Approach to illness prevention in athletes with spinal cord injuries

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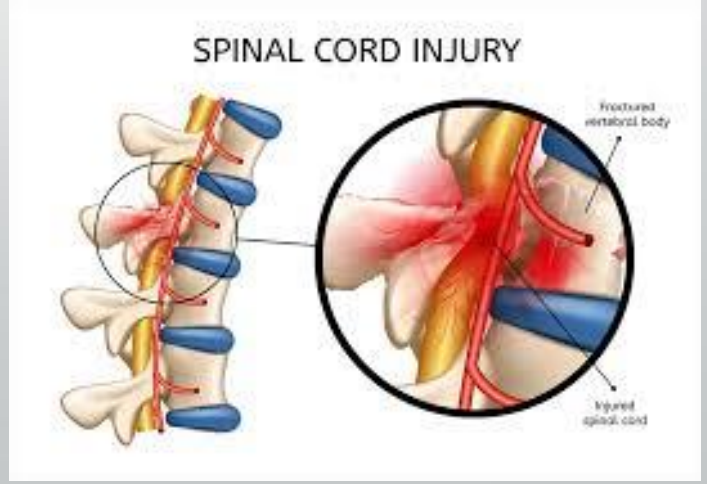
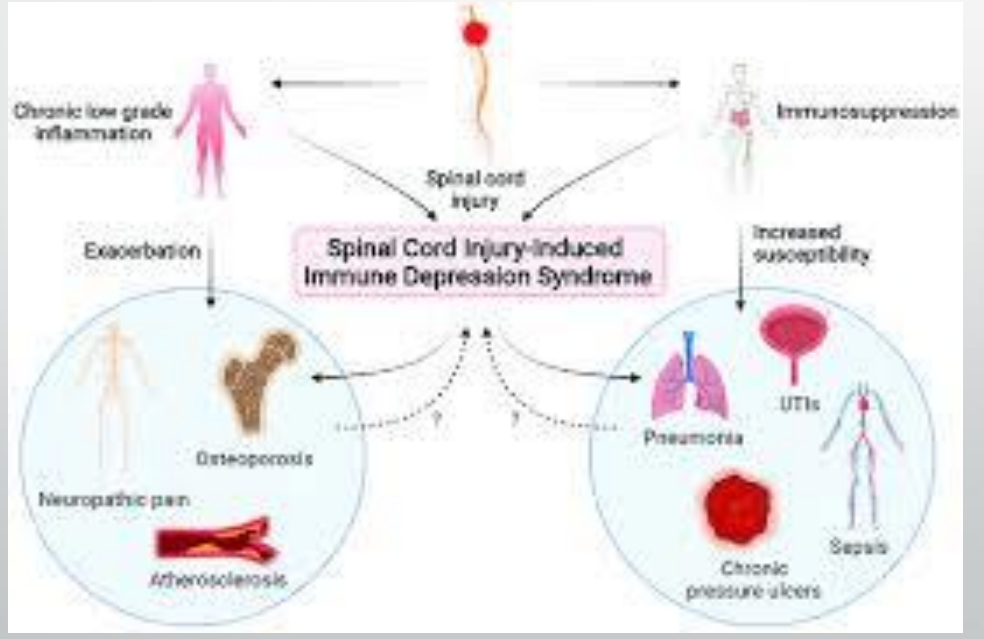
Spinal cord injury (SCI)

- Spinal cord injury (SCI) is a serious medical condition that causes functional, psychological and socioeconomic disorder.
- The goals of rehabilitation and other treatment approaches in SCI are to improve functional level, decrease secondary morbidity and enhance health-related quality of life.



Spinal cord injury (SCI)

- Prevention, early diagnosis and treatment of acute and chronic secondary complications in patients with SCI is critical for limiting these complications.



Long-term complications after SCI

- Respiratory complications
- Cardiovascular complications
- Urinary and bowel complications
- Spasticity
- Pain syndromes
- Pressure ulcers
- Osteoporosis and bone fractures

RESPIRATORY COMPLICATIONS

- Respiratory complications associated with SCI are the most important cause of morbidity and mortality in both acute and chronic stages.
- Forced vital capacity (FVC) and forced expired volume (FEV1) were normal in patients with low-level paraplegia who had never smoked but they found that both decreased with rising SCI level more prominently in patients with tetraplegia.
- Duration of injury, smoking history, age and body mass index (BMI) effect on this complication.

RESPIRATORY COMPLICATIONS

- Significant decrease in all lung volumes with increasing BMI
- SCI patients have a high prevalence of sleep-related respiratory disorders particularly in para powerlifting athletes.(%25-%45)

RESPIRATORY COMPLICATIONS

- **Management of respiratory complications include** :
- Positioning and postural changes, breathing techniques, spontaneous cough and cough assistance, suctioning, respiratory muscle training, ventilation techniques and education, vaccination agents for influenza and pneumococcal infections and pharmacological interventions.
- Respiratory muscle training improve respiratory function & improve performance(core box).

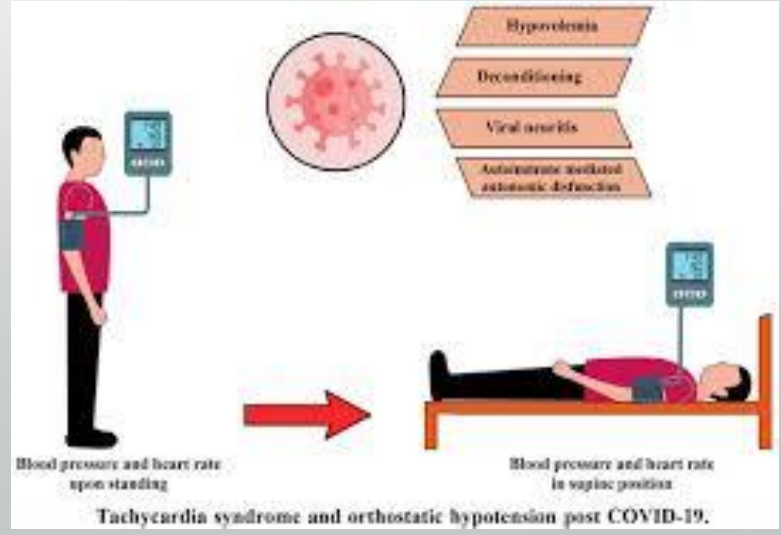
CARDIOVASCULAR COMPLICATIONS

- Thromboembolism and autonomic dysreflexia(AD).
- orthostatic hypotension (OH)
- impaired cardiovascular reflexes
- Reduced transmission of cardiac pain
- loss of reflex cardiac acceleration
- Cardiac atrophy with tetraplegia due to loss of left ventricular mass
- pseudo-myocardial infarction

Orthostatic hypotension

- It is defined as a decrease in systolic blood pressure of 20 mmHg or more, or a reduction in diastolic blood pressure of 10 mmHg or more, when the body position changes from supine to upright after 3 min .(30-20-10)
- low level of efferent sympathetic nervous activity and the loss of reflex vasoconstriction after SCI.

➢ 21% and cervical injuries had the highest prevalence



Tachycardia syndrome and orthostatic hypotension post COVID-19.

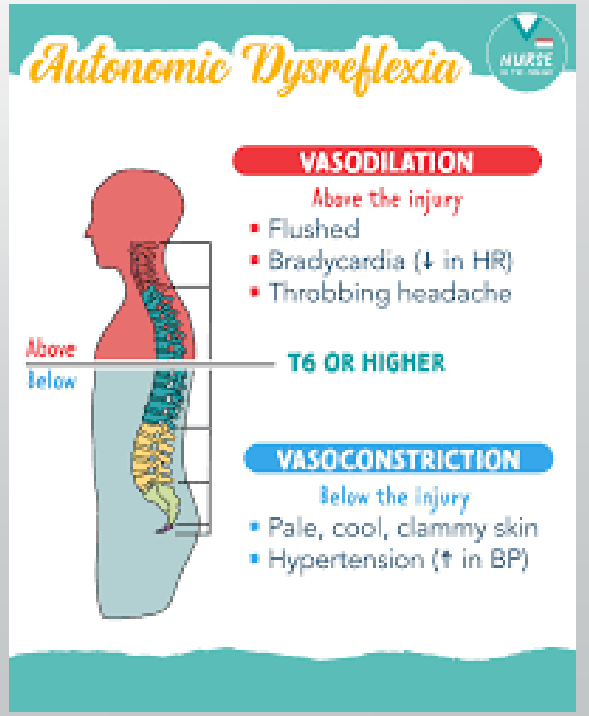
Management of OH

- Management of OH includes application of pressure stockings and abdominalbinders, adequate hydration, gradual progressive daily headup tilt and administration of pharmacological agents (salt tablets, midodrine, fludrocortisone, dihydroergotamine,ephedrine or L-DOPS).

####***Doping***####

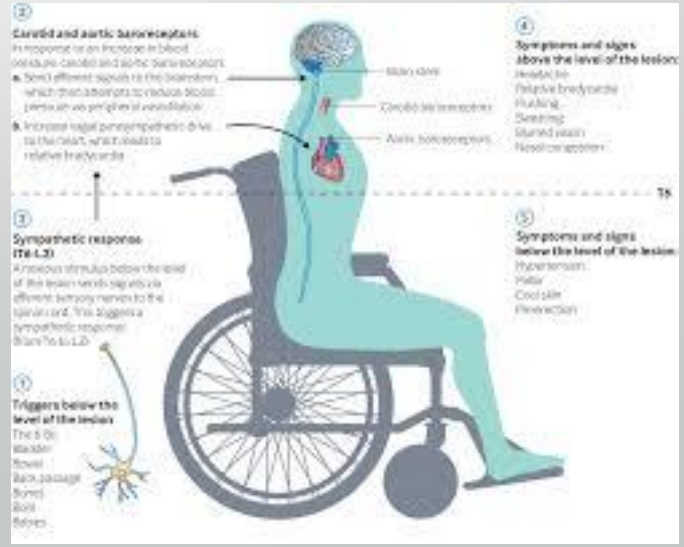
Autonomic dysreflexia

- Autonomic dysreflexia (AD) is a well-known medical emergency.
- It generally occurs in patients with SCI at levels of T6 and above.
- Incidence :19%-70%
- Initiated by a noxious stimulus entering the spinal cord below the level of injury.
- Bladder distension is the most common triggering factor for AD.
- The second most common triggering for AD is bowel distension.
- (more than in para athletes)



Autonomic dysreflexia

- **Management:**
- Prevention
- non-pharmacological
- Placing the patient in an upright position to take advantage of any orthostatic reduction in blood pressure.
- loosen tight clothing.
- Blood pressure is controlled at least every 5 min



Autonomic dysreflexia

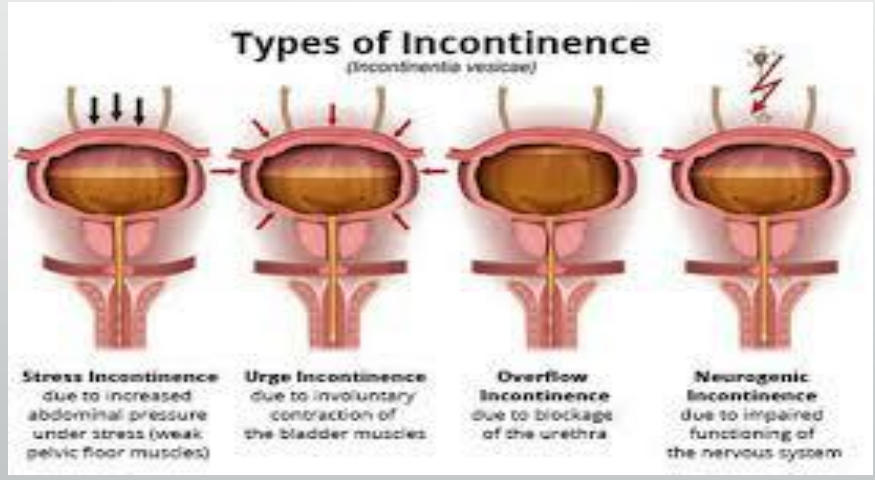
- If arterial blood pressure is 150 mmHg or greater,pharmacological management should be initiated.
- Antihypertensive agent:Nifedipine and nitrates
- captopril, terazosin, prazosin,phenoxybenzamine, Prostaglandin E2 and Sildenafil.

URINARY AND BOWEL COMPLICATIONS

- **Bladder dysfunction:**
- *neurogenic bladder*
- Decrease psychological and social well-being of the patient.
- Bladder function: the cerebral cortex, the pontine micturition center and the sacral micturition center.
- Urodynamic evaluation is essential to provide a precise diagnosis and treatment

Bladder dysfunction

- Treatment methods for neurogenic bladder can be categorized into two groups: therapy to facilitate bladder emptying and therapy to facilitate filling or storage of urine.
- Clean intermittent catheterization (CIC)
- Permanent indwelling urethral or suprapubic catheter*(for acute phase)*



Crede maneuver

- **Dont recommended for bladder emptying in the long-term because vesicoureteral reflux, hernia, rectogenital prolapse and hemorrhoids.**
- **<u>pharmacological interventions</u> (anticholinergic medications, α-blockers, botulinum toxin)**

neurogenic bowel

- **Two main types of neurogenic bowel presented as upper motor neuron (UMN) bowel syndrome and lower motor neuron (LMN) bowel syndrome.**

SPASTICITY

- **Spasticity affects 70% of patients with SCI and causes considerable disability for many.**
- **light to moderate spasticity may have a positive impact on functional activities, including standing, transfers and ambulation!!!**
- **Severe spasticity may contribute to increased functional impairment**

SPASTICITY

- Additionally,it contributes to better peripheral circulation, thereby avoiding edema and reducing the risk of deep vein thrombosis.
- Exacerbating factors (such as urinary tract infection,constipation, ingrown nails, pulmonary Infection, pressure ulcers.
- Drug agent: baclofen,tizanidine, botulinum toxin, benzodiazepine, dantrolene sodium, gabapentin and pregabalin.

SPASTICITY

- **Tizanidine** acts to reduce reflex mechanical responses substantially without inducing comparable changes in intrinsic muscle properties in individuals with SCI.(without change in postural stability).
- **Botulinum toxin** is an injectable medication that acts on the neuromuscular junction. A chemical denervation in intrafusal and extrafusal muscle fibers and its effect is reversible.
- **Benzodiazepines**
- **Dantrolene sodium**(directly on muscle but it tends to cause generalized weakness)

PAIN management

- **Chronic pain is one of the frequent secondary complications for individuals with SCI, with up to 80%.**
- **Chronic pain may lead to functional disability and emotional discomfort.**

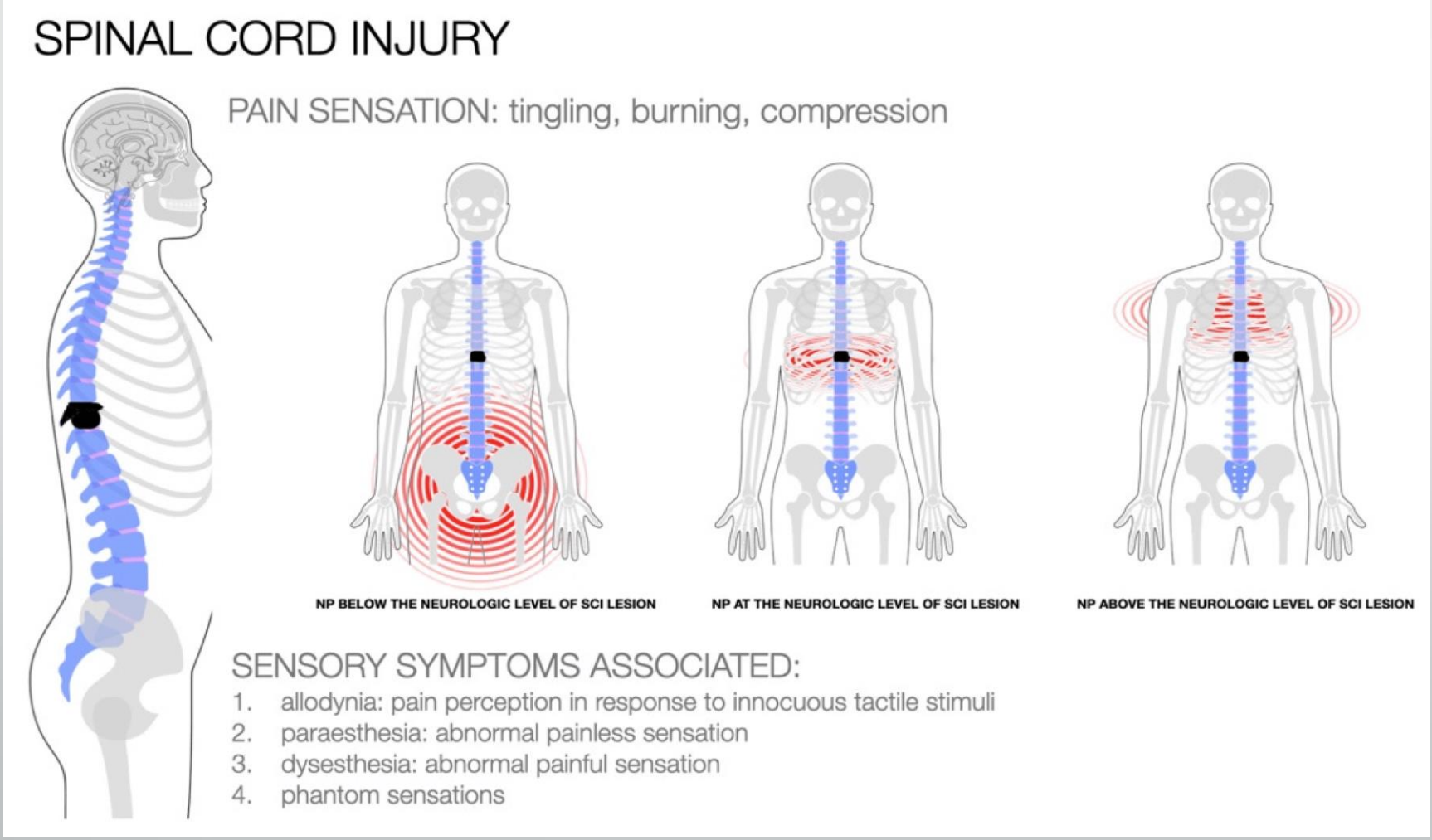
PAIN

- **Pain types are divided into two main groups: nociceptive (musculoskeletal or visceral) and neuropathic (either above level, at level or below level of injury.**

PAIN

- **Nociceptive pain:**
- Shoulder pain due to manually operated wheelchair
- Carpal tunnel syndrome and ulnar nerve entrapment
- Muscle spasm pain in patients with incomplete SCI
- Visceral pain due to irritation or distention of internal organs. This type of pain is reported in 15% of patients with chronic SCI .

Neuropathic pain



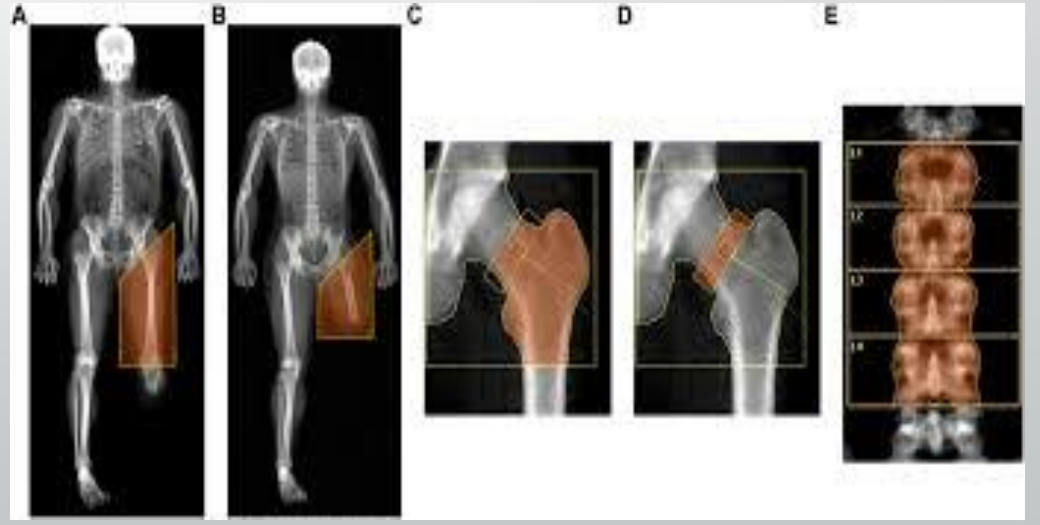
Pain treatment

- Simple analgesics, non-steroidal anti-inflammatory drugs and opioids.
- Physiotherapy (transcutaneous electrical nerve stimulation, acupuncture,spinal cord stimulation) with and without drug.
- Surgical interventions.
- Anticonvulsants ,Antidepressants.

OSTEOPOROSIS AND BONE FRACTURES

- Osteoporosis, a condition characterized by low bone mass and deterioration of the skeletal microarchitecture.

- It occurs rapidly in the first 12-18 mo but continues for several years.

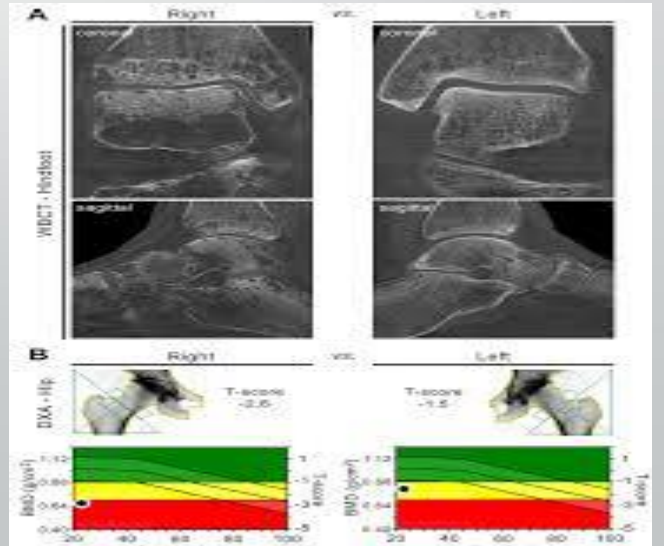


OSTEOPOROSIS AND BONE FRACTURES

- **The mechanism of osteoporosis is complex and multifactorial .**
- **Disuse(regional) may play an important role .**
- **Non-mechanical factors also appear to be important:**
  - ***insufficient nutritional support***
  - ***disordered Vaso regulation***
  - ***hypercortisolism (either therapeutic or stress-related)***
  - ***alterations in gonadal function and other endocrine disorders .***

OSTEOPOROSIS AND BONE FRACTURES

- The most common fracture sites appear to be those around the knee, such as the distal femur or proximal tibia.
- More severe in patients with complete SCI than with incomplete SCI .
- No standardized treatment guidelines for management of osteoporosis in patients with SCI .
- pharmacological and rehabilitation-oriented approaches .



OSTEOPOROSIS AND BONE FRACTURES

- **Bisphosphonates (strongly inhibit bone resorption).**

✓ Gilchrist *et al* concluded that alendronate 70 mg orally per week for 1 year initiated soon after acute SCI prevents bone loss .

✓ Zehnder *et al* also reported that SCI bone loss was stopped at all measured cortical and trabecular infralesional sites over 2 years with alendronate .

✓ In a recent study, zoledronic acid.

- **Non-pharmacological treatment methods :**
  - standing-up.
  - orthotically aided walking.
  - weight - bearing physical exercises.
  - functional electrical stimulation .
  - pulsed electromagnetic fields.

Inspiring!