MANAGEMENT OF KNEE PATIENTS

I. FUNCTIONAL ANATOMY AND PATHOPHYSIOLOGY

A. FUNCTIONAL ANATOMY

- Knee needs a highly complex combination between mobility and stability
- Mechanism of stabilization: active stabilization (through muscles) or passive stabilization (through shape of bones and ligaments)
- Schematic and simplified construction of the knee:
  1. 4 Bones
  2. 4 Ligaments + 2 Retinacula
  3. 2 Menisci
  4. 5 Groups of Muscles (3 coming from cranial, 2 coming from caudal) and Iliotibialis Tract
  5. Veins + Arteria + Nerves
  6. 3 Joints
- Knee Joints have to be in equilibrium i.e. the axes have to be adjusted. If desequilibrium (ex. Genu varus, genu valgus), sooner or later pathology such as arthrosis, meniscus degeneration.
- Importance of foot for knee joint (axes!).
- Importance of Vastus Medialis (Obliquus) Muscle for medial stabilization of knee joint.
- Stretch of Ligaments in F (Ligg. Collaterale) or E (Cruciate Ligg.)

B. PATHOPHYSIOLOGY

- Reasons for Pain and Dysfunction: “NDO”
  1. New Use
  2. Disuse
  3. Overuse
- If dysfunction, sooner or later different structures and regions involved!

1. Knee Arthrosis

- One of the most common reasons for knee pain of old people.
- Cause: **“wrong” knee axis and Disuse/Overuse for a long time** (eg. genu valgus, genu varus): the knee has to bear more weight than its capacity to bear, either because the charge is too heavy or because the muscles are too weak to protect the joint. A knee arthrosis is almost always the result of a long degenerative process of many years. **Young people with arthrosis are rare!** Exceptions: (1) accident with cartilage injury leading to knee arthrosis (possible at any time); (2) knee arthritis with frequent joint inflammations of the joint leading to degeneration of the cartilage; (3) high performance sports.

a) Femoro-Tibial Arthrosis

- Often linked with genu varum (arthrosis medial + irritated Lig. Collaterale laterale/Retinaculum laterale) or genu valgum (arthrosis lateral + irritated Lig. Collaterale mediale/Retinaculum mediale)
Symptoms:
- Pain (medial, lateral or “whole” knee)
- ROM decreased (F and/or E)
- Stiffness of knee (problems with first minutes of walking in the morning or after rest, then getting better)
- Cracking noises (crepitation) medial or lateral when moving the knee (F/E)

Assessment
- C/O (problems with first minutes of walking in the morning or after rest, then getting better)
- Inspection: Muscle atrophy (especially Vastus Medialis muscle)
- Examine ROM, stiffness, cracking, muscle atrophy
- Imaging: x-ray!

b.) Femoro-patellar Arthrosis
- Often linked with high performance sports, fall on the patella (accident) or with ongoing age.

Symptoms:
- Pain (“behind” Patella)
- Feeling of overpressure behind Patella with need to extend the knee while sitting (“economy class syndrome”). E after F accompanied by cracking and patient feels better.
- Cracking noises (crepitation) when moving the knee (F/E)
- Often linked with high performance sports, fall on the patella (accident) or with ongoing age.

Assessment
- C/O (pain behind patella after rest; pain behind patella/problems when walking downstairs or down a slope; problems to come up from Squad position)
- Inspection: Atrophy Quadriceps Muscle (especially Vastus medialis muscle)
- Cracking (crepitation) when passive movement of patella
- Strong sharp pain and crepitation when Patella Push with Compression
- Often Quadriceps Muscle shortened

2. Meniscus Injury
- Causes: Trauma or degeneration
- Localisation: Medial or lateral meniscus; anterior or posterior horn

Symptoms:
- Blockage F/E; ROM can be decreased, especially when putting weight on leg (Squad position)
- Giving way
- Pain: pain lateral when lateral meniscus affected, medial when medial meniscus affected; pain when coming up from Squad position; pain when doing Knee E; pain when first steps
- Sometimes cracking (crepitation) and moving pain during F/E
- Swellings (especially in acute phase)
Assessment:
- C/o: Blockages; Giving way; pain lateral or medial, depending on localisation of injury
- Inspection: often atrophy Quadriceps Muscle (especially Vastus medialis), when End E painfully limited.
- P/E: Special Tests to provoke pain (will be done in chapter Assessment)

3. Ligament Injury

- Definition: partial or total rupture of a ligament
- Localisation: Lig. Collaterale laterale/mediale; Anterior/Posterior Cruciate Lig.;
- Causes: Trauma (Valgustrauma: Injury Lig. Collaterale mediale and/or Anterior Cruciate Lig.; Varustrauma: Injury Lig. Collaterale laterale)

Symptoms:
- Pain: medial; lateral or “whole knee"
- Subjective feeling of instability
- Possible stiffness or decreased ROM because of swelling and pain (especially in acute phase)
- Swelling (especially in acute phase)

Assessment
- C/o: Trauma (may be accompanied with cracking noise) with sudden strong pain?!
- Inspection: swelling in case of fresh and strong trauma
- P/E: Palpation: Pain and “hole”; Special Tests (will be done in chapter Assessment) to assess pain and instability

4. Fractures

- Cause: trauma

Types:
- Tibia fracture (head of tibia; collum tibiae; tibia plateau)
- Fibula fracture
- Patella fracture

Symptoms:
- Intense pain directly following the trauma
- Problems to put the weight on the leg or to even move the leg

Assessment
- C/o: Trauma with immediate intense pain and extreme difficulty to walk?
- Inspection: Deformation of the leg possible (collum tibiae fracture)
- P/E: x-ray

5. Muscle Injuries

- Types: partial or total rupture of a muscle; contractures, Trigger Points
- Causes: trauma, NDO, lack of stretching, bad alimentation (lack of calcium/magnesium)
Symptoms:
- Pain: sudden intense pain in case of trauma with partial or total rupture; dump pain in case of contractures and Trigger Points (Trigger Points may be with referred pain)
- Muscle weakness
- ROM might be decreased

Assessment
- C/o: in case of rupture, patient often thinks that someone shot into his leg. Rupture accompanied by noise like a shot; in case of contracture or Trigger Point no trauma, but often following a NDO-activity.
- Inspection: in case of old Musculus Gastrocnemius rupture, this muscle is retired to caudal and becomes like a ball instead of being a long muscle bow.
- P/E: muscle power tests; length testing (stretching)

Other pathologies which will not be treated in this course:
- Bursitis: prae-/supra-/infrapatellar Bursitis (often linked with other dysfunction or with acute trauma)
- Morbus Schlatter: often during childhood

II. ASSESSMENT OF THE KNEE

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 SIN 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):** Basically 3 possibilities: pain / mobility (stiffness) / weakness (lack of stabilization, lack of power)
   - Where (localization)
   - Superficial/Profound
   - Duration: constant, variable, constant-variable
   - Quality of Symptom (eg. P+N, dump, “like a knife”, burning, stiffness, weakness etc.)
   - Intensity on Scale between 0-10

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?)
   - Any problem with the spine (pain, referred pain, stiffness etc.)
   - Any problem with hip or feet?

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

5. **Increasing/decreasing factors:**
   - which activities, positions help or make it worse? ADL to find out NOD (new use, over use, disuse): housework: eg. female patients might work a lot in squat position or on their knees; job/hobbies/sport: much sitting/walking/weight lifting?; which are the preferred sitting positions?; more difficulties to walk downstairs/down a slope than upstairs?; economy class syndrome?
   - Heat? Ice?
   - Previous treatment: was there any? What helped?

6. **Sensibility and power:**
   - Subjective feeling of hyper-/hyposensibility (could be referred pain from L3/4/5)?
   - Subjective feeling of loss of power or instability?

7. **Special questions:**
   - General health status; other illnesses; surgeries; accidents; osteoporosis
   - Drugs: anticoagulative drugs; corticosteroids or NSAID
   - Pictures: x-ray ; MRI
   - 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: varus/valgus knees or feet (have a look at the shoes) = axes; Leg in internal or external rotation; atrophy; swellings; difference in length of legs; colour of skin.
   - Lateral: genu recurvatum; F-position (=E deficit)
3. Palpation I: Temperature, sweat, tonus
4. Functional Demonstration:
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- Walking (as well upstairs, downstairs), One leg stand, squads (on 1 or 2 legs), jumping

**Supine position:**
5. Knee F/E (+ o.p.); HyperE: anterior horn menisci; HyperF: posterior horn menisci
6. Mobility Patella
7. Dancing patella
8. Patella Push with compression (Femoro-patellar arthrosis test)
9. Proximal Tibio-fibular joint: gliding
10. Hip joint: F, F+Add, IR
12. Palpation II: Lig. Patellae, Femoro-tibial joint with collateral ligg., caput fibulae (M. Biceps femoris), Tuberculum adductorium, Tuberculum Guérdi (Tractus iliotibialis), Trigger Points (M. Vastus lateralis and medialis, M. Rectus femoris, M. Tensor Fasciae Latae, M. Tibialis anterior, M. Gluteus medius)

13. Special Tests:
   - Böhler Test: Add / Abd stress in KneeE leads to compression of medial/lateral Meniscus and to distraction Lig. Collaterale laterale/mediale (on opposite side of stressed meniscus)
   - McMurray I: From 90°F+IR to E (lateral Meniscus)
   - McMurray II: From 90°F+ER to E (medial Meniscus)
   - Anterior + posterior Drawer: for Anterior + Posterior Cruciate Ligg.

**Supine at bed-end:**

**Prone position:**
15. Difference between length legs?
16. Muscle Lengths: Quadriceps
17. Isometric Test: F/E

19. Special Tests:
   - Appley: In 90° KneeF:
     (1) Traction+IR: Cruciate anterior lig.
     (2) Traction+ER: Ligg. Collaterale mediale+laterale
     (3) Compression+Rot: Menisci (IR: lateral Meniscus; ER: medial Meniscus)

**Sitting (optional):**
20. Internal + external Rotation Knee, active (+o.p.)

**Standing (optional):**
22. Muscle Power: Quadriceps (3x12 squads); Hamstrings (3x12 Bridging); Triceps surae

➢ PLANIFICATION OF RX TO BE DONE DURING ASSESSMENT!
III. TREATMENT OF THE KNEE (Rx)

Objectives:

1. Stabilization (Strengthening)
2. Mobilization (Joint, Joint Capsule, Muscles, Connective tissues) including Traction
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. Ergonomics/ADL: instruction

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. Automobilization
   - E: Prone hangs; supine with towel under talon
   - F: Sitting: pushing from proximal; kneeing position and trying to sit on talon (first with thick pillow in between, then with thinner pillow)
   - Patella mobilization

2. Muscle Strengthening
   - M. Quadriceps, especially M. Vastus medialis (obliquus):
     (1) sitting: E in neutral position; End E in ER
     (2) sitting with legs on bed: (a) Isometric Quadriceps contraction; (b) Patella Push
     (3) side lying: Adduction lower leg
     (4) prone position: Knee E
     (5) Squads: with 1 or 2 legs
     (6) “Cleaning the floor”: (a) lateral cleaning; (b) posterior cleaning
     (7) “Walking down the step”: increasing the height of step
   - Hamstrings muscles:
     (1) Bridging: with 1 or 2 legs
     (2) Belly Bridge
     (3) F/E Knee in Prone position (optional: against resistance Thera Band)
     (4) Knee F in Supine position with leg on Ball against resistance Thera Band
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- **Gluteus maximus:**
  1. Kneeing on “4 legs”
  2. Hip E in Supine position with Leg at side of bed on ball: compressing the ball

- **Triceps Surae Muscles:** in standing position on step: pushing upwards

- **Global Exercises:**
  1. Mexican Hut (optional: with closed eyes)
  2. PNF Patterns

3. **Muscle Stretching Exercises**

- M. Iliopsoas
- M. Quadriceps
- Hamstrings muscles (in the door frame; standing); option: Combined with mobilization of N. ischidadicus
- M. Gastrocnemius
- M. Soleus
- Adductor Muscles

4. **Manual Therapy**

- Patella Mobilization
- Cartilage massage, followed by ice application
- Traction Art. Femorotibiale (sitting on bed or prone position) + may be IR
- Angular Mobilization in F (in Prone position), in E (in Supine position)
- Gliding Mobilization Art. Femorotibiale (E: ventral gliding; F: dorsal gliding) and Art. tibiofibulare
- Trigger Point Therapy: M. Rectus femoris, M. Vastus lateralis, M. Tensor Fasciae Latae, M. Popliteus, M. Gastrocnemius. Afterwards always ice/cold water!
- Massage: connective tissues, muscles (“inside up, outside down”, especially when swellings)
- Deep Frictions (Lig. Patella, Ligg. Collaterale)

5. **Analgesia**

- Autotraction: sitting, put weight around tibia and let leg hanging (especially when arthrosis)
- High positionning of knee
- Electrotherapy: TENS, Interferential (stimulation Vastus medialis, especially when swellings)
- Ultrasound: eg. for painful ligaments such as Ligg. Collaterale laterale.
- 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 and aggressive mobilizations.
- Heat therapy (for chronic pain): hot/steam packs, infrared lamps.

6. **ADL/Ergonomics**

- Avoid Valgus position (in sitting, standing, walking)
- Crutches and assisstic devices for position of foot (special shoes)
- Knee bandage or Knee Tape for stabilization
- Chair for toilet
- Brushes with long grip
- Instruction of how to walk up/down the stairs