Equilibrium Disorders in the Elderly

A worldwide public health issue

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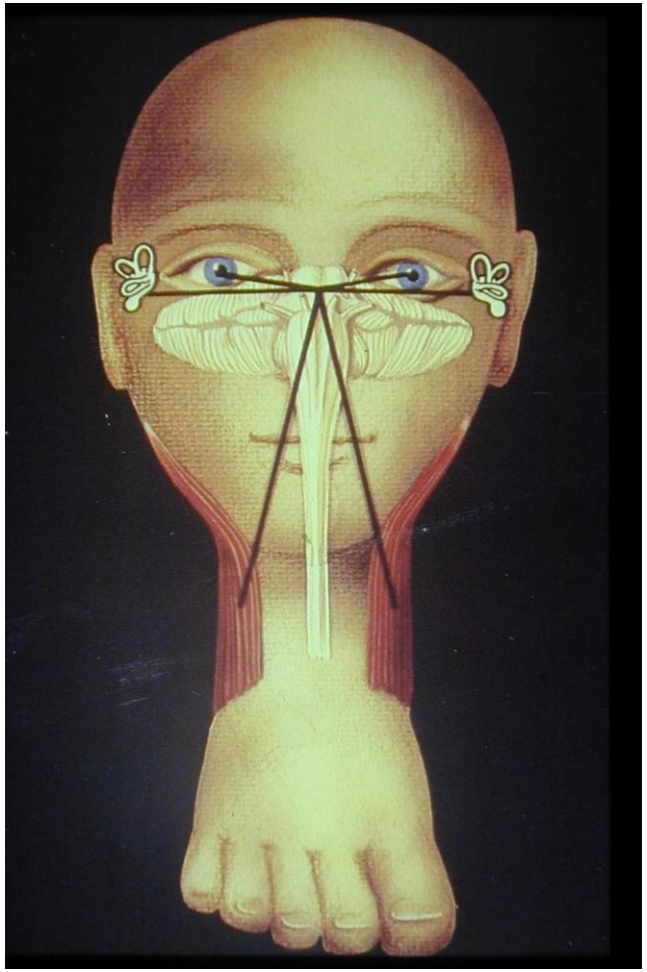
Equilibrium Disorders in the Elderly

Increasing prevalence with age and demography
Affecting 1/3 > 65 yo – 1/2 > 80 yo

Equilibrium Disorders in the Elderly

Major risk of falls ➔ 6th cause of mortality +++ - 10 000 deaths/year
First cause of accidental death after 65 years - 136 450 hospital admissions
Financial burden : 2 billions Euros/year in France ➔ 20 billions in 2050

The Balance system

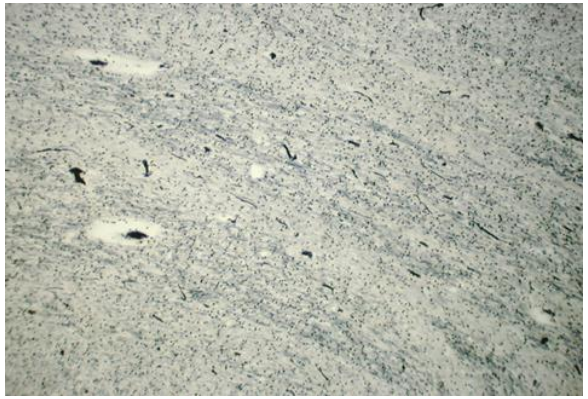


- 3 peripheral sensory captors
- Central integrating structures
- Oculomotor, and somatic muscles
- → to stabilize gaze and posture

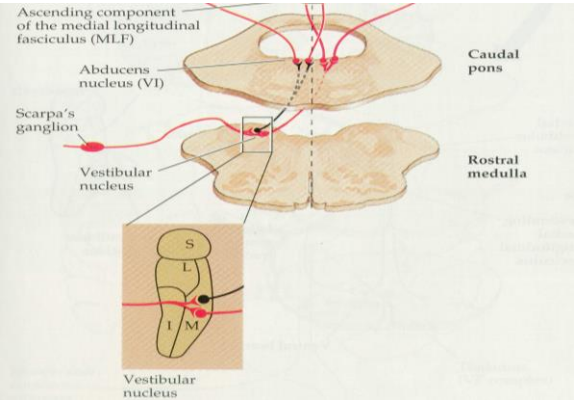
Aging of the Vestibular system

Loss of hair cells

Desintegration of otoconia



Decrease of primary neurons

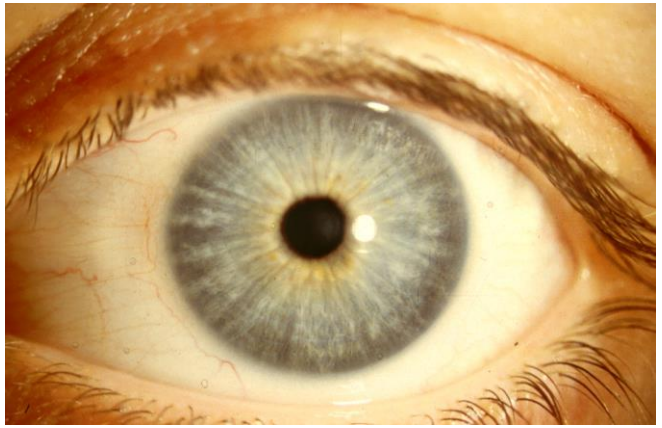


Shrinkage of vestibular nuclei

Decrease of the VOR and V-spinal gain

Aging of the Visual system

- Loss of cones and rods, reduction of pupil diameter, senile myosis, slowing of the pupillary reflex, yellowing of the crystalline lens



➔ **Field of view, acuity, color discrimination, contrast sensitivity, depth and motion perception, viusual processing speed, etc.**

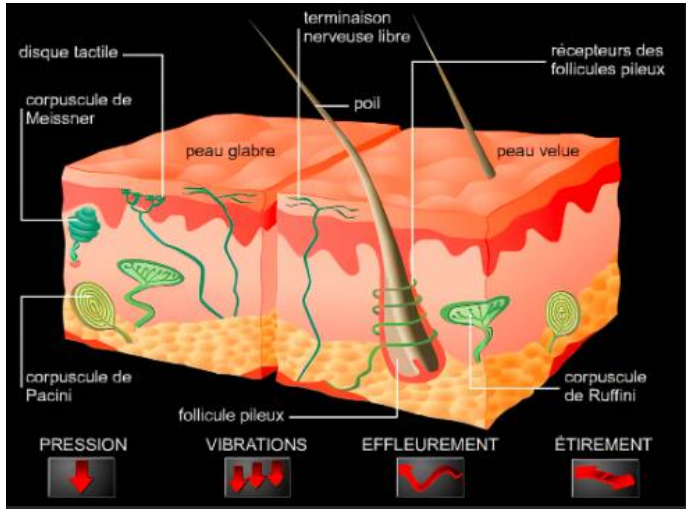
Aging of the Proprioceptive system

- External

  Meissner corpuscules ➔ Vibrations (200 Hz)

  Ruffini corpuscules ➔ Pressure

  Pacini corpuscules ➔ Vibrations (300 Hz)



- Internal

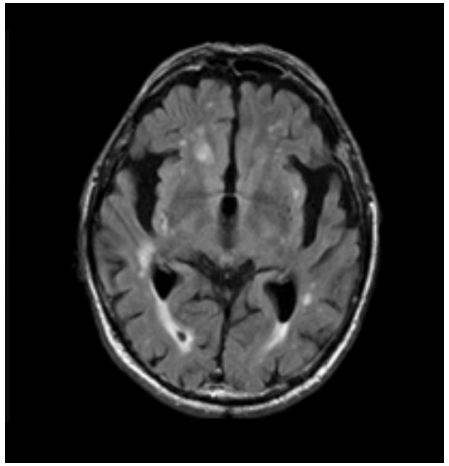
  Neuromuscular sensory structures

  Osteo-articular Vater-Pacini corpuscu

➔ Reduced proprioceptive informations

Aging of the Central structures

- Demyelinisation, neuronal degeneration
- Cortical atrophy, synaptic density reduction

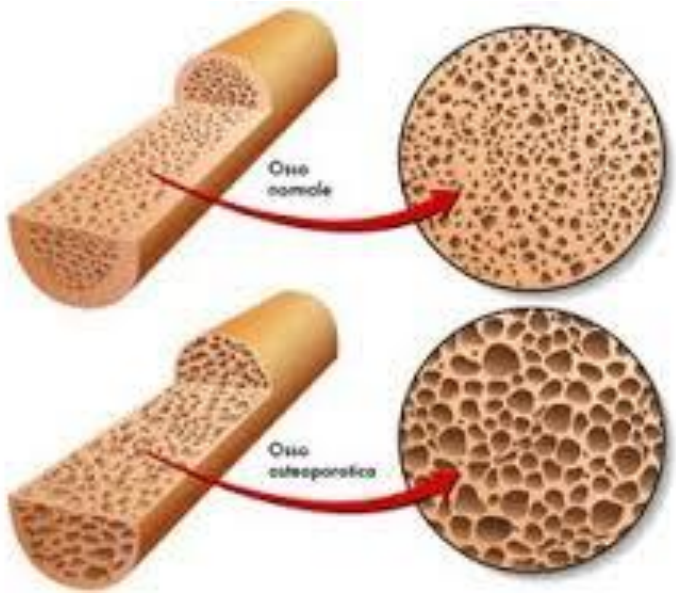


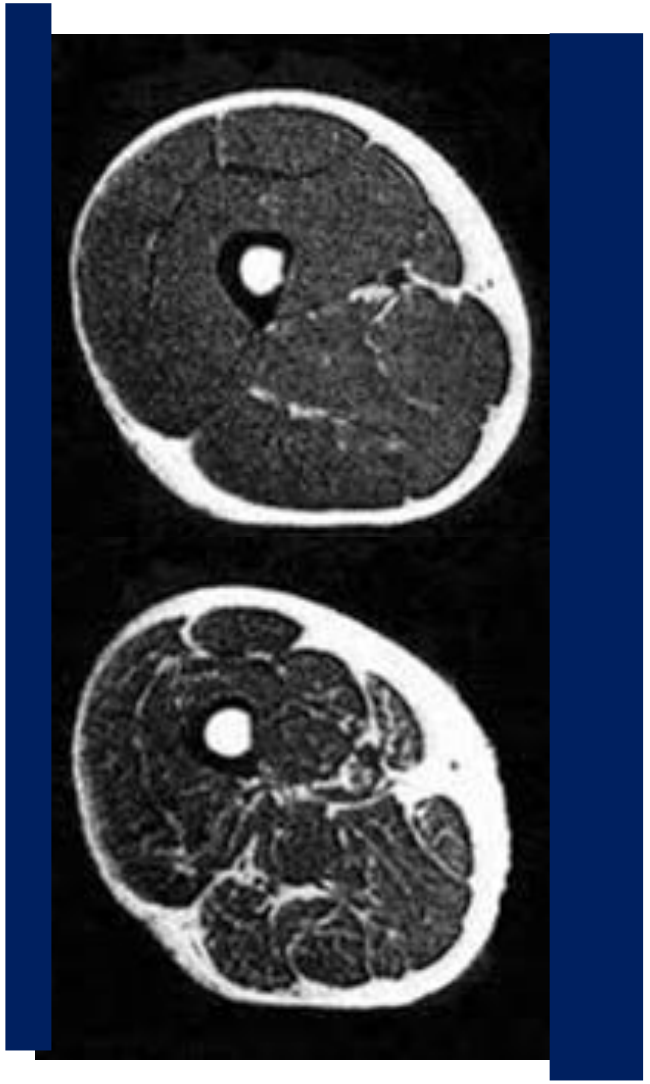
➔ **Cognitive impairment**

➔ **Incapacity to integrate and stratify peripheral inputs**

Aging of the Effector system

- Osteoporosis, arthrosis, etc.
- Sarcopenia, adipocytosis, etc.

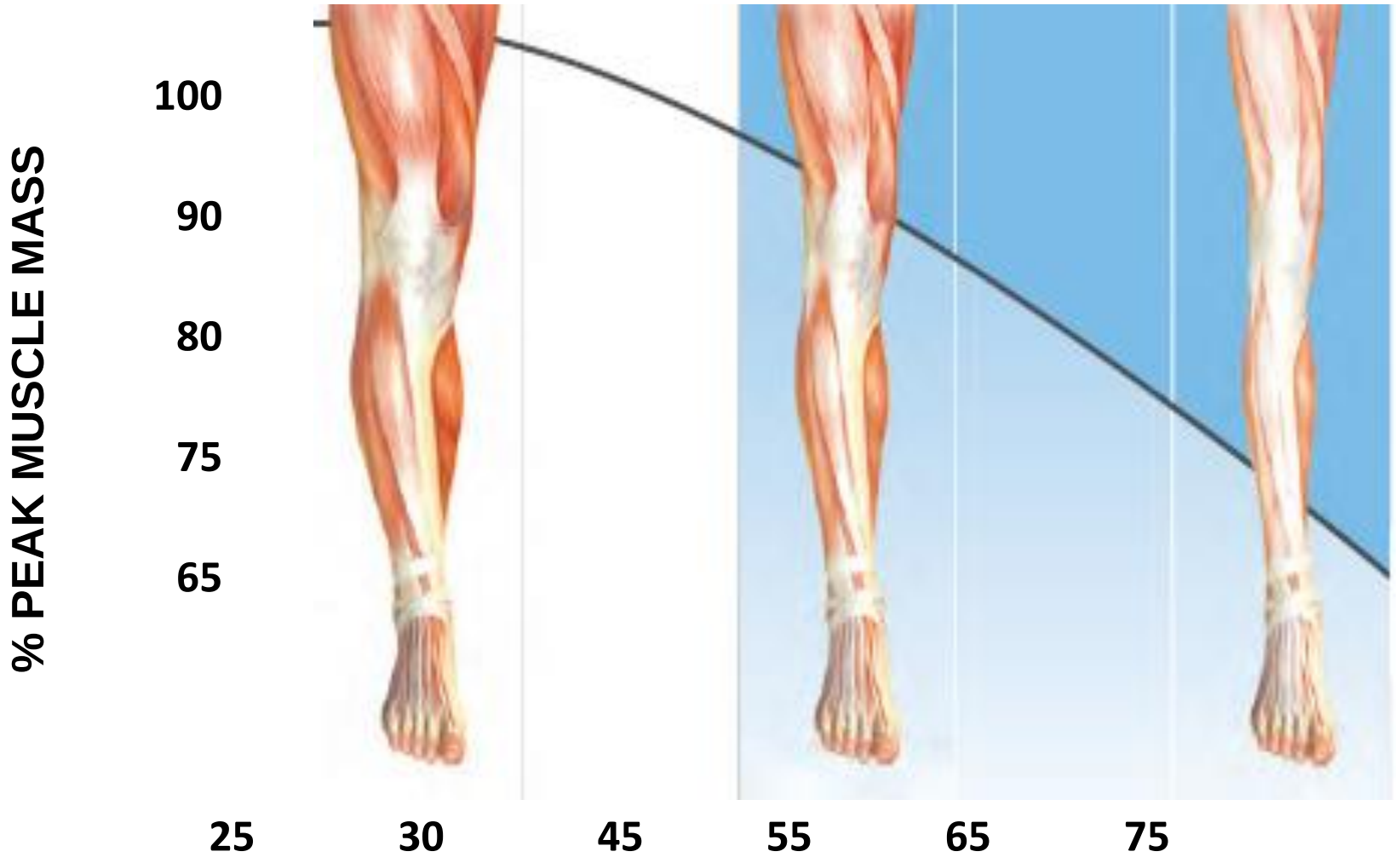




24 yo

65 yo

Loss of 24% skeletal muscle mass between 45 & 75 years



After age 70

⇓

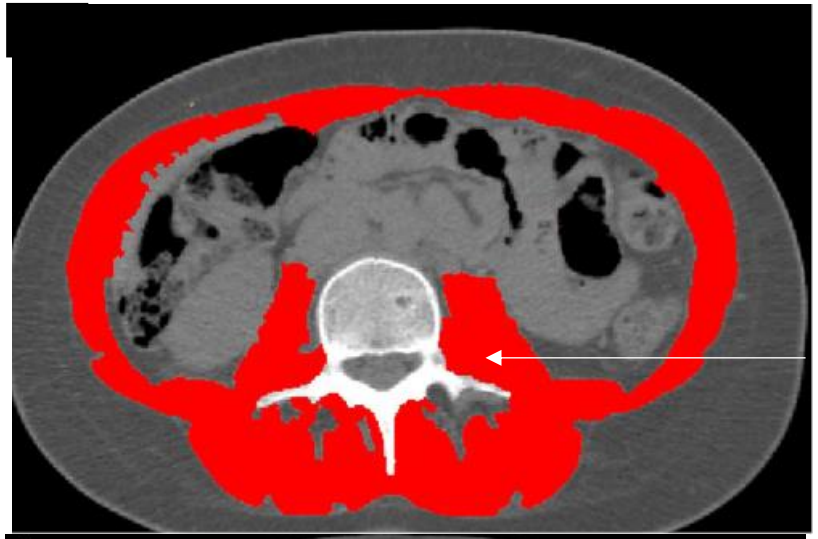
8 to 15%

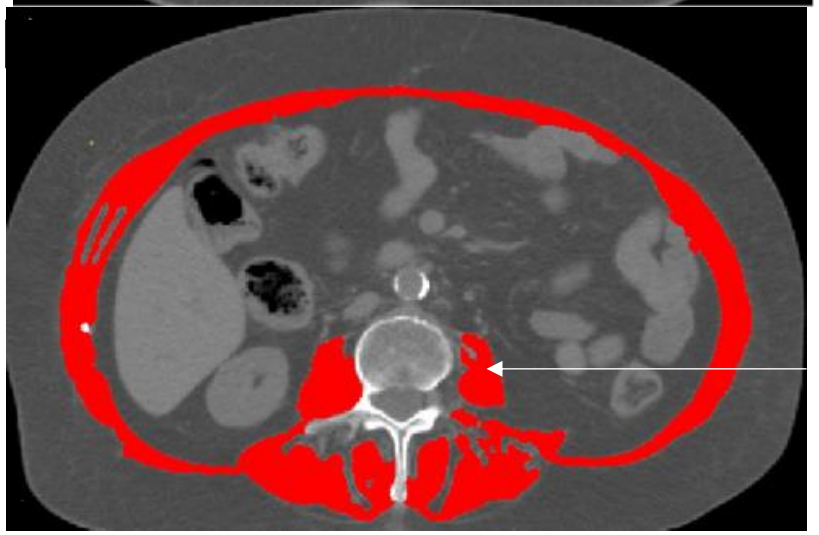
of muscle loss, each decade of life

GRIMBY G et al Clin Physiol 1983; 3:209-18 ; FLAKOLL P et al. Nutrition 2004; 20: 445-51
BAIER S et al JPEN J 2009; 33: 71-82, JANSSEN I et al J Appl Physiol 2000; 89: 81-8

FAM FONDATION DE L'ACADÉMIE DE MÉDECINE

Computer assisted tomography





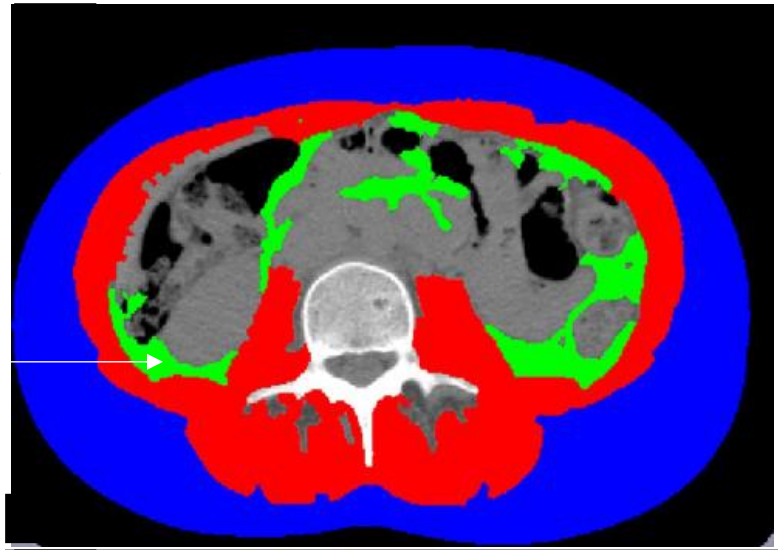
Control

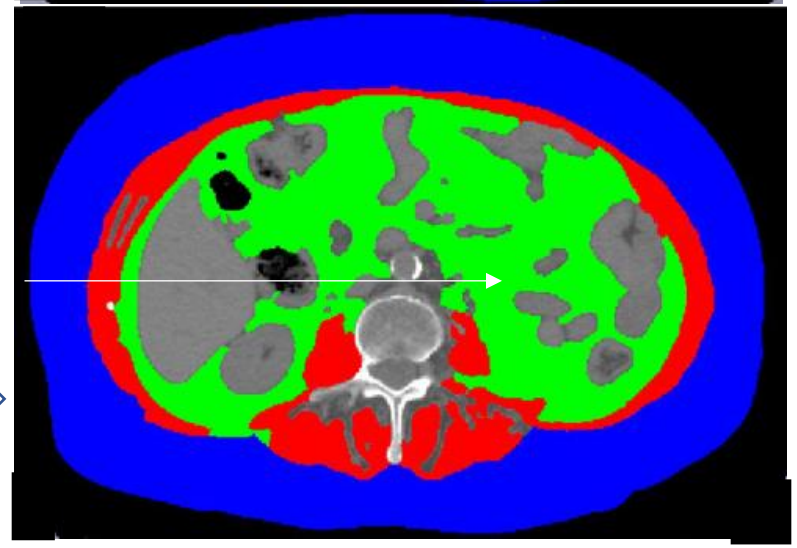
Red: muscles

Green: Fat

Blue: sub cutaneous fat

Sarcopenia

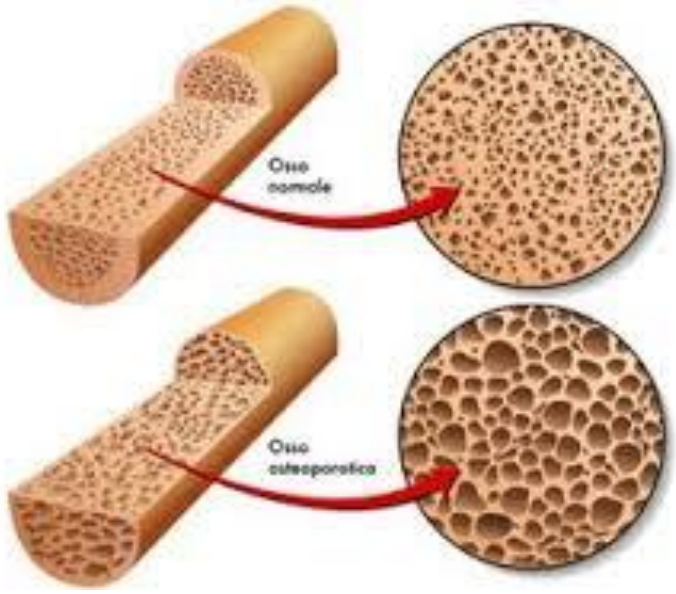


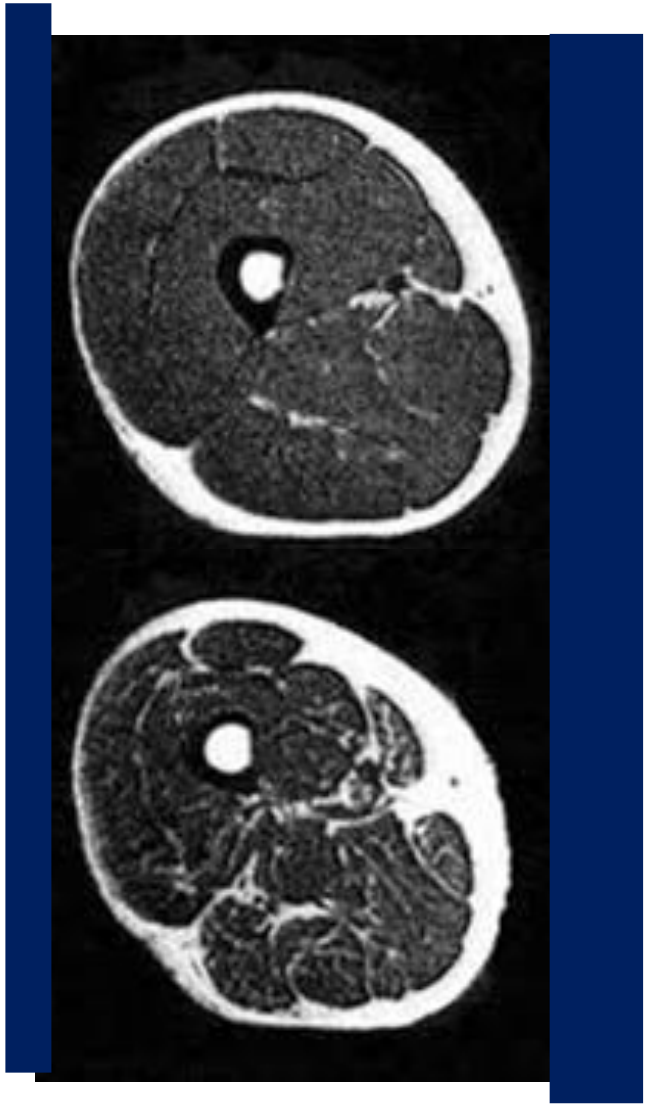


V CHIANCA et al Abdominal Radiology 2022; 47: 3205–16

Aging of the Effector system

- Osteoporosis, arthrosis, etc.
- Sarcopenia, adipocytosis, etc.





24 yo

65 yo

➔ **Delay the reaction to postural disturbance**

Equilibrium disorders is

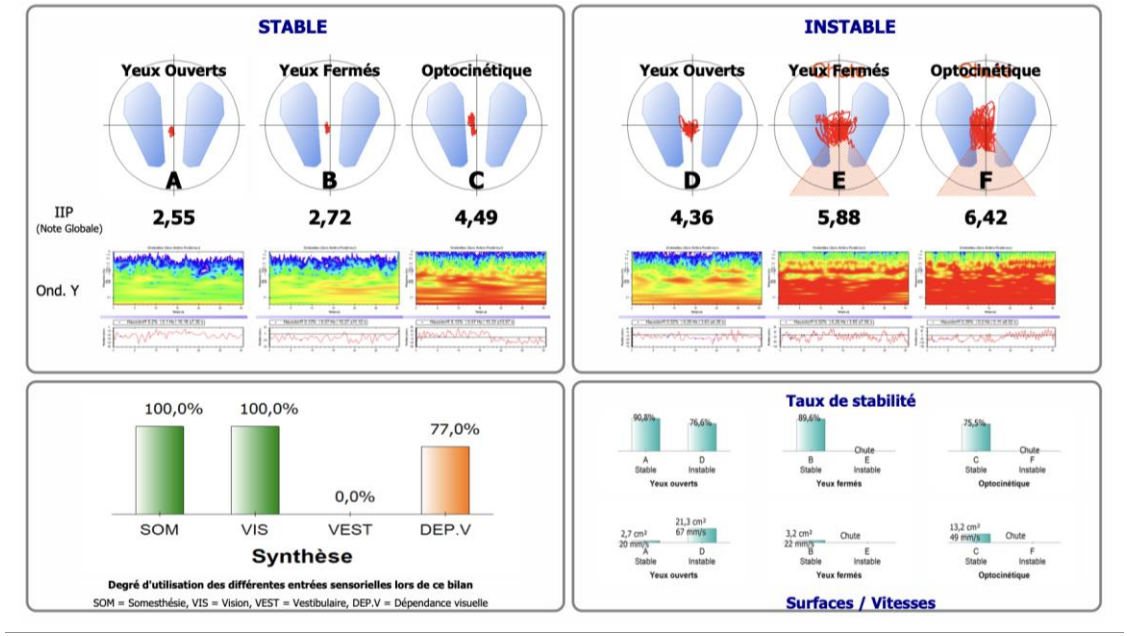
a multifactorial problem

Clinical evaluation

1. Multidisciplinary screening of the balance system

2. Identify the risk factors

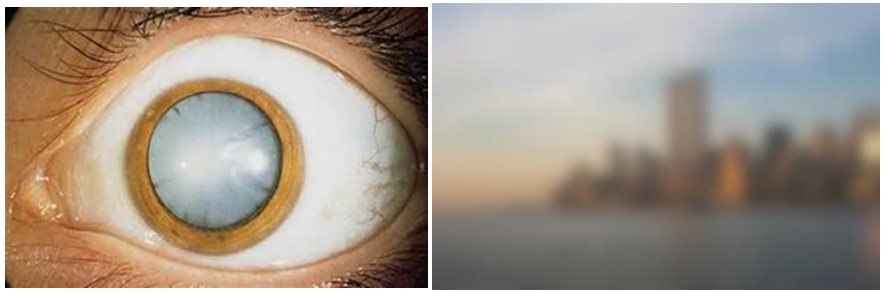
Vestibule examination



Static and Dynamic Posturography

Ophtalmologic evaluation

- Visual field > Fundus examination



Cataract

AMD

Diabetic retinopathy ++

Glaucoma ++

Peripheral visual disorders disturb balance more than central disorders

Orthopedic evaluation

- Osteoarticular flexibility, vertebral stasis disorder, plantar abnormality, skeletal deformation, muscle strength,
- Gait and posture




Walking speed is highly correlated with functionality and lifespan

STUDENSKI S et al JAMA 2011; 305: 55–8

Neurologic evaluation

- Neurodegenerative diseases, Low pressure hydrocephaly, Pseudobulbar syndrome, cerebellar atrophy, etc.

- Procedural memory +++

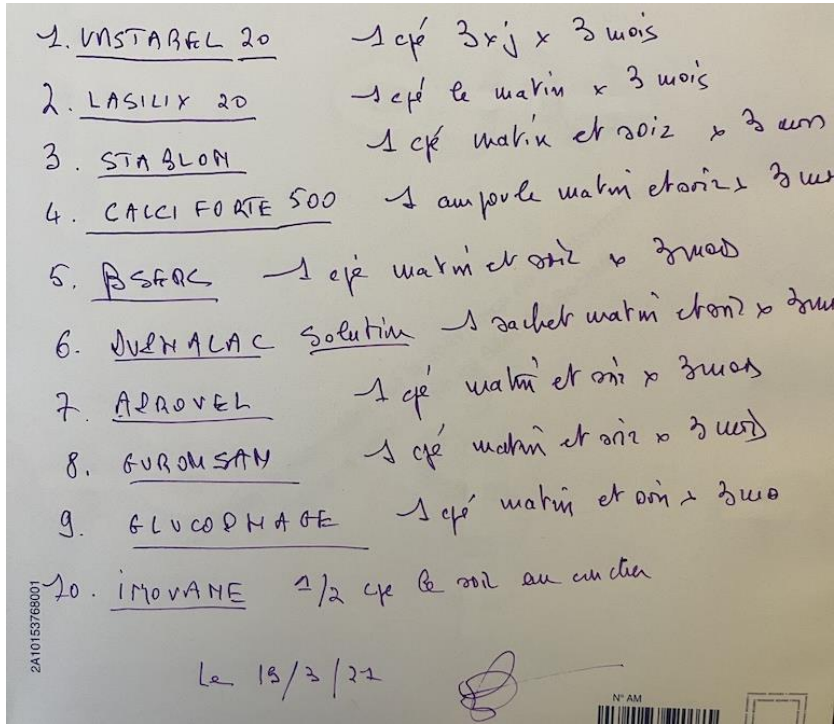
- Depression

➔ **Cognition +++**

Geriatric evaluation

- General condition
  - diabetes, atherosclerosis, hypertension, etc.
  - Recent anesthesia or confinement

- POLYMEDICATION +++
  - sedatives, antidepressants, hypnotis, diuretics, asthenia, etc



List of agents investigated in the fields of frailty and registered at ClinicalTrials.gov

Agent	Registration number	Completion date[a]
Phase I		
Allogeneic MSCs	NCT02065245	October 202
Allogenic MSCs (umbilical cord)	NCT05018767	No
Allogenic MSCs (umbilical cord)	NCT04919135	
Cord blood	NCT02418013	
Fecal microbial transplantation[b]	NCT0559811?	
G-CSF-mobilized fresh-frozen plasma	NCT	y 2023
Ghrelin		December 2008
Leucine		October 2019
MSCs (umbilical cord)		March 2022
MSCs (UMC119-06-05)	914403	July 2025
Therapeutic plasma e	NCT05054894	May 2025
Phase II		
Al	NCT04919135	November 2023
	NCT05727384	April 2025
riboside	NCT03579693	April 2021
quercetin	NCT02848131	April 2025
inib and quercetin, or fisetin alone	NCT04733534	July 2024
Epigallocatechin-3-gallate and vitamin C	NCT04553666	December 2023
Fisetin	NCT05595499	May 2025

Therapeutics are not successful yet

Identifying the risk factors

1. Previous falls : « Who falls will fall … »
2. Environment and lifestyle
3. 2 maneuvers

Identifying patients at risk

2 maneuvers ➔ systematic after 65 YO

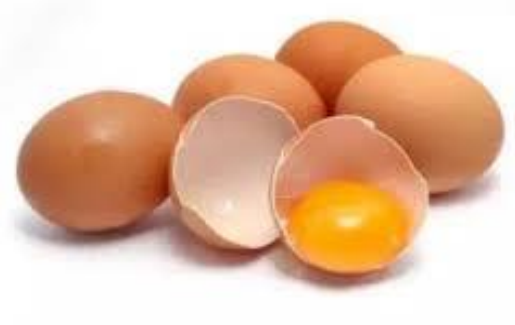
Unipodal test

Up and Go test

PREVENTION

Preventive measures

- Avoid hypermedication
- Diet



Protein intake +++. (minimum 1-1.2g/kg of BW/day)

Preventive measures

- Medication
- Nutrition
- Metabolic and vitaminic deficiencies

Preventive measures

- Medication
- Nutrition
- Metabolic and vitaminic deficiencies
- Ophtalmologic measures

➔ **Avoid progressive lens**

Preventive measures

- Medication
- Nutrition
- Metabolic and vitaminic deficiencies
- Ophtalmologic measures
- Footwear

Preventive measures

- Medication
- Nutrition
- Metabolic and vitaminic deficiencies
- Ophtalmologic measures
- Footwear
- Home safety & environment

Preventive measures

- Medication
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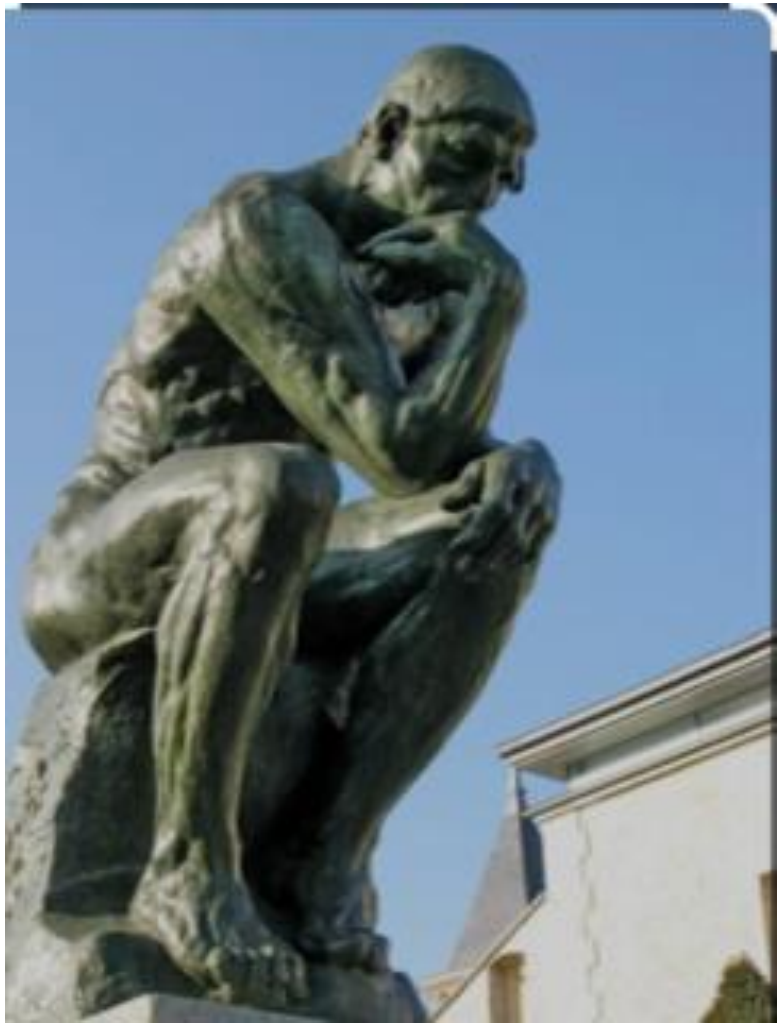
- Footwear
- Home safety & environment
- Familial and social isolation

Cognitive exercises



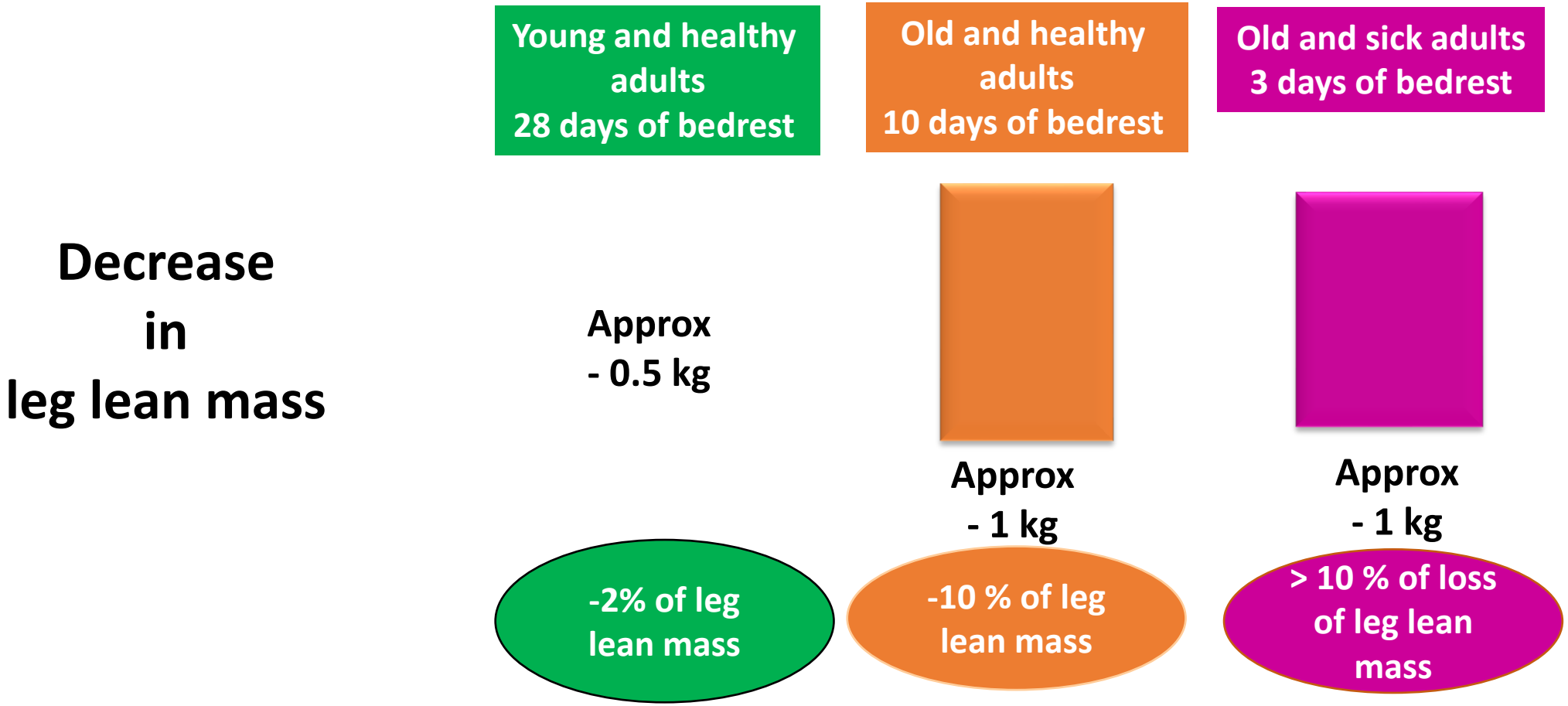
Sudoku

2	5							
				1	6			9
	6				7		3	4
6	1	3		4		9		2
	9		2					
					9		1	
7							6	
5	3							7
		2			8			

Physical activities

Deleterious effects of bedrest in old adults with an eucaloric diet

Muscle mass loss during bedrest or hospital stay of adults of different ages and health states: young and old in good health compared with old and sick



PADDON-JONES D et al. J Clin Endocrinol Metab. 2004; 89: 4351-8 ; KORTEBEIN P et al. JAMA. 2007; 297: 1772-4
PADDON-JONES D, 110th Abbott Nutrition R&D Conference Presentation, July 23-25, 2009

PHYSICAL EXERCISES and SARCOPENIA

MRI of the knee extensor muscle before and after 12 weeks of STRENGTH training in a 92 years old man

↗ 44 % of the skeletal muscle mass

HARRIDGE SD et al Muscle Nerve 1999: 22: 831-9

Idea for Christmas !

CONCLUSIONS

- A major worldwide public health problem
- Midlife evaluation
- Multifactorial and simple preventive measures

Preventive measures

- Avoid hypermedication