MANAGEMENT OF LUMBAR SPINE PATIENTS

I. FUNCTIONAL ANATOMY AND PATHOPHYSIOLOGY

A. FUNCTIONAL ANATOMY

- Spine: 7 Cervical + 12 Thoracic + 5 Lumbar Vertebral bodies + Sacro-iliac Joints + Sacrum
- Whole spine is one functional unit built of different units. 1 unit contains:
  1. 2 vertebral bodies
  2. 1 intervertebral disc
  3. Ligaments (Lig. Longitudinale anterior+posterior; Ligg. Flava)

- Mechanism of stabilization: active or passive stabilization
- Spine is dynamic system and needs therefore dynamic stability
- Very important: transversal stability (Joint-Play)
- Each unit has to be in an equilibrium (S-curve). If desequilibrium (ex. because of hyper-/hypokyphosis, hyper-/hypolordosis), sooner or later pathology such as Disc Protrusion/Discal hernia, Spondylarthrosis, Osteochondrosis.
- Other desequilibrium is stiffness or wrong position of bones, discs etc.: in this case a combination of mobilization/manipulation and stabilization is needed (Techniques of Manual Therapy). If the stiffness of an articulation is consolidated by a bridge (ex. Morbus Bechterev), then only very gentle mobilization but above all active muscular exercises.
- Why do we have so many problems with the disc in the lumbar spine?

Lumbar Spine not done for Rotation (worst is Flexion+Rotation+Lateralflexion combined). Centre of gravity in lumbar spine units is very posterior, so vector forces pull the disc backwards (posterior) to the centre of gravity. Flexion of the spine: disc is pulled backwards for 3 reasons: (1) centre of gravity; (2) divergency between the vertebral bodies; (3) Lig. Longitudinale posterior.

B. PATHOPHYSIOLOGY

- Reasons for Pain and Dysfunction:
  1. New Use
  2. Disuse
  3. Overuse

- If dysfunction, sooner or later different structures involved!
1. Protrusion/Discal hernia

- One of the most common reasons for low back pain and dysfunction.
- Cause: bad ergonomy for a long time (eg. bad way of lifting weights; bad way of washing, cleaning; too much sitting; bad sitting positions). A discal hernia is almost always the result of a long misbehaviour! Moreover, degeneration of the Anulus Fibrosus starts at the age of 25 years. Disc gets damaged little by little until the annulus fibrosus breaks and the nucleus pulposus compresses the lig. Longitudinale posterior, the nerve root(s) or the spinal cord. Compression may start long before rupture of the annulus fibrosus. Passage from Protrusion to Discal hernia is fluent.

Types: Discal hernia in lumbar spine: posterior or posterior-lateral; with or without sequester.

If prolaps touches Lig. Long. Post., the nerves within the ligament get under tension and cause low back pain. If compression of nerve root, then radicular referred pain.

A: Prolaps by parts of nucleus which puts Lig. Longitudinale Posterior under compression

B: Rupture of Lig. Longitudinale Posterior and Prolaps enters as sequester into spinal cord channel

C: Sequester which puts Lig. Longitudinale Posterior under compressio but without cutting it.

D: Caudal migration of the sequester

Symptoms:

- Pain: Lumbar (or lumbo-sacral) back pain with possible referred pain to the periphery passing by Gluteus region – Hip to lower limb. Referred pain follows dermatome ("pins and needles": P+N).
- Stiffness of lumbar spine (stiffness more in the morning when getting up)
- Possible muscle weakness: L3: Quadriceps; L4: Tibialis anterior; L5: Extensor hallucis longus; S1: Triceps surae; Peronaei.
- Sensibility: Possible Hyper-/Hyposensibility in Dermatom; P+N
- Muscle reflex: possibly weakened (L3/L4: Quadriceps; L5/S1: Achilles tendon)
Spinal Cord Symptoms (SCS): incontinency of urethra or colon; impotency: when these symptoms occur, it is an emergency and one should think about neuro-surgery since the loss of those functions might be irreversible! By the way, many discal hernia patients tell of an increased need to go to toilet. Other, more usual SCS: lumbar back pain while coughing (overpressure in the Spinal Cord Canal).

Muscle weakness means that the discal hernia is serious, the loss of innervation may be irreversible. Weakened muscle reflex shows even a further phase, it's the last thing the patient loses and the last thing to come back.

Assessment:
- C/o: questioning of patient very important; often a “starting event”
- P/e: Typically painful Flex and Ext of spine, LF (uni-/bilateral) as well. SLR (Lasègue) +; prone knee bend maybe +. Typically hypertonus of paravertebral spine muscles and of quadratus lumborum muscle.
- Treatment: conservative or surgery (start physical work 8-12 weeks after surgery)

2. Spondylolisthesis

Causes: Spondylolisis uni-/bilateral; degenerative intervertebral discs or intervertebral joints (Pseudospondylolisthesis)
Types: Retrolisthesis (when Flex); Anterolisthesis (when Ext)

Symptoms:
- Pain: lumbar (lumbo-sacral) back pain when monotonous static positions (eg. sitting or standing in same position) or when monotonous Flex/Hyperext.
- Instability: Transversal hypermobility (joint-play); Subjective feeling of instability
- All the symptoms of discal hernia are potentially possible if Spondylolisthesis strong enough to compress the nerve root or the spinal cord (in case of spinal cord compression, even paraplegia is possible). Also increased risk of discal protrusion/discal hernia since with the exception of the muscles and ligaments, lower intervertebral disc is only structure to stabilize upper vertebral body i.e. disc moves with vertebral body.

Assessment:
- C/o: questioning of patient very important (pain while monotonous positions). When dynamic movement or laying, patient typically feels better. No typical “starting event”
- P/e: Hyperflexion/-extension active or with overpressure; PAs; hypertonus of paravertebral spine muscles and of quadratus lumborum muscle possible (to compensate the instability); x-ray from posterior-lateral (“dog with necklace”) or in Flex/Ext (More than 5 mm of Listhesis is relevant).
- Rx: Conservative (stabilization through active muscle strengthening, good ergonomy and lumbar back support. Mobilization only softly to put back in place but not to mobilize!) or surgery (spondylodesis)

3. Lumbovertebralsyndrom (LVS)

Definition: stands for lumbar back pain of different origins, such as Spondylarthrosis, Osteochondrosis, muscular problems, blocked Intervertebral Joints, blocked Sacroiliacal Joints.
- Special case: Spinal Stenosis
Causes: depend on origin, but almost always linked to bad ergonomy.

Symptoms:
- Lumbar Back Pain with possible referred pain (joint referred pain pattern, Trigger Point referred pain pattern)
- Possible stiffness (blocked joints, contracted muscles)
- Often degenerative processes over years with a mixed picture of different structures involved, so symptoms differ greatly.

Assessment
- C/o: questioning of patient very important (sudden start: muscle contracture?; blocked joint?)
- P/e: To distinguish muscular pain from blocked joints/spinal stenosis:
  - Muscular pain: Flex, LF contralateral, Rot contralateral
  - Blocked Joints/spinal stenosis pain: Ext, LF ipsilateral, Rot ipsilateral; Irritation zones paravertebral
  - Palpation (hypertonus muscles; irritation zones paravertebral or on Sakrum as sign for blocked joints);
- Rx: conservative

4. Fractures

- Localisation: Thoracic part, thoraco-lumbar part, lumbar part
- Causes: Osteoporosis, accidents (eg. traffic), drops from several meters, sports such as horse riding

Types:
- Typ A: Compression fracture: compression most of the time ventral, leading to Hyperkyphosis
- Typ B: Distraction fracture: Ext and Flex forces at same time during trauma. Ligaments and/or vertebral arks are ruptured (HyperExt injury: ventral part of intervertebral disc is ruptured).
- Typ C: Rotation fracture: longitudinal ligaments ruptured; rotatory dislocation of spine with processus transversus or serious vertebral body fractures.

Symptoms: Back pain (especially doing spine movements or when coughing); Typ B + C often accompanied by neuro-injuries and vegetative symptoms.

Assessment
- C/o: Questionning of patient important (accident?)
- P/e: x-ray and gentle active movements of spine
- Rx:
  - If fracture stable: conservative therapy with focus on stabilization (first co-contraction and isometric exercises, later dynamic exercises; lumbar back support) and ergonomy. First 1-2 weeks in bed (flat! May be with pillow in lumbar spine for lordotic position) with focus on instruction of stable transfers.
  - If fracture unstable (Typ B + C): usually surgery with internal fixation. Treatment same as conservative therapy but sooner out of bed.
  - Pneumonia and thrombosis prophylaxe.
  - Fractures stable after 3-4 months

REMARK re. fractures caused by Osteoporosis: treatment has to include lots of active exercises with gravity (walking, biking, muscle strengthening)
5. Morbus Bechterev

- Spine becomes like a bamboo stick, stiff and rigid. Patient has intermediary pain.

**Assessment**
- C/o: listening to history of patient (starts in young years and gets worse)
- P/e: Active and passive movements: little range of motion, stiffness; Inspection (Hyperkyphosis); x-ray (Hyperkyphosis)
- Rx: Focus on active exercises and sports (Ext + Rot + LF) and treatment of the contractured muscles. Gentle passive mobilization (PAs) possible but very carefully, especially when stiffness is consolidated (bridges between the vertebral bones).

II. ERGONOMY AND ACTIVITIES OF DAILY LIVING (ADL)

Cf. Power Point Presentation:

- **Slide 1:** Disc Pressure in different positions:
  - Bending forward: 150%
  - Bending forward with 5 KG: 220%
  - Sitting: 140%
  - Sitting and bending forward: 185%
  - Sitting and bending forward with 5 KG: 275%

- **Slide 2:** Wrong lifting: Posterior divergence of vertebral bones and disc shifts to posterior
- **Slide 3:** Correct lifting with straight back: no divergence and no disc shift
- **Slide 4:** Lifting the object as near as possible to the body in order to avoid heavy load on lumbar spine. With extended arms, the weight held multiplies by factor 10 (eg. hold a 10 kg weigh with extended arms makes 100 kg on the lumbar spine). Don't lift up out of a rotation, object should be in front of the body.
- **Slide 5:** Carrying of weights whenever possible on the back or symmetrically divided on both hands (otherwise unilateral Lateralflexion). Pulling weights on wheels is other good solution.

**CORRECT LIFTING (pulling, pushing or any other heavy work):**

1. Straight back – use knees and hips
2. Lift up the weight as near as possible in front of the body (no rotation!)
3. Contract abdominal muscles
4. Expiration while lifting (as well when putting down or any other activity)
SITTING

- Avoid long sitting
- Sit in a good position and change position
- Extension exercises after long sitting (Mc Kennzie 1+2)
- Walking and lying is better than sitting and standing

LAYING

- Change position
- Prone position good because is lordotic position

III. ASSESSMENT OF THE LUMBAR SPINE

Objectives (what has to be clear after assessment):

1. Category of the patient: SIN (severity, irritability, nature), EOR (end of range), ROM (range of motion), MoP (momentary pain)? This is essential to know for treatment.
2. Reproduction of the symptom(s) by at least one provocation test
3. Have a precise idea about the problem (causes and origin; structure etc.) in order to design an efficient and adequate treatment plan.
4. Have at least 2 parameters for reassessment (1-2 subjective + 1-2 objective parameters). These have to be qualitative and quantitative indicators at the same time!!

- **ASSESSMENT HAS TO BE DONE BY WRITTEN ON FORM!!!**
- **3 PARTS: C/O; P/E; PLANNIFICATION OF RX**
- **YOU GUIDE !!!**

1) **C/o (Complains of):**

Objectives:

1. Have a first hypothesis about the problem (which structure makes the problem?) in order to do an efficient p/e.
2. Know if it is a S1N patient and if there are contraindications or tests we are not allowed to do.

1. **First question:** “What is presently your Main Problem?”

2. **Symptom(s) (sy):**
   - Where (localization)
   - Superficial/Profound
   - Duration: constant, variable, constant-variable
   - Quality of Symptom (eg. P+N, dump, “like a knife” etc.)
   - Intensity on Scale between 0-10
   - Referred pain (eg. P+N)
   - Spinal Cord sy: Pain while coughing or pressing; CEQ; neurovegetative sy (dizziness, sweat)

3. **History**
   - Present history (when and how did it start? One event or little by little?)
   - Former history (did the patient have this problem already earlier in his life?)

4. **24-hours behaviour of sy:**
   - morning (at the moment you get up), day, evening

5. **Increasing/decreasing factors:**
   - which activities, positions help or make it worse? ADL (housework; job, may be with much lifting or sitting; hobbies; TV; dressing socks and shoes etc.); Heat? Ice?
   - Previous treatment: was there any? What helped?

6. **Sensibility and power:**
   - Subjective feeling of hyper-/hyposensibility (if bilateral: think about spinal cord compression)?
   - Subjective feeling of loss of power, especially in lower limb (if yes: compression of nerve)?

7. **Special questions:**
   - General health status; other illnesses; surgeries; accidents; osteoporosis
   - Drugs: anticoagulative drugs; corticosteroids or NSAID
Lecturer: Björn Schranz, Rehabilitation Project Manager Handicap International

- Pictures: x-ray; MRI
- Family history
- Next control at the doctor's previewed? When?

➢ Planification of p/e has to be done during c/o!!!

2) P/E (PHYSICAL EXAMINATION)

➢ P/e through clothes is useless!

Standing position
1. Present Pain
2. Inspection:
   - Pa: Scoliosis (rips prominent), Shift, shoulder-/pelvis asymmetry in height; swellings; varus/valgus knees/feet (have a look at the shoes); colour of skin.
   - Lateral: hyper-/hypokyphosis Tx; hyper-/hypolordosis Lx; position head; adipositas
3. Palpation I: Temperature, sweat, tonus
4. Functional Demonstration:
   - Standing/walking on toes or talons, One leg stand, Walking, Bending forward and check SIJ at same time (if not SIN)
5. Active movements:
   - Lx: F, E, LF, Rot + o.p. (in repetition and/or combined, if necessary)
   - SIJ: One leg stand with contralateral hip flexion (Stork test)

Sitting:
Optional: F, E, LF, Rot active or active-assistive; Palpation Rips

Laying on back:
6. Sensibility + Muscle power + Accumulation Test (L3-S1) / Reflexes (PTR/ATR)
7. Hip Joint: F, F+Add, IR/AR; Length Piriformis muscle
8. Sacro-Iliiac Joint (SIJ): „4 sign”
9. Straight Leg Raise (SLR/Lasègue)/Neurotension Tests (NTT) including length Hamstrings/Triceps surae (indicate Degrees of Hip Flexion or Centimetres of distance Talon-Bed)
10. Palpation II: ventral + lateral (Iliacus; Gluteus medius + minimus)

Prone position:
11. Difference between length legs?
12. Springing test of spine / PAIVM’s (PAs) central/unilateral
13. “3-Phase-Test” (including length lliopsoas muscle / Hip Extension)
14. SIJ: Ventralisation/Nutation/Denutation
15. Length Quadriceps Muscle
16. Palpation II: dorsal +lateral (Tonus paravertebral muscles, Latissimus dorsi, iliocostalis lumborum, quadratus lumborum, gluteus maximus/medius/minimus, piriformis muscles ; Irritation zones paravertebral and on sacrum)

➢ PLANIFICATION OF RX TO BE DONE DURING ASSESSMENT!
IV. TREATMENT OF THE SPINE

Objectives:

1. Stabilization
2. Mobilization (Joint, Joint Capsule, Muscles, Connective tissues)
3. Analgesia

Always be sure about what is your objective!!! The objective(s) change according to the different phases of an illness.

General tools of physiotherapy

1. Active Exercises (auto-mobilization/stretching, stabilization, muscle strengthening)
2. Passive techniques: stretching techniques, manual therapy, Trigger Point therapy, deep frictions, other massage techniques (eg. for connective tissues)
3. Ergonomy/ADL: instruction (optionally: reminder tape)

Any ineffective therapeutic measure (exercises, techniques etc.) has to be eliminated. Reassessment shows if measure appropriate or not.

Advice: If not sure about problem and no reproduction of symptoms possible during treatment, do a TRIAL TREATMENT and see next time if you’re on the right way (in this case: don’t mix techniques).

1. ACTIVE EXERCISES

The top 5 exercises in case of protrusion/discal hernia

1) F/E Lx in different positions (supine, prone, lateral position; 4 paths; sitting+standing position)
2) LF Lx in different positions (supine+prone position; 4 paths)
3) Mc Kennzie 1-3 (Mc Kennzie 2: optionally out of LF position; Mc Kennzie 1: optionally combined movement with LF+Rot
4) Cat Extension Movement (in 4 paths position)
5) Neuromobilization: mobilization of Nervus Ischiadicus

Additionnally:
- Put ice, no heat
- Lumbar Back support
- Sitting is forbidden, but walk and lay (…and do the exercises!!!)
- Crutches (especially when shift and/or limping)

Other active exercises for automobilization: Rot Lx in lateral position; Klip Klap in supine position; “edge of the bed L4-S1 Autotraction”

2. Muscle Strengthening

- Belly Bridge: isometric (later: dynamic)
- Bridging: with 1 or 2 legs
Lateralflexion Bridge
- Abdominal muscles: pelvis elevator; oblique abdominals
- Isometric “Perception Exercises” (in different positions and combined with Expiration. Option: additional dynamic exercises with upper limb while stabilizing spine): principle: recruitment of transversal abdominis, profound spine muscles and pelvic floor muscles.
- Rotation with Thera Band etc.
- Eagle

3. Muscle Stretching Exercises
- Iliopsoas
- Rectus femoris
- Piriformis (sitting or supine position)
- Gluteus maximus
- Hamstrings (in the door frame; standing); option: Combined with mobilization of N. ischidadicus

4. Manual Therapy
- Segmental Traction
- Passive Assistive Intervertebral Movements (PAIVM’s or PAs): central or unilateral
- Passive Physiological Intervertebral Movements (PPIVM’s): lock from caudal and cranial
- Sacro-Iliac Joint (SIJ): mobilization in supine, prone and lateral position
- Trigger Point Therapy: quadratus lumborum, gluteus maximus/medius+minimus, piriformis, iliacus, iliocostalis lumborum, multifidii. Afterwards always ice/cold water!
- Massage: connective tissues, muscles. From cranial to caudal.

5. Analgesia
- Electrotherapy: TENS, Interferential with 4 electrodes (lumbar spine; lumbar spine – abdominal muscles 2-2; lumbar spine – gluteus maximus 2-2)
- Ultrasound: eg. for painful ligaments such as Lig. Iliolumbale which can be overstretched and thus irritated.
- Kryotherapy (for acute pain): 2-8 times a day for short time (2-10 minutes) with Cold Water, cold packs, ice massage with ice cubes. Especially after trigger point therapy, PAs, PPIVM’s, to finish the treatment.
- Heat therapy (for chronic pain): hot/steam packs, infrared lamps. Especially with psychosomatic patients, suffering war trauma etc.

V. NOTATION
- Use the form for EVERY assessment and EVERY treatment!
- Use the same form for assessment and treatment
- Write a minimum but have a maximum of visibility
- Qualify and quantify assessment and treatment
- Use signs and abbreviations
Lecturer: Björn Schranz, Rehabilitation Project Manager Handicap International

- Put stars (asterisks) in red colour in front of the most important statements, assessment parameters, so that you can orientate yourself very quickly at the next treatment.

A. Assessment

- Divide the symptoms in sy 1,2,3 etc. (max. 4 symptoms) and put them in the body chart.
- Describe EACH symptom and put it directly in the body chart: Quality of pain, superficial/profound, duration, intensity (eg. P+N, superficial, v, I:4)
- Put also referred pain, asymmetries (pelvis, shoulder), shifts, rotation of the pelvis etc. in the body chart.
- Divide assessment in c/o and p/e and put those titles into the form
- Outline remaining questions you want to ask the doctor, the patient or his family

B. Treatment

- Put the date of each treatment (and the number of the session behind into brackets)
- Write what you did during the treatment and if the technique was efficient (eg. 1 serie of 40 PAs with degree IV, reassessment: Symptome 1: pain intensity 4 when Left Lateral Flexion (before technique: pain intensity 6). Be very precise with these indications since they guide your treatment.
- Write what you want to do the next time, or ideas/techniques you want to try later.