BUCCAL MUCOSAL GRAFTS: Principles for Urethral Reconstruction

Grand Rounds
Jennie Mickelson
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OBJECTIVES

• Principles of grafts
• Pros and cons of buccal mucosa grafts
• Techniques of reconstruction using buccal mucosa
• Gracilis backing for buccal grafts
GRAFT BIOLOGY

- **IMBIBITION**: diffusion of nutrients between donor and recipient site
  - 1st 48hrs

- **INOSCULATION**: new blood vessel growth between recipient and donor graft
  - 2-4 days
OPTIONS FOR GRAFTS

• PATCH
  (skin, buccal mucosa, bladder mucosa)

• TUBE
  (buccal mucosa, bladder or pedicle skin)

- Gupta et al, 2004

COMPLICATIONS WITH SKIN AND BLADDER GRAFTS

• Shrinkage
• Recurrent strictures
• Diverticuli (urine dribbling)
• Trapped urine
• Ejaculatory dysfunction
• Graft necrosis
• Fistulas

- Gupta et al 2004
PRINCIPLES OF IDEAL MUCOSAL GRAFT

1) well vascularized recipient site

2) rapid and efficient IMBIBITION

3) rapid and efficient INOSCULATION

4) immobilization of graft and recipient site as neovascularization and healing take place

HISTORY

• 1st discovered by Humby in 1941 for urethral recon (dog model)

• Remained a “sleeping beauty” until rediscovery by Burger in 1990s (Kamp et al, BJU 2005)

• 1st series - 18 pts - Duckett - 1995
ADVANTAGES OF BUCCAL MUCOSA GRAFTS

1) ease of application/harvest
2) hairless
3) multiple hairless donor source
4) wide versatility
5) rare sacculcation
6) normal appearing conduit that closely resembles urethra
7) thick mucosa with thin lamina propria - good inosculcation
8) Resistant to infection
9) Compatibility with wet environment

AUAUS LESSON 20 2006, Bhargava et al 2004

HISTOLOGY of BUCCAL MUCOSA

- buccal mucosa has THICK epithelium compared to bladder mucosa and penile skin
- thin lamina propria (compared to bladder and penile)
- Good inosculcation

- AUAUS lesson 34 1994
COMPARISON

BUCCAL MUCOSA
- thick epithelium
- Thin lamina propria

PENILE SKIN

BLADDER MUCOSA

HISTOLOGY

• Heavy infiltration of elastin - resilient and less likely to form diverticuli

• Less shrinkage than bladder mucosa - can be used in 1:1 fashion

• Lamina propria has richer vascular network than skin or bladder mucosa - better insoculation

• - AUAUS Lesson 34, 1994
## Indications for Mucosa Graft Urethral Reconstruction

- Severe complications of hypospadias
- Severe hypospadias variants
- Exstrophy and epispadias
- **Urethral strictures**
- Chordee without hypospadias

> 2cm in length

McAninch et al JU 2003
SEQUENCE OF PROCEDURE

- Scrub, shave and abx coverage
- 1) prepare urethra
- 2) mobilize muscle (if using gracilis grafting)
- 3) SP tube
- 4) harvest buccal graft

- AUAUS Lesson 20 2006
APPROACHES

• Ventral onlay (+/- gracilis support)
• Dorsal onlay (+/- gracilllis support)
• One stage dorsal circumferential buccal graft (spongioplasty)
• 2 stage buccal for complex strictures (peds)

URETHRAL PREPARATION

• -midline perineal incision (extending into mid scrot raphe) or inverted U incision
• Lone star or Turner-Warwick retractor
• bulbocavernosus divided
• urethroty - 2-3 cm beyond stricture

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BUCCAL HARVEST

- Nasal intubation
- Extend neck
- Identify Stensen’s duct - opposite 3rd molar
- 2 x 6-9 cm strip with indigo carmine
- 2 L retractors - sponge in mouth or 2 suture retractors
- Dingman retractor

AUAUS Lesson 20, 2006

BCCH, 2007
BUCCAL HARVEST

- Infiltrate with 1% lido or 0.25% marcaine with epi
- Incise boundaries with 15 blade
- Elevate mucosa using plastics sharps
- Transect at anterior tonsillar pillar
- Soak in saline
- Leave donor site open or close with vicryl rapide
BUCCAL PREPARATION

- Clean and thin graft
- Defat and remove fibro-fatty surface until shiny and white

AUAUS Lesson 20, 2006

BCCH, 2007
COMPLICATIONS OF HARVEST

• Hemorrhage
• Infection
• Pain
• Swelling
• Damage to Stenson’s duct (Parotid)
• Perioral or cheek numbness
  - Bhargava et al BJU 2004

Oral complications after buccal mucosal graft harvest for urethroplasty

NORMAN DUBLIN and LAURENCE H. STEWART
Department of Urology, Western General Hospital, Edinburgh, UK
Accepted for publication: 10 June 2004

• Dublin et al, 2003, BJU - 35 pts
  - 73% had no pain 48 hrs post-op
  - 57% pt developed numbness at 48 hrs
  - 16% numbness > 1 yr (mental nerve)
  - Transient mouth tightness - 75% at 48hrs
  - 74% of pts would have proceed with procedure again
- 2 groups (12 pts) - harvest from cheek vs lip

- Harvest from cheek shows less morbidity than harvest of inner lip

  - pain 1 mo when harvested from cheek vs 6 mos

  - numbness 1 mo (cheek) vs 10 mos (lip) - longer lasting neuropathy of mental nerve

PAIN
DONOR SITE CLOSURE

• Primary donor site closure has been associated with increased pain (Wood et al. JU 2004)
• Closure of edges of rectangular defect for hemostasis (Fabbroni et al BJOMS 2005)
• Salt water or benzydamine hydrochloride (Difflam mouth wash) mouth rinses
• Chamomile tea rinses (Kamp et al BJU, 2005)

RECOMMENDATIONS

• Leave 1 cm from labial commisure (Fabbroni et al BJOMS 2005)
• Stay 1 cm away from Stensen’s duct (Bhargava et al BJU 2004)
• Avoid cautery and using sponges (compression) for hemostasis (Kamp et al BJU, 2005)
• Leave donor site open - however, if thinking of reharvesting - close (Wood et al. JU 2004)
APPLICATION OF GRAFT TO VENTRAL URETHRA

• 3 interrupted 5-0 monocryl to fixate graft
• Running 5-0 around graft

Results of Ventral Onlay

• McAninch et al 2003 - 60 pts - 90% success - 97% with internal urethrotomy
• Barbagli et al 2005 - 17 pts - 83% success
DORSAL URETHROPLASTY

Any urethral stricture.

INDICATIONS:
• Paraplegic with bulb stricture
• Bulbar fistula
• Recurrent stricture
• Poor tissue quality of urethra

DORSAL ONLAY - mobilization

• Bulbar urethra mobilized
• Rotated 180 degrees
• Structured tract open on dorsal surface

Barbagli et al 2002
DORSAL ONLAY

- Left side of graft is sutured to left side of urethral mucosa
- Right to right
- Urethra rotated back to position
- 16F foley in place

- Barbagli, 2002
RESULTS

- Barbagli et al 1998, 2002
  - 92% success (31 pts in 21.5 mos)
  - 85% success at 41 mos
VCUG post Dorsal onlay graft urethroplasty
Barbagli et al 2002

ONE STAGE CIRCUMFERENTIAL BUCCAL GRAFT (spongioplasty)
RESULTS

• Barbagli et al 2003
  - 40 pts
  - 5 pts with urethral mucosa completely removed
  - F/u 12 - 58 mos - none required repeat urethral manipulation
  - Peak flow rate 18 - 29 ml/sec (mean 21)

FOLLOW UP

• FOLEY X 3 WEEKS (16 F)

• VCUG - if leak present - catheter in place X 2 more weeks

• - Gupta et al BJU 2004, Bharbagli et al
VENTRAL ONLAY - pros and cons

- Bulbar spongiosum has enough vascular viability for no backing required
- Caution in pendulous urethra (not enough vascularity/muscle backin) (Wessels, McAninach 1996)
- Lack of mechanical backing leads to
  - Sacculation
  - Trapping of urine/semen
  - Graft necrosis
  - Fistula
- Bharbagli 1996, 2002

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<th>Success (%)</th>
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*First-stage revision; Follow-up not available and hence excluded from determining the means.
BHARGAVA et al JU 2005

• Review of ventral, dorsal and lateral application of buccal grafts
• None supported by gracilis
• 50 bulbar urethral stricture
• Overall 84% success
• 17 Ventral grafts - 83%, 27 dorsal grafts - 85%, 6 lateral grafts - 83%
• Stricture recurrence uniformly distributed
• NO SIGNIFICANT DIFFERENCE

2-STAGE URETHROPLASTY

• Commonly used in pediatrics

• Complex urethral reconstruction - adverse local conditions fistula, radiation, infection (abcess or inflammation), fibrosis

• Buccal graft used as inlay which is tubularized at later time (6 mos)   OR
• Buccal graft is placed as onlay ventrally as 2nd stage after urethra has been prepared
The Puppeteers
BCCH EXPERIENCE

- 18 pts
- 20 buccal grafts (2 pts had 2 grafts)
- 15/18 pts (83%) hypospadius cripple (multiple previous surgeries)
- 13/18 pt (72%) required no additional surgery
- 4/14 (24%) required revision
- 3/18 fistula
- 1/18 stricture

2-STAGE

- 2 studies - f/u 26.5 mos
- 23% (4% - 43%) pts required revision after 1st stage- most commonly proximal graft stenosis
- 1 pt in each series developed urethrocutaneous fistula
- No diverticulum

GRACILIS FLAP - WHY BOTHER?

- possibility for graft loss (15 - 30%) without muscle backing
- needs reliable inosculation

ADVANTAGES OF MUSCLE GRAFTS

1) inosculation
2) provide coverage
3) obliterate dead space
4) separate suture lines
5) improve vascularity
6) enhance WBC fnx in chronically fibrotic wounds
7) prevent seroma formation and contracture

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MUSCLE GRAFTS

1) gracilis
   • short version - more muscle volume for dead space
   • myocutaneous - skin paddle for defect coverage
   • prefabrication - transfer of muscle with established neovascularized grafted skin

2) rectus abdominus
3) gluteus maximus
4) rectus femoris
5) free lat. dorsi

ADVANTAGES OF GRACILIS

• reliable vascular supply
• ease of retrieval
• expendable
• proximity to perineum
GRACILIS ANATOMY

6x24 cm
- originates inferior ramus of pubis
- Inserts on medial condyle
- Predictable pedicle from medial circumflex femoral (branch of profunda femoris)

GRACILIS HARVEST

• Line btwn pubic tubercle and medial condyle
• Gracilis tendon palpable medial to semitendinosus in popliteal fossa
• Incise 2 cm posterior to line
• Penrose around tendon and divide skin from anterior surface of muscle
GRACILIS APPLICATION

- Tunnelled to perineum through capacious tunnel to prevent ischemia
- Pexed to periurethral tissue

GRACILIS APPLICATION

- Periurethral suturing allows muscle graft to be fixed to lamina propria of buccal muscosa
- inosclusion
CONCLUSION

• Buccal mucosa is graft of choice most urethroplasty

• Dorsal and ventral onlay are equivalent approaches

• Consider gracilis backing