Infection of bones and joints

Rozkydal, Z.

Infection of bones- osteomyelitis

Osteomyelitis occurs often in childhood

Infection in compound fractures type II. III.
7- 20 %

Infection in elective orthopaedic procedures
0,5-3 %

Periprosthetic infection – primary up to 2%
revision 2-14 %

Acute haemotogenous osteomyelitis

- Bacteria:

  Gram- positive and Gram- negative

  with aerobic or anaerobic metabolism

Acute haemotogenous osteomyelitis

- Gram positive:
- Staphylococcus aureus in 80 %
  Streptococcus pyogenes
- Staphylococcus epidermidis
- Haemofilus influenzae

Acute haemotogenous osteomyelitis

- Gram negative:
- Escherichia coli
- Klebsiella
- Proteus vulgaris
- Pseudomononas aeruginosa
- Salmonella, Shigella
- Clostridium

MRSA methicilin resistant staphylococcus aureus
MRSE methicilin resistant staphylococcus epidermidis
Multiresistant G- bacteria
Clostridium difficile

The way of infection

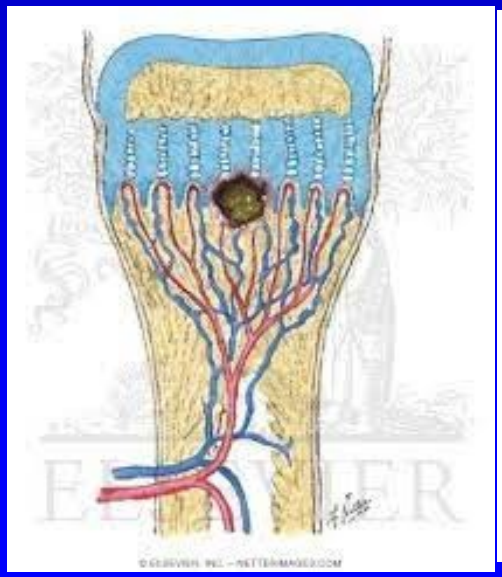
- Haematogenous seeding
  from infection focus in the body

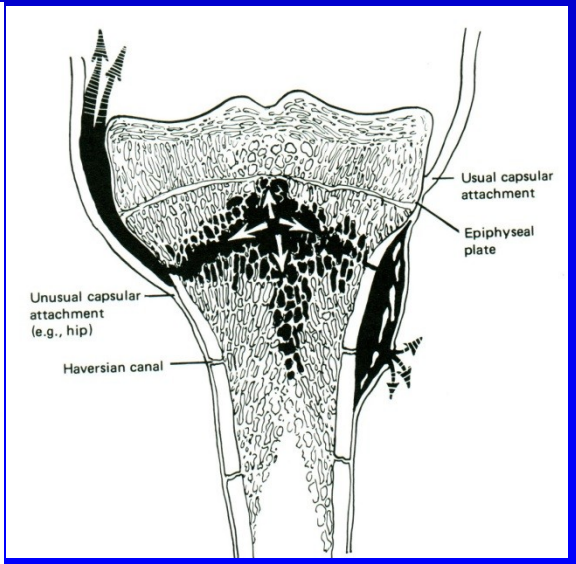
- Suppurative focus in the vicinity (phlegmona, absces, Batson plexus in urinary tract infection)

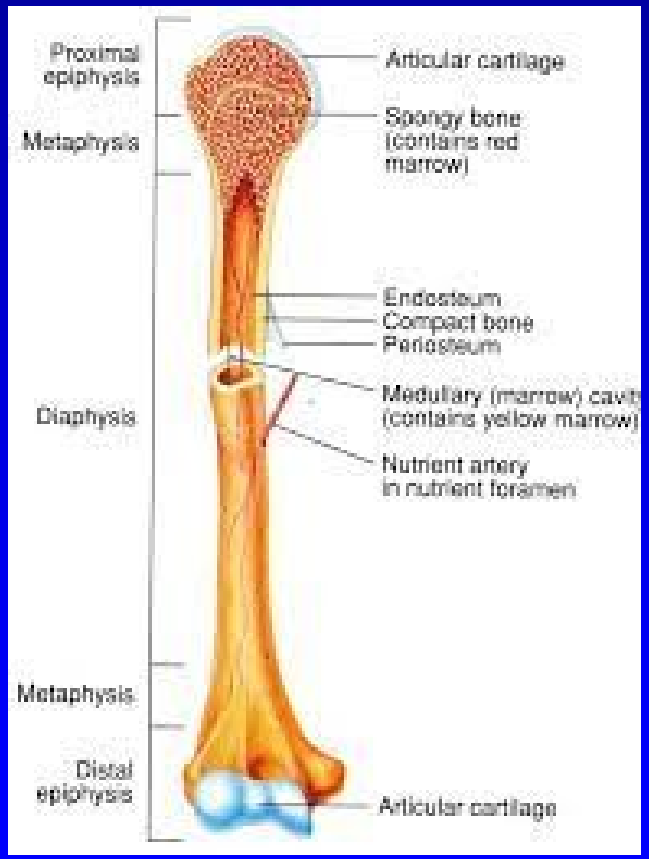
- Direct transport (open fracture)

Acute haemotogenous osteomyelitis

Typical localisation -
Metaphysis of long bone
More often in children



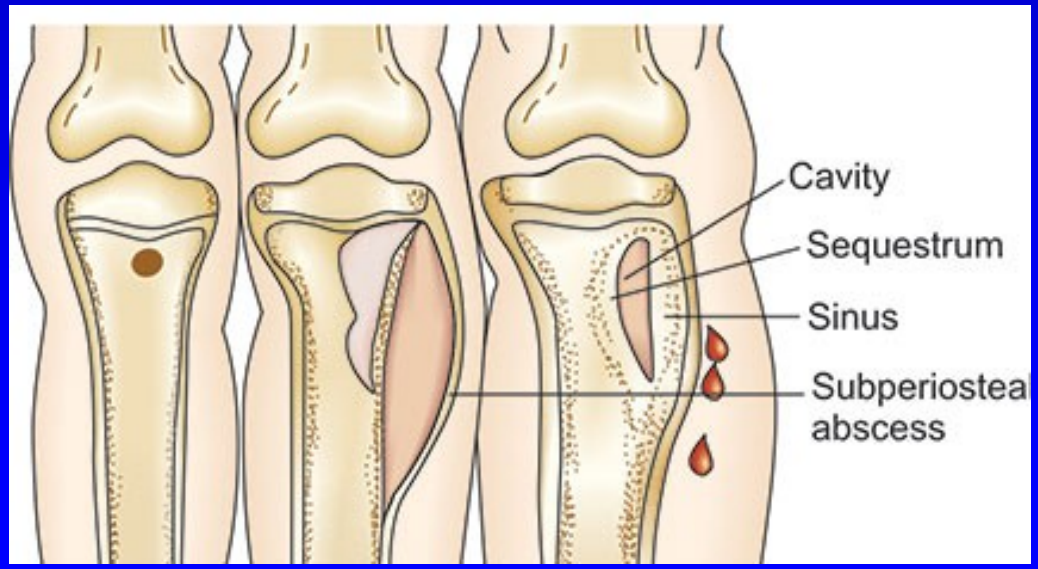




Pathological anatomy

Hyperemia, swelling, pus
Subperiostal abscess
Disturbace in circulation, infective trombosis
Osteolytic lesion

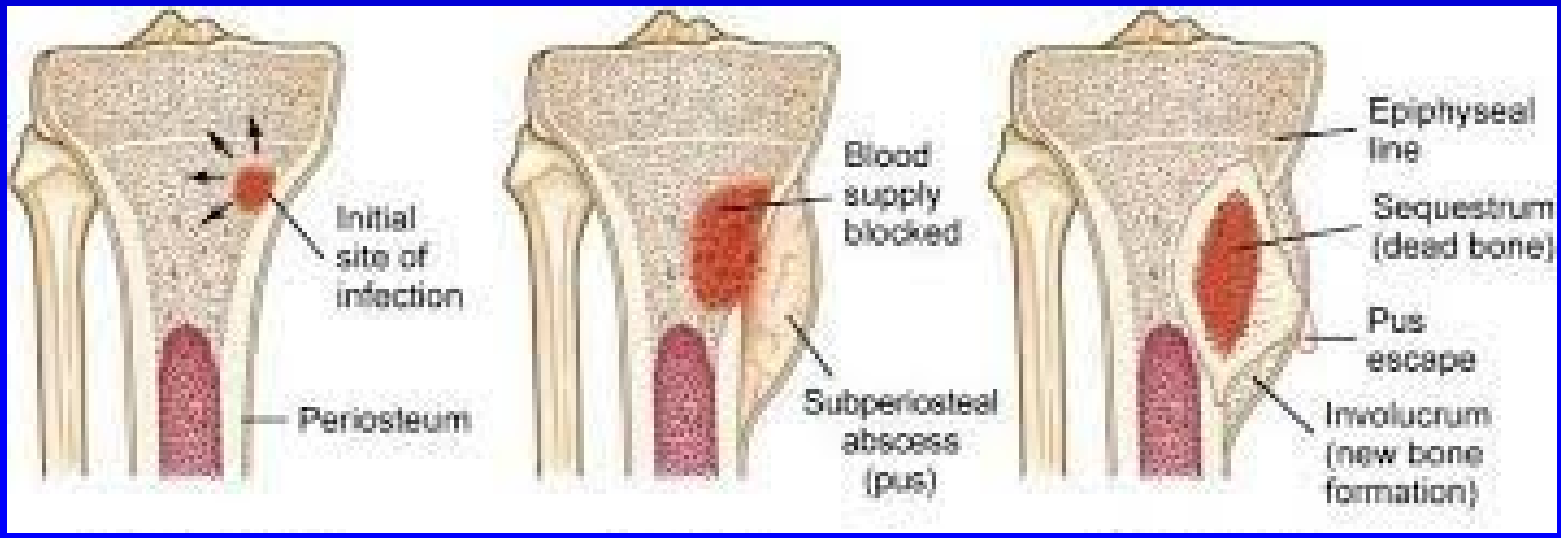
Necrosis of bone, sequestra
Sequestra of the whole diaphysis - involucrum
Destruction of growth plate
Spread into the lungs and other bones
Sepsis



Pathological anatomy

Hyperemia, swelling, pus
Subperiostal abscess
Disturbace in circulation, infective trombosis
Osteolytic lesion

Necrosis of bone, sequestra
Sequestra of the whole diaphysis - involucrum
Destruction of growth plate
Spread into the lungs and other bones
Sepsis



Local symptoms:

Rubor, calor, dolor, tumor, functio laesa

Tenderness, fistula, discharge

Systemic symptoms:

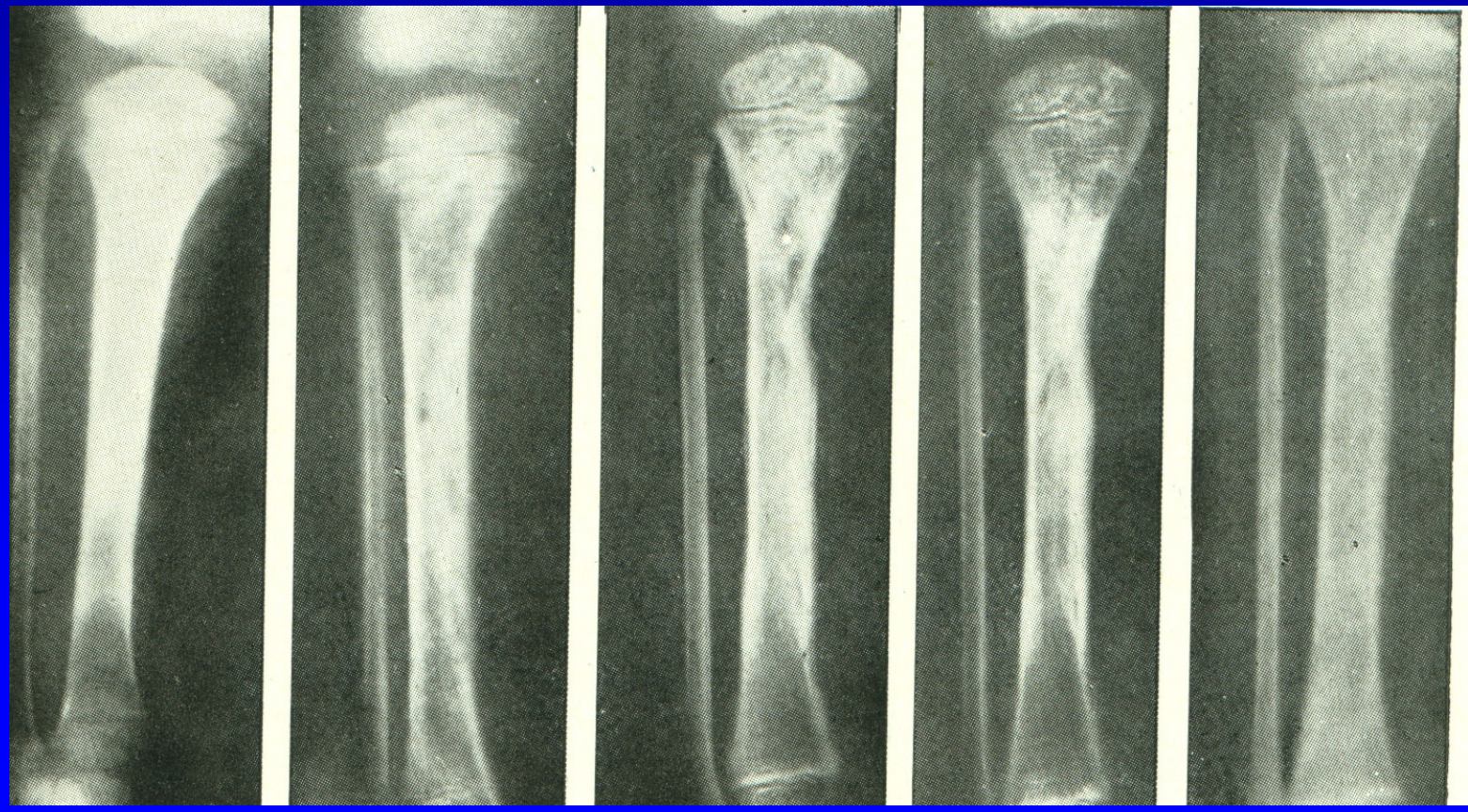
Fever (septic fever – two degress between in the morning and in the afternoon)
Shivering
Fatique
Tachycardia, tachyponoe,hypotension
Nausea, stomach problems

Laboratory tests

- Leucocytosis
- ESR
- CRP
- Bacteriological examination from the pus
- Haemoculture
- Differential blood test
- Electrophoresis of proteins
- Metabolic acidosis

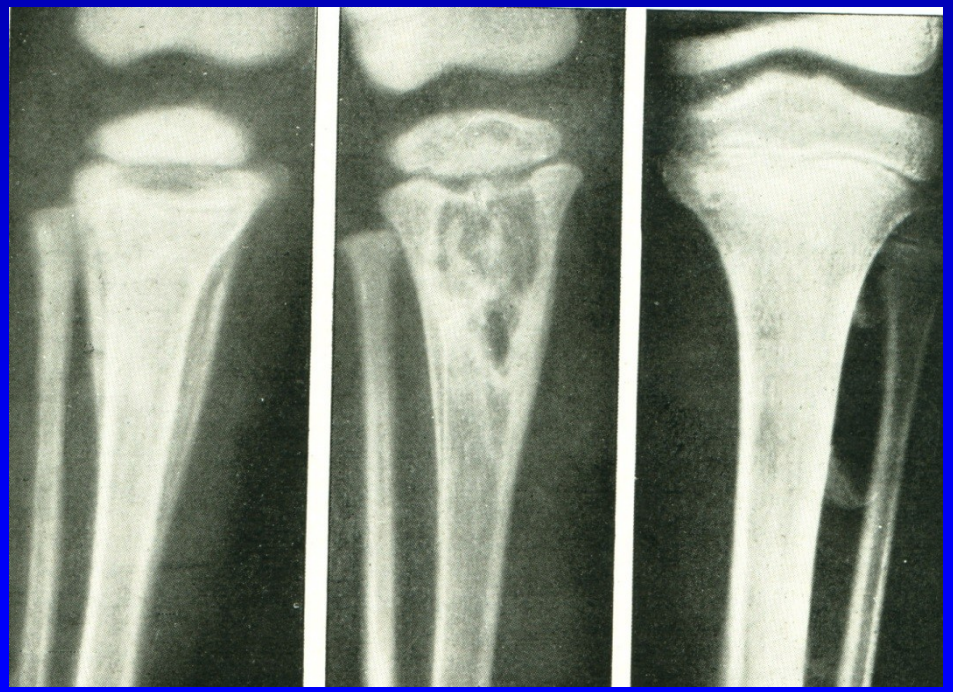
Radiological finding

Swelling of soft tisseue
Irregular rarefaction in bone
Osteolysis in the metaphysis
Elevated periosteum
Sequestra



Radiological finding

Swelling of soft tissues
Irregular rarefaction in bone
Osteolysis in the metaphysis
Elevated periosteum
Sequestra

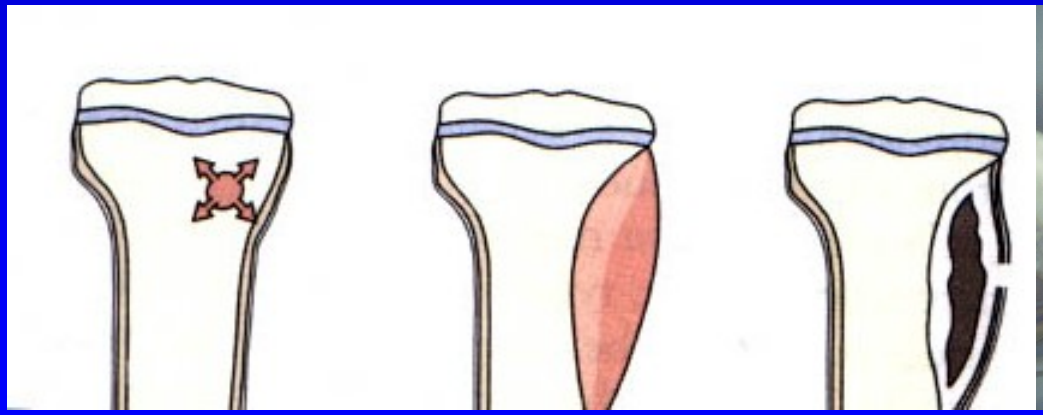


Management

Bed rest, splinting
Analgetics
Antibiotics i.v. for 2 weeks, than oraly 6-8 weeks
Amoxicilin/ ac. clavulanicum
Ciprofloxacin, cefalosporins, dalacin
Gentamycin
Vancomycin - MRSA infection
Change of antibiotics – according sensitivity
to bacteriological examination

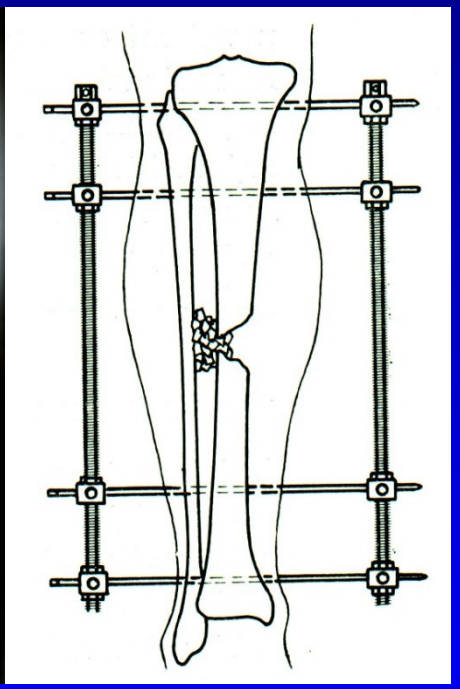
Surgical treatment

Aspiration of the abscess
Drilling of the bone and decompression, curretage
Drainage
Local application of antibiotics
Systemic antibiotics



Posttraumatic osteomyelitis

Antibiotics
Debridement
Jet lavage
Rinsing lavage 7 days
Removal of internal fixation
External fixator
Local application of antibiotics



Chronic osteomyelitis

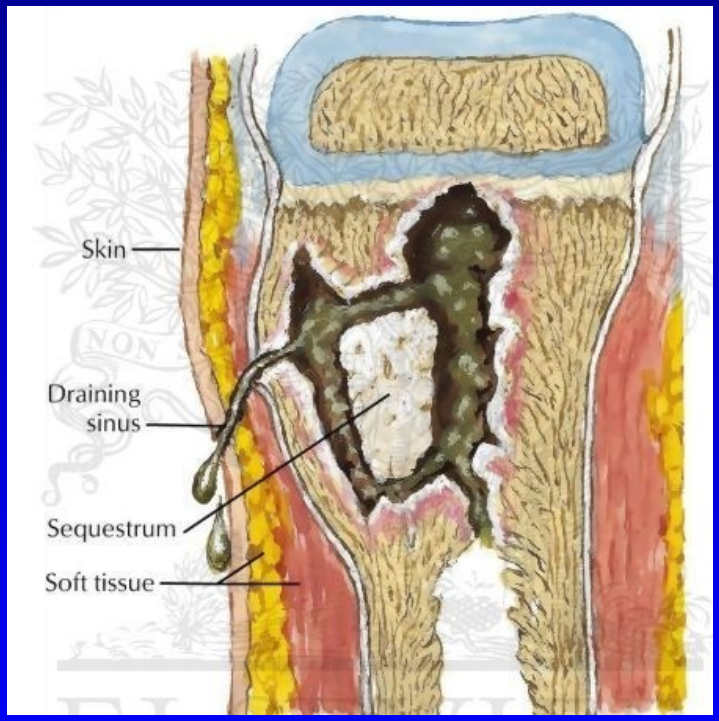
Cause: unsuccesfull treatment of acute stage
imunodeficiency
high virulent organism

Chronic osteomyelitis - pathological anatomy

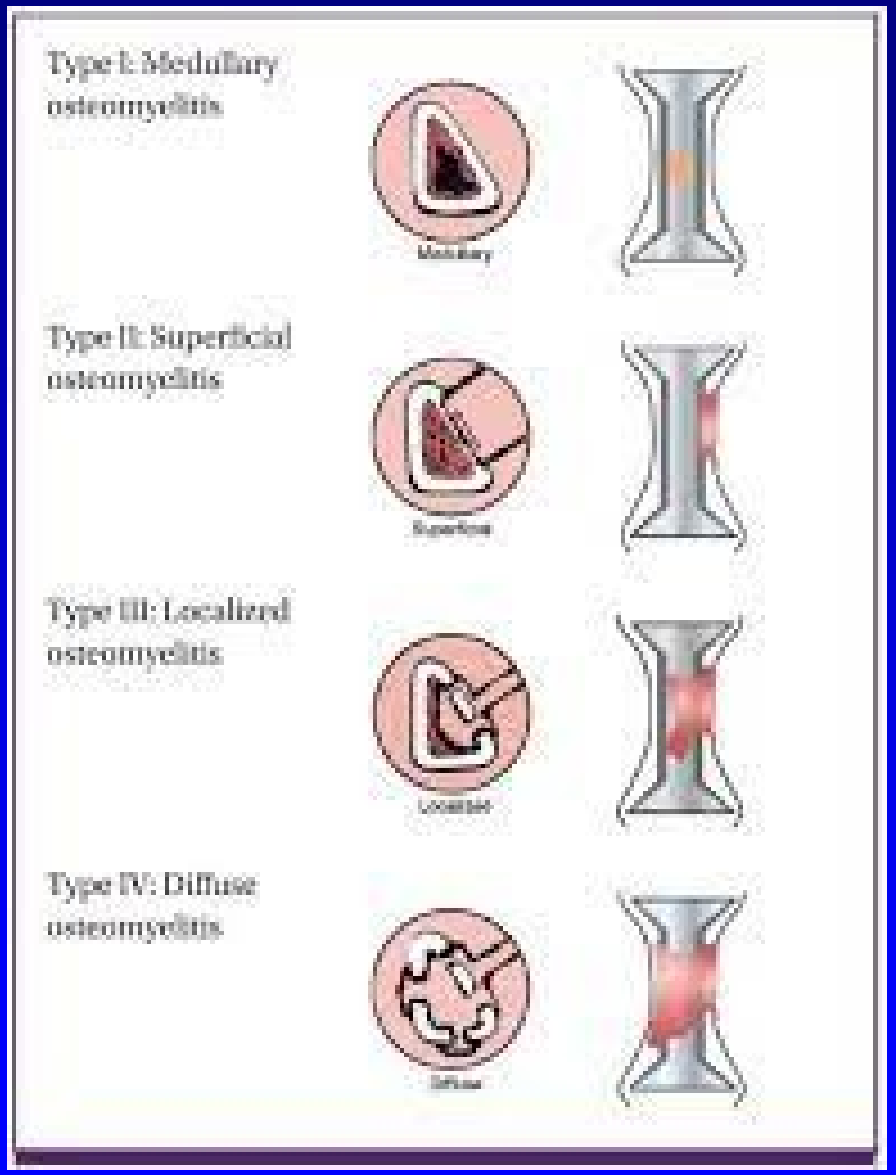
Sequestra
- necrotic bone surrounded by pus and granulation tissue

Pyogenic membrane
Sclerotic surrounding
- prevents revasculation and transport of antibiotics

Diffuse rarefication and osteolysis



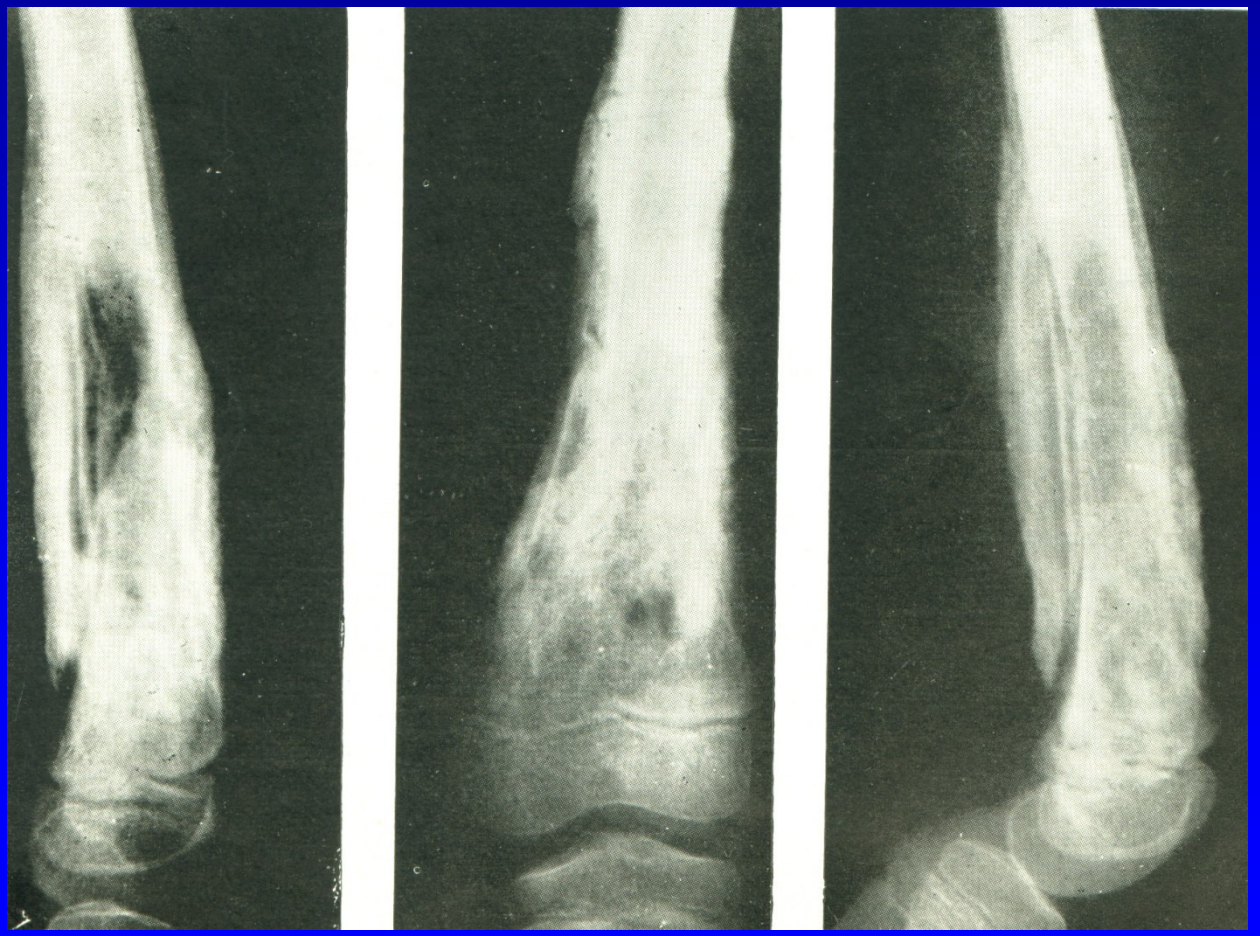
Cierny, Mader classification of chronic osteomyelitis



Symptoms

Pain, tenderness, limited function
Discharging sinuses with small sequestra
Recurrence of acute stage
Fatique
Cachexia

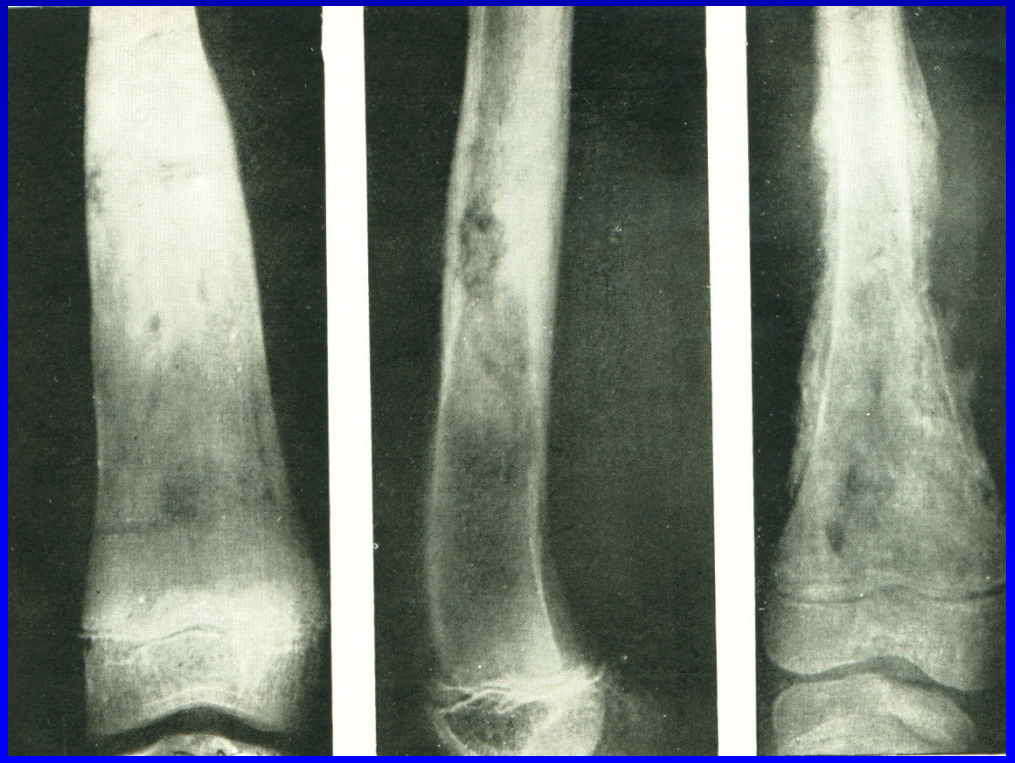
Combination of rarefication and sclerosis of bone
Sequestra
Periosteal apposition of bone



Radiological finding

Combination of rarefaction and sclerosis of bone
Sequestra
Periosteal apposition of bone

Fistulography
MRI
CT



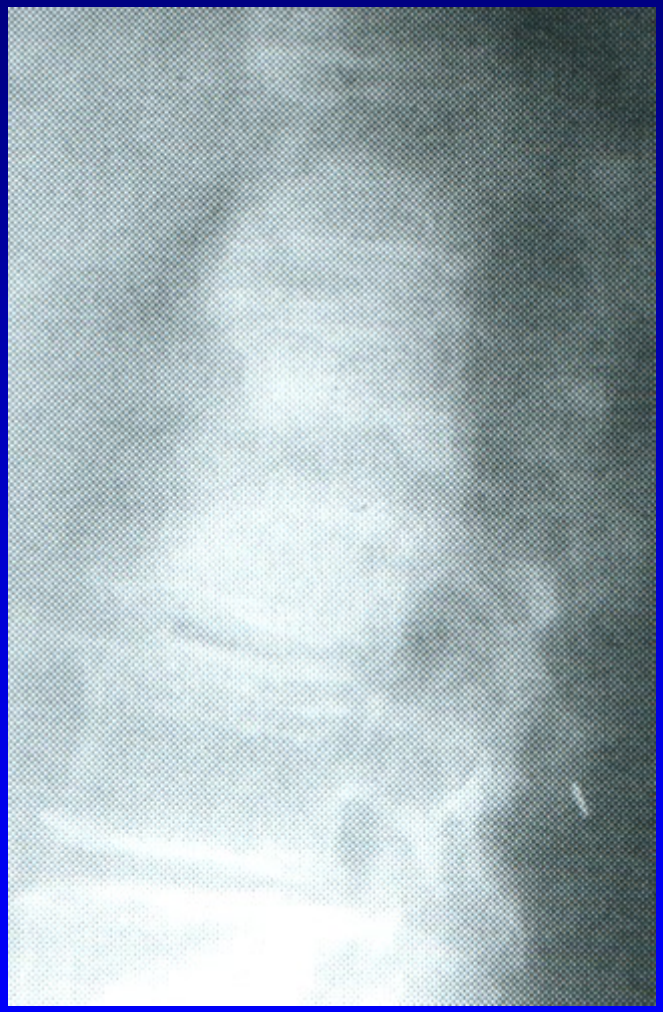
Management of chronic osteomyelitis

The rule: ubi pus, ibi evacua !
Sequestrotomy, lavage
Local antibiotics – garamycin
Systemic antibiotics
Support of imunity

Seldom: conservative treatment

Osteomyelitis of the vertebra - spondylodiscitis

Slow onset
Fewer
Back ache
Limited movements
Tenderness
Spasm of paravertebral muscles



Radiological finding

Swelling of soft tissue
Erosion of the end plates
Osteolysis and destruction
Narrowing of intervertebral space

MRI

Scintigraphy

Management

Bed rest, orthesis
Antibiotics i.v., after 2-3 weeks oraly 6-10 weeks
If not succesul – aspiration from the abscess
Drainage, debridement, sequestrotomy
Antibiotics localy, oraly

Differencial diagnostics

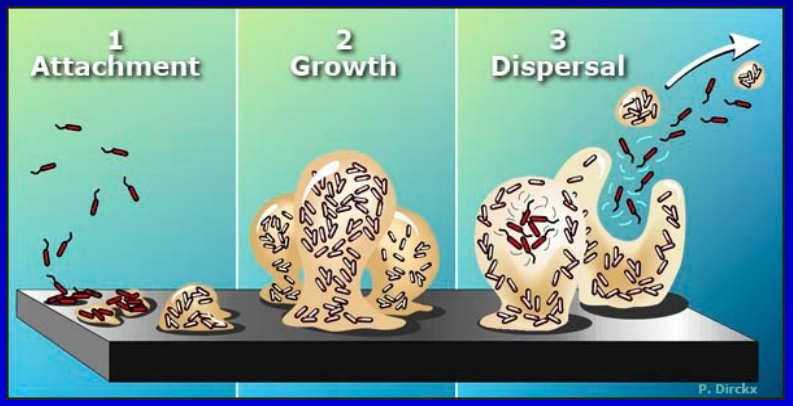
Tumors
Tumor like lesions
Stress fractures
Entesopathies

Clostridium difficile

After antibiotic therapy- postantibiotic colitis
- aminopenicilins, fluorochinolons, cefalosporins.
Toxin A- enterotoxin, efect on GI mucose membrane
Toxin B- cytotoxin, 10-100 more efective
Risk of colonisation of GI during hospitalisation 10-20 %
Causes severe enterocolitis with diarrhoea, sepsis
Management: Metronidazol, Vancomycin, Meropenem

Periprosthetic infection

St. aureus
St. coagulase negative
Streptoccoci
Enteroccoci
MRSA, MRSE
Polyresistant G- bacteria
to betalactam antibiotics



Biofilm

Planctonic and sesssile forms
Bacteria- race for surface
- Glycocalyx (mucouse substance of glycoproteins)
Leads to high resistance to antibodies and antibiotics

Biofilm

Adhesion of bacteria
- reversible

Exopolymers
- glycolalyx
- extracelular matrix
irreversible

Dispersal

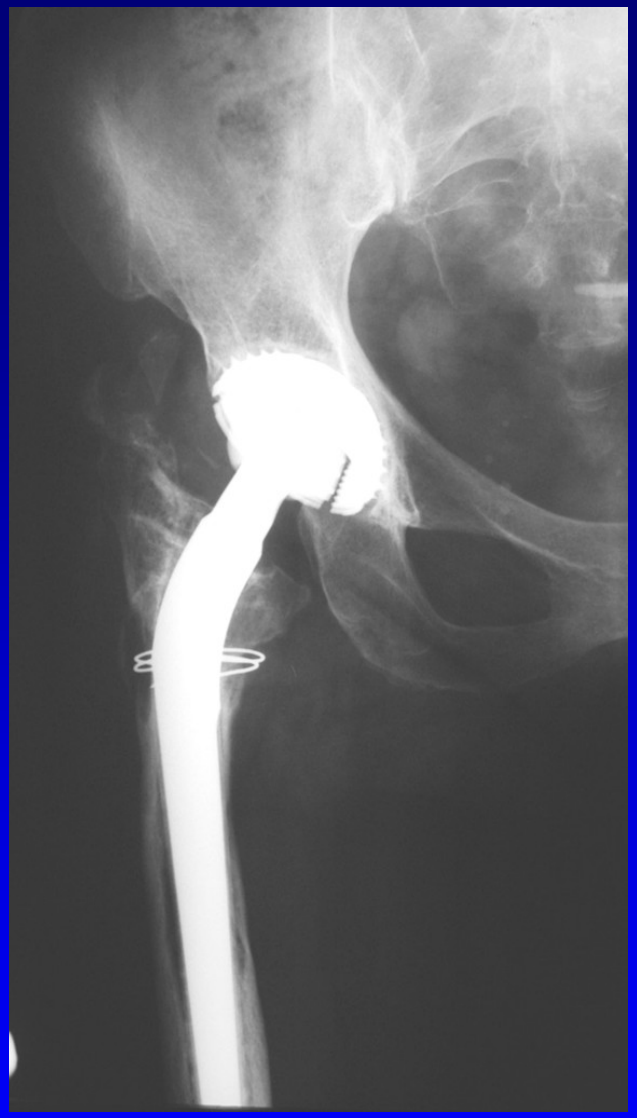
Periprosthetic infection - diagnosis

Symptoms:- pain, oedema, readness, fistula
loss of function
Labor: CRP, leu, ESR
bacteriological ex.
X-ray- osteolysis, rdiolucency
USG-soft tissues
Scintigraphy Tc-99

Perioperative finding- liquid, pus
Sonication of implant
Bacteriological examination
Prolonged cultivation 5-7 dayes

Therapy in THA

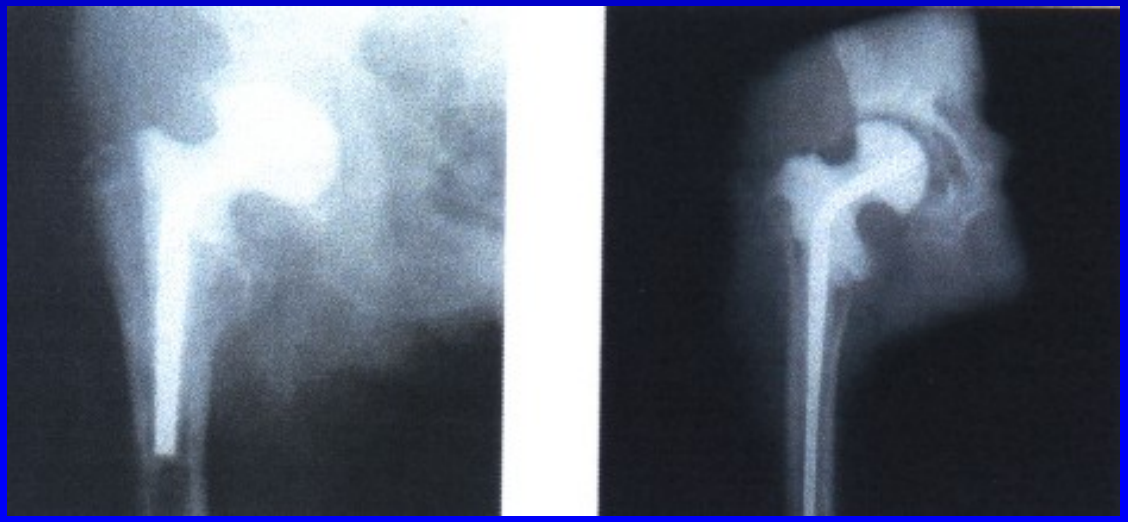
Debridement, synovectomy
One stage reimplantation
Two stages reimplantation (spacer)
Resection arthroplasty
Long antibiotic supression



Spacers

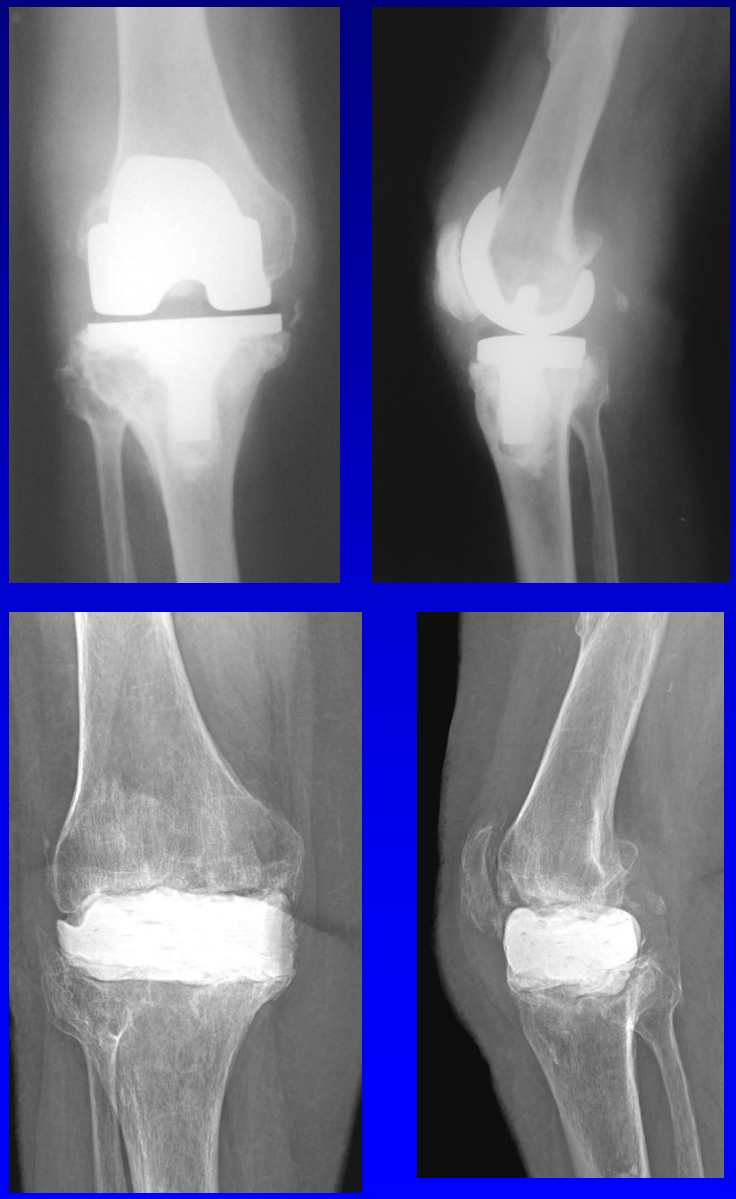
Better movement
Better walking
Correct distance
Release of antibiotics
- 90 % of all pathogens
+ MRSA, MRSA, Entero
+ Enteroccoci

Easier revision



Therapy in TKA

- Up to 2 weeks: debridement,
  lavage, synovectomy
- Later: one stage revision
  two stage revision
  Prostalac

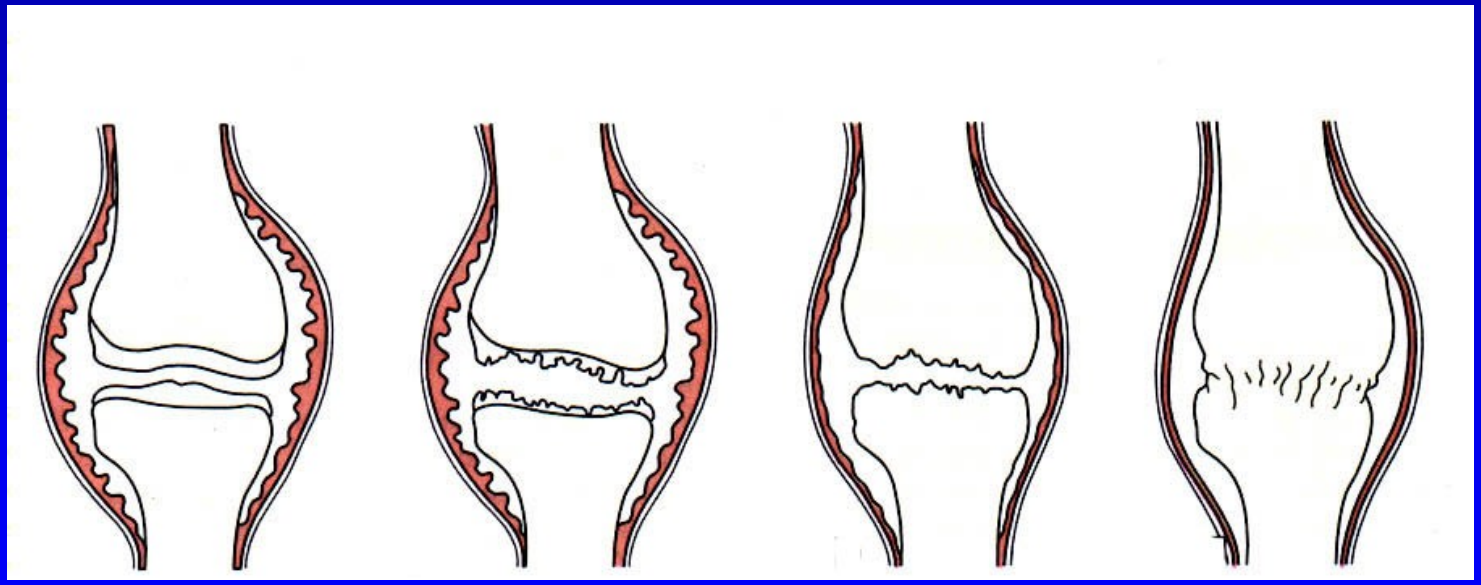


Consequences of chronic inflamation of bone

Recurrence of infection
Growth arrest – shortening of the extremity
Weaknes of muscles
Joint contracture
Septic arthritis
Amyloidosis
Epidermoid carcinoma
Patological fracture
Sepsis

Pyogenic (septic) arthritis

Suppurative arthritis of the joint



Septic arthritis

- Gram positive:
- Staphylococcus aureus
- Streptococcus pyogenes
- Staphylococcus epidermidis
- Haemofilus influenzae
- Gonococcus
- Pneumococcus

Septic arthritis

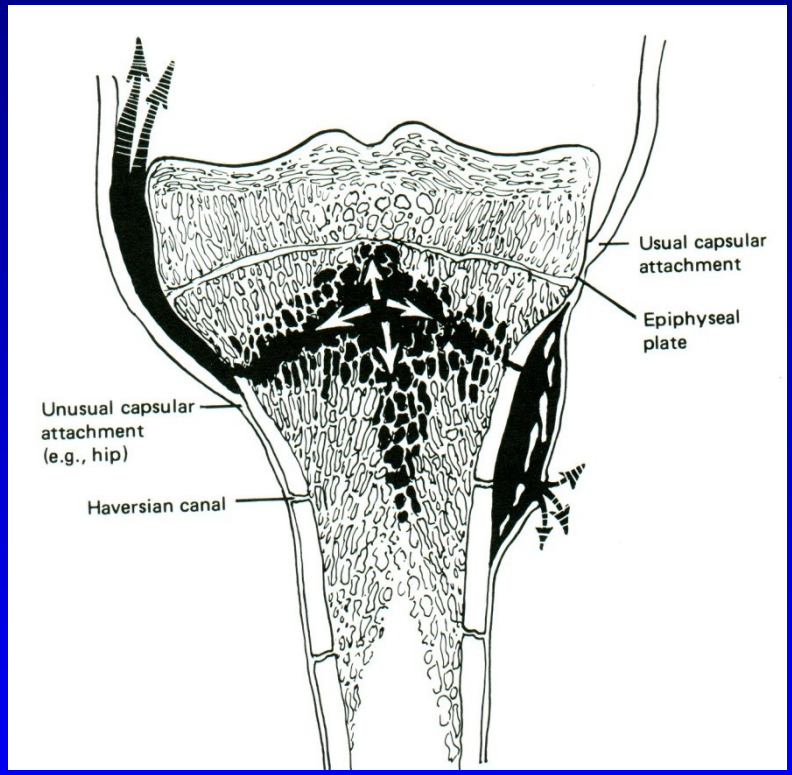
- Gram negative :
- Escherichia coli
- Klebsiella
- Proteus Hauseri
- Pseudomononas aeruginosa
- Salmonella

The way of infection

Haemotogenous seeding

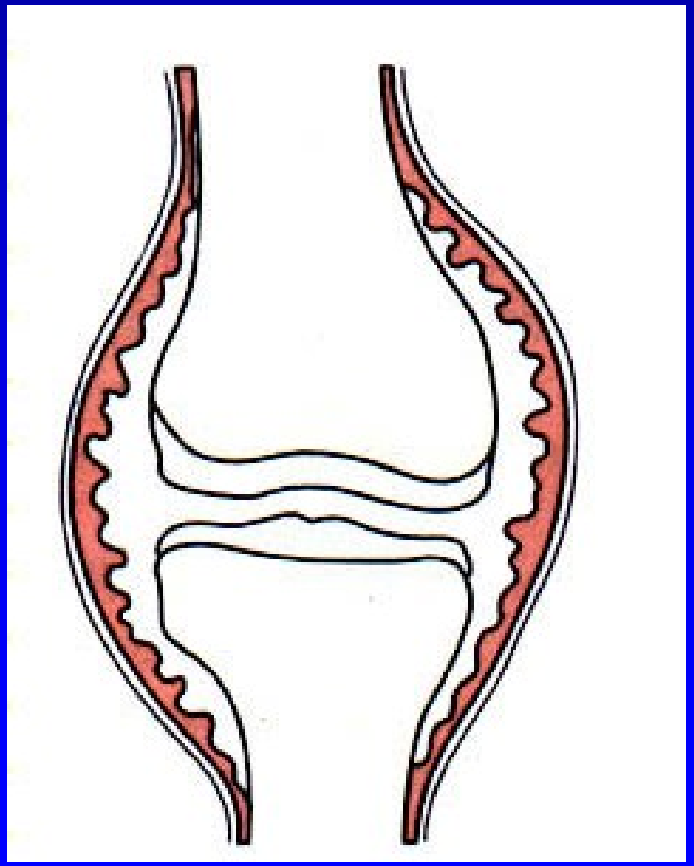
From metaphysis – hip, elbow

Direct way-
by aspiration, surgery, trauma



Pathological anatomy

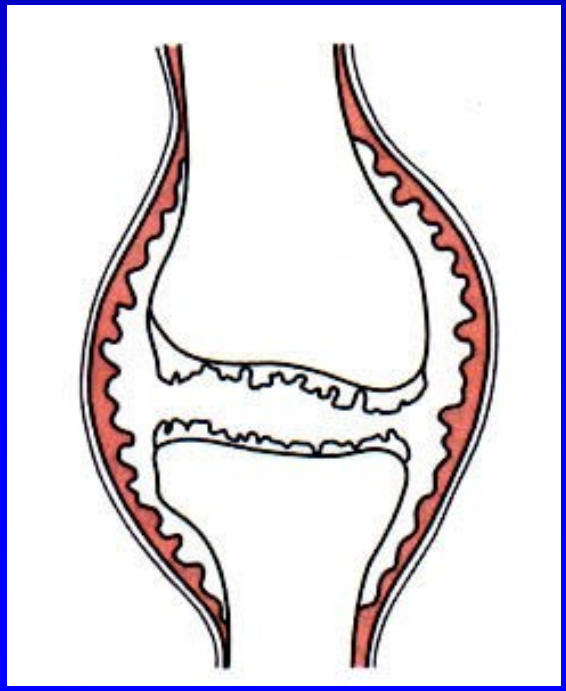
1. Synovitis purulenta
   synovial membrane is thick, pus



Pathological anatomy

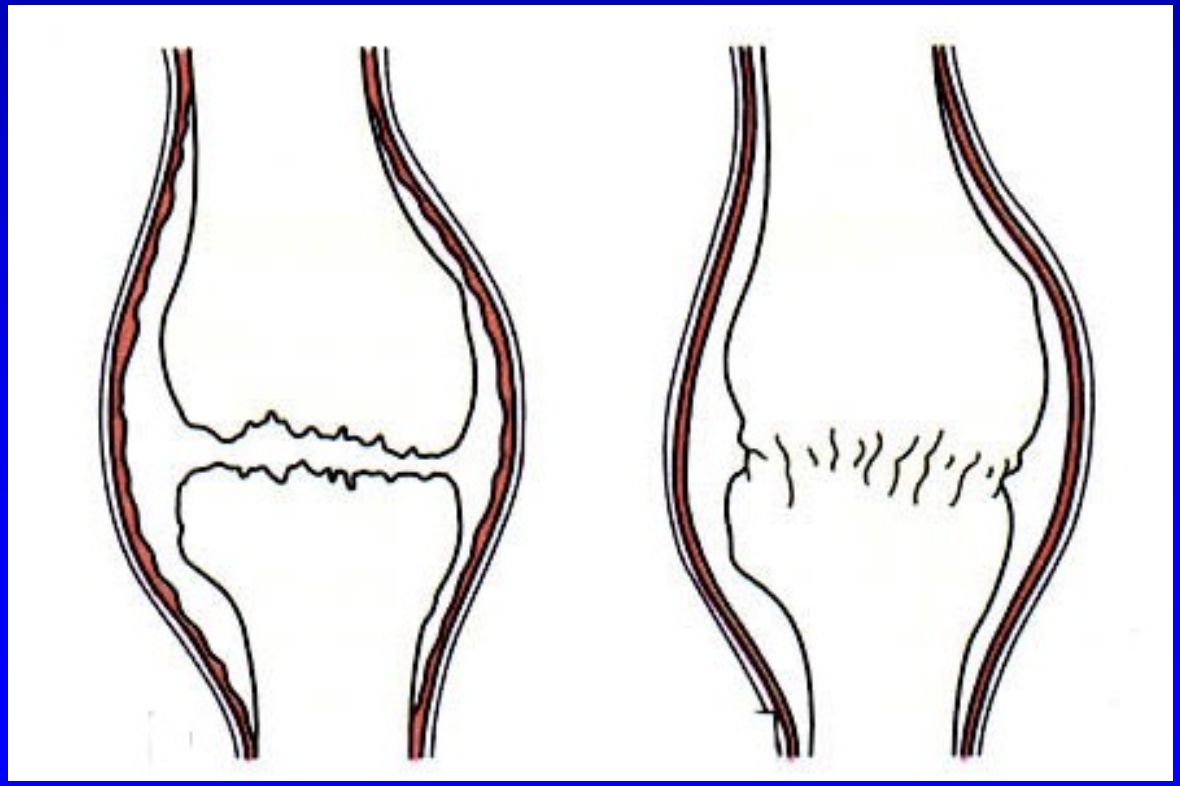
2. Phlegmone of joint capsule

   The whole joint capsule is involved, pus and granulation tissue, erosions of the cartilage, pannus formation



Pathological anatomy

3. Panarthritis. Inflamation involves the joint and periarticular tissues, abscesses, destruction of cartilage, fibrous or osseous ancylosis



Local symptoms

Rubor, calor, dolor, tumor, functio laesa
tenderness, discharge from sinuses

Systemic symptoms

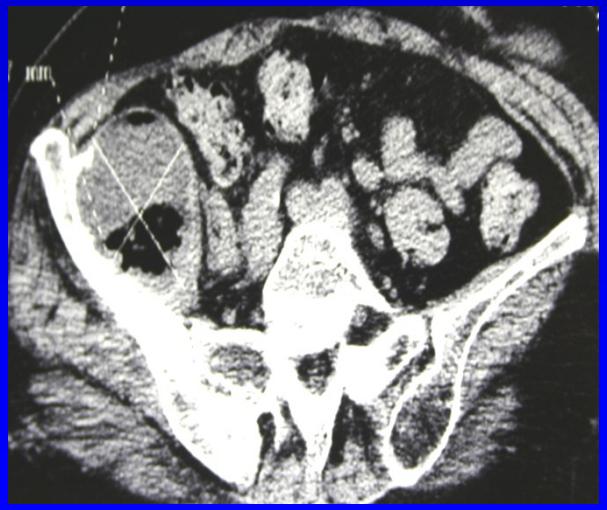
Fever (septic fever – two degress between in the morning and in the afternoon)
Shivering
Fatique
Tachycardia, tachypnoe, hypotension
Nausea, stomach problems

Newborn septic arthritis

X-ray:
Soft tissue swelling
Widening of joint space
Pathological subluxation
Periostal thickening
Rarefication of epiphysis and metaphysis
Later on narrowing of joint space

Adult septic arthritis

X-ray:
Soft tissue swelling
Widening of joint space
Pathological subluxation
Periostal thickening
Rarefaction of epiphysis and metaphysis
Later on narrowing of joint space

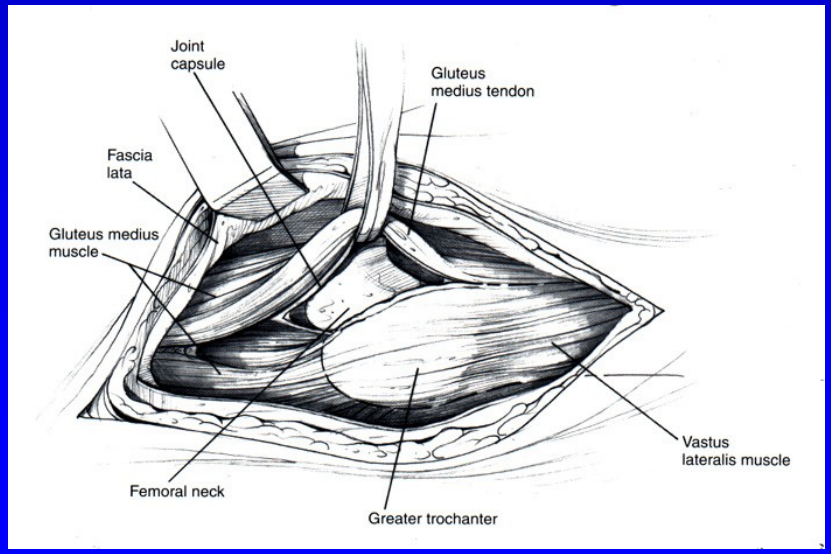


Laboratory tests

- Leucocytosis
- ESR
- CRP
- Differential blood test
- Electrophoresis of proteins
- Metabolic acdosis
- Bacteriological examination from the pus
- Haemoculture

Management

Aspiration
Splinting, analgetics
Antibiotics i.v., after 2 weeks oraly 6-8 weeks
Arthroscopy and lavage
Incision and drainage



Consequences

Osteoarthritis
Epiphyseal destruction
Necrosis
Disturbace of growth plate
Ancylosis
Subluxation or dislocation
Sepsis

Tuberculosis- TB

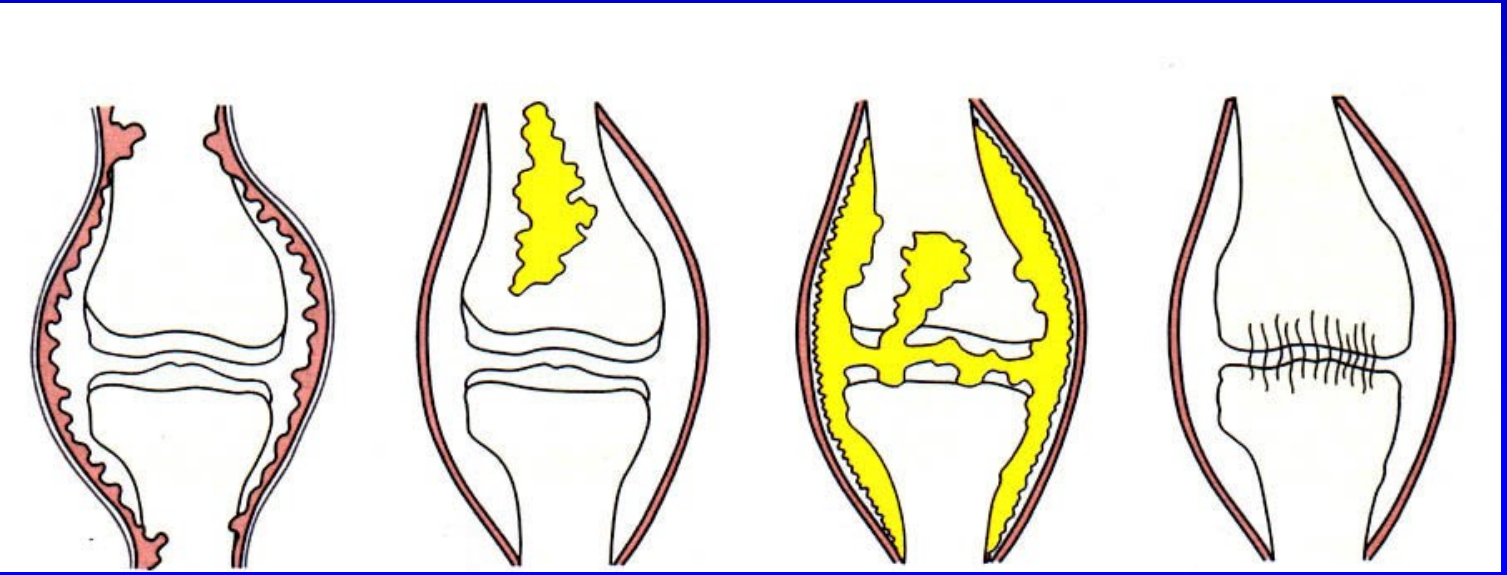
Granuloma formations

Nodes 1-2 mm connecting together

The cause- Mycobacterium tuberculosis

Mycobacterium bovis

Haemotogenous seeding (from lungs)



Pathological anatomy

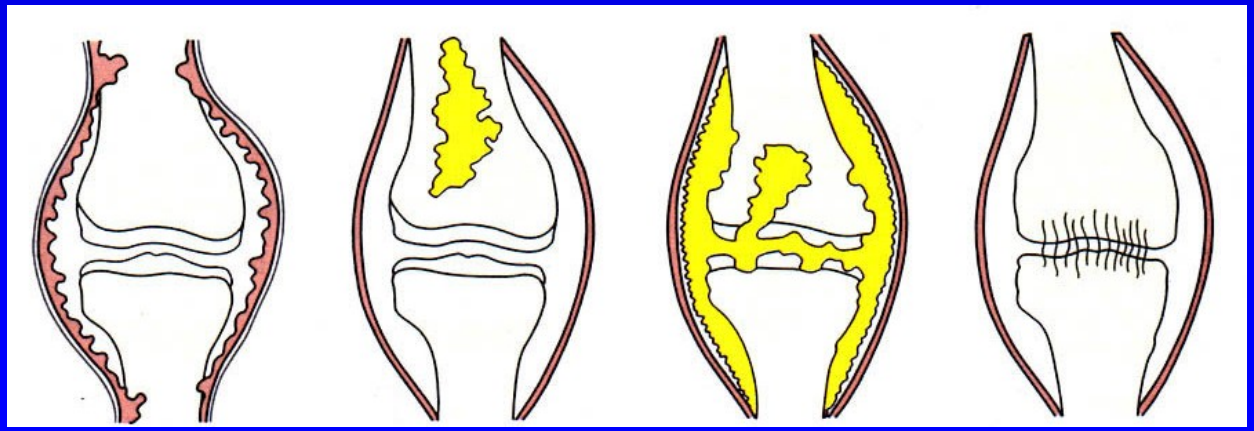
1. Proliferative form (tbc granuloma, fungus)
2. Exsudative form (caseation, hydrops, empyema)

Miliar TB nodes:

Langerhans cells (with Mycobacteria)

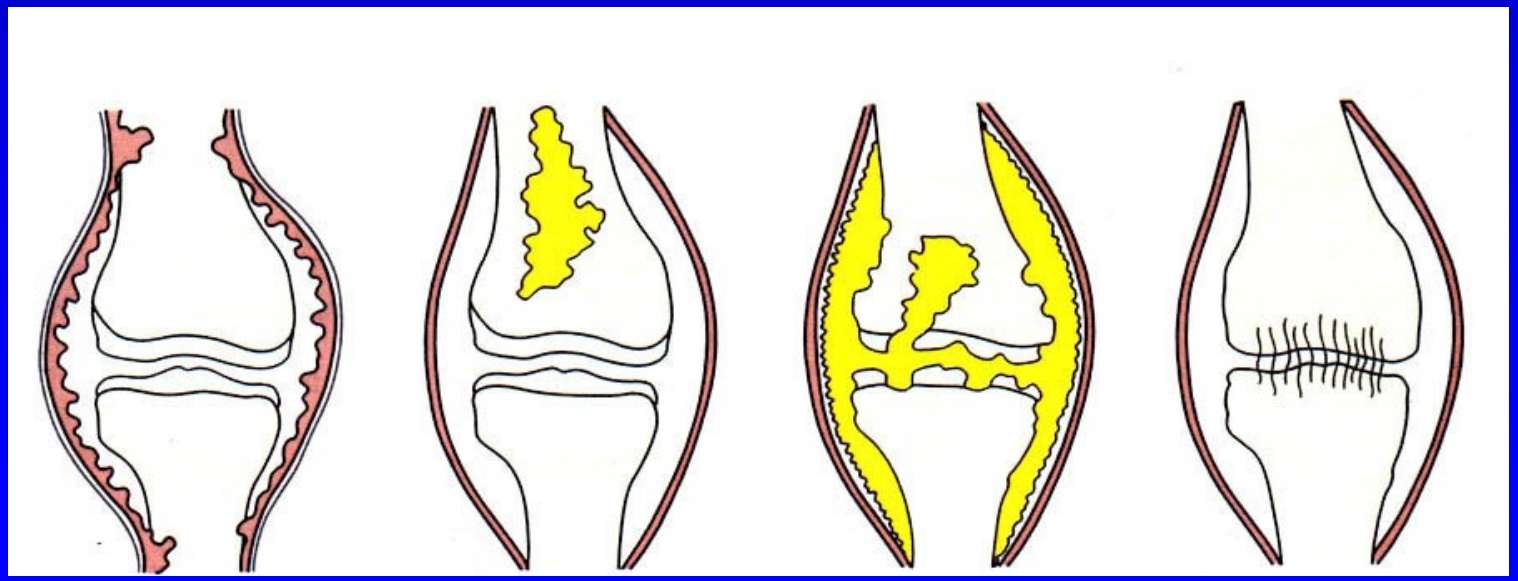
Epiteloid celles, lymfoid cells

Nodes form TB granuloma

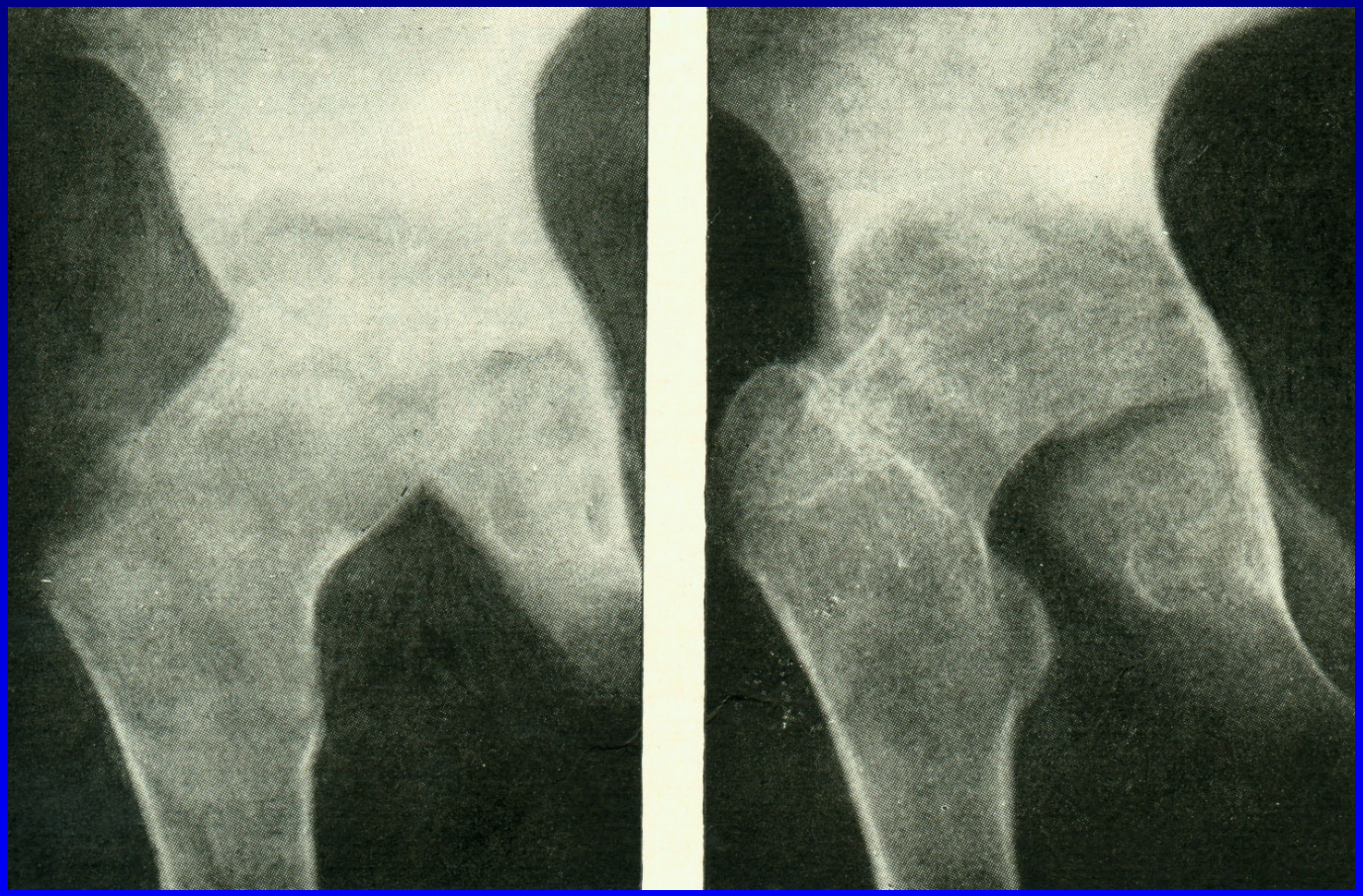


Pathological anatomy

Cold absces
Hydrops
Fungus
Starts as synovitis or spreads from epiphysis
Slow progression
Destruction of cartilage
Fibrous or osseous ankylosis

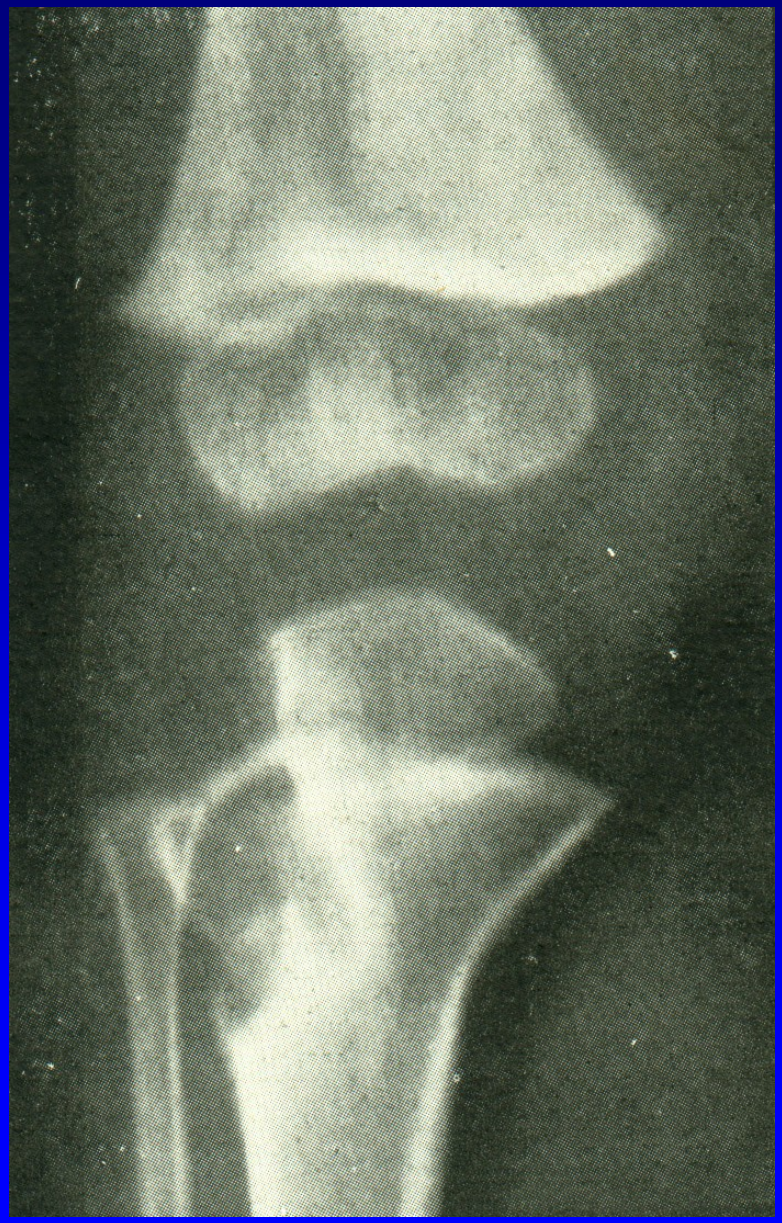


TB coxitis

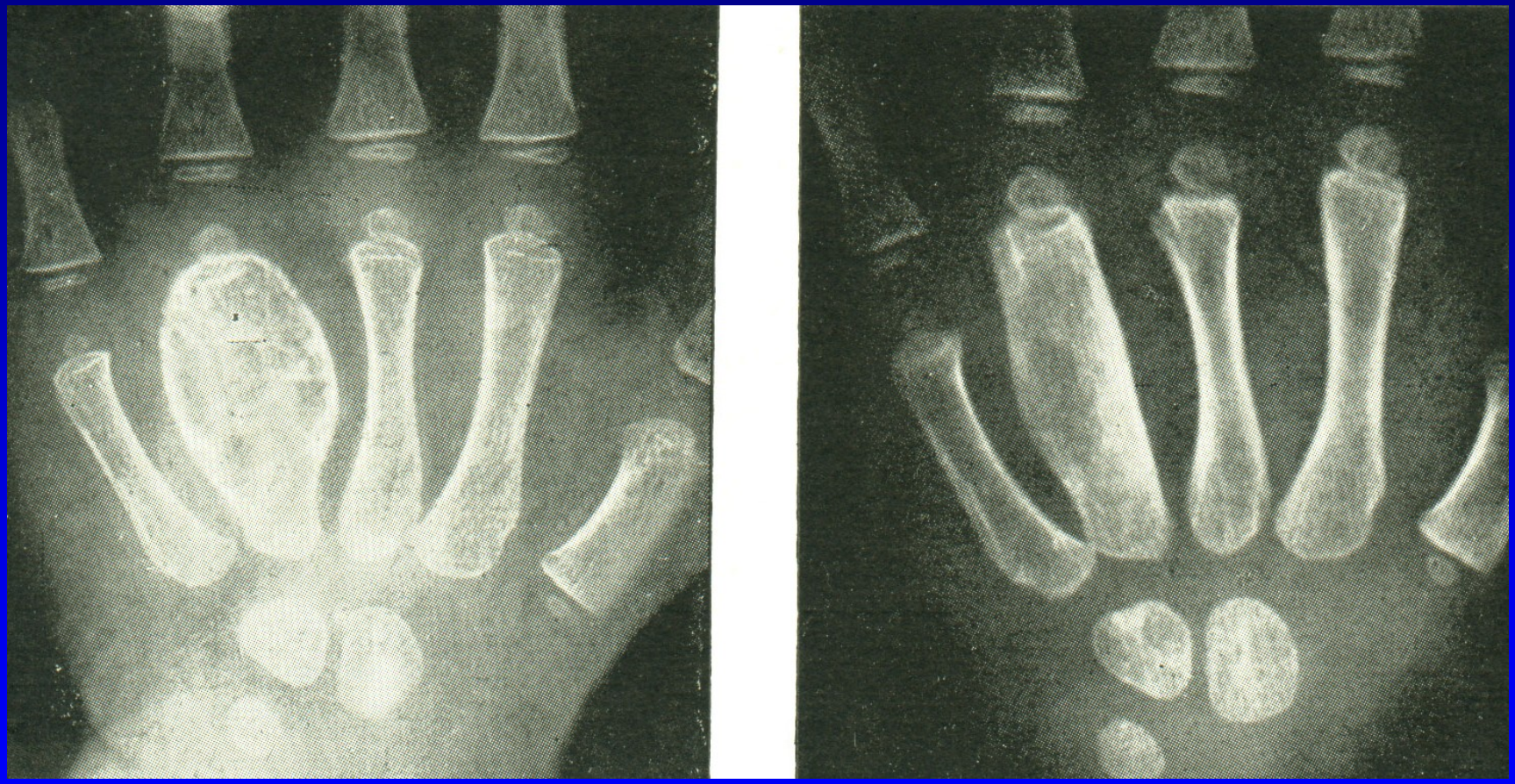


TB of the knee joint

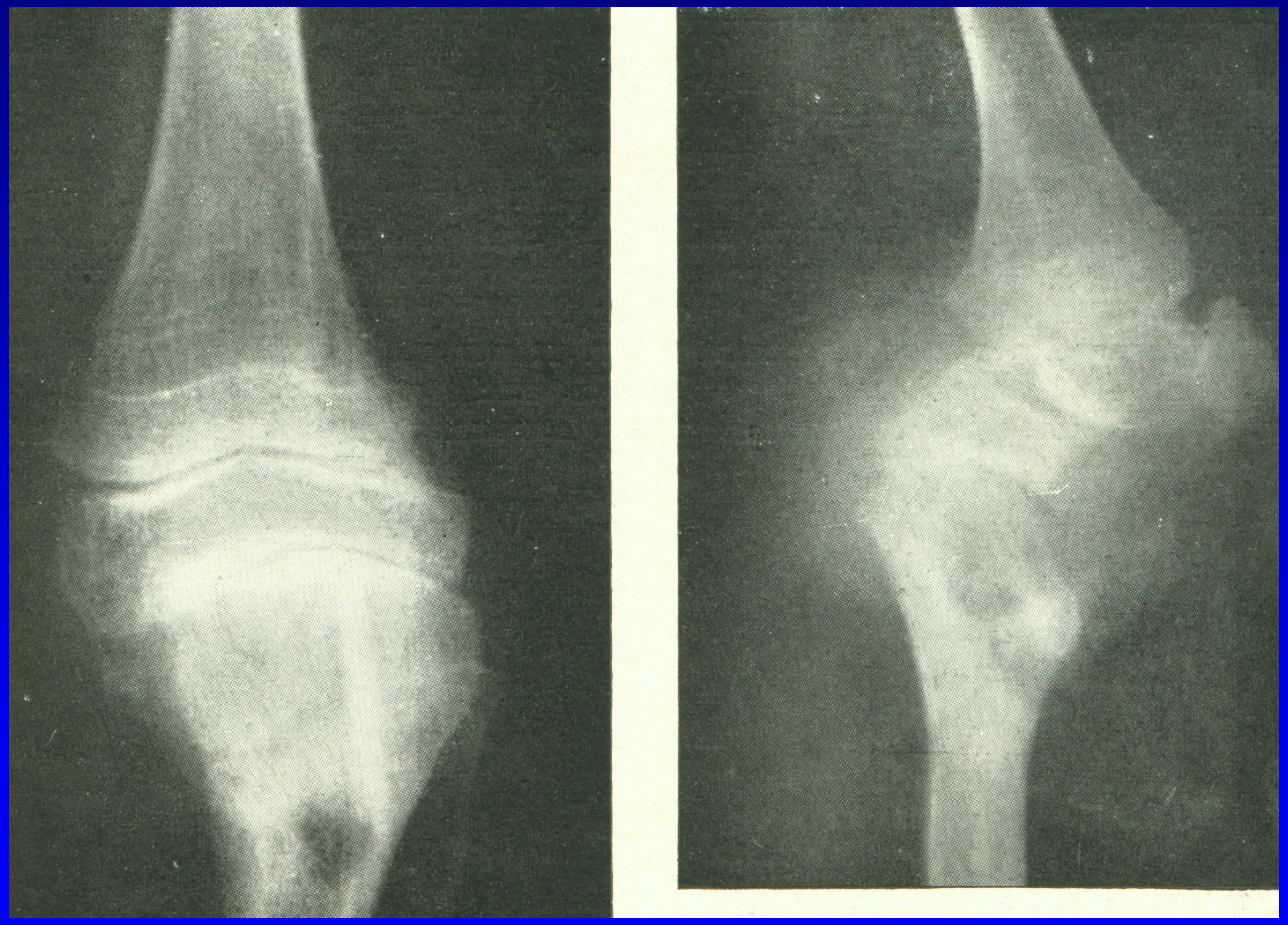
TB paraarticular lesion in metaphysis



Spina ventosa



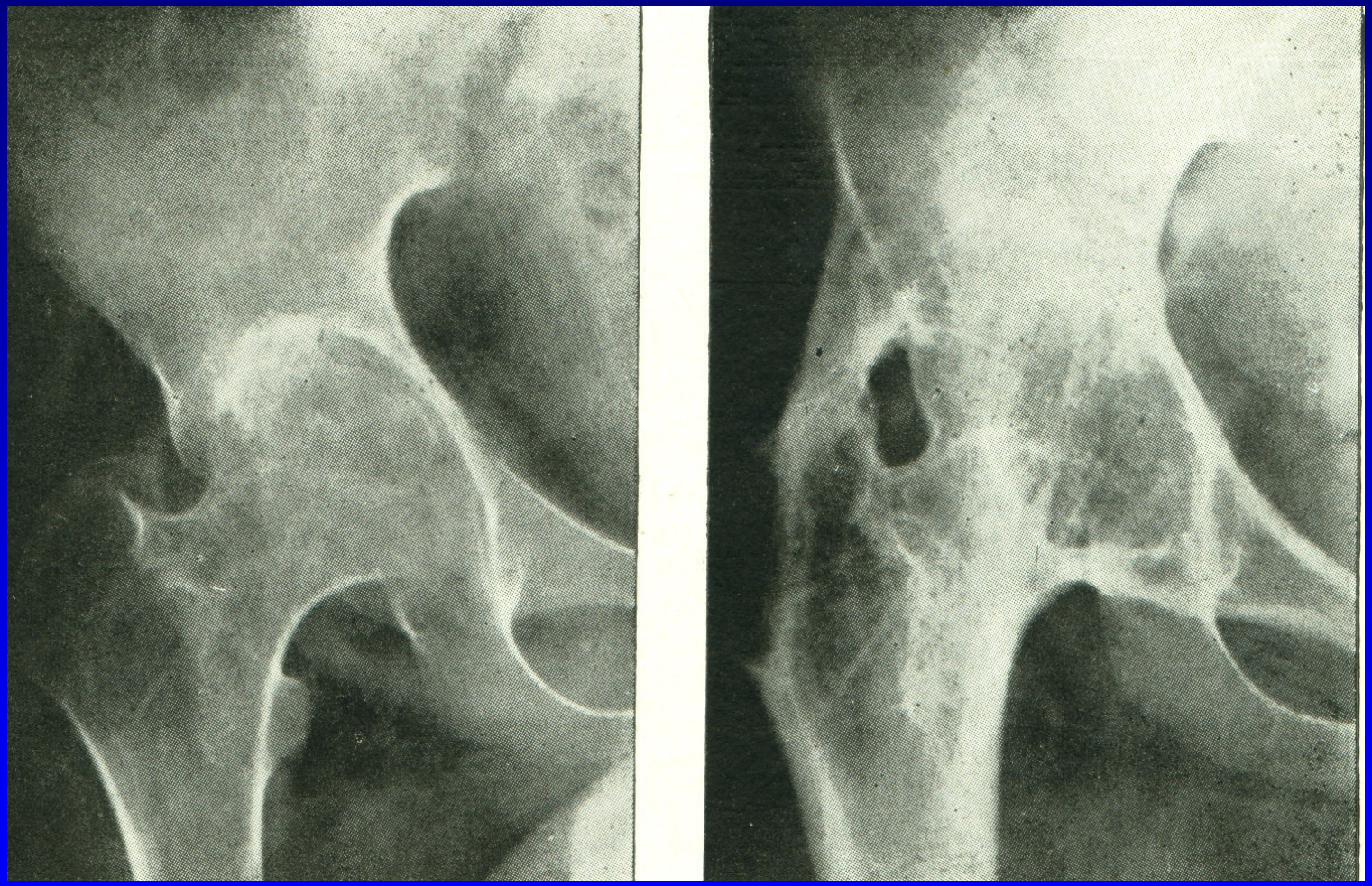
TB of the knee joint- subluxation



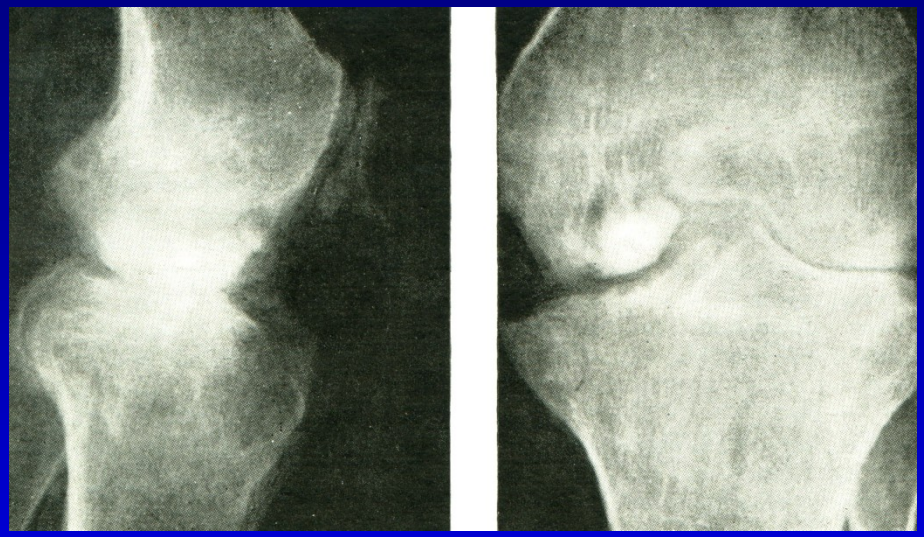
Diagnostics

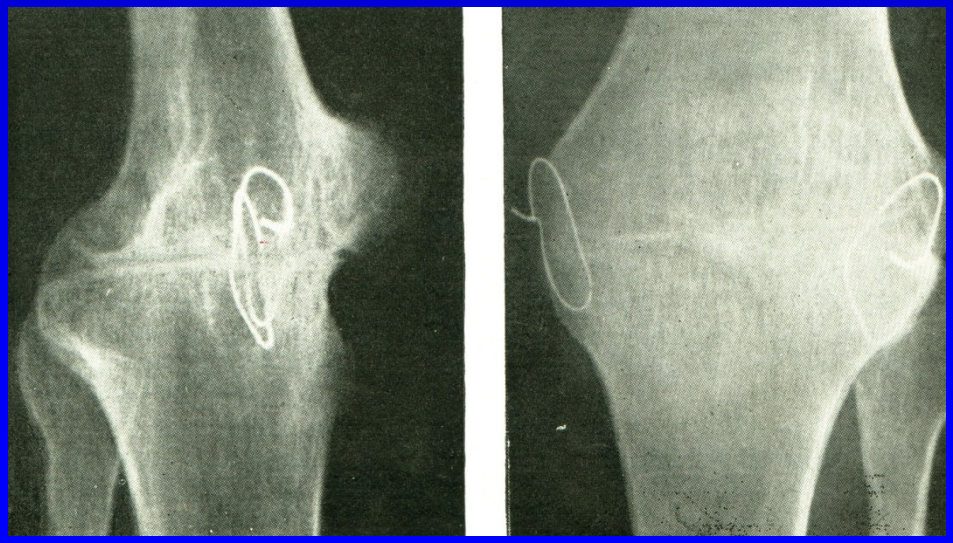
Aspiration
Biopsy
Histology
Mantoux II
PCR (polymerase chain reaction)
Serology: IgM, IgA, IgG
QuantiFERON –TB Gold

TB coxitis healed by extraarticular arthrodesis



TB arthrisis of the knee joint
Arthrodesis





Management

Antituberculous chemotherapy:
Combination of bactericid agent: Isoniazid, rifampicin, PAS, ethambutol, pyrazinamid,
cycloserin, capreomycin, STM.
Therapy is long lasting- 9 months at least
Rest, orthesis
Surgery- debridement, synovectomy,
In the hip – Girdlestone resection
arthrodesis

TB spondylitis

Half of all cases
Thoracic and lumbar spine- malum Potti
Cervical spine -malum Rusti

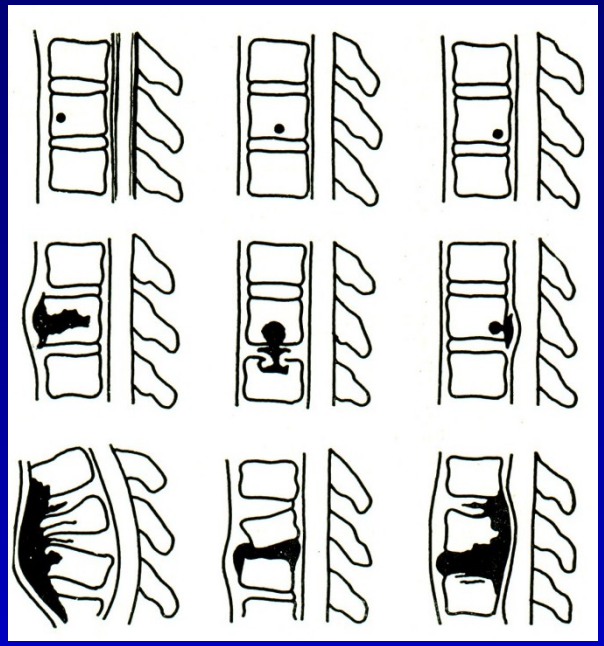
Osteolytic lesion in anterior part
of the body
Paravertebral abscess
Narrowing of disc space
Spreading into the adjacent vertebra
Collapse forwards
Angular kyphosis

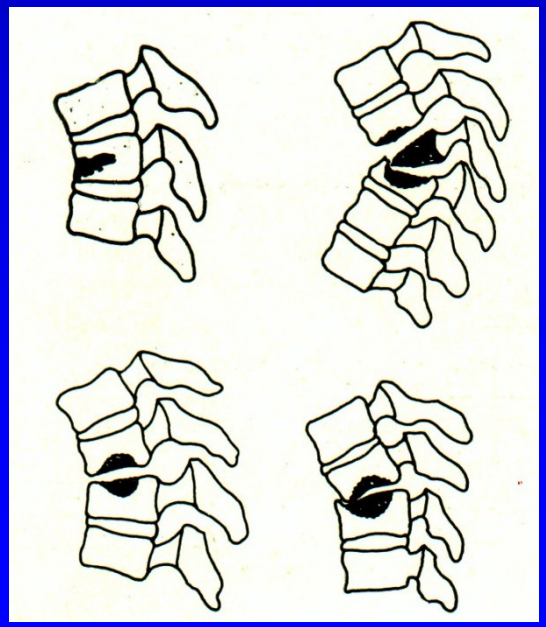
Symptoms

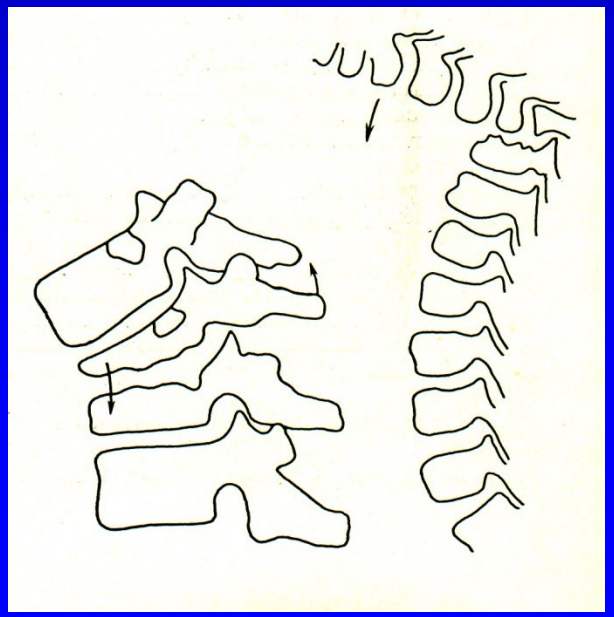
Back ache, tenderness, spasm
Sharp gibbus
Spasticity, paraparesis, paraplegia
Sinuses from cold abscess

Radiological finding

Osteolytic lesion in anterior part
of the body
Paravertebral abscess
Narrowing of disc space
Spreading into the adjacent vertebra
Collapse forwards
Angular kyphosis







Management

Antibiotics for TB
Debridement of the lesion
Revision of abscess
Decompression of spinal cord and nerve roots
Stabilisation of the spine