for vascularization
    - Tobacco usage, Radiation, DM, Pulmonary Disease, ASCVD, PVD, Obesity, Steroid Use



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## Tubularized Graft/Flap vs Staged Buccal (> 5cm; not BXO)

- **Single stage tubularized graft** used to jump >5 cm stricture
  - 9% (2/22) without complications at 5 yrs
- **Single stage tubularized flap** used to jump >5 cm stricture
  - 39% (7/18) without complications at 5 yrs
  - $p = 0.024^*$
- **Staged buccal grafts**
  - 89% (25/28) without complications at 5 yrs
  - $p=0.023^{**}$



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## Lichen Sclerosis et atrophicus Balanitis xerotica obliterans

- Unknown etiology
  - Autoimmune response to **urinary infiltration into epithelium**
- Characteristics
  - Dry white area
  - Classically on foreskin or glans (balanitis)
  - Atrophic epithelium
  - Sclerotic dermal layers
  - Vascular (small arterial and capillary) sclerosis



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## Skin vs Buccal Grafts Buccal superior because?

- Hairless
- Easy to handle- elastin rich epithelium
- Highly vascular lamina propria that encourages inosculation and imibition and neovascularization
- Avoids need to conceal donor site
- Immunological rich
- Water repellant
- Rarely affected by lichen sclerosis (BXO)
  - Lichen sclerosis recurs in skin grafts



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## Treatment of Lichen Sclerosis

- Excision of foreskin if that is all that is involved
- Steroids only for brief duration 1-3 months can aggravate atrophy
- Emollients i.e A&D ointment
- Involvement of urethra
  - Buccal graft (Multiple stages = 3)
  - Perineal urethrosomy
  - CIC to maintain patency



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Thank You!

