MEDICOL
CENTRE ORTHOPEDIQUE LAUSANNE

Discogenic LBP

Total Disc Arthroplasthy

Dante G. Marchesi MD

hirslanden

Spine Unit
Clinique Bois-Cerf
Lausanne / Switzerland

NS, female 42 y

invalidating LBP > 6 mo

increased with ph. activity

increased in sitting position

no leg pain

physical exam. flex. pain

neurol. exam. N

failed conservative ttt

- AI + PM
- physical ttt
- infiltrations

NS, female 42 y

invalidating LBP < 6 mo
increased with ph. activity
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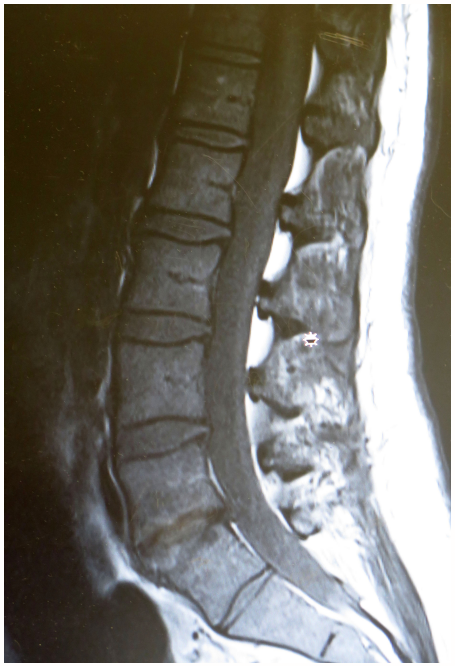
NS, female 42 y



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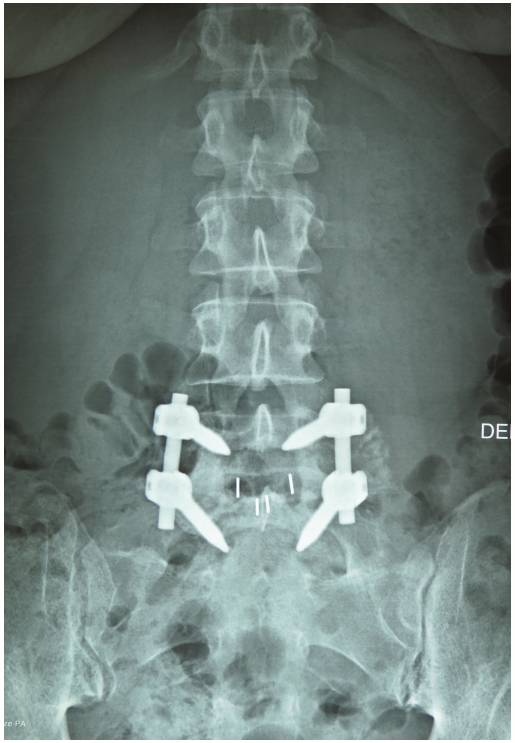
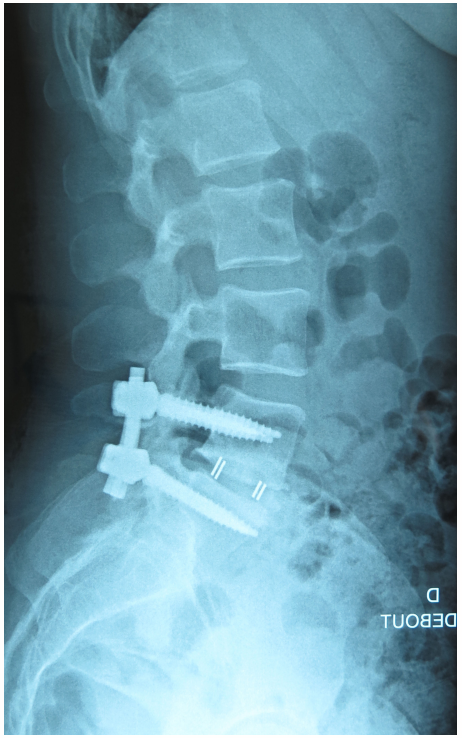




Discogenic LBP

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP ?

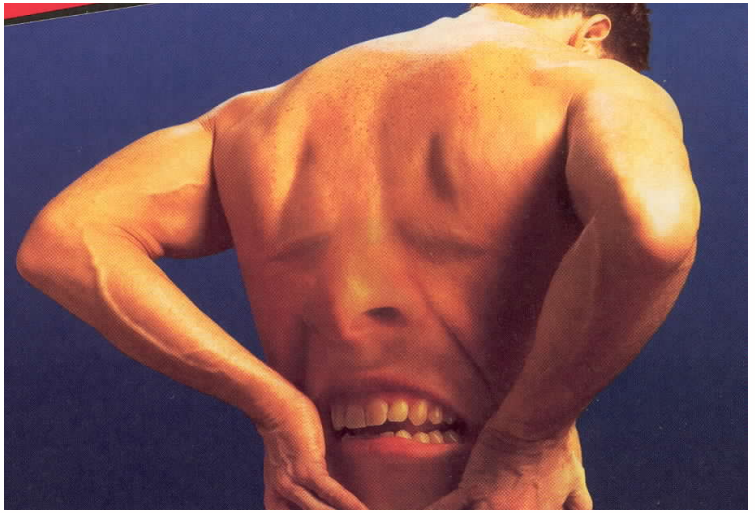
intervertebral disc
facet joint - capsel
spinal ligaments
spinal muscles

instability

mixed

referred

non-specific



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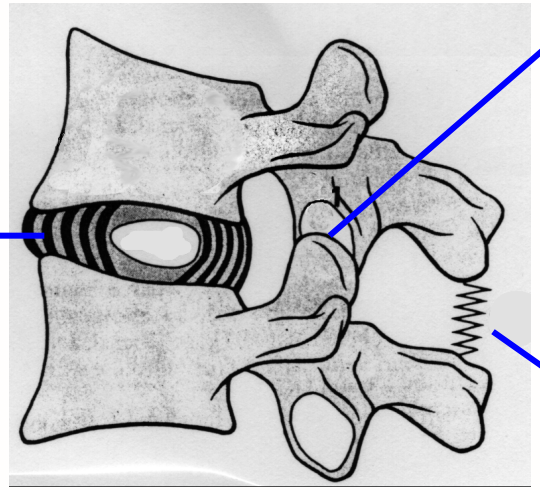

3-joint complex (Kirkaldy-Willis)
Ortho Clin North Am 1983

Discogenic LBP

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physiopathology

disc degeneration

impaired nutritional supply

↓

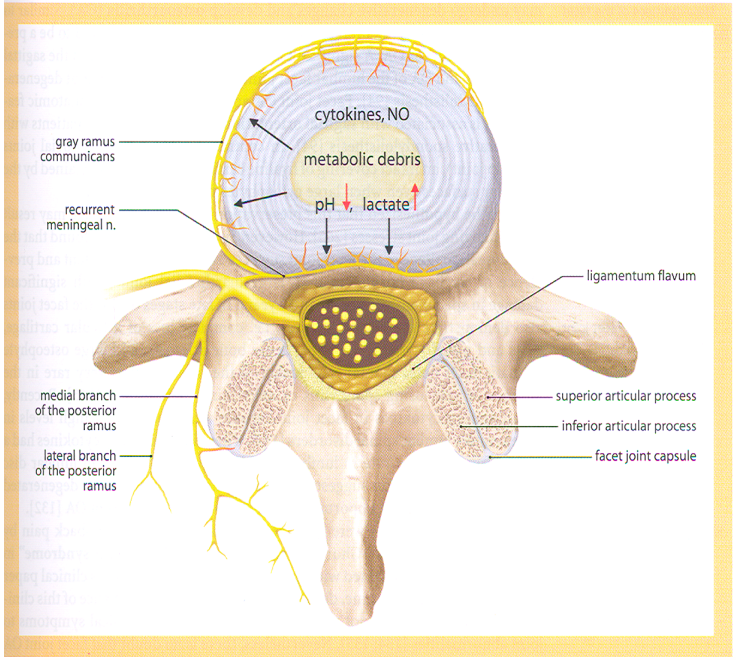
↗ lactate ↗ pH ↗ cytokines metabolic debrits

↓

cellular changes
matrix degradation

↓

structural changes in anulus
(tears, clefs...)



Discogenic LBP

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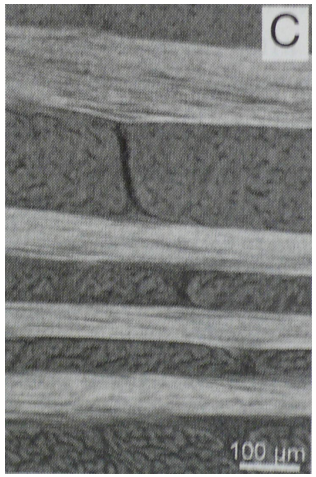

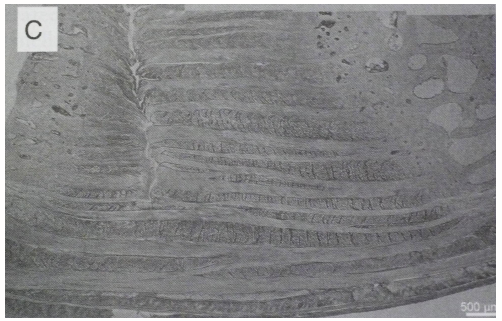

Spinal pathologies

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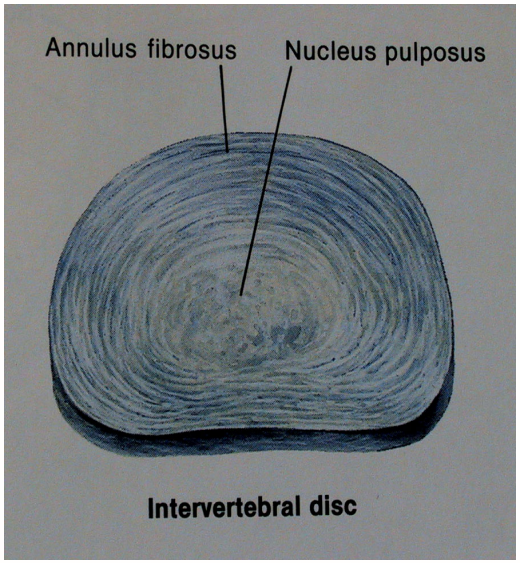
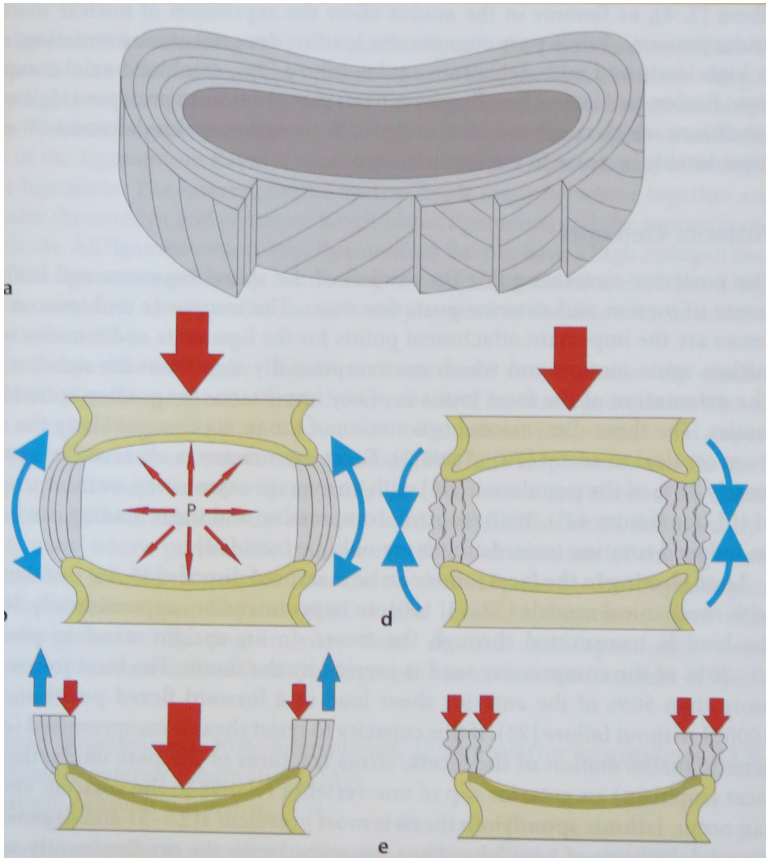
Anatomical considerations





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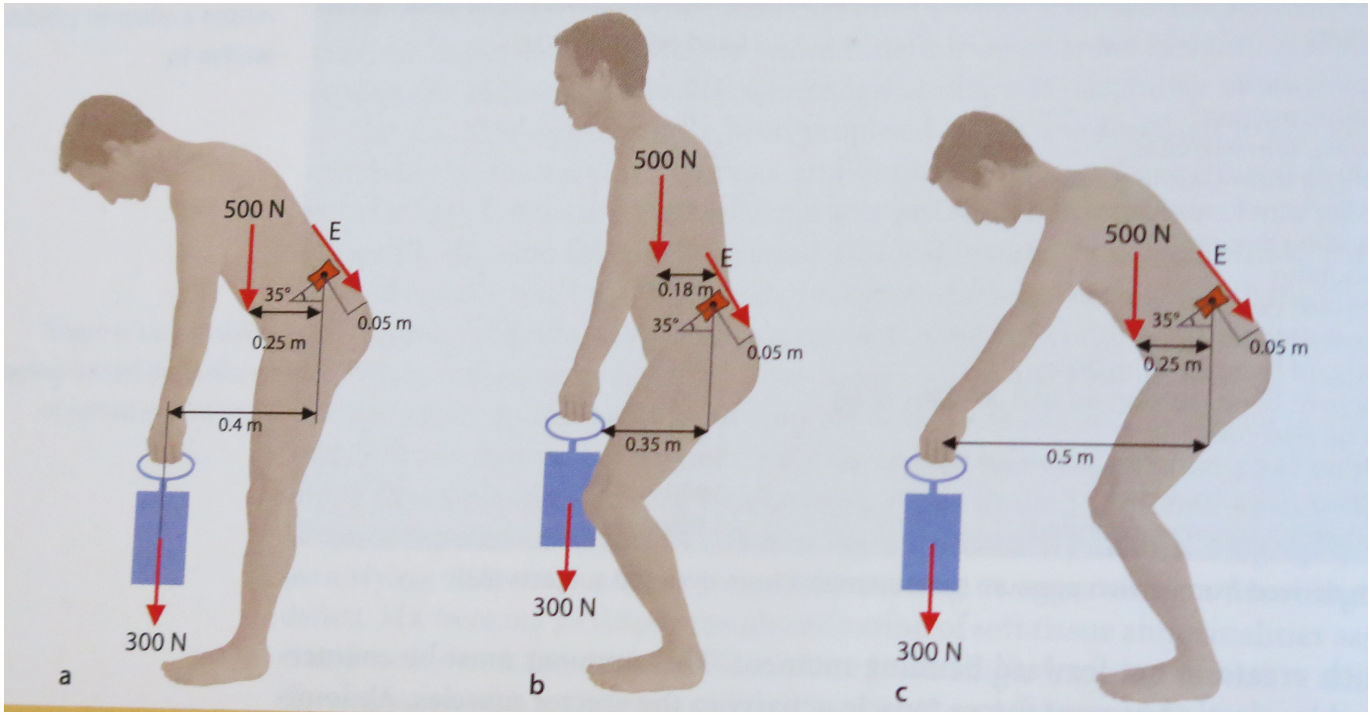
Biomechanical considerations



degenerative LSpine

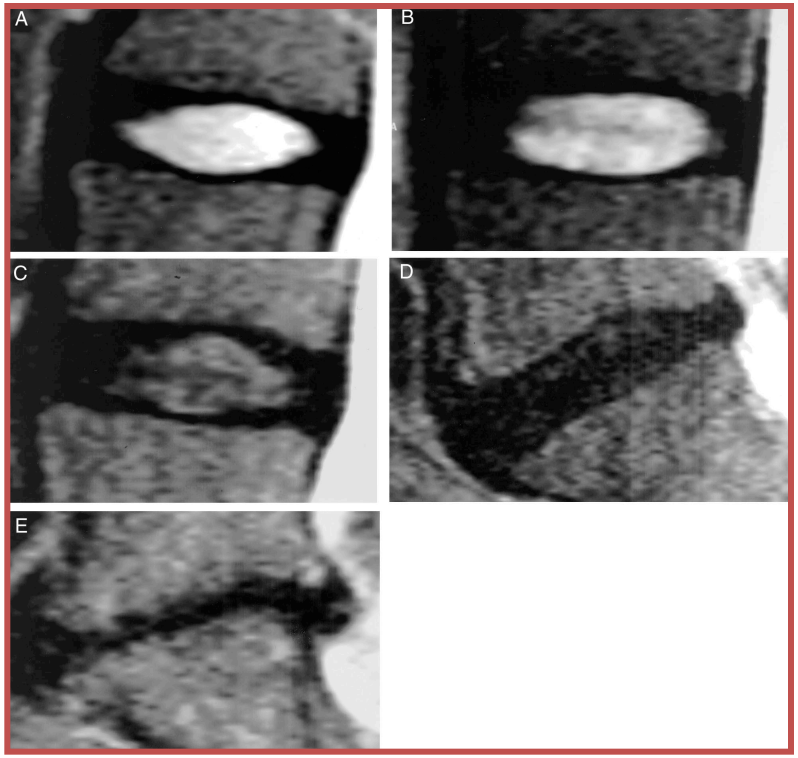
MEDICOL

C

SPINE Volume 26, Number 17, pp 1873–1878

Magnetic Resonance Classification of Lumbar Intervertebral Disc Degeneration

Christian W. A. Pfirrmann, MD,* Alexander Metzdorf, MD,† Marco Zanetti, MD,*
Juerg Hodler, MD,* and Norbert Boos, MD†



loss of proteoglycan content leads to decreased hydration of disc and low MRI signal

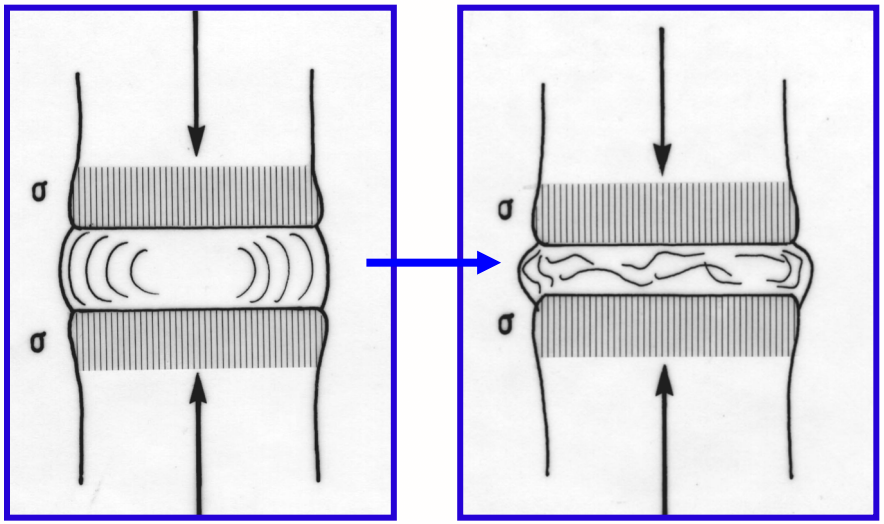
5 grades described

degenerative LSpine

degeneration of the lumbar motion segment

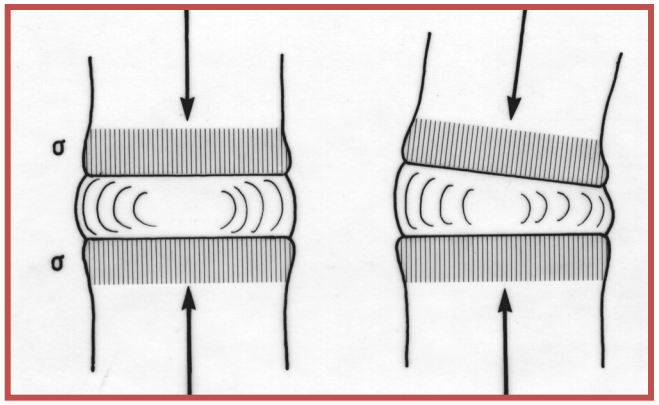
- ***begins with disc degeneration***

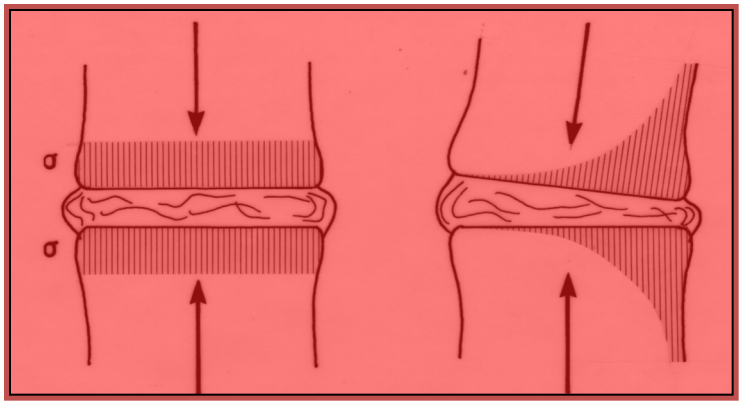
Butler et al. Spine 1990
Fujiwara et al. Eur Spine J 1999
Moore et al. Spine 1999
Thompson et al. Spine 2000
Fujiwara et al. Spine 2000
Schmidt et al. Spine 1998
Kirkaldy-Willis et al.
Clin Orthop Rel Res 1982

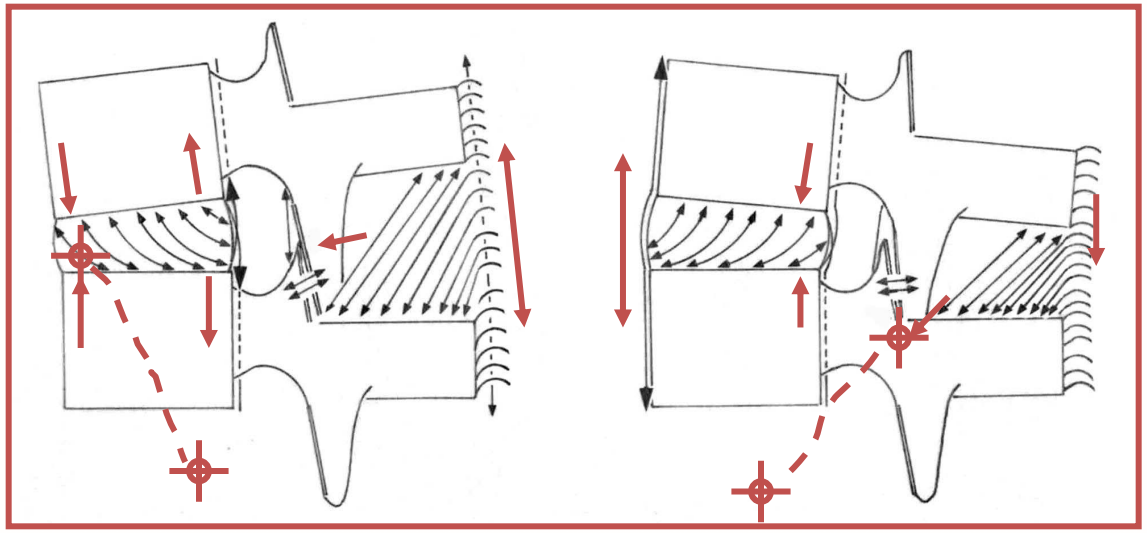


- reduction of proteoglycan content
- loss of nucleus pressure and annulus tension
- increased neutral zones (laxity of motion segment)
- initial destabilisation phase (disc affected only)

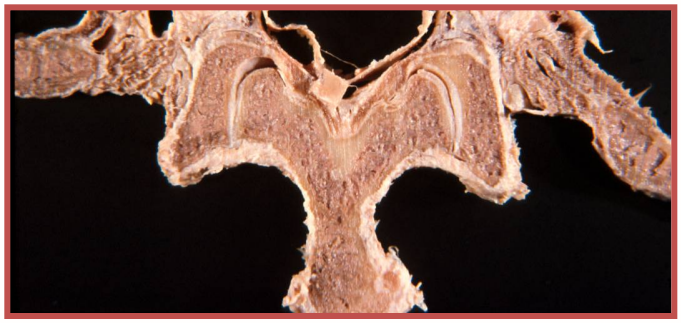
degenerative LSpine

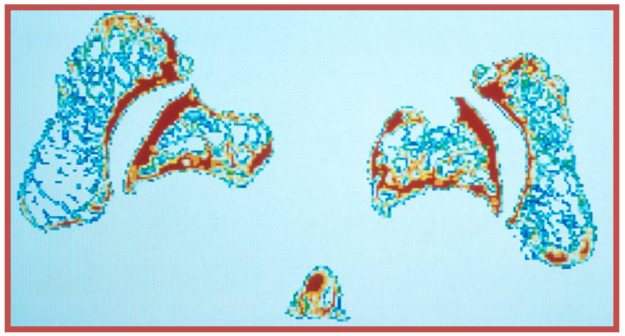


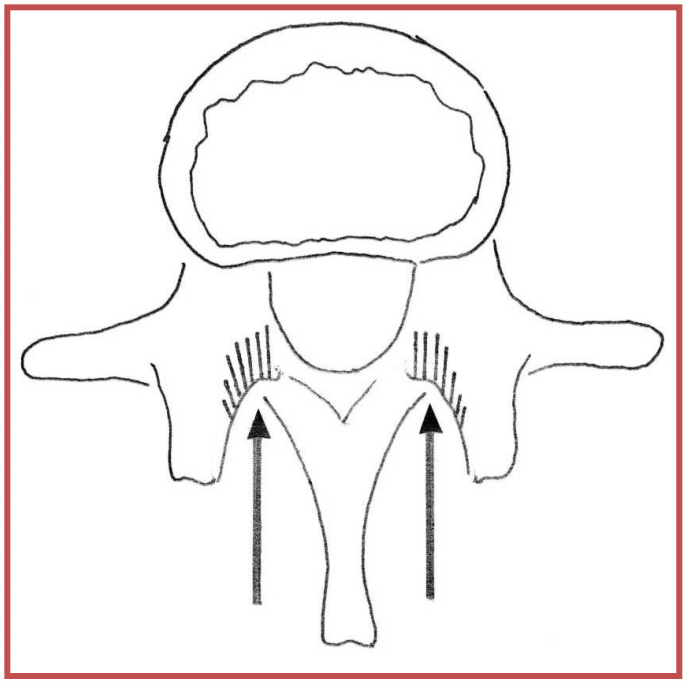


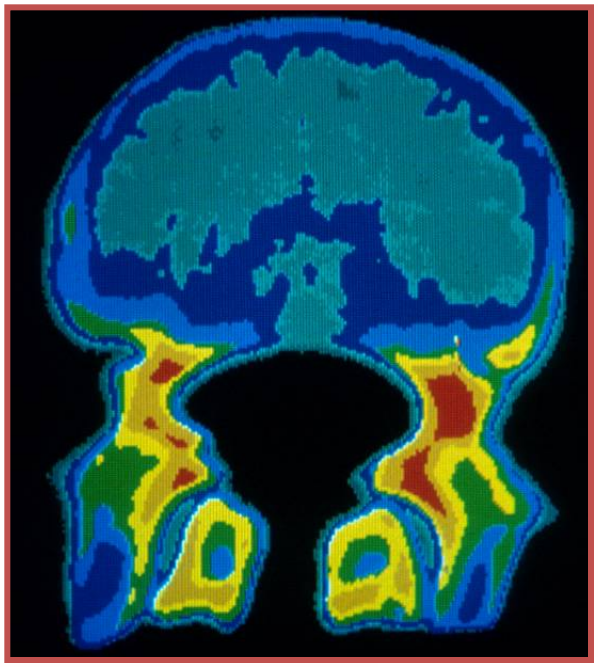


degenerative LSpine









degenerative LSpine

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L

degeneration of the lumbar motion segment

- ***begins with disc degeneration***

Krismer et al. Spine 1996
Latham et al. Clin Biomech 1994
Mimura et al. Spine 1994

resistance of the annulus to torque is reduced

increased mechanical demand on posterior elements

mal de dos chronique

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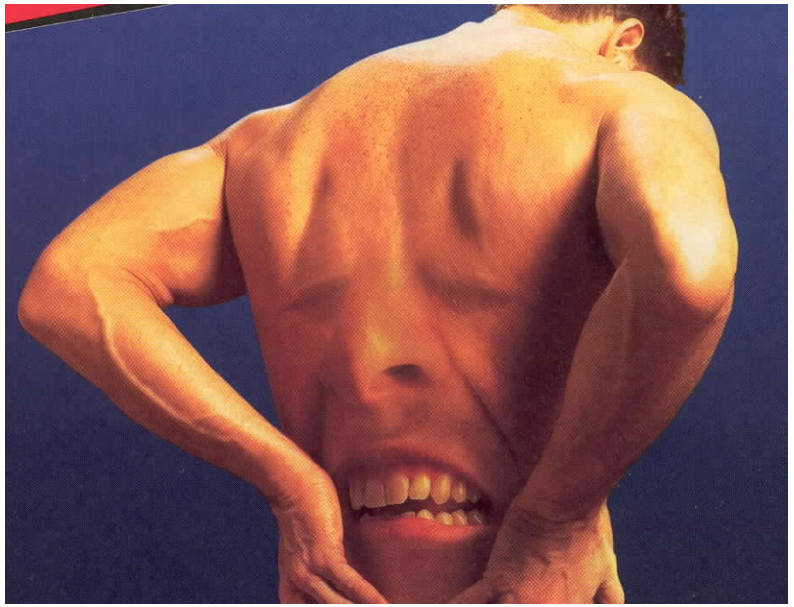
symptomes:

- lombalgie chronique
- 1/3 lombaire inférieure
- intensité variable (par fois invalidante)
- ↗ activité physique
- ↗ flexion lombaire
- ↗ position assise
- ↙ position horrizontale
- pseudo-radiculopathie



Degenerative Lumbar Spine

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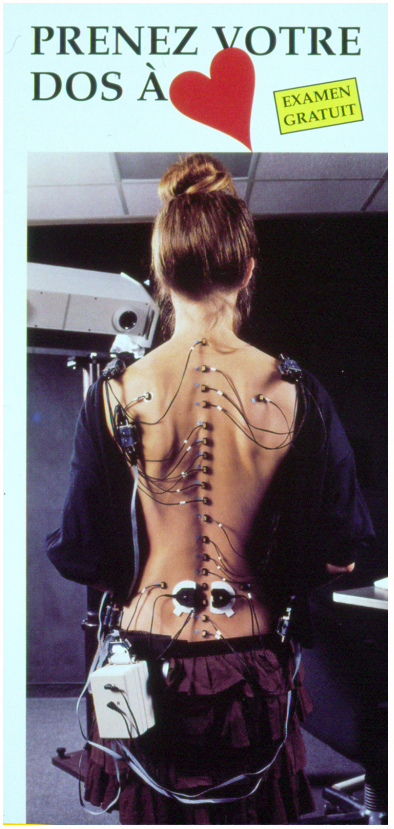
CENTRE ORTHOPEDIQUE LAUSANNE

Patient assessment

- History
- Physical examination
- Neurological evaluation
- Radiological assessment
- Other
  - lab
  - vascular
  - electrophysiol.
- Invasive tests



Discogenic LBP

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LBP diagnosis ?

radiological

x-rays

MRI HIZ
Modic

Discogenic LBP

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

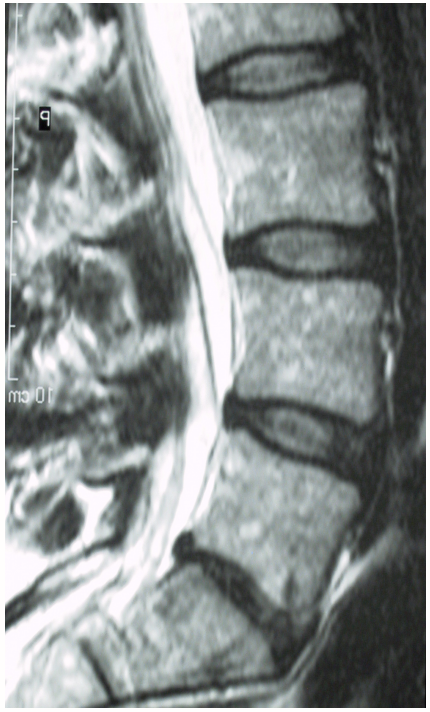
LBP diagnosis ?

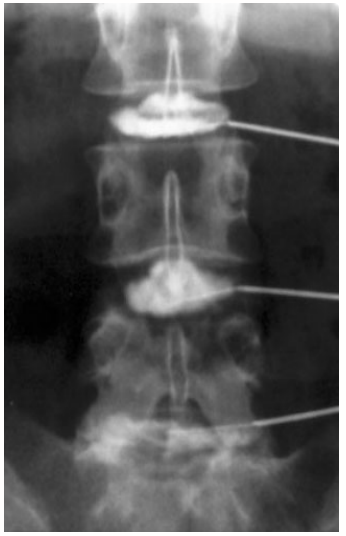
<u>radiological</u>

discography

morphology
pain reproduction

facet blocks





Carragee E: not predictive!!.....but....
Spine 2003/04

Discogenic LBP

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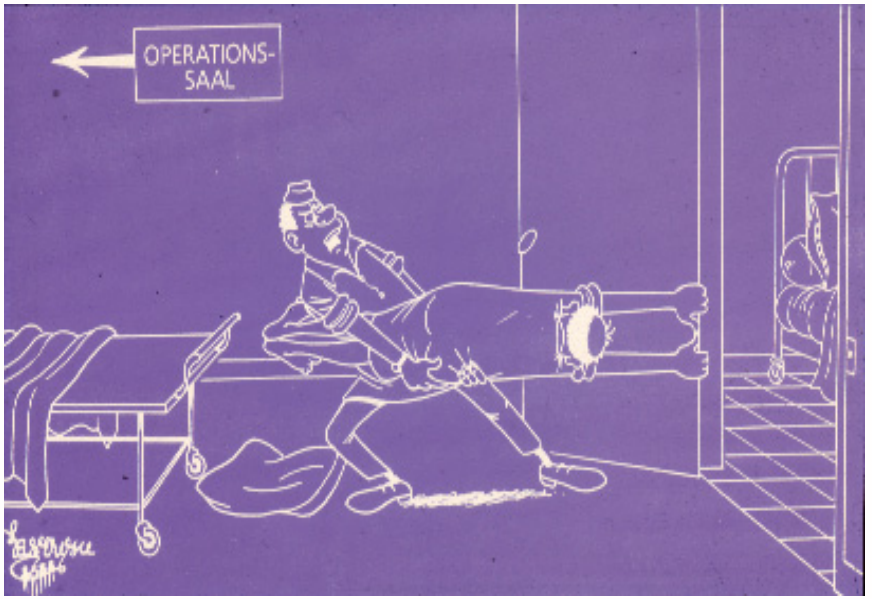
LBP: patient selection for treatment

- medical factors
- psychosocial factors
- sociological factors
- work-related factors

- risk factor flags ?



Discogenic LBP

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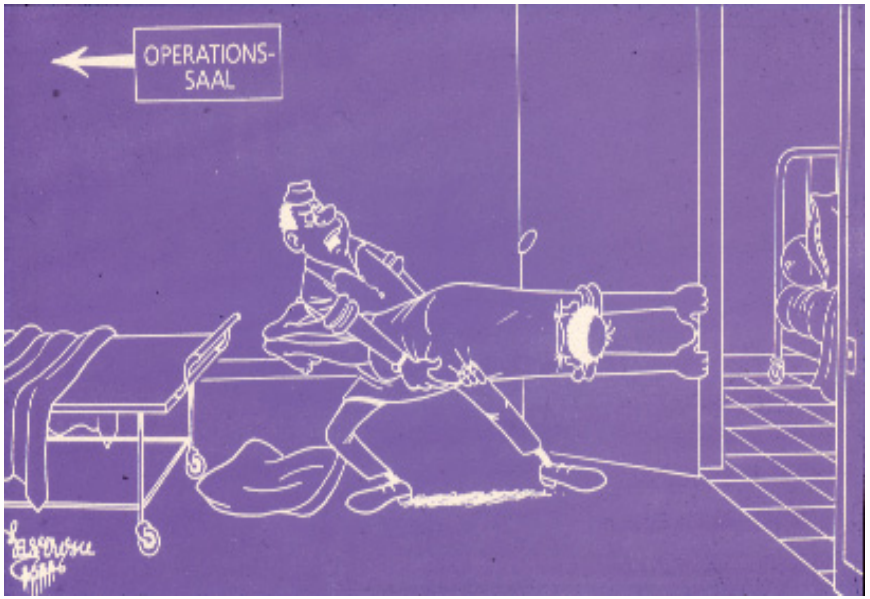
LBP: patient selection for treatment

when adequate trial of non-operative treatment has failed

which non-operative ttt ?

6 weeks
3 months
6 months
2 years



no consensus !!!

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LBP: surgical management

favorable indications

- severe structural alterations
- one (or two-level) disease
- concordance of clinical symptoms with pathological alterations
- positive pain provocation and/or pain relief tests
- short duration of persistent symptoms (<6 months)
- absence of risk factor flags
- highly motivated patient
- initial response to a rehab program but frequent recurrent episodes

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LBP: surgical management

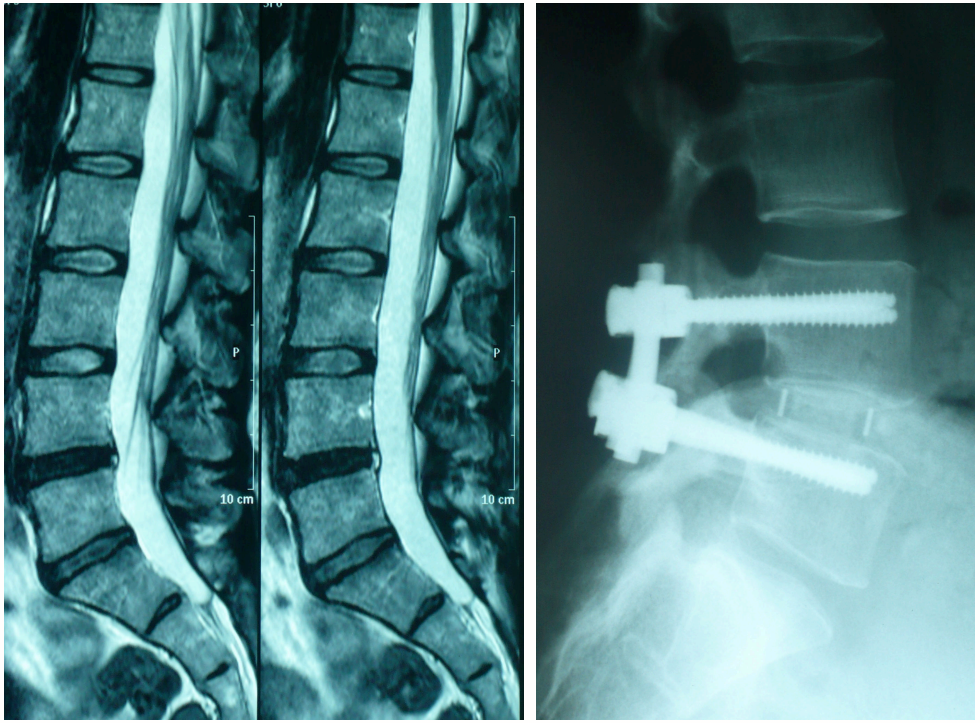
segmental fusion

popularized also for discogenic LBP

hope:

↗outcome when fusion rate close to 100%

outcome not closely linked to fusion status!

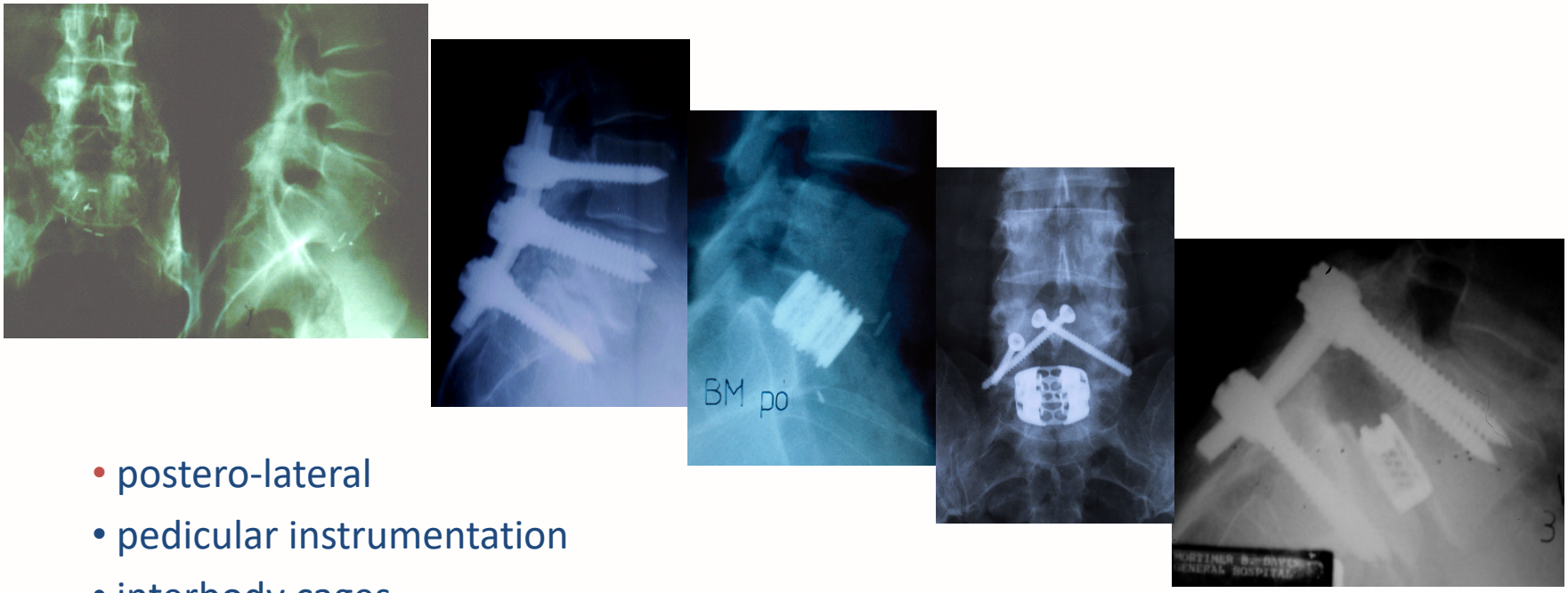


Discogenic LBP

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

segmental fusion



- postero-lateral
- pedicular instrumentation
- interbody cages
- cages + instrumentation

overall success rate 50-80% ?

Clinical Pathway of Low Back Pain

A. Korge Spine Center München

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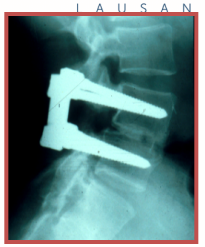
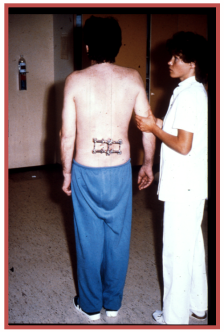
CENTRE ORTHOPEDIQUE LAUSANNE

Level of invasiveness

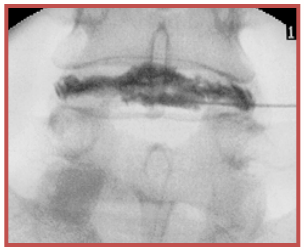


fusion

motion pres. arthroplasty



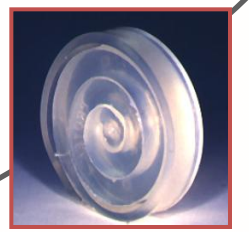
Fix ext

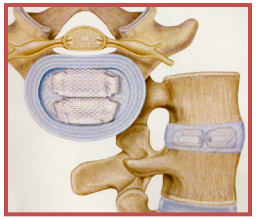


discogram
ID injection

facet / epidural injections

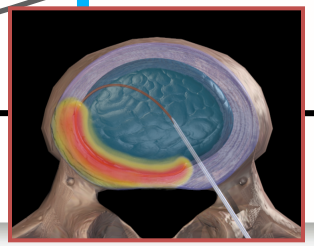
PT
meds





nucleus replacement

IDET



Time

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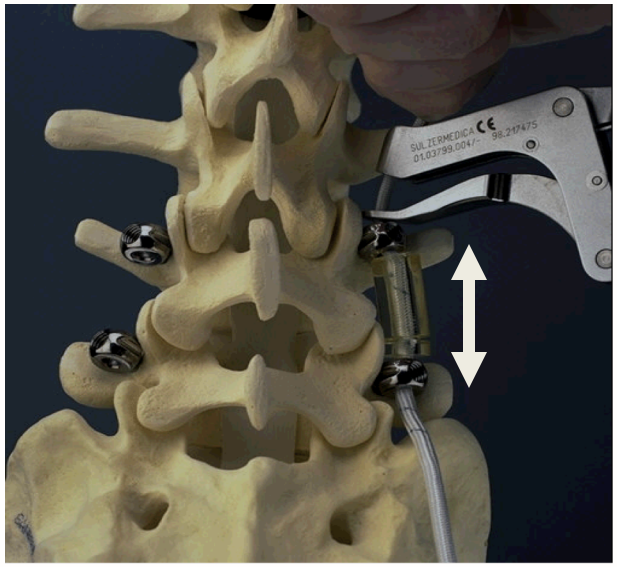
LBP: surgical management

motion preserving surgery: Dynesis



reduces movement both in flexion and extension
unloads the disc to a degree that is unpredictable

Mulholland et al, Eur Spine J 2002

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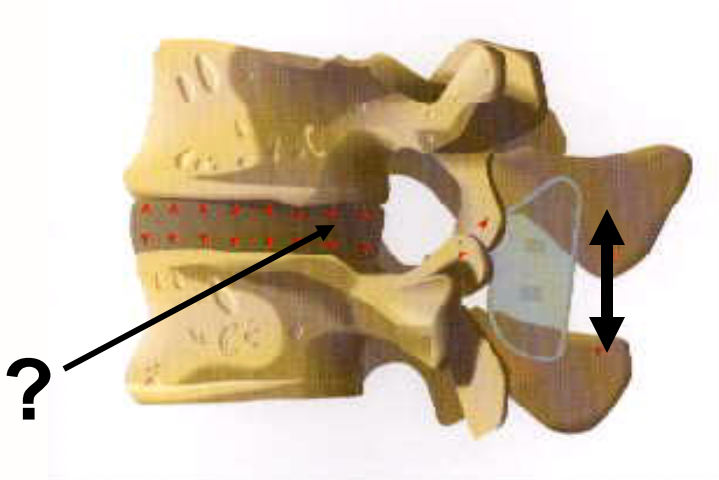
LBP: surgical management

motion preserving surgery: interspinous implants



distract the spinous processes
restrict segmental extension

reduce post annulus pressure ?

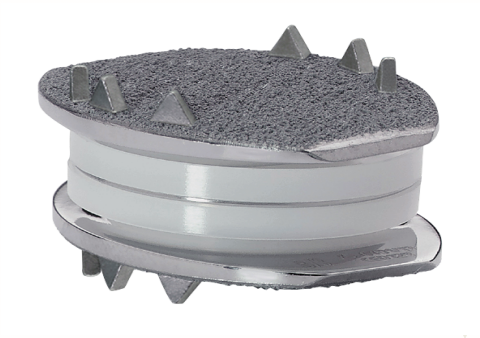
Christie et al, Spine 2005

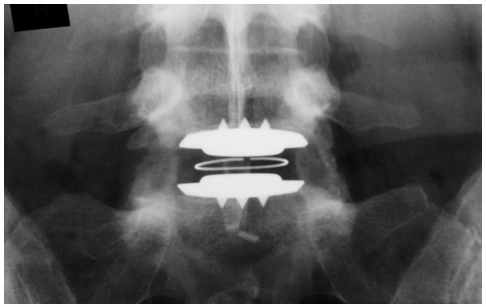
numerous short-term NR studies

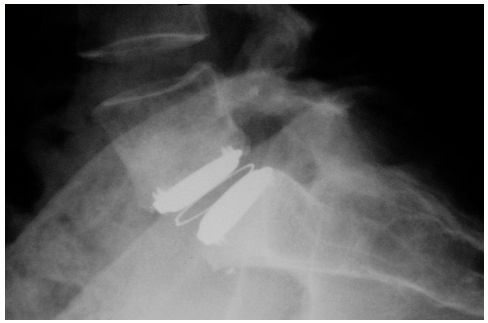
MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

motion preserving surgery: Total Disc Arthroplasty







SB.Charité prosthesis, developped by Schellnack and Büttner-Janz in 1982

popularization of TDA in the last decade with various alternative designs

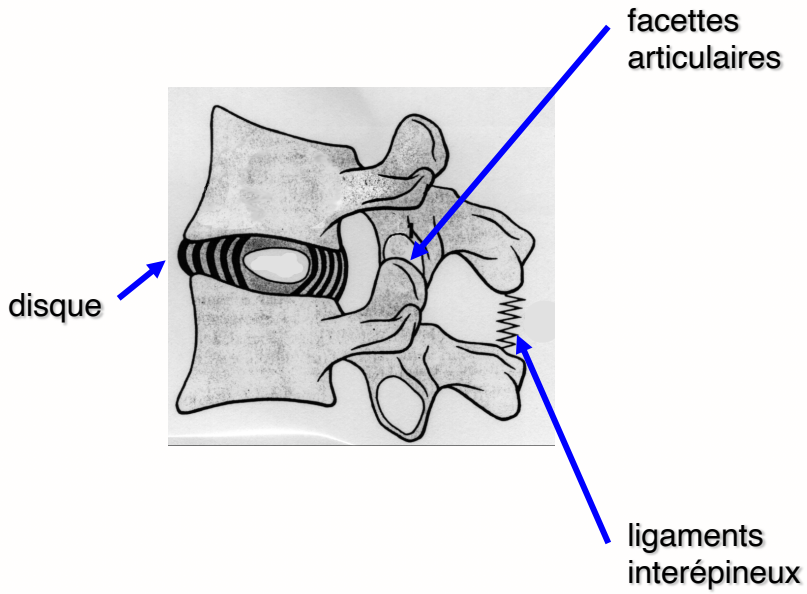
ProDisc-L	Maverick
FlexiCore	Kineflex
Activ-L	AcroFlex

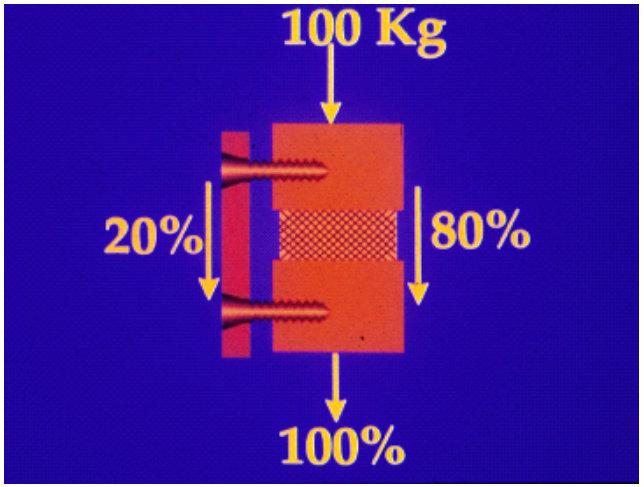
Spondylodèse

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

Considérations biomécaniques

« tri-articular unit »





Spondylodèse

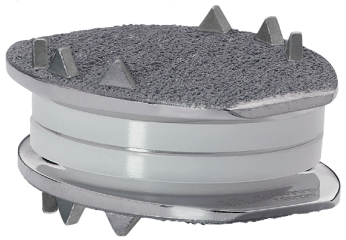
MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

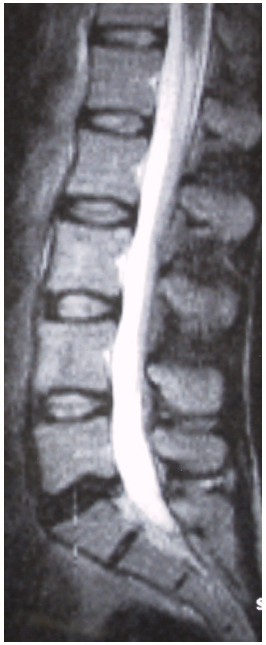
Prothèse discale (Charité, Prodisc, Maverick, Dinardi,…….)

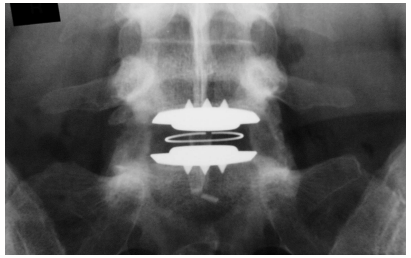
utilisée depuis années 2000

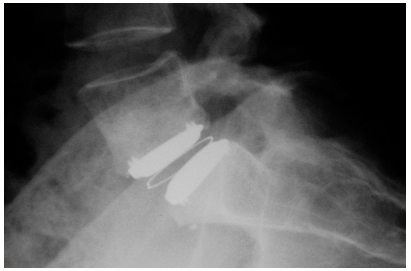
Indications:
- lombalgie chronique avec discopathie dégénérative
- patient jeune

CI
- instabilité segmentaire
- arthrose facettaire
- > 2 niveaux
- ostéoporose
- révision chirurgicale
- (disque L5/S1)









Spondylodèse

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CENTRE ORTHOPEDIQUE LAUSANNE

Prothèse discale

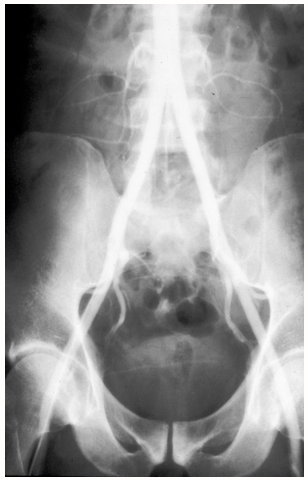
Approche chirurgicale antérieure

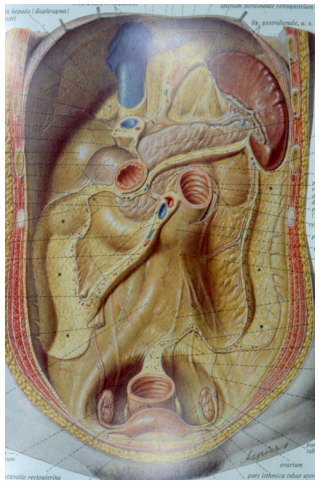
- rétropéritonéale
- transpéritonéale

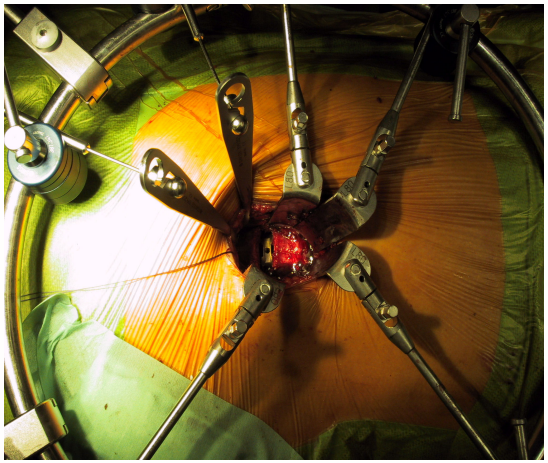
Décompression spinale pas possible

Risque de lésions vasculaires

Ejaculation rétrograde chez l'homme







Spondylodèse

MEDICOL
CENTRE ORTHOPEDIQUE LAUSANNE

Prothèse discale

Avantages:
- préserve mobilité segmentaire
- ↓ dég. adjacent

Désavantages:
- résultats ?
- FU ?
- usure ?
- segment adjacent ?
- risques chirurgicaux
- pas de décompression

Spondylodèse

MEDICOL
CENTRE ORTHOPEDIQUE LAUSANNE

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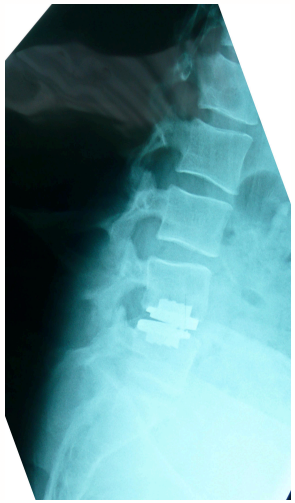
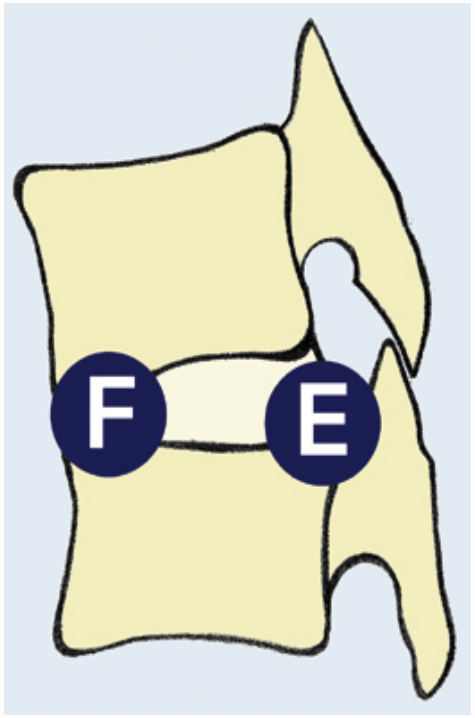
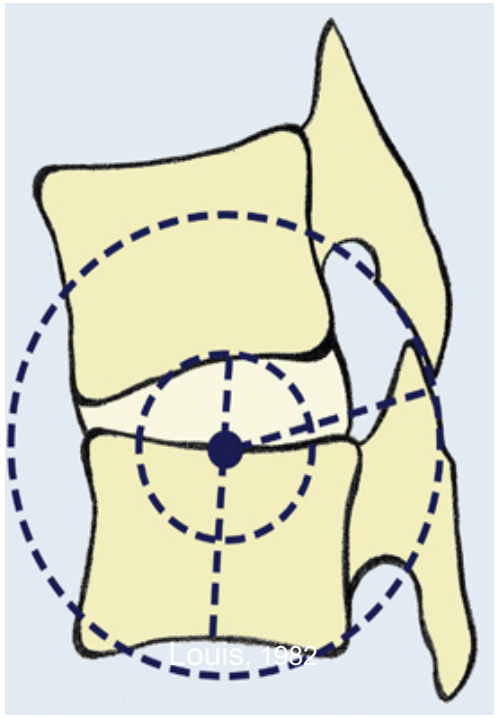


Segmental motion

10° Flexion / 5° Extension

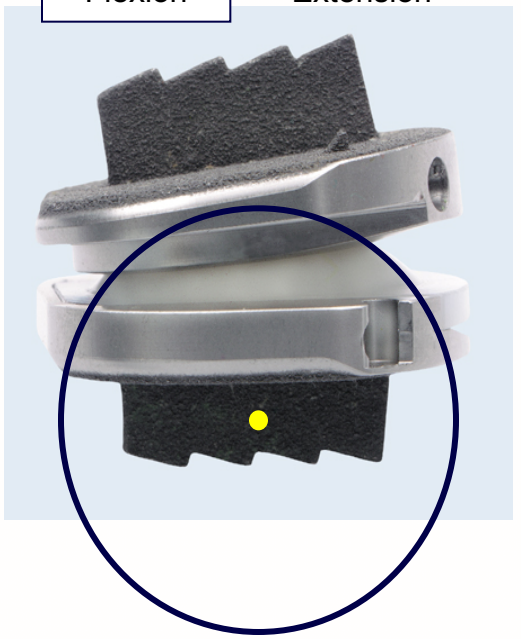


White, Panjabi, 90
Hayes, 89
Pearcy 84, 85
Dvorak, 89,91



Louis, 1982

13° Flexion | **7° Extension**



Segmental motion

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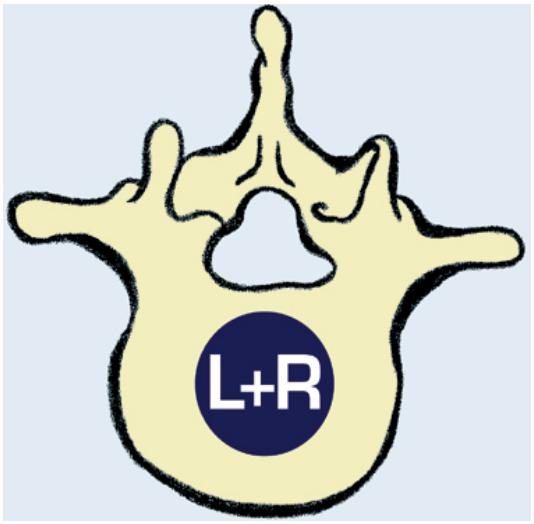
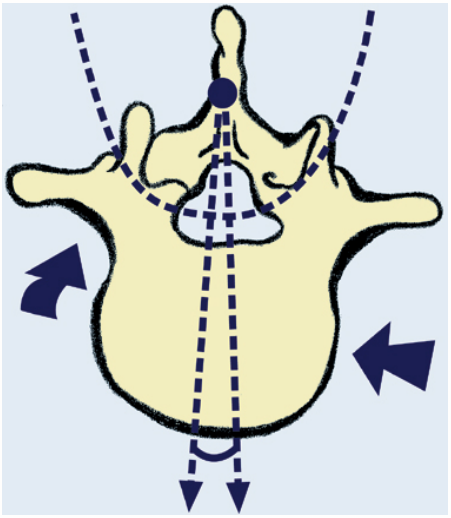
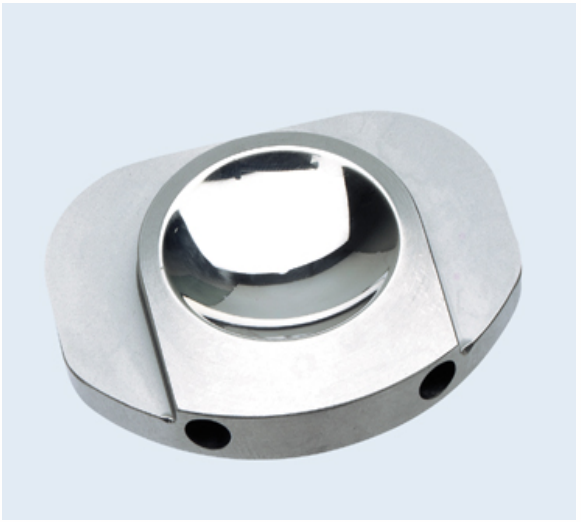
+/- 3°

ROM unlimited



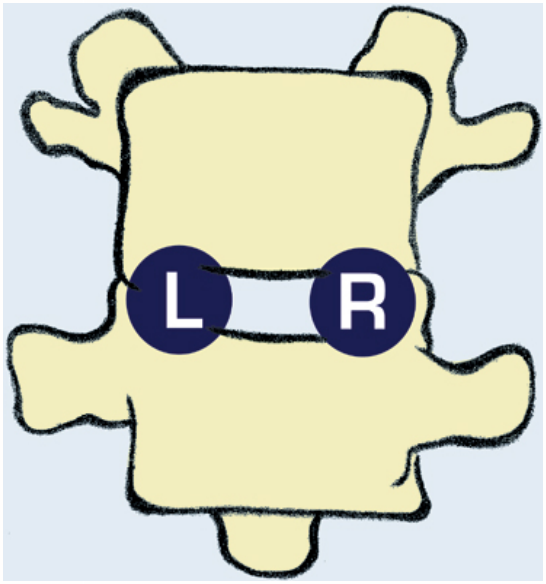


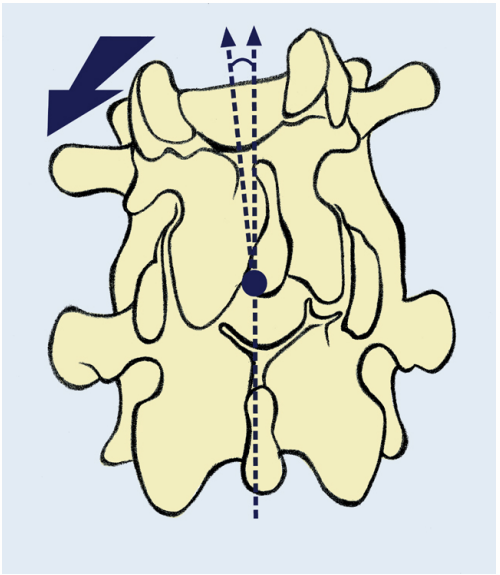


White, Panjabi, 90
Hayes, 89
Pearcy 84

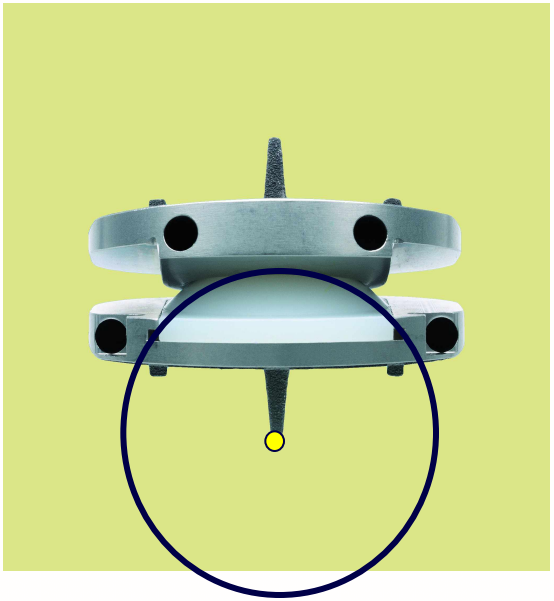
Segmental motion

Left	+/- 5°	Right





Left	+/- 10	Right



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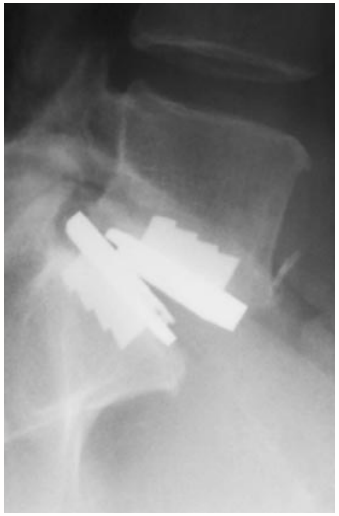
Spondylodèse

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

Prothèse discale

Avantages: Préserve mobilité segmentaire

Désavantages:
Résultats
FU
Usure ?
Segment adjacent ?
Risques chirurgicaux
Pas de décompression



Positionnement et orientation parfaite

Modification du centre de rotation du segment

Spondylodèse

MEDICOL
CENTRE ORTHOPEDIQUE LAUSANNE

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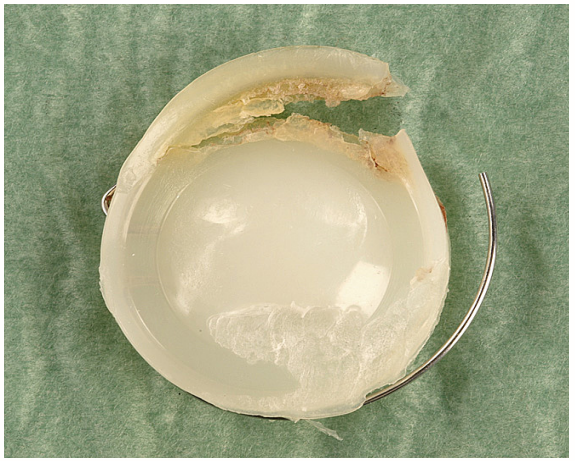


Positionnement et orientation parfaite

Modification du centre de rotation du segment

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Total Disc Arthroplasty

contraindications:

- osteoporosis
- multilevel disc degeneration (> 2)
- facet joint osteoarthritis
- spinal deformity or instability
- prior lumbar fusion
- obesity
- consuming illness (tumor, infection, inflammatory disorders)
- metabolic disorders
- known allergies

Ziegler et al, Spine 2004
Guyer, McAfee, Spine 2004

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Total Disc Arthroplasty

biomechanical considerations:

preserves segmental motion similar to the intact spine

no universally accepted testing system to study the effect on facet loading
- influence by ADR design (unconstrained vs semiconstrained)
- anterior intervertebral placement increased facet loading

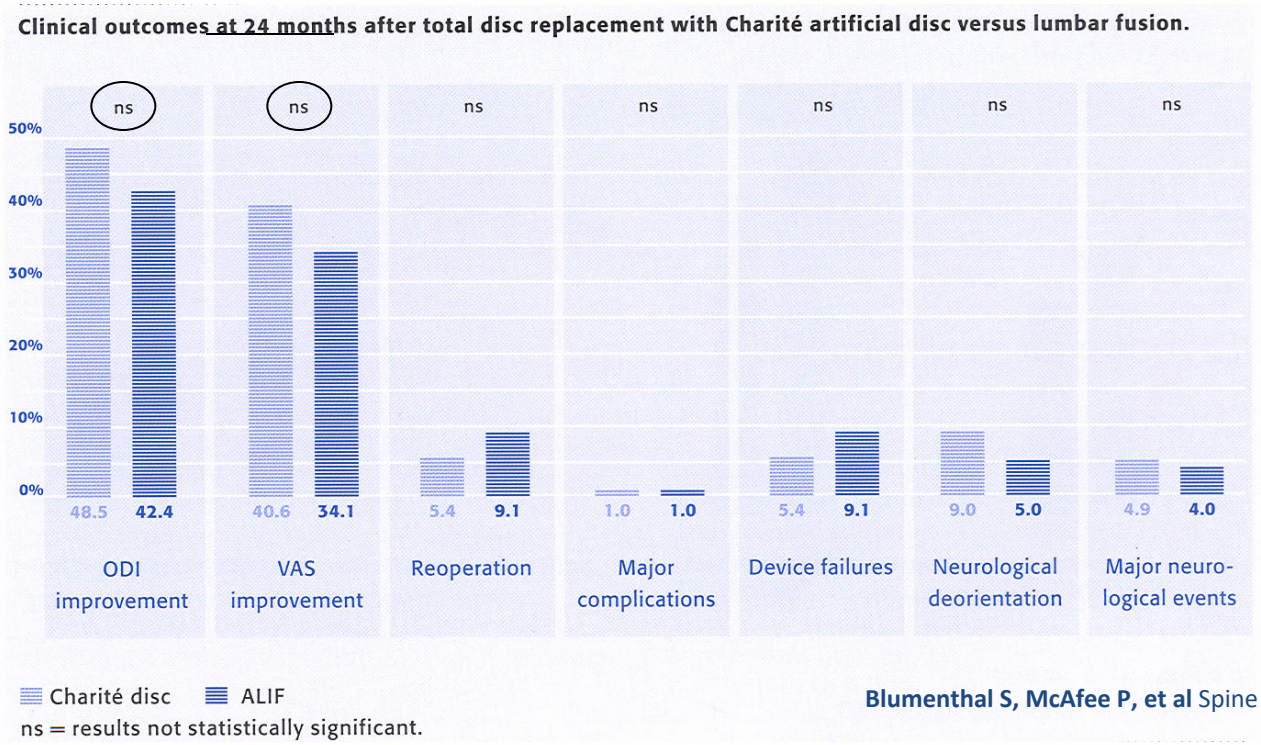
intradiscal pressure in adjacent segment discs is affected minimally compared with the intact spine (statistically significantly increased with fusion)

MEDLINE search: 8 in vitro studies,1 in vivo study and 4 finite element analysis

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Lumbar fusion vs TDA

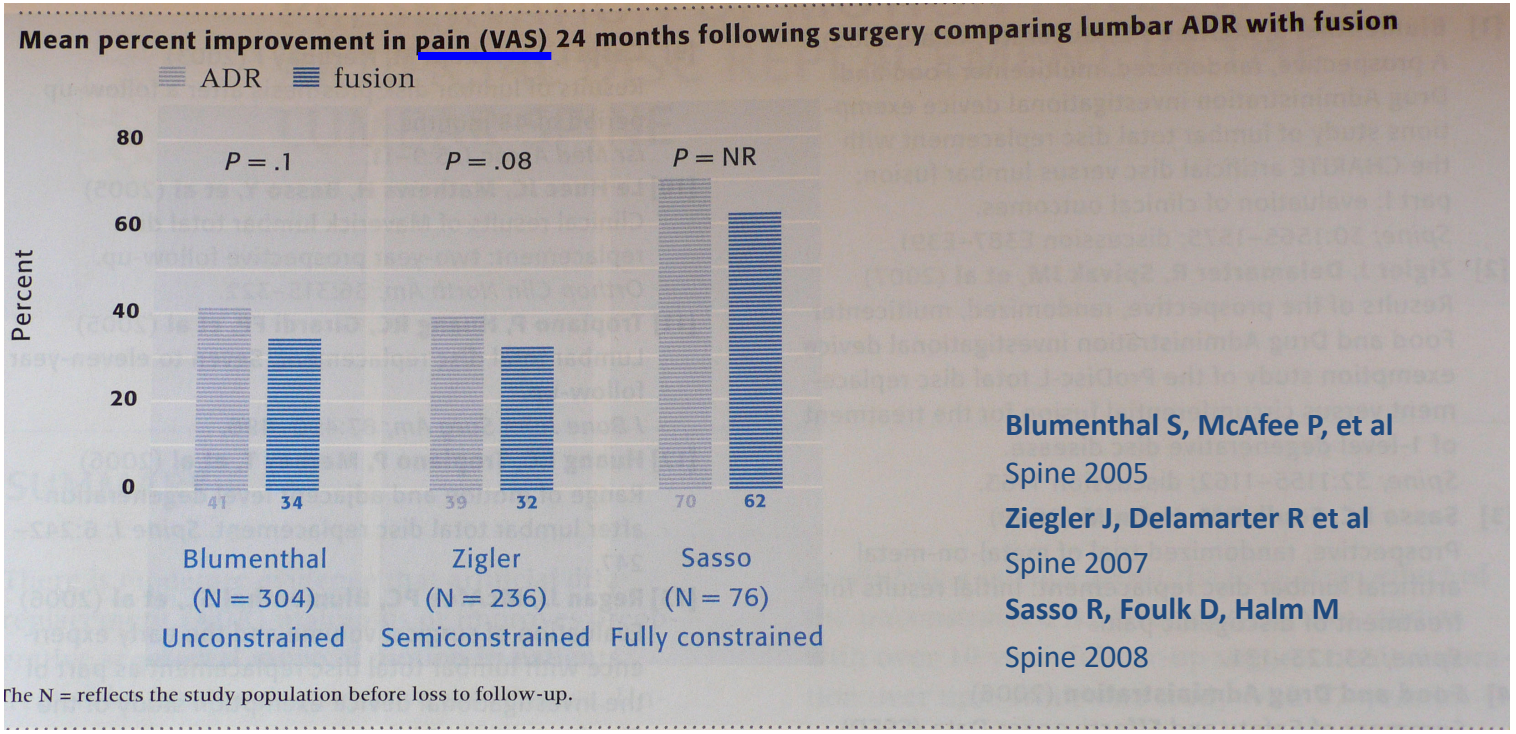


Blumenthal S, McAfee P, et al Spine 2005

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Lumbar fusion vs TDA

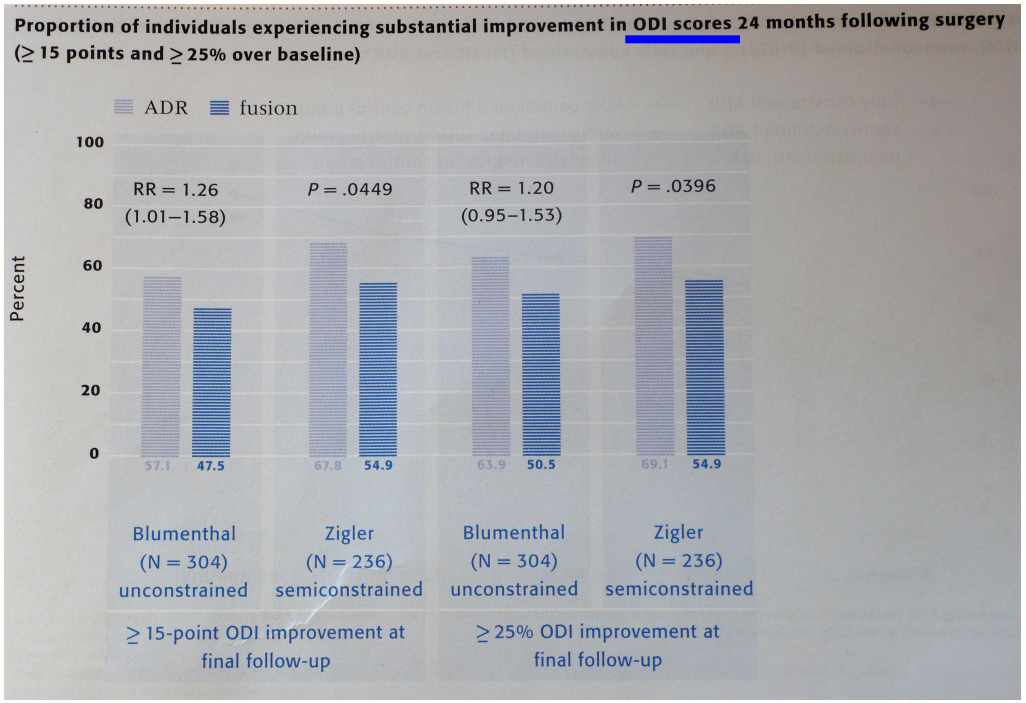


Blumenthal S, McAfee P, et al
Spine 2005
Ziegler J, Delamarter R et al
Spine 2007
Sasso R, Foulk D, Halm M
Spine 2008

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Lumbar fusion vs TDA



Blumenthal S, McAfee P, et al
Spine 2005
Ziegler J, Delamarter R et al
Spine 2007

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LBP: surgical management

Lumbar fusion vs non-fusion techniques on adjacent segment disease

~ 25% of patients receiving lumbar fusion may develop new lumbar adjacent segment disease within 10 years following surgery (L3/4 most frequently involved)

Seitsalo S, Schlenzka D, et all
Eur Spine J 1997

increased risk for L-ASD in patients who underwent fusion compared with patients who recieved non-fusion or no treatment

Kumar M, Jacquot F, Hall H
Eur Spine J 2001

the differences failed to reach statistical significance

Hambly M, Wiltse L, et al
Spine 1998

Class III CoE

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LBP evidence for surgical treatment ?

Accurate diagnosis and proper surgical indications are crucial for the patient's ultimate success

The best chances are with the first surgery!

But which surgery?

What so ever no clear evidence for surgical management in discogenic LBP!!

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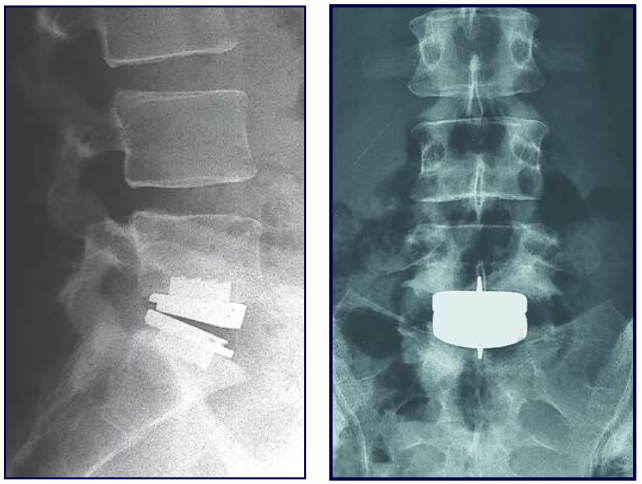
LBP: surgical management

Total Disc Arthroplasty

indications:

- age 18-60 years
- severe back pain
- severe disability (ODI > 30-40)
- failed non-operative treatment for > 6mo
- single (or two-level) disc degeneration

Ziegler et al, Spine 2004
Guyer, McAfee, Spine 2004



Spondylodèse

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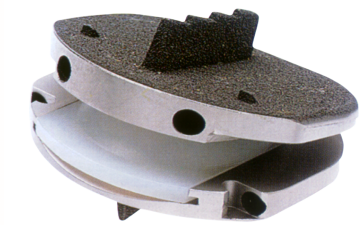
Prothèse discale

Peu d'études valables (EBSS)

Etudes rétrospectives la plupart

En investigation en CH (Santésuisse)

Pas remboursé par certaines assurances !!!



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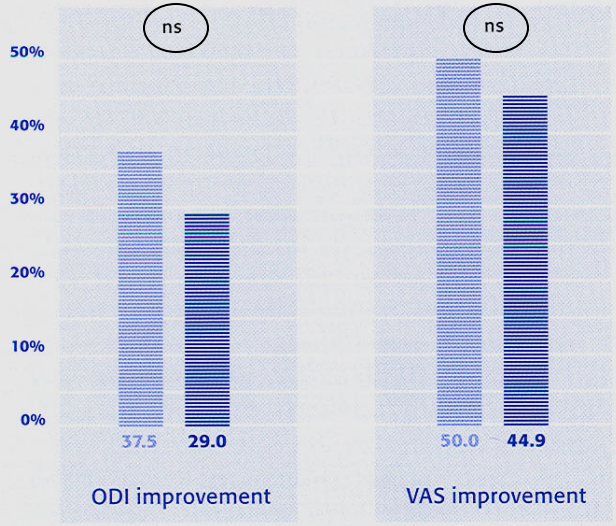
LBP: surgical management

Lumbar fusion vs TDA

Total disc replacement with ProDisc-II disc versus lumbar fusion: percent improvement in ODI and VAS scores at 18 months compared with preoperative values.



ns = results not statistically significant.

Delamater R Bae H, et al
Orthop Clin North Am 2005

Spondylodèse

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Solutions

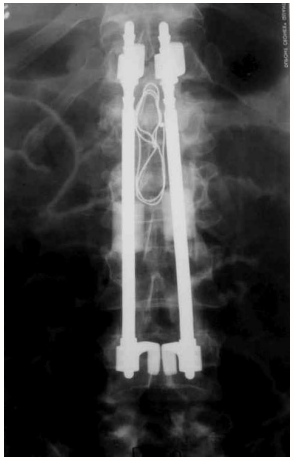
Spondylodèses courtes

Techniques de non-fusion

- prothèses discales
- fixations souples (Dynesis)
- espaceurs interépineux
- implants intradiscaux

Techniques de transitions

- fixations à rigidité variable
- fixations hybrides



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LBP: surgical management

Lumbar fusion vs TDA

class II studies
prospective randomized FDA regulated

similar short-term clinical results
but
carefully selected patients

Blumenthal S, McAfee P, et al
Spine 2005

Delamater R Bae H, et al
Orthop Clin North Am 2005

Geisler F, Blumenthal S, et al
J Neurosurg Spine 2004

Discogenic LBP

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP ?

intervertebral disc
facet joint - capsel
spinal ligaments
spinal muscles

instability

mixed

referred

non-specific

syndroms

discogenic back pain
facet syndrom
instability syndrom

Discogenic LBP

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pain mechanism ?

neo-vascularization
neo-innervation/nerve ingrowth

impaired nutritional supply
- lactate ↗
- pH ↙

impaired metabolism
- cellular changes
- matrix degradation

tear / cleft formation

proinflammatory cascade

pain

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LBP diagnosis ?

history

- localization back
  legs
  both
- onset
- duration
- position
- day/night
- physical activity
- medications
- work status
- social

pain assessment forms
personal assessment

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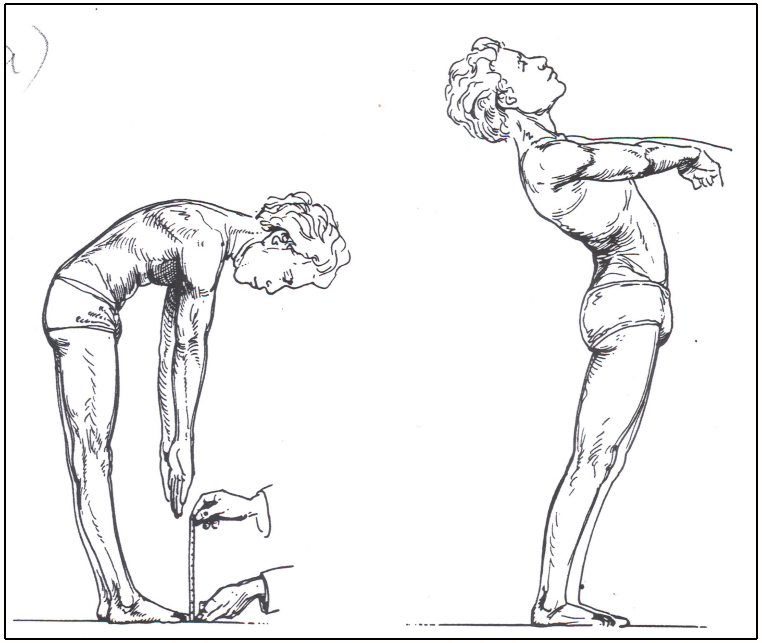
LBP diagnosis ?

clinical



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LBP diagnosis ?

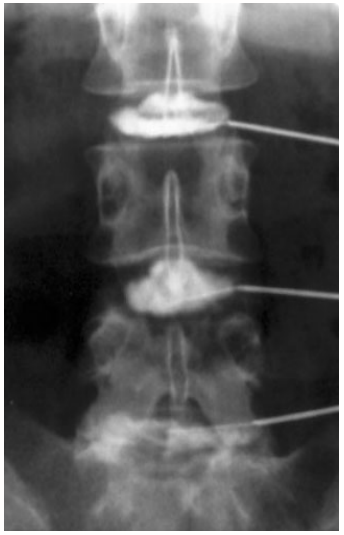
unproven efficacy of diagnostic tests for isolated back pain

Deyo, Weinsteinm, N Eng J Med 2001
Nachemson, Clin Orthop 1992

predictive power of injection studies to improve patient selection for surgery is poor

Leonardi, Boos, Clin Orthop 2006
Carragee, Spine 2009
Madan, J Spinal Dis 2002

<u>in our institution</u>: all patients preselected for surgery
third person evaluation
technique



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LBP: surgical management

segmental fusion: **ant vs post IB lumbar fusion for discogenic LBP**

no class I or II studies available

2 well directed class III studies

similar **rate of fusion**
pain improvement
functional improvement
clinical outcome
duration of hospital stay

higher complication rate with post surgery

Madan S, Boeree N
Comparison of instrumented anterior IB fusion with instrumented circunferencial lumbar fusion
J Spinal Dis Tech 2003

Scaduto A, Gamradt S, et al
Perioperative complications of treaded cylindrical lumbar IB fusion devices: Ant vs post approach
Eur Spine J 2003

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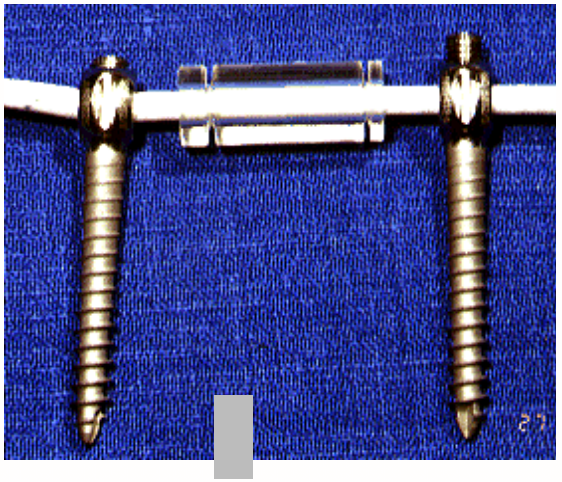
LBP: surgical management

motion preserving surgery

- Graf ligamentoplasty
- Dynesis system
- interspinous implants
  - Diam
  - X-Stop
  - Wallis
- Total Disc Arthroplasty



Gilles Dubois, 1994

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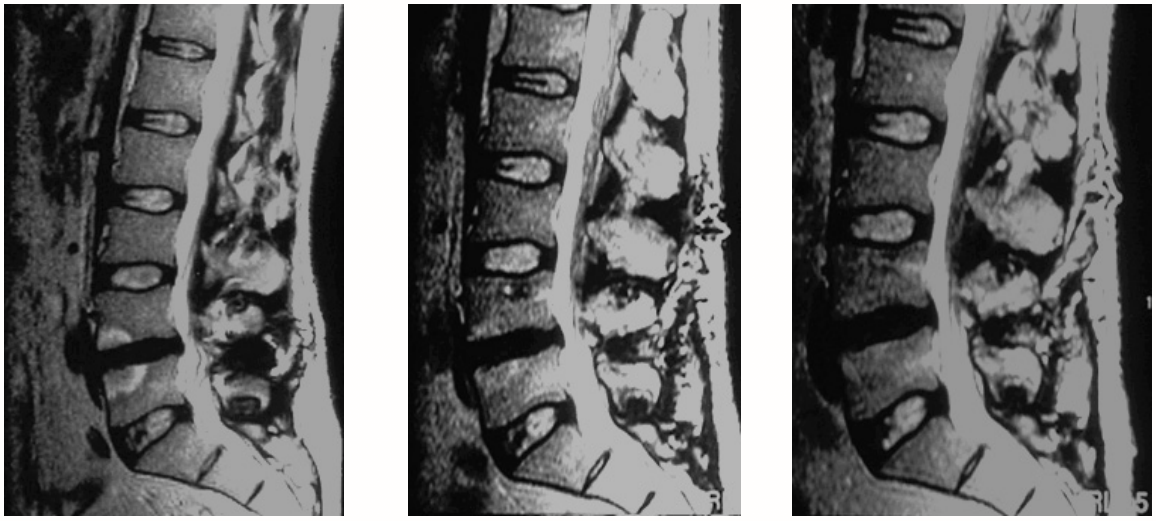
LBP: surgical management

motion preserving surgery: Dynesis



preop | 2 mo po | 6 mo po

reverse disc degeneration ?

N Specchia, 2005

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LBP: surgical management

motion preserving surgery: Dynesis

promizing clinical results in short-term NR studies

Schwarzenbach, Dubois, Orthop Clin North Am 2005
Stoll, Dubois, Eur Spine J 2002
Putzier, Spine 2005
Welch, Neurosurg Focus 2007

improved overall quality of life 50%
improved functional quality <50%

high reoperation rate

Grob et al, Spine 2005

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

LBP: surgical management

Total Disc Arthroplasty

contraindications:

- osteoporosis
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- spinal deformity or instability
- prior lumbar fusion
- obesity
- consuming illness (tumor, infection, inflammatory disorders)
- metabolic disorders
- known allergies

Ziegler et al, Spine 2004
Guyer, McAfee, Spine 2004

Prevalence in „low back pain patients“:

95% contra-indication for TDR in 100 consecutive patients.

Average number of contraindications was 2.48

Huang et al, Spine 2004

osteoporosis

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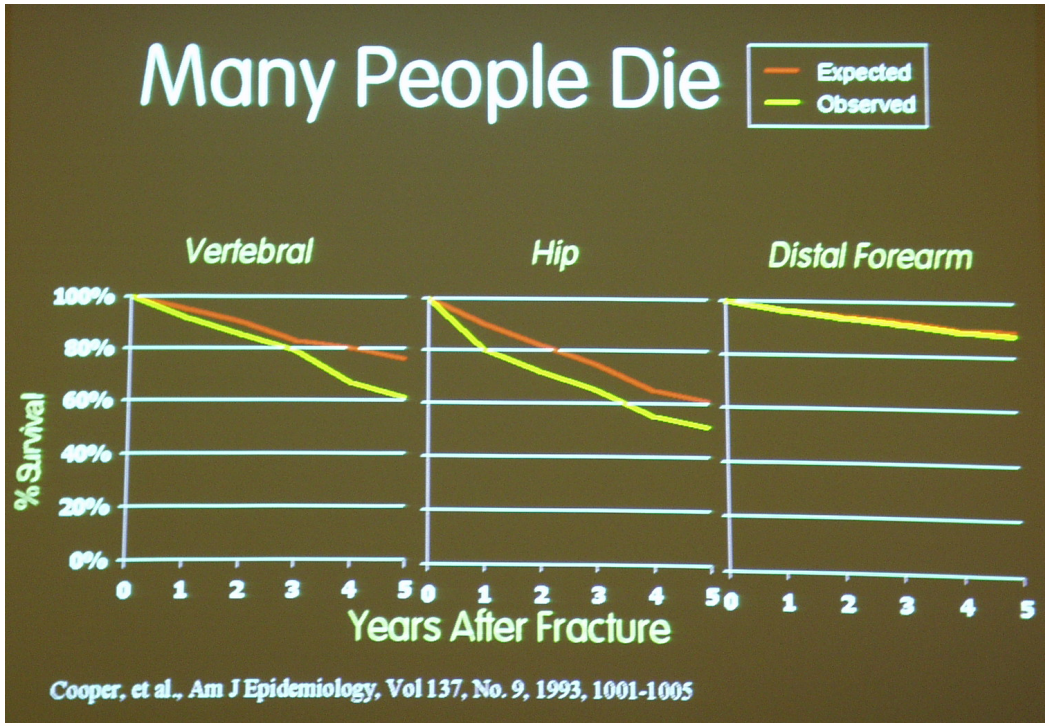
epidemiology



Discogenic LBP

MEDICOL CENTRE ORTHOPEDIQUE LAUSANNE

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