The Intervertebral Disc (IVD)

Review and new science!!
US Statistics and $

- About 6 million cases of IVD related diseases / year
- Annual incidence : 5 % of population
- 2.4 million workers out at any time
- Lifetime incidence 60-90 %
- 30 million visits to MD/DC/DO annually
- 600,000 back surgeries / year USA
- costs: 10-15 billion $ non workmans comp and 20-30 billion $ workmans comp annually
Pt presentations

- LBP
- Radiating pain a] radicular b] nonradicular
- Other sx, i.e. weakness, paresthesias, dysesthesias
Healthy spine IVDs = 25% of column height

- Outer disc – annulus fibrosus; high amount of type I collagen, less proteoglycans, low water content: strong, tough, sheer resistant.

- Inner disc – nucleus pulposus; type II collagen, high proteoglycans, 88% water; distributes pressures evenly, avoids compression.
ANATOMY

Diagram showing:
- Annulus Fibrosus
- Nucleus Pulposus
- Lamellae
Blood supply: capillaries terminate at vert. endplates so nutrition [and meds, etc] reach only by diffusion. IMPORTANT: blood cells do not normally enter the disc!

Disc aging leads to decreased water content—diffusion decreases, aging worsens, classic vicious circle!

Converts to fibrocartilage—loss of elasticity and loss of resistance to compression.
MORE ANATOMY

- Anterior annular fibers are bolstered by powerful anterior longtitudinal ligament (ALL).
- Posterior longtitudinal ligament is narrower and more shallow; provides only week midline reinforcement esp. at L4-5 and L5-S, where disc pressures are also greatest.
ALL and PLL
ALL and PLL
More Anatomy

- Innervation: [important to ‘discogenic pain’] two routes
- One enters adjacent dorsal nerve root segmentally as the root exits thru the neural foramen
- Other route is non-segmental ascending thru the anterior paravertebral sympathetic chain.
- Discogenic pain – ‘visceral pain’ hypothesis
NEW PARADIGMS

- In fairly recent several new research findings have changed our understanding of disc disease and related back pain and radiculopathy. These results will likely lead to more marked changes.

- Three areas in particular are of interest: the genetics of disc diseases; probable role of infection in some disc pathologies; and the role of the immune system, particularly in radicular pain.

- We will visit this information as we examine disc pathologies.
DISC DEGENERATION

- Disc degeneration: loss of ‘bright signal’ on T2 indicates dessication- loss of water in the nucleus
- Leads to loss of disc height
- Transfers load to the annulus and the facet joints.
- Degenerative disc disease [ DDD ] is multifactorial but genetics has major role
NL vs. DESSICATED

- dessication
TWINE SPINE STUDY

- Finnish study of identical twins- followed for years with thorough exams and histories include work and recreation, etc
- Approx 60% of DDD was genetic/familial, the remainder occupational, recreational etc
- Loss of disc height correlated with heavy lifting but NOT with dessication itself!
DDD

- Dessicated disc more compressible, lacks resiliency to ‘spring back’ from loads
- May lose disc height and ‘bulge’ circumferentially
- This may cause direct mechanical problems: compression of nerve root, narrowing of canal, i.e. spinal stenosis
- Increased load on facet joints- facet DJD, which may be symptomatic, and with ligament hypertrophy, contribute to stenosis
DDD
Majority of deg. discs are asymptomatic at any given time unless facet DJD or spinal stenosis [SS] is present.

Classic stenosis symptoms bilateral leg pain and paresthesias, and eventually weakness.

Genetic factors prominent and includes naturally narrow canal / short pedicles. May be multilevel.

Pain relieved by flexion/leaning forward – i.e. on grocery cart. Obviously sx greatest when upright and active.
Positional changes
SPINAL STENOSIS

- RX: NSAIDS, acetaminophen, restricted activity, exercises, lumbar brace, ? meds
- Manipulation, exercise, self care, +/- meds
- Generally is progressive, often slowly
- Intervention with injections, lumbar epidural steroids [LESI] may help and can often postpone need for surgery
- Surgery often inevitable for some
SPINAL STENOSIS and HNP SURGERY

- Surgery now favors ‘less is more’ approach
- Broad decompression may seem intuitive but results are no better, problems greater
- Some cases can now be done by ‘endoscopic’ percutaneous means
- Dr. Anthony Yeung, spine surgeon at Desert Institute for Spine Care in Arizona
SPINAL STENOSIS and HNP SURGERY

- YESS system
SPINAL STENOSIS
and HNP SURGERY

- Approach; pt awake, same day surgery
SS L4-5
DISCOGENIC PAIN

- DDD with LBP- etiology is problematic
- Disc does have intrinsic innervation from the nerve root and the sympathetic chain, these may mediate pain in many cases
- If level is not obvious, discometrics [through large bore needle] may identify the level if surgery contemplated.
- However, recent studies have revealed a new explanation of LBP in a significant minority of these discs
DISCOGENIC PAIN

- Modic type 1 end plate changes
DISCOGENIC PAIN

- These changes are seen in 6% of population and in 35-40% of LBP pts.
- The changes are similar to those due to disc infections.
- Tissue excised from half of the patients with such changes showed signs of chronic infx, 80% of those grew Propionibacterium acnes, a bacterium associated with acne and also found in the oral cavity.
DISCOGENIC PAIN

- Randomized double blind study gave a common antibiotic for just over 3 months
- Study has been replicated at other centers
- All were patients with LBP longer than 6 months
- 80% had reduction of pain; half of those were essentially pain free
- This may be effective rx for many chronic LBP patients
- ? Mechanism of effectiveness of ozone Rx
ANNULAR TEARS
HNPs

- The other common disc pathology is disruption of the annulus of the disc.
- This varies in degree from very minor to very large disruptions with major extrusion of the nucleus pulposus.
- Can occur at any age; many mechanisms of injury.
- LBP but most often with radicular pain.
Even tiny annular tears can be associated with severe pain – severe nerve root pain

Recent studies have revealed a new paradigm of this mechanism

Excised HNP material was found to have high levels of certain molecules involved in immune responses

Two of these, Interleukin 17, IL 17, and Tumor Necrosis Factor Alpha, TNF-A, play major roles in inflammation esp in patients with auto-immune diseases such as RA and SLE
When we are in the uterus and in the first few years of life, the immune system learns to recognize our own tissue.

The nucleus is isolated early in utero and is not recognized as part of our tissues.

Recall that the disc normally has no blood vessels, receives nutrients by diffusion.

When annulus is torn, our own wbc's then think the nucleus is ‘foreign tissue’, an invader.
DISC, IMMUNE RESPONSE

- Duke university professor, author of the major study, Dr. Mohammed Shamji, M.D., Ph.D., states;
- “The center of the disc is immune-privileged, since it has never been exposed to the immune system,” and further that ‘when a disc is injured, the body reacts against the invading inner material [nucleus] as it would against any virus or foreign body, and launches a response targeted at destruction. The nerve root, which is present, near the protruding disc material, becomes painfully inflamed, swollen and damaged during the cascade of events’.
DISC, IMMUNE RESPONSE


DISC, IMMUNE RESPONSE

- Additional experiments with isolated rabbit spinal neurons and aspirated material from nucleus confirm this
- Explains why corticosteroids help - they shut down the immune response
- TNF-A is main mediator of nerve root pain
- TNF-A plays role in immune regulation, but also in diseases including alzheimers, autoimmune disease, inflammatory bowel disease, etc.
- Inhibited by drugs like Remicaid and Enbrel, which are expensive and potentially dangerous
If annular tear / HNP not responsive to conservative care, including chiropractic care, consider intervention esp in acute.

- LESI is safe and often very effective. Additionally can ‘hydraulically’ lyse adhesions that form with inflammation.

- Disadvantages include can not be used too frequently so not a ‘maintainence’ med.
DISC, IMMUNE RESPONSE RX VINPOCETINE

- There is a naturally occurring substance that is a TNF-A inhibitor that is taken orally
- Derived from the plant vinca minor, the lesser periwinkle plant
- Being studied at Mayo and NIH- has anti-inflammatory effects of steroids without the side effects
- Often very useful to maintain improvement
TNF-A inhibitor

Available at Roy’s Health Foods and Natural Pantry

![Vinpocetine](image)
ANNULAR TEARS
HNPs

- spectrum
ANNULAR TEARS

- Small tear
ANNULAR TEARS

- Tear – contrast under PLL
ANNULAR TEARS
ANNULAR TEARS
ANNULAR TEAR
PLL TORN
ANNULAR TEAR
PLL TORN

- Extruded fragment, above and below
PLL / ‘WEAK SPOTS’
Torn PLL, extruded nucleus, visible tear
LUMBAR EPIDURAL STEROID INJECTION [ LESI ]

- If conservative Rx not working, may actually be safer and more conservative than prolonged oral meds
- Can shut down the immune response process
- Can hydraulically lyse – break up – adhesions between nerve root and dural membranes, and help prevent them reforming
LESI SCARRING

- adhesions
LESI
LESI