Introduction

• The diagnosis and treatment of mechanical LBP remains challenging and controversial.
• A combination of relatively poor clinical results and judgement has significantly limited our ability to address lumbar DDD from a surgical perspective.

  – Many payors limit or, increasingly, do not cover fusion and/or lumbar TDR procedures for lumbar DDD.
Introduction

• Surgical IDE results: Composite success results
  – Charite (57.1%) v BAK (46.5%): 2 year results
  – Charite (57.8%) v BAK (51.2%): 5 year results
  – Prodisc-L (53.4%) v Ant/Post Fusion (40.8%)

• Payor conclusion: TDR is non-inferior to a ‘gold standard’ (i.e. surgical fusion) that is, in itself, largely ineffective.

Introduction

• Investigational disc repair procedures:
  – Gene therapy
  – Growth factor therapy
  – Cell therapy

• Nucleus replacement procedures:
  – PDN, Dascor, Nucore, Nubac (only nucleus replacement device to reach pivotal trial – failed)

• No FDA-approved devices/procedures.
Introduction

- Based on clinical experience and intuition, many spine surgeons maintain that the disc is a pain generator.
- A subset of patients show dramatic and sustained improvement following DDD surgery, but evidence-basis remains relatively weak.

Intervertebral Disc (IVD)

- **Annulus Fibrosus**
  - Heavily crosslinked, laminated collagen fibers
- **Nucleus Pulposus**
  - Remnant of notochord
  - Chondrocytic cells
- **ECM**: Proteoglycans w/in Type II collagen scaffold; keratan sulfate, chondroitin
  - DDD: ↓ Proteoglycans
  - ↓ Type II/Type I, III collagen
- 70-90% water
  - DDD: ↓ H2O

ECM

- Extracellular matrix primarily consists of:
  - (a) Proteoglycans
    - Aggrecan and versican, largest/most common
    - Hydricellulose molecules: protein stems surrounded by highly neg-charged GAG side chains.
    - Chondroitin sulfate and keratin sulfate:
      - 2 most abundant GAG molecules, attract and hold pos-charged H2O molecules.
  - (b) Type II collagen: scaffold
IVD

• Degenerative Disc Disease
  – Loss of chondrocytic nucleus pulposus cells results in inability to produce and maintain normal ECM.
  – Annulus fibrosus
    • Delamination: annular tears.
  – Nucleus pulposus
    • Cellular loss: depletion of extracellular matrix, replacement with fibrocartilage.
    • Dessication: progressive loss of proteoglycans/H2O.

• DEGENERATIVE DISC DISEASE (DDD)
  – Progressive changes in disc composition and function out of proportion those associated with normal aging.
  – Calcification of cartilaginous endplate (sclerosis) limits blood/nutrient supply.
  – Factors favor ECM destruction (catabolism) over production (anabolism).

Balance

Anabolic

Catabolic

Photos courtesy of Prof Rauschning MD
Lumbar Pain Generator

- Altered biochemical composition
  - Loss of GAGs
  - Loss of water content
- Altered biomechanical properties
  - Loss of viscous behavior
  - Loss of compressive resistance
- Injury response
  - Elevated inflammatory cytokine expression

CASE STUDY

- ElW: Pt is a motivated, professional 40 yo F who presents with progressively severe mechanical LBP 4 years after L5-S1 microdiscectomy for RLE radiculopathy.
  - Sxs requiring routine narcotic usage, pt unable to continue work activities.
  - PE: Nonfocal
  - PSH: s/p hemilaminotomy/discectomy L5

CASE STUDY

- MRI: severe spondylosis L5-S1 with loss disc ht and Modic changes, mild disc dessication L4-5 with ‘minimal’ bulge.
  - Remainder of lumbar spine is unremarkable.
CASE STUDY

• Provocative discography
  – L5-S1: internal disc disruption, but no pain/press
  – L4-5: internal disc disruption, 9/10 concordance
  – L3-4: nl control

CASE STUDY

• ElW (con’t):
  – Pt undergoes L4-5 TDR (Lg disc, 10mm core, 6 degrees lordosis) and L5-S1 ALIF hybrid (off-label).

CASE STUDY

• ElW (con’t):
  – Off all narcotics and pain meds by 4 wks postop and back to work as a Secret Service agent without restrictions by 12 wks postop.
  – Pt now over 6 yrs postop continues full time employment, off all narcotics and muscle relaxers.
Conclusion

• Lumbar pain generator remains elusive.
• Potential lumbar pain generators include:
  – Disc: nucleus pulposus/annulus pulposus
  – Facet Joints
  – SI Joint
  – Musculoskeletal
  – Psychological overlay
    • Powerful placebo effect, at least 2 separate IND studies with sustained saline injection success rate in the 40-50% range at two year follow-up.

Conclusion

• Are we closer to finding the true lumbar pain generator?
  – No
  – Intuitively, we recognize the lumbar disc can be a pain generator, but not the only pain generator.
  – We are not good at diagnosing mechanical LBP and the relatively poor treatment results are a direct reflection of this diagnostic inadequacy.
  – Continued investigation into the diagnosis and treatment of this common and often debilitating diagnosis is warranted.

THANK YOU!