Avoiding Complications of ACL Surgery

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ACL Complications

• Not “if”, but “when”…

Incidence

• 60 - 100,000 ACL reconstructions/year
• 5% - 15% failure rate
Causes of Failure

- Technical errors
- Traumatic failure
- Secondary instability
- Biologic failure

Common Complications

- Loss of motion
- Persistent pain
- Recurrent instability

Recurrent Instability

- 8% of Failures
- Causes:
  - Technical Errors
  - Traumatic Failure
    » Secondary Instability
    » Biologic Failure
### Pre-Operative Considerations

- Patient selection
- Timing selection
- Graft selection
- Procedure selection

### Patient selection

- Age
- BMI
- Alignment
- Past surgical history
- Arthrosis
- Ability to do rehab properly

### When is a patient “ready for surgery”…?

- Time from injury
  - not a “cookbook” answer
  - “6 weeks”
- ROM
  - 0-135 degrees
- Swelling/effusion
- Muscle status
## Graft Selection: Allografts

**Area of Controversy:** KNOW YOUR SOURCE!

**Pro:**
- Shortened OR time
- Smaller incisions
- No limit on tissue availability

**Con:**
- Slower incorporation
- Infection / immunologic reaction risk
- Altered mechanical properties (sterilization)

### Allograft: Sterilization and Storage

- **Gamma Irradiation**
  - 3 Mrad+ Needed to Sterilize Fresh Frozen
  - Can Affect Biomechanical Properties
- **Ethylene Oxide**
  - Associated Inflammation, effusion, graft failure
- **Sterilization Fluids**
  - Efficacy and Safety Not Established
- **Fresh Frozen / Freeze Dried**
  - Decreased Immunogenicity

### The MGH / UMass Experience

**“What I See...”**

- Largest revision group = young athletes with allograft reconstruction
  - Age < 25y
  - Athletic Population
  - Male = Female
Intra-Operative Considerations

- Graft harvest
- Notch assessment
- Tunnel placement
- Instrumentation

Harvest: Patellar Tendon

- Problem
  » Small / thin plugs
  » Fractured bone plugs
  » Patellar fracture

Solution

» Bone graft the plug, augment from coring reamer in tibia

» Reverse the graft
  » use Krakow sutures
  » tie over button

(Courtesy of Don Johnson)
Prevention: Patellar / Bone Plug Fracture

- Use 2.0mm drill rather than saw for transverse cuts
- Use saw like a cast saw
  - Follow same line – no double cuts
  - Avoid deep ‘V’
  - Trapezoid shape, esp on patella
- Lift out gently with an osteotome
  - do not “lever”
  - re-cut with saw if needed

Patellar Fracture at Harvest

- Don’t past-point with saw on longitudinal cuts
- Recognize early
- Avoid “It’ll be O.K…”
Patellar Fracture at Harvest

- 2 cannulated 4.5mm screws
- No change in rehab
- Let patient know…

Harvest: Hamstrings

- Problem
  » Graft cut off short

Prevention

- Adequate incision
- Cut bands to gastroc
  » especially Semi-t
- Tendon should pull past tibial tubercle with elastic recoil
Prevention

- Stay parallel – flex knee
  - Visualize 3-D anatomy
- Blunt dissection with finger until m-t junction
- Watch for small bands when pushing stripper forward
- See what you cut!

Solution

- Convert to different graft
  - Patellar tendon
  - Allograft
- Avoid urge to use doubled graft, tripled graft, or short graft

Problem: Dropped Graft

#@#$^&^#$ !!!
Solution

- Stay calm…
- Change graft source
  - Obtain from same side
  - Allograft
  - Fellow/resident…
- Cleanse graft
  - Chlorhexidine soaking
  - Serial dilutions - triple antibiotics

Prevention

- 100% avoidable
- Wrap around finger before transport
- Only surgeon touches graft
  - No “passing” from nurse

Notch Considerations

- Indications for Notchplasty
- 15 mm
  - open pituitary rongeur
- Sex of patient
- Type of reconstruction
- Check graft in full extension after femoral fixation
Notchplasty: Is It Necessary?

- Narrow notch
  - Anatomic Variant / Association
- Strong association between notch stenosis and ACL injuries
  - Uhorchak 2003; Shelbourne 1998; Souryal 1993
- Notch may regrow up to 1 cm
  - Safran and Harner 1995

What Are The Problems?

- Graft Impingement
  - Loss of Extension
  - Cyclops Lesion
  - Mechanical Damage to Graft
- Both Are Detrimental to Ligamentization
  - Alters Vascularity
  - Limits Cellular Ingrowth

Tunnel Placement

- Single most important factor to avoid comps…!!
Tunnel Placement

- Traditional Reconstruction
  » 11 o’clock / 1 o’clock
  » AP stability
- Recent Literature
  » 10 o’clock / 2 o’clock
  » Same AP stability
  » ↑ Rotatory stability

How do we get it wrong?
- Femur too anterior
- Posterior wall blow out
- Tibia too anterior
- Tibia posterior
- Vertical tunnel

Why do we care?
- Biomechanical effects

Femoral Tunnel: Too Anterior

- Tensioned in Extension
  » Loss of flexion
  » Stretching of graft
- Tensioned in Flexion
  » Laxity in extension
- Vertical Graft
  » Rotational instability
Solution

- Use a guide!!
- Slightly anterior
  » Trough over the top
  » Bone graft, re-drill
- Far anterior
  » Drill another tunnel behind
  » Bone graft anterior tunnel
  » Fill defect with a Composite Screw

Prevention

- Must see “over the top”
  » Don’t guess
  » “Resident’s ridge”

Femoral Tunnel: Too Posterior

- Hard to do …
- Main issue is loss of fixation
- Tunnel blowout
Solution

- Change from screw to endo-button fixation
- 2 incision technique

Prevention

- Make a footprint prior to drilling

Double Tunnel Problems

- Double tunnels become confluent
New Problem: Femoral Fixation for Soft Tissues

- Blow out of proximal femoral cortex
- More common with 10/2 tunnels

Solution

- Small tunnel
  - 2 Endobuttons… "ExoButton!"
- Large tunnel
  - secondary incision
  - tie leader sutures over post/button

Prevention

- More common problem with “anatomic” grafts
- Measure femoral tunnel length
  - Endo drill
  - 4.5 drill bit
  - depth gauge
- Stop drilling with any resistance
  - especially > 40 mm
Tibial Tunnel: Too Anterior

- Graft impingement in extension
- Excess graft strain in flexion

Solution

- Make notch bigger
- Chamfer back of tunnel

Prevention

- Anterior horn LM
- Downslope of medial spine
- Posterior half of footprint
- Double check with pin in extension
Prevention

Tibial Tunnel

- **Error**: Posterior
  - Excess laxity in flexion
- **Error**: Vertical/midline graft
  - Rotational instability
- **Error**: Medial/lateral
  - Wall and roof impingement

Why Does Fixation Fail?

- Bone density
- Tunnel integrity
- Tunnel size
- Graft type
- Fixation technique
Interference Screws

- Good for BTB
- May be inadequate for soft tissue alone
- Composite screws
- Absorbable screws
- Metal screws

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Alternative Fixation Techniques

- Endo-button
- Cross-pins
- Intra-Fix
- “Screw/Post”
- Staple

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Screw Issues

- >15° divergence can cause loss of fixation
- Material properties
- Size / length
Prevention

- Guide wire
- 2-pin passer

Problem

- Screw cuts bone plug off graft

Prevention

- Use low anteromedial portal
- Hyperflex knee until guidepin is straight
Loss of Fixation - loose screw

- Use correct size screw
  » 7mm on femur
  » 8/9mm on tibia
  » Oversize for allografts
  » One screw size larger than tunnel for hamstrings
  » Augment with endobutton or button

Prevention of Tunnel Enlargement

- Fix soft tissues close to aperture

Graft / Tunnel Mismatch

- Solution
  » Advance graft into femoral tunnel
  » Trough the tibia and staple
  » Fold over bone plug onto tendon
- Prevention
  » Measure graft and tunnel length
Trouble with Graft Passage

- No need for press-fit!!
- “Easy 10, snug 9….”
- Clear soft tissue at tibia
- Bullet shape femoral block

Graft Tensioning

- “70N”…why?
- Flexion
  - Overconstrains
  - Limits extension
- Extension
  - Can’t overconstrain
  - Double check when using allografts
  - ? Loose in flexion

Summary

- Most complications are avoidable, but not all
- Think of each step and what could go wrong
- Recognize early
- Treat immediately
- Let patients know…
Thank you…