

Role of physical medicine and rehabilitation in diseases of the musculoskeletal system

PhD, Jure Aljinović, assistant professor

Department of physical medicine and rehabilitation Clinical Hospital Center Split

April, 2016

Definition of PM&R

Physical medicine and rehabilitation (PM&R), also referred to as physiatry, is a medical specialty concerned with diagnosis, evaluation, and management of persons of all ages with physical and/or cognitive impairment and disability.

a medical specialty concerned with treating disabling disorders and injuries by physical means (as by the use of electrotherapy, therapeutic exercise, or pharmaceutical pain control) —called also physiatry, physical medicinefrom Merriam Webster dictionary

The physiatric evaluation

- Goal of PMR is identifying and treating the primary impairment to maximize performance
- It is done through physiatric history taking and examination
- The patient is asked for the chief complaint that caused him/her to seek for medical treatment
- After that family history is asked followed by past medical and surgical history (rheumatologic, MSD, neurologic, cardiopulmonal, medications)

Table 1-1 World Health Organization definitions			
Term	Definition		
1980 Impairment	Any loss or abnormality of psychologic, physiologic, or anatomic structure or function		
Disability	Any restriction or lack resulting from an impairment of the ability to perform an activity in the manner or within the range considered normal for a human being		
Handicap	A disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfillment of a role that is normal for that individual		
1997 Impairment	Any loss or abnormality of body structure or of a physiologic or psychologic function (essentially unchanged from the 1980 definition)		
Activity	The nature and extent of functioning at the level of the person		
Participation	The nature and extent of a person's involvement in life situations in relationship to impairments, activities, health conditions, and contextual factors		

The physiatric history taking

History of the present illness (pain)

- Exploring: location
- Time of onset
- Quality
- Context
- Severity
- Duration
- Modifying factors
- Associated signs and symptoms

Functional history

- Gathering information about current and prior functional status
- Mobility: bed mobility, transfers, wheelchair, ambulation, driving, and required devices
- ADL: bathing, toileting, dressing, eating, hygiene and grooming..
- Instrumental ADL: meal preparation, laundry, telephone use, home maintainance, pet care...
- Cognition
- Communication

The physiatric evaluation

Table 1-3 Levels of function on the functional independence measure			
Level of function	Score	Definition	
Independent	7 6	 Another person is not required for the activity (<i>no helper</i>) Complete independence: all the tasks described as making up the activity are performed safely; without modification, assistive devices, or aids; and within a reasonable amount of time Modified independence: one or more of the following can be true. The activity requires an assistive device The activity takes more than a reasonable time There are safety considerations 	
Dependent	5 4 3 2 1	 The patient requires another person for either supervision or physical assistance for the activity to be performed (<i>requires helper</i>) Supervision or set-up: the patient requires no more help than stand-up or cueing without physical contact, or the helper sets up needed items Minimal contact assistance: the patient requires no more help than touching and expends 75% or more of the effort Moderate assistance: the patient requires more help than touching and expends 50–75% of the effort Maximal assistance: the patient expends 25–50% of the effort Total assistance: the patient expends less than 25% of the effort 	

 Most commonly used index for functional measurement is FIM - Functional Independence Measure (1-7 score in 18 activities)

The physiatric examination

- More patients with complex comorbidity are admitted for inpatient rehabilitation
- General examination is needed to determine the level of mobilization and physical management
- Neurological examination- for stroke, multiple sclerosis, peripheral neuropathy, spinal cord injury, brain injury patients

	General medical physical examination	Cardiac Pulmonary Abdominal Other
d	Neurologic physical examination	Level of consciousness Attention Orientation Memory General fund of knowledge Abstract thinking Insight and judgment
	Communication Cranial nerve examination Sensation	MOOD and anect
	Motor control	Strength Coordination Apraxia Involuntary movements Tone
	Reflexes	Superficial Deep Primitive

Musculoskeletal examination

- Inspection, palpation, active and passive range of motion, assessment of joint stability, manual muscle testing and joint provocative manoeuvres
- Functional unit of MSK system is joint
- Inspection is the first part of the exam: spine- scoliosis, kyphosis, lordosis, limbs- symmetry, length, circumference, contour, joint- position, swelling, redness
- In persons with amputation the level, length and the shape of the residual limb should be noted, also the gait in all patients should be analyzed

- Palpation is used to confirm initial findings from inspection, helping to determine structural origins of soft tissue or bony pain, localizing trigger points, muscle guarding, spasms and referred pain
- Joint and muscles palpated for swelling, warmth, masses, tight muscle bands and crepitus
- While assessing the ROM the tone of the muscles can be analyzed
- Joint stability depends on bony congruity, capsular and cartilaginous integrity, strength of ligaments and muscles



Shoulder







Example: Normal abduction 0°/180° Contracture 0°/90° or 10 ° /110 °











Hip







Hip



Knee



Ankle



Assessment of muscle strenght

- MMT measures the ability to voluntary contract the muscle group at one joint
- Grade less then 3, the limb will require external support and is prone to contracture
- Muscle grade of 3 is important because it has antigravity strength and can be used for activity
- Other test include dynamometric measurement

Table 1-10 Manual muscle testing			
Grade	Term	Description	
5	Normal	Full available range of motion (ROM) is achieved against gravity and is able to demonstrate maximal resistance	
4	Good	Full available ROM is achieved against gravity and is able to demonstrate moderate resistance	
3	Fair	Full available ROM is achieved against gravity but is not able to demonstrate resistance	
2	Poor	Full available ROM is achieved only with gravity eliminated	
1	Trace	A visible or palpable contraction is noted, with no joint movement	
0	Zero	No contraction is identified	

Assessment of limb lenght

- Arm length; from acromion until the tip of the middle finger
- Leg length: anatomical- great trochanter- lateral malleolus functional- Spina iliaca anterior superior- medial malleolus





Other measurements

- Joint diameter: the widest part of the joint
 Upper arm: 10 cm above olecranon
- Forearm : 10 cm below olecranon
- Hand: 2-5 head of metacarpal bones
- Upper leg: 10 cm above patela
- Lower leg: the widest part



Diseases of musculoskeletal system

- are injuries or pain in the body's joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back.
- MSDs are the leading cause of disability in working population and they result in significant loss of productivity
- They make 10% of all diagnoses in general practice
- They can be acute, subacute or chronic
- Constant increase in incidence of MSC diseases: older population, sedentary life, bad posture at work- more computers, repetitive movement (mechanization of working process), alcohol and tobacco consumption

Etiology of musculoskeletal diseases

CongenitalAcquired

Rheumatologic Metabolic Degenerative Mechanical Posttraumatic Infective Tumours

Epidemiology of MSD

- 17 % of population in Croatia has some type of joint arthritis
- 3 % of people older of 55 yrs has problems with hip/s
- 16 % of women that are working and 20 % of men have spondylosis

- MSD are 9th reason for hospitalization in Clinical Hospitals
- 93% of hospitalized people are younger then 64 yrs
- Leading cause of long term absence from work (30%)
- In the second place for short absence from workrespiratory diseases 1st

Spine- back pain

- From functionality point of view the organizing segment of the spine is vertebral dynamical segment
- There are 24 of VDS, but 33 or 34 vertebrae
- The most mobile parts of spine are cervical and lumbar part and are usually affected by degeneration and injury
- Two lordosis, two kyphosis
- A lifetime prevalence of back pain is 84%
- Vertebrae are made of: body, neural arch and posterior elements, intervertebral disks are connecting the vertebral bodies



Cervical spine- examination

- 7 cervical vertebrae including atlas and axis
- Inspection: lordosis, scoliosis, paravertebral muscles followed by palpation and range of motion
- Distance from protuberantia occipitalis ext. to proc.spinosus C7 from neutral position to max anteflexion – more then 6 cm
- Retroflexion 4 cm
- Index of sagittal movement= 10 (6+4)
- Rotation chin to acromion
- Lateroflexion acromion processus mastoideus
- MMT, neurologic exam





Radiological signs

- Uncarthrosis
- Intervertebral disk narrowing
- Dorsal osteophytes
- Cervical lordosis straightening



Early degenerative process can cause uncovertebral, zygapophyseal or intervertebral arthritis- spondylosis- syndroma cervicale. If neural structures are affected clinical syndroms like radiculopathy and myelopathy can appear



Compressive diseases

- Bulging
- Protrusion
- Extrusion
- Relative and absolute stenosis

Radiculopathy- Syndroma cervicobrachiale: Tests: axial depression of the head, distraction test, Spurling's test

Root	Pain Location	Sensory Disturbance	Weakness	Reflex Change
C3-4	Paraspinal muscles, superior shoulder	Neck	Diaphragm, nuchal muscles, strap muscles	None
C5	Neck, shoulder, anterior arm	Shoulder	Deltoid, supraspinatus, infraspinatus, rhomboids, biceps, brachioradialis	Biceps, brachioradialis
C6	Neck, shoulder, anterior upper arm extending to antecubital fossa	Thumb, index finger, radial forearm	Deltoid, supraspinatus, infraspinatus, rhomboids, biceps, brachioradialis, pronator teres, flexor carpi radialis, extensor carpi radialis	Biceps, brachioradialis
C7	Neck, shoulder, dorsum of forearm	Middle finger	Triceps, latissimus dorsi, pronator teres, flexor carpi radialis, extensor carpi radialis	Triceps
C8	Neck, shoulder, ulnar forearm	Ring, little fingers, hypothenar eminence	Intrinsic hand muscles, finger extensors, finger flexors	None
T1	Neck, shoulder, ulnar arm	Ulnar forearm	Intrinsic hand muscles (Horner's syndrome)	None

Adapted from Geckle, D.S., Hlavin, M.L., 1995. Spondylosis and disc disease. In: Samuels, M.A., Feske, S. (Eds.), Office practice of neurology. Churchill Livingstone, New York, NY.

Clinical picture:

Pain radiating to upper arm, hand. Neurological deficits: motor- weakness, reflex- diminished, and sensory-loss of feeling of touch. Paraspinal muscle tenderness, scoliosis due to pain, loss of cervical lordosis, paresthesias

Cervical spine therapy

Medical exercise therapy, electrotherapy (TENS), termotherapy, traction, mobilization, manipulation, acupuncture,

Thoracic spine- examination

12 vertebrae

- Women- osteoporotic fractures, men spondyloarthritis
- Medical history taking important: rheumatological inflammatory pain: younger people 20-40 yrs, pain in the second part of the night, good responce to exercise and NSAR. Pain from osteoporosis: loss of height, older people, corticosteroid therapy, early menopause.
- Examination of ROM: sagittal movement: 3,5 cm anteflexion, 2 retroflexion = 5,5 cm- measured from Th1-30 cm below
- Respiratory index: intermammilary line 6-10 cm younger, 5-6 older ppl

Thoracic spine pathology

- ←Ankylosing spondylitis
- Osteoporosis \rightarrow

- \leftarrow TBC
- Neoplasm \rightarrow

Osteoporosis

Compressive fracture, advance in kyphosis, decrease in height, pain at percussion

Osteoporosis

Injuries to thoracic spine

Therapy of thoracic spine pain

Medical exercise therapy electrotherapy (TENS), termotherapy, traction, mobilization, manipulation, acupuncture, orthoses

Lumbar spine- anatomy

- 5 vertebrae, lordosis
- Conus medullaris ends at the bony level of L2 and below is cauda equina
- Lumbar spine: strength coupled with mobility
- Three joint complex interverebral disk with vertebral end plates and two zygapophyseal joints
- Lumbalization or sacralization of vertebrae

Lumbar spine- anatomy

- Zygapophyseal joints allow flexion and extension and some lateroflexion but no rotation, synovial joint
- Ligaments: anterior, posterior longitudinal, ligg flava, lig interspinale, intertransversale, lig supraspinale

Lumbar spine- history taking

85% no specific cause for back pain

- Pain history examination: location, character, severity, timing, duration, frequency, alleviating and aggravating factors
- Searching for red flagssymptoms that can direct us to the diagnosis of metastatic cancer, infection, injury, rheumatologic disease, cauda equina

Figure 4. Red Flag Symptoms

Red flags for the cauda equina syndrome include:

- · Saddle anaesthesia.
- · Recent onset of bladder dysfunction or faecal incontinence.
- Major motor weakness.

Red flags that suggest spinal fracture include:

- Sudden onset of severe central pain in the spine which is relieved by lying down.
- Major trauma such as a road accident or fall from a height.
- Minor trauma, or even just strenuous lifting, in people with osteoporosis.
- Structural deformity of the spine.

Red flags that suggest cancer or infection include:

- · Onset in a person over 50 years, or under 20 years, of age.
- History of cancer.
- Constitutional symptoms, such as fever, chills, or unexplained weight loss.
- · Intravenous drug abuse.
- Immune suppression.
- Pain that remains when supine; aching night-time pain disturbing sleep; and thoracic pain (which also suggests aortic aneurysm).

The basis for these red flag recommendations is from the synthesis of national and international guidelines which are largely based on expert opinion. Reproduced from Back pain (low) and sciatica.¹⁰

Lumbar spine- history taking

Yellow flags are psychosocial factors that can predict chronic back pain development: poor job satisfaction, catastrophic thinking pattern about pain, the presence of depression, excessive rest.

Figure 5. Yellow Flags

Risk factors for developing or persisting chronic pain and long-term disability are called 'yellow flags'. Yellow flags are psychosocial barriers to recovery. They include:

- The belief that pain and activity are harmful.
- Sickness behaviours, such as extended rest.
- Social withdrawal, lack of support.
- Emotional problems such as low or negative mood, depression, anxiety, or feeling under stress.
- Problems or dissatisfaction at work.
- · Problems with claims for compensation or applications for social benefits.
- Prolonged time off work (e.g. more than 6 weeks). Length of time off work prognostic factor 4wks 10-20% chance will not return within yr. 3 months only small chance return to work ever.⁷
- Overprotective family.
- Inappropriate expectations of treatment, such as low expectations of active participation in treatment.

Reproduced from Back pain (low) and sciatica.10

Lumbar spine- examination

- 1. Observation: posture, skin, muscle mass, bony structures, gait
- 2. Palpation fully relaxed, lying prone, pillow under the abdomen
- **3**. Range of motion
- 4. Neurologic examinationmotor strenght- foot; sensory exam, motor reflexes, sfincters
- 5. Ortopedic special tests

Lumbar spine- mobility

- Inclination-anteflexion The Schober test – from L5 processus spinosus till 10 cm above – normal 4 – 6 cm
- **Reclination** 1,5 cm
- Index of sagittal mobility = 5,5- 7,5 cm
- Lateroflexion tip of the middle finger floor, or draw two marks on lateral leg
- Vertebral dynamical segment-90% motion in L4/L5/S1 segment

Lumbar spine- examination

- Straight leg raise testpositive for lumboishialgia 30-70°, 0-30° syndrom m piriformis, from 70-90° can be false positive due to hamstring shortening and pain
- Streching nervus femoralis lying prone, knee flexion- pain in the quadriceps femoris
- Passive intervertebral mobility testing, prone instability test
- Examining the joint above and below

Lumbar spine- osteoarthritis

Injury to muscle and ligaments: strain, sprain and contusion

Degenerative: disk flattening, bone spurs, disk degeneration, zygapophyeal OA: facet hypertrophy, osteophytes

Lumbar spine- i.v.disk pathology

Initial changes

Radial lesions

Protrusion of nucleus pulposus

Mechanism of radiculopathy

Clinical picture:

Pain radiating to thigh, leg, foot. Neurological deficits: motorweakness, reflex- diminished, and sensory-loss of feeling of touch. Paraspinal muscle tenderness, scoliosis due to pain, loss of lumbar lordosis

Lumbar spine radiculopathy

Root	Pain Location	Sensory Disturbance	Weakness	Reflex Change
L3	Anterior thigh, groin	Anterior thigh	lliopsoas, adductors, quadriceps	(Knee)
L4	Anterior thigh	Medial calf, medial foot	Quadriceps, adductors, (iliopsoas)	Knee
L5	Posterolateral thigh and calf, extending into great toe and dorsum of foot	Dorsum of foot, great toe, lateral calf	Tibialis anterior, tibialis posterior, extensor hallucis longus, peronei, gluteus medius, tensor fascia latae	None
S 1	Posterolateral thigh and calf, extending into lateral toes and heel	Lateral foot, posterior calf, sole of foot	Gastroc-soleus, hamstrings, gluteus maximus	Ankle

Adapted from Geckle, D.S., Hlavin, M.L., 1995. Spondylosis and disc disease. In: Samuels, M.A., Feske, S., (Eds.), Office practice of neurology. Churchill Livingstone, New York, NY.

DERMATOMES OF THE LEG

Cauda equina syndrome

Etiology:

Compressive cause: Herniated lumbosacral disk, spinal stenosis, spinal neoplasm, fracture of vertebrae, and non –compressive cause like infection, inflammation and ischemia

Saddle Anaesthesia

Loss of feelings around the buttocks, anus and genitals?

Severe nerve pain in back and/or down one or both legs?

Incontinence

Bladder incontinence or inability/ difficulty urinating and/or bowel incontinence/constipation

Numbness

Lack of sensation and/or weakness in the legs

Emergency

Any of the above symptom could be a sign of Cauda Equina Syndrome – please contact your GP or A & E department immediately – without urgent treatment the damage can become permanent.

Spinal stenosis

©MMG 2002

Etiology:

Central or lateral, absolute or relative

Long history of backache, bilateral diffuse radicular pain, neurogenic claudications, stooped walking, progressive in nature

Spondylolisthesis

Defect of pars interarticulariscongenital, aquired, slippage of vertebrae

Piriformis syndrome

Painful cramp in buttock, burning, aching, tightness in back or buttocks, discomfort while sitting, pain goes throught back of the leg

Lumbar spine- rheumatologic

Ankylosing spondylitis, reactive arthritis, psoriatic arthritis...

DIFFERENTIATION OF INFLAMMATORY VERSUS MECHANICAL LOW BACK PAIN

	Inflammatory pain	Mechanical pain
Age at onset	<40 yr	Any age (usually later)
Type of onset	Insidious	Acute
Symptom duration	>3 mo	<4 wk
Morning stiffness	>30 min	<30 min
Nocturnal pain	Common	Absent
Effect of exercise	Improvement	Exacerbation
Sacroiliac joint tenderness	Frequent	Absent
Back mobility	Loss in all planes	Abnormal flexion
Chest expansion	Often decreased	Normal
Neurologic deficits	Unusual	Possible

Sacroiliac joint

Ligaments: sacroliliac anterior, posterior and interosseus, sacrotuberal and sacrospinal ligament movement: nutation, contranutation

Sacroiliac joint- examination

Sacral Thrust

Anteriorly directed thrust on sacral to attempt pain provocation

Pain in the back or butock region- SI joint

Anterior groin- hip joint

Mennel's test Positive if pain is elicited in buttock region ipsilateral

Test of SI joint when standing on one legipsilateral pain- same region

