



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

“Orthopaedic or neurologic?”
Gualtiero Gandini

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«Naturalmente li omini desiderano di sapere»
Leonardo da Vinci, 15th century

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Goal

Provide practical and useful information on the clinical approach to the gait problems

INDEX:

1. Basic Concepts
2. Gait examination: normal and abnormal
3. Problem in a single limb



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1. Basic concepts

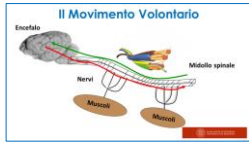


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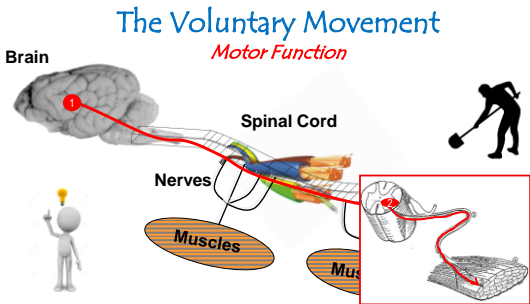


The Voluntary Movement

Synergistic action between:
MOTOR FUNCTION (descending)
 &
SENSORY FUNCTION (ascending)
(proprioceptive, vestibular, visual)
 +
INTEGRATION (cerebellum)



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Is strenght only required to make a correct movement?



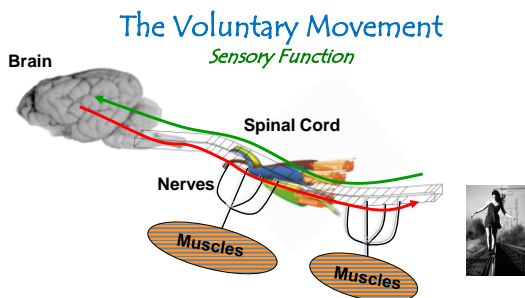
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SENSORY FUNCTION
(ascending - afferent)

PROPRIOCEPTION:
Sensory modality permitting to perceive "in real time" the position of the limbs and body in the space (KINESTHESIA)

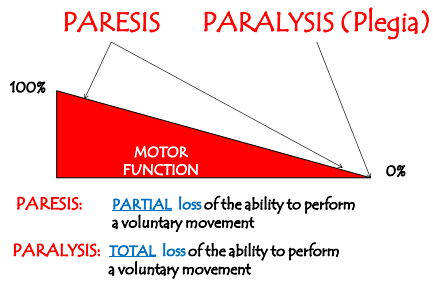


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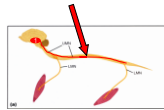
GAIT ABNORMALITIES



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Basic concepts: lesion of the upper and lower motoneuron System

UPPER MOTOR NEURON LESION:
NORMAL/INCREASED REFLEXES
Normal/Increased muscle tone
Spastic Paresis/Paralysis



LOWER MOTOR NEURON LESION:
DECREASED/ABSENT REFLEXES
Decreased muscle tone
Flaccid Paresis/Paralysis



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THORACOLUMBAR lesion: spastic paraplegia



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LUMBOSACRAL lesion: flaccid paraplegia



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Gait examination

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GAIT EXAMINATION

NORMAL GAIT: "Correct sequence of voluntary movements"

EVALUATION:
(on flat, non-slippery surface)

- DIRECTION OF THE GAIT
- LENGTH OF THE STRIDE
- HYPER/ HYPOMETRIA
- ABILITY TO BEAR THE WEIGHT
- COORDINATION contralateral limb
- COORDINATION fore/ hind limbs



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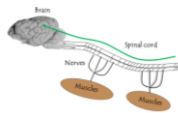
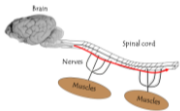


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GAIT ABNORMALITIES

PARESIS (weakness)
Inability to perform adequately a voluntary movement

MOTOR DEFICIT



ATAXIA (incoordination)
Inability to coordinate the movement and/or the sequence of the movements

SENSORY DEFICIT

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GAIT ABNORMALITIES

LAMENESS:

Alteration in the normal gait due in most cases to **pain** or to **mechanical limitations**



(true mainly in case of PAIN):

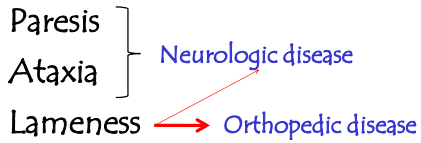
- ✓ Reluctance to bear weight on the affected limb
- ✓ Short bearing weight on the affected limb
- ✓ "head elevation" when the limb is bearing weight (front limb)
- ✓ "back elevation" when the limb is bearing weight (hind limb)

NORMALLY AFFECTS ONE SINGLE LIMB, RARELY TWO, ALMOST NEVER FOUR!!!



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GAIT ABNORMALITIES



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.... Orthopaedic or Neurologic???



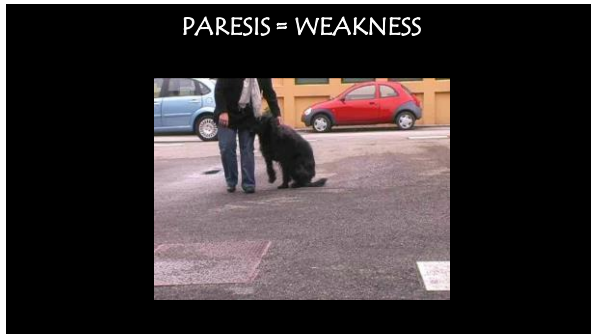
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GAIT EXAMINATION

TERMINOLOGY

- MONOPARESIS - MONOPLÉGIA
- PARAPARESIS - PARAPLÉGIA
- HEMIPARESIS - HEMIPLÉGIA
- TETRAPARESIS - TETRAPLÉGIA
- Vestibular ATAXIA
- Cerebellar ATAXIA
- Proprioceptive or spinal ATAXIA
- Circling, Leaning, Drifting

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ATAXIA

Inability to coordinate the movement and/or the sequence of the movements

LESION OF THE ASCENDING TRACTS (SENSORY)

«Proprioceptive» (or spinal) ATAXIA
*mainly due to spinal cord lesions.
 dysmetria, hypo/hypermtria; «don't know where are the limbs»*

«Cerebellar» ATAXIA
*due to cerebellar lesions.
 Hypermtria, intention tremors, difficulty in starting movements*

«Vestibular» ATAXIA
*due to vestibular system lesions:
 falling, drifting, leaning, rolling towards the side of the lesion*



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Proprioceptive ATAXIA



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Cerebellar Ataxia



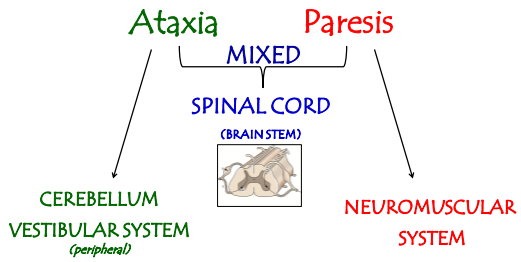
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Vestibular Ataxia



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NS and GAIT abnormalities



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Ataxia or paresis?



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Spinal cord and gait abnormalities

Pin Size	Pinion	Signs with Increasing Compression
1	1	Proprioception
2	2	Proprioceptive Deficits
3	3	Voluntary Motor
4	4	Paralysis, Paralysis
5	5	Superficial Pain
6	6	Loss of Cutaneous Sensation
7	7	Deep Pain
8	8	Loss of Deep Pain

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EVERYTHING OK?



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KEY POINT:

when I observe a patient which «is walking abnormally» the questions are:

1. Has enough strenght? (is it weak?) → *PARESIS*
2. Is incoordinated in the movement? → *ATAXIA*
3. Is painful? → *LAMENESS*

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... what do you think?



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... what do you think?



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..... slow motion



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LAMENESS ON ONE LIMB

Orthopaedic or
neurologic?



....look for some associated
neurologic sign....

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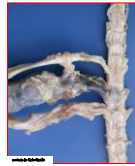
Lameness and.... associated neurologic signs

FRONT and HIND LIMB:

- ✓ Monoparesis
- ✓ Proprioceptive deficits
- ✓ Selective muscle atrophy

✓ FRONT LIMB:

- ✓ Neck pain
- ✓ Horner's Syndrome
- ✓ Decreased cutaneous trunci reflex



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"Camilla", Caucasian Shepherd, F, 10Y; NRN 2190



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"Ivan", DSH M,3y; NRN 1175



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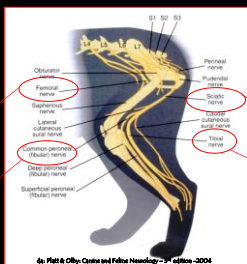
.... Orthopaedic or Neurologic???

Which nerve???



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PNS: NERVES OF THE HIND LIMB



(mainly)
EXTENSION
of the limb

FLEXION of
the hock
EXTENSION
of the fingers

FLEXION
of the limb

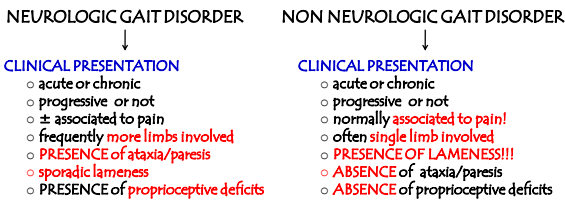
EXTENSION
of the hock
FLEXION
of the fingers

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✉
*Take home message



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Problem of one limb : In conclusion....

- ◇ **Gait examination:**
 - only lameness?
 - monoparesis?
 - deficits on other limbs?
- ◇ **Postural reaction examination :**
 - deficits on the affected limb?
 - deficits on other limbs?
- ◇ **Spinal reflexes examination:**
 -decreased on the affected limb?
- ◇ **Palpation :**
 - pain on palpation of the affected limb?
 - muscle atrophy of the affected limb?
 - Hypoesthesia on specific areas?



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In conclusion: Orthopedic or Neurologic?



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...Questions!...



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