

Penetrating injuries of spine

Penetrating wounds
stab wounds
Missiles inj



Epidemiology

SCI

- falls
- motor vehicle
- Penetrating inj
 - Stability
 - Neurologic inj



Age

Sex

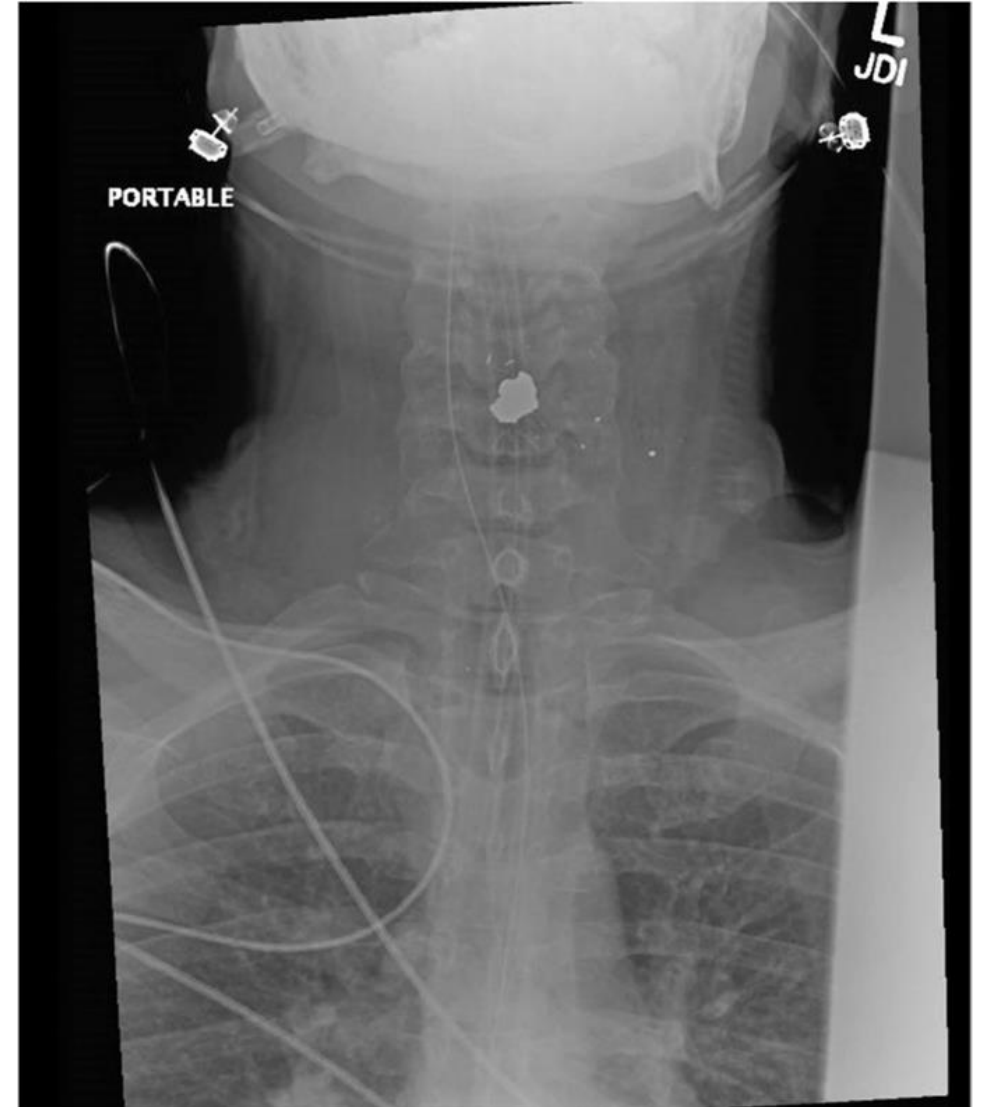
Socioeconomic



- Location
thoracic : 1/2
lumbar : 1/3



- cervical lesions : complete cord
- Lumbosacral : cauda equina 70%



Prognostic factors

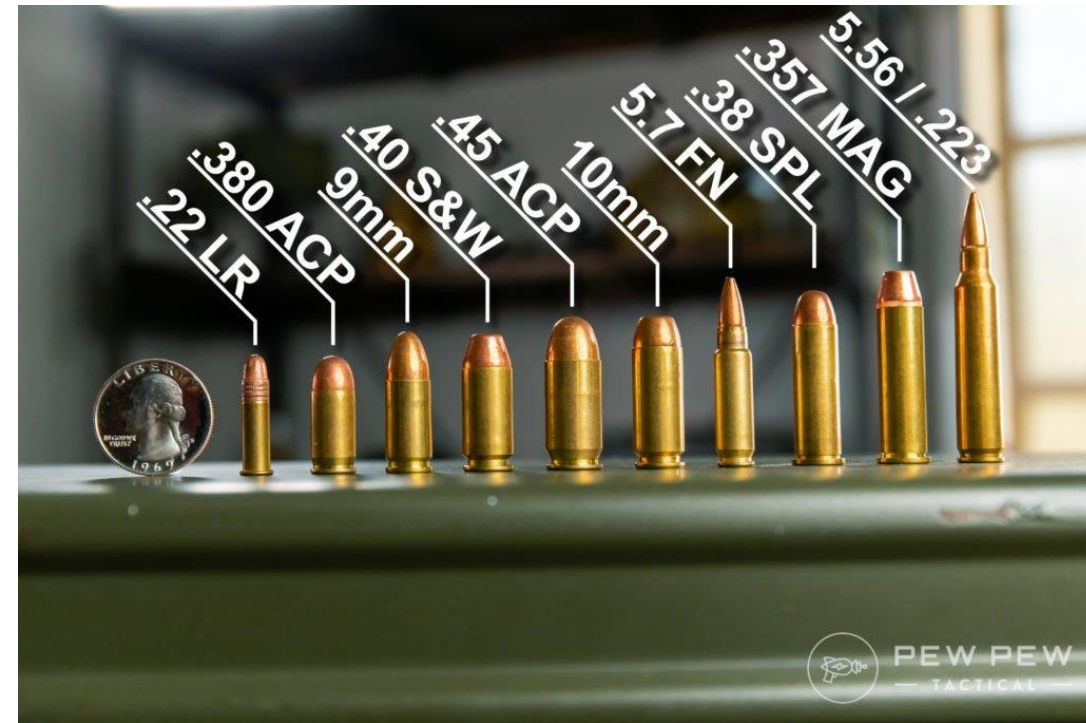
- initial neurological status
- GSW versus other trauma
- Associated inj
- location



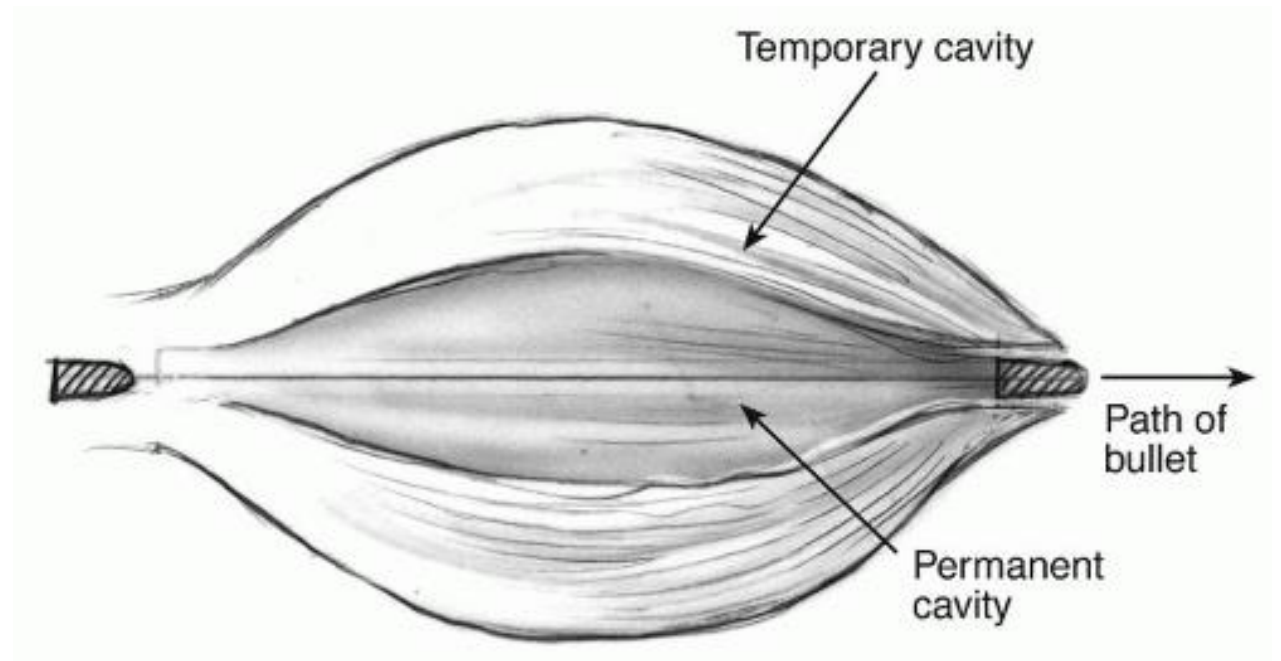
BALLISTICS

Dammage

- energy mass and velocity ($E=1/2mv^2$)
Low-velocity : 1000–2000 feet per second
high-velocity : 2000–3000 f.p.s.
- Caliber
- physical properties

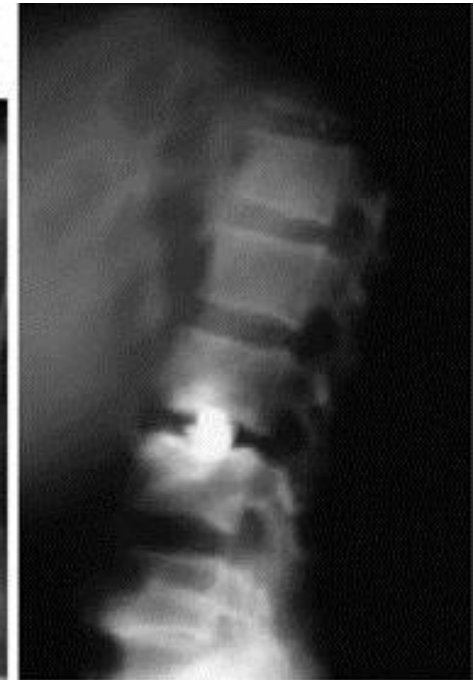
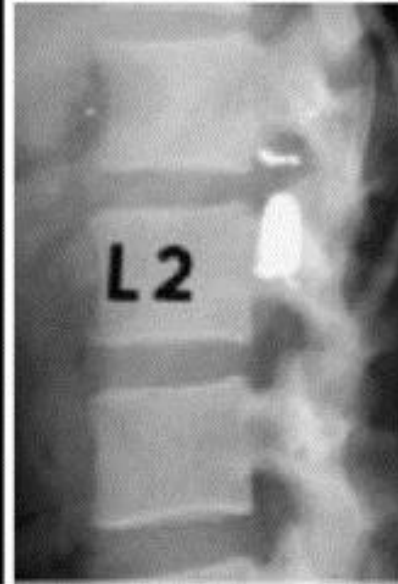
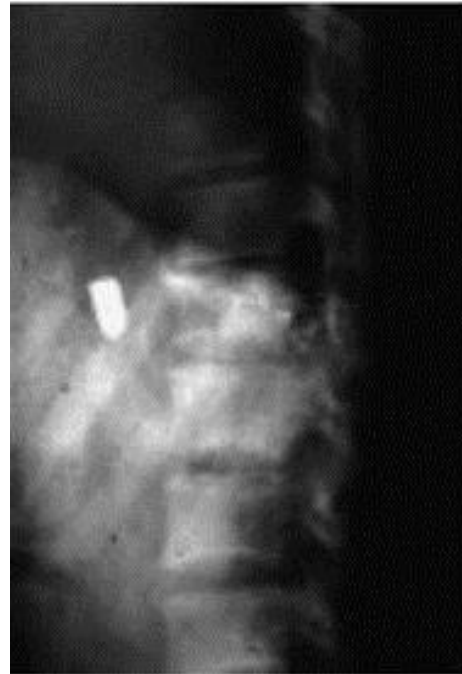


- three mechanisms even without direct trauma



CLASSIFICATION

- type I
- type II
 - type III
 - Subtype A
 - Subtype B



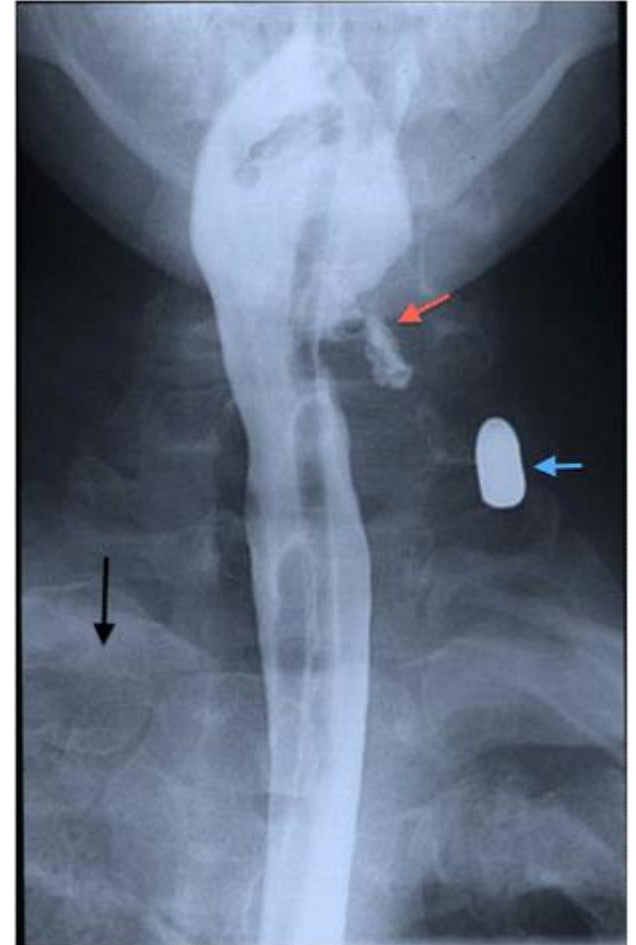
EVALUATION

- ATLS : 'ABCDE'
- type of weapon
- bullet holes
- entry VS exit
- palpation of all the spinous processes
- neurological examination



Cervical

- airway lesions
- vascular injuries
- Injuries of the larynx and esophagus
 - infection



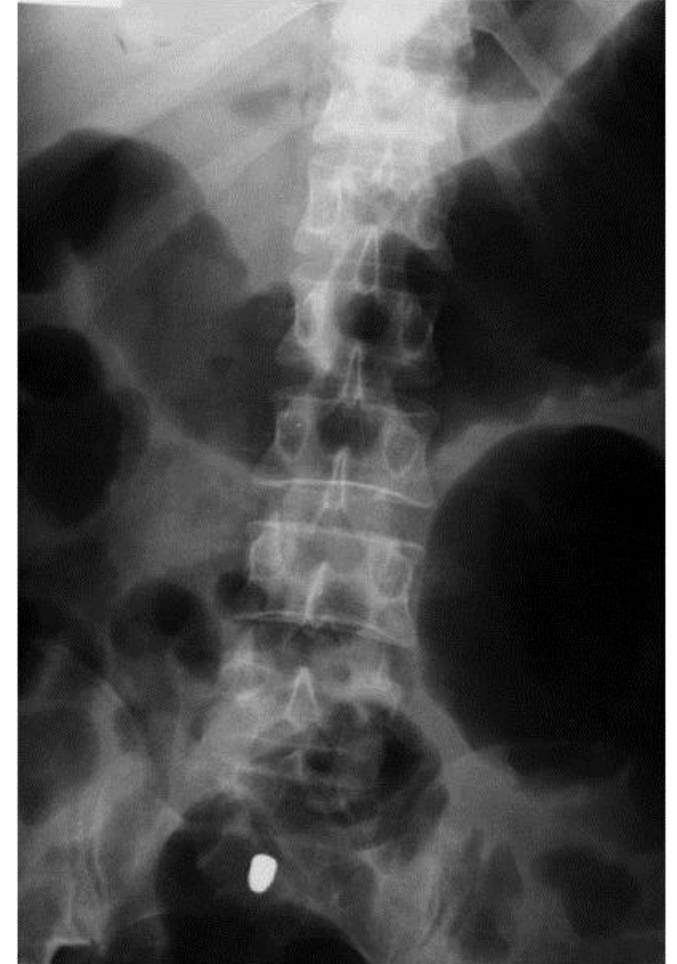
Thoracic

- heart
- Lungs
- great vessels



Lumbosacral

- GI : colon
- GU
- Great vessels



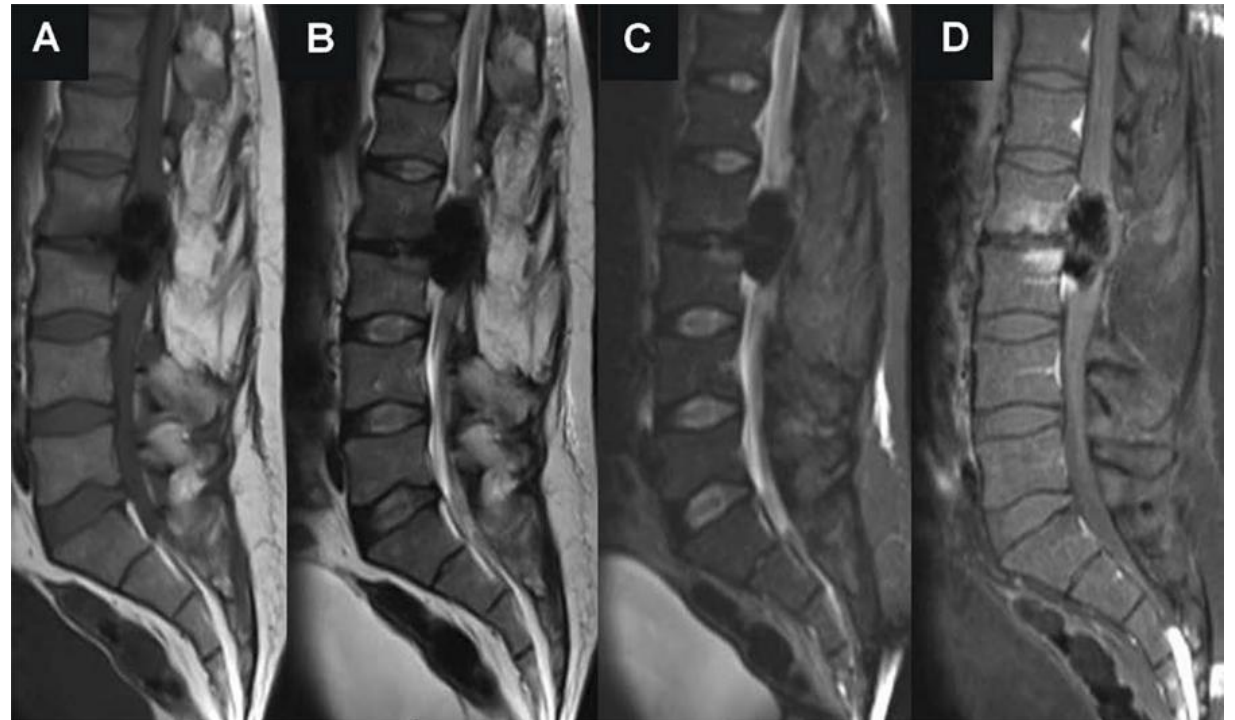
Diagnostic imaging

- Screening : CT scan
 - location of bullet
 - Instability
 - radiography
 - potential for associated injuries
 - severity of SCI based on bullet trajectory



- Mri

- Motion : steel
 - Acute
 - Chronic
- Temperature : 3-Tesla
- Artifact : steel

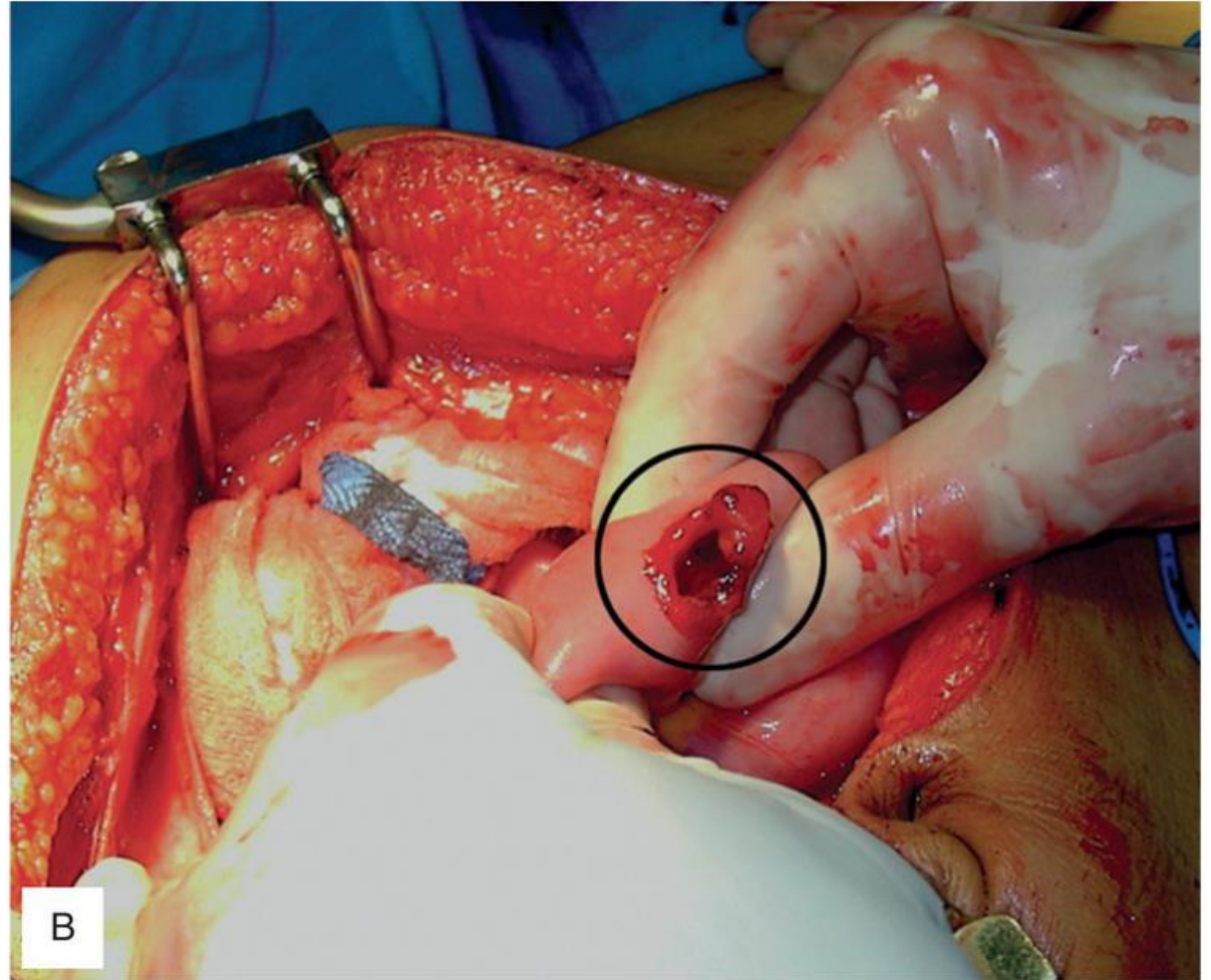


Treatment

- Cord inj
 - Blood pressure support
 - Methyl prednisolone



- Associated inj
 - priority



soft tissue

- low-velocity :
 - tetanus prophylaxis
 - antibiotic treatment
 - skin debridement.



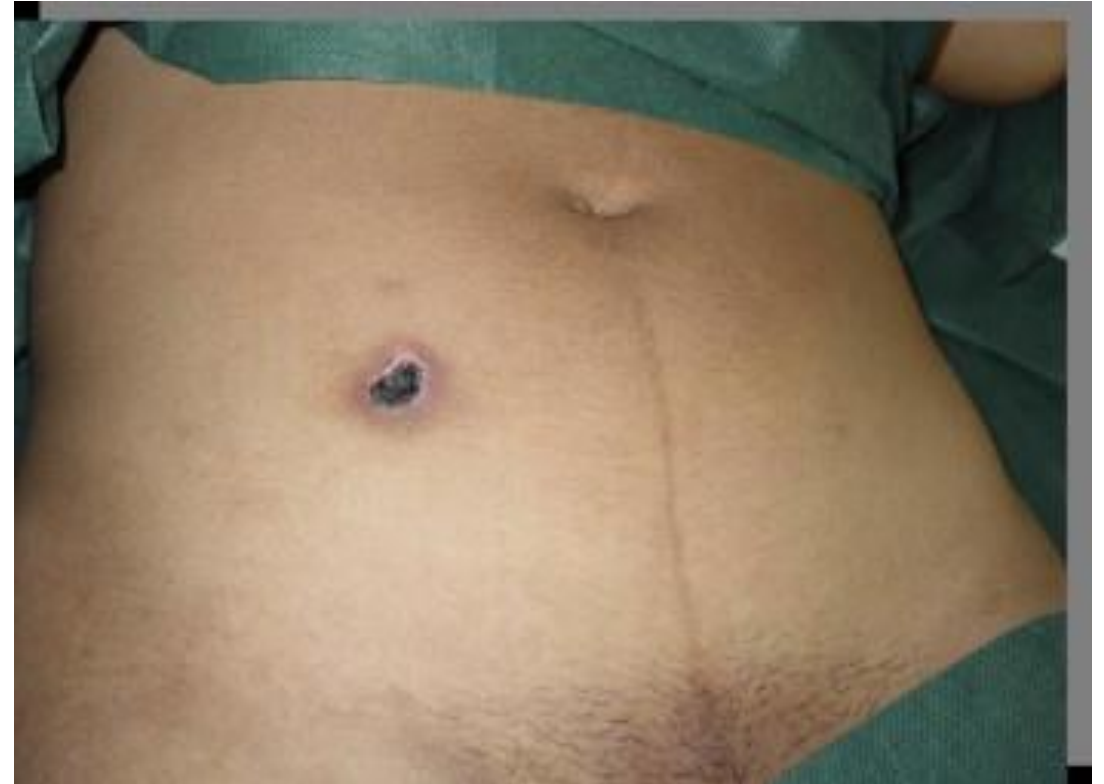
- Tetanus

- Toxoid : 3 dose . > 5 years
- toxoid and immunoglobulin : > 5 years . < 3

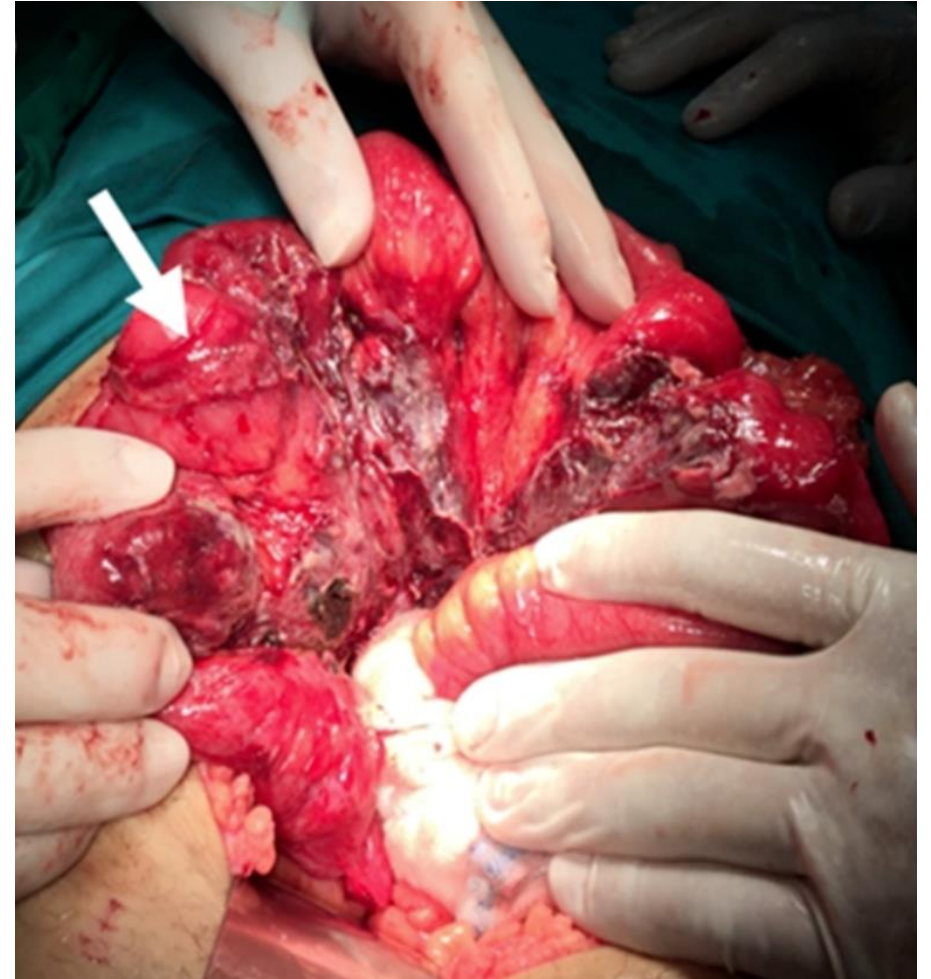


Antibiotics

- Low velocity
 - Sub type a : second-generation cephalosporin . 3 days : skin flora
 - Subtype b : least 7 days
 - teicoplanin 400mg twice daily, amikacin, 750mg daily for 5 days. metronidazole at a dosage of 500 mg three times daily



- High velocity
 - Longer antibiotics
 - Extensive debridement



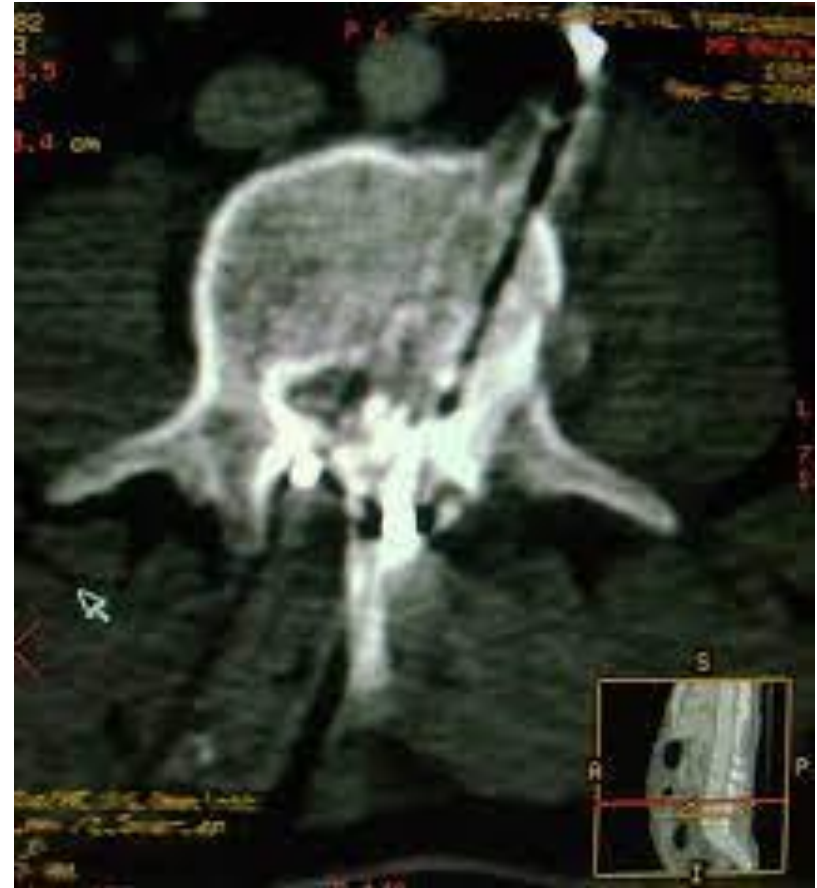
Surgical indications

- Spinal Stability
 - low-velocity
 - Stable
 - Even plc
 - High velocity



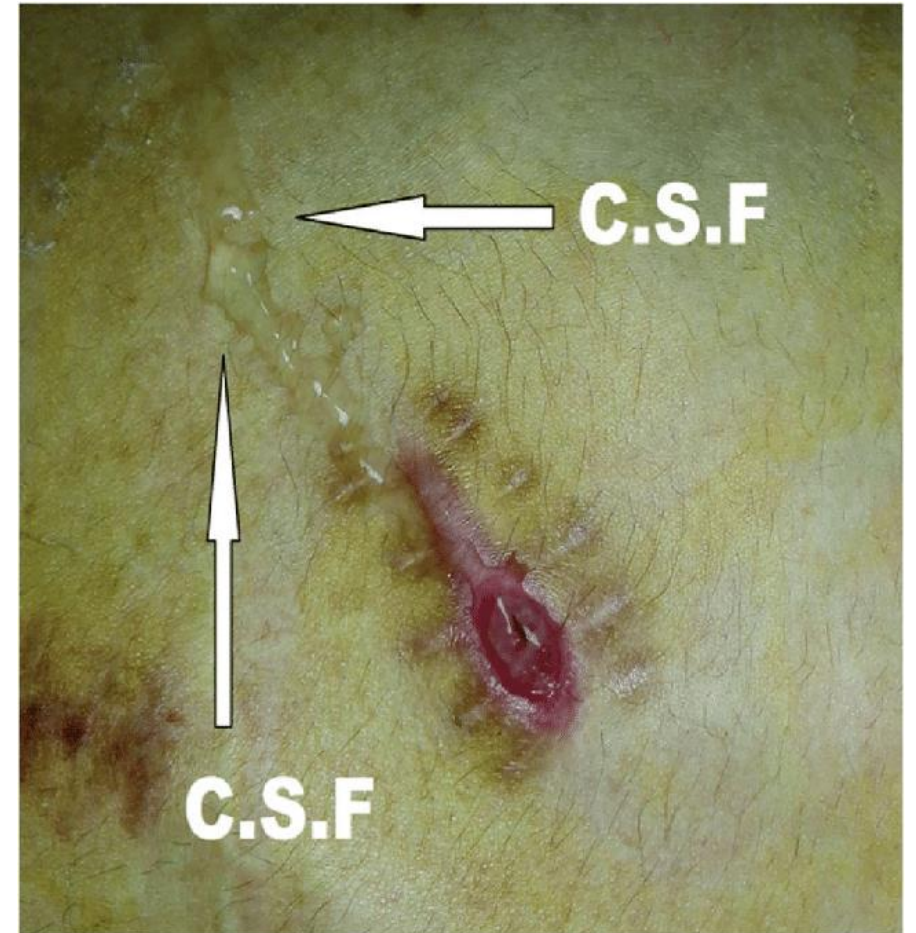
Figure 4. Bullet in the spine at level T12.

- Neurologic Injury
 - Surgical indication
 - incomplete
 - progressive neurologic deficits
 - compressive lesion such as bone, disc material, epidural hematoma, or bullet fragment
 - complete



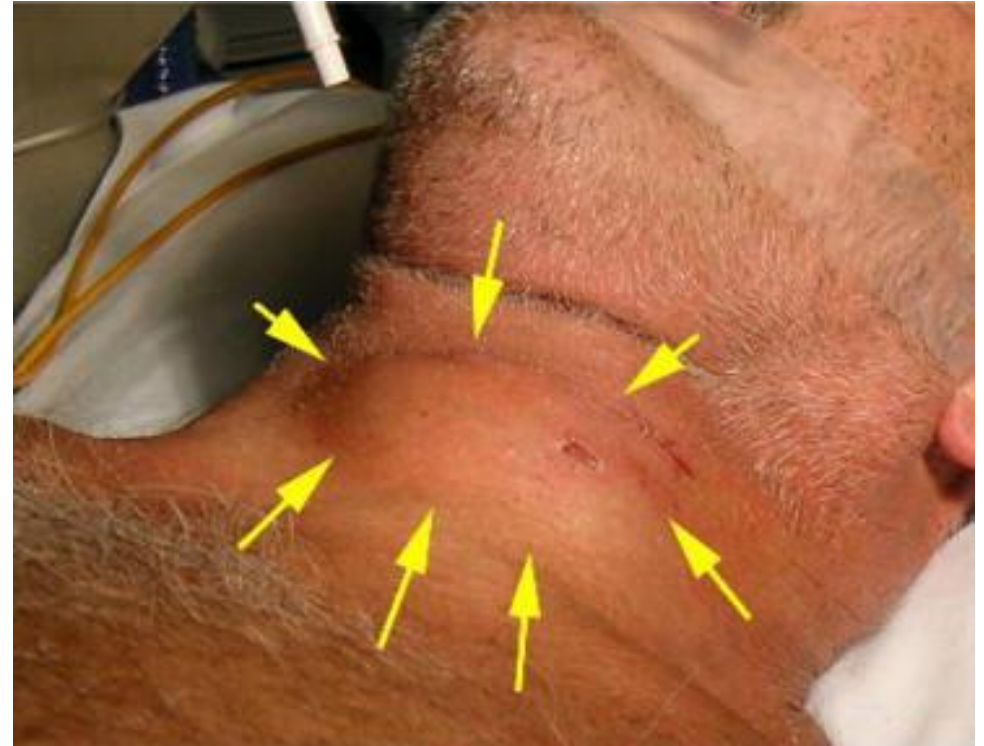
- CSF Leakage

- complications
- Fistula
- meningitis
- subdural hematoma
- tonsillar herniation



- Symptoms

- Headache
- diplopia
- nausea
- even without drainage



- Bullet Fragments
 1. neurologic decompression
 2. local toxicity
 3. systemic toxicity



- Compression
 - T12 and L4
 - above T11



- Local Toxicity

- copper bullet : neurotoxicity
 - within the spinal canal
- others



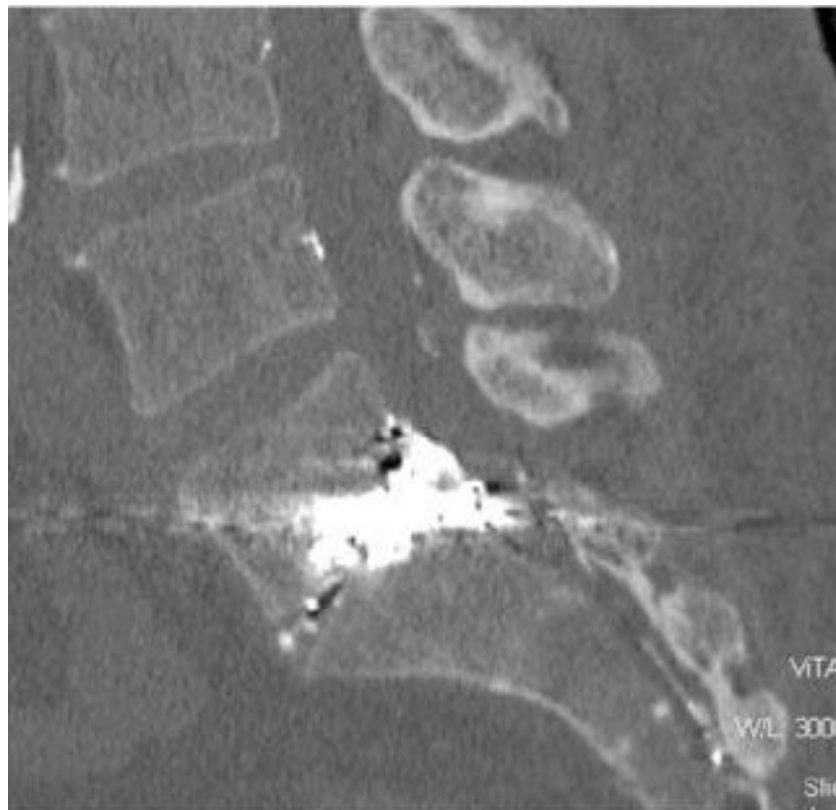
- Systemic Toxicity
- Lead
- Symptoms :
 - arthralgias, myalgias,
 - hypertension, abdominal pain,
 - headache, difficulties with
 - memory or concentration,
 - lethargy, mood disorders



- Surgical indication
 - soft tissues : fibrous tissue
 - CSF : not corrosive
 - synovial fluid corrosive



- intervertebral disc : bursa-like fluid
- discogram effect



- serum lead level
 - > 10 mcg/dL



Late neurologic worsening

- syringomyelia (60%)
- arachnoid cyst formation (25%)
- infection (10%)
- bullet migration
- Lead toxicity



Take home message

- Type of weapon is important
- Spine is more stable and cord damage is more severe in penetrating injuries
- MRI is not contraindicated
- Surgery for bullet removal usually is not necessary
- Late neurologic worsening is possible