

Infection of bones and joints

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Orthopaedics

Inflamations of bones, joints and tendons

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 haematogenous osteomyelitis

- Causal organism:
Gram- positive and Gram- negative
with aerobic or anaerobic metabolism

Acute haematogenous osteomyelitis

- Gram +:
- Staphylococcus aureus in 80 %
Streptococcus pyogenes
- Staphylococcus epidermidis
- Haemophilus influenzae

Acute haemotogenous osteomyelitis

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

MRSA methicilin resistant staphylococcus aureus

MRSE methicilin resistant staphylococcus epidermidis

Multiresistant G- bacteria

Clostridium difficile

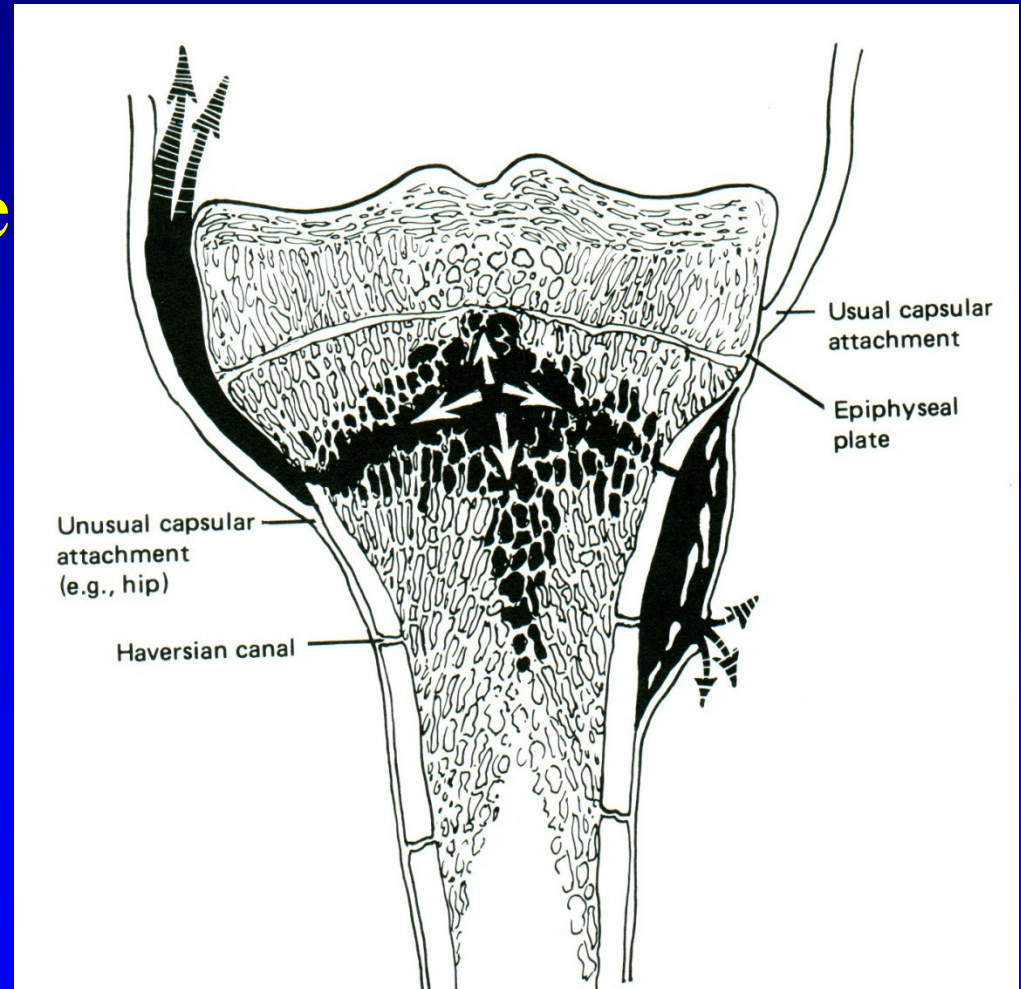
The way of infection

- 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

Subperiosteal abscess

Disturbance in circulation,
infective thrombosis

Osteolytic lesion

Necrosis of bone, sequestra

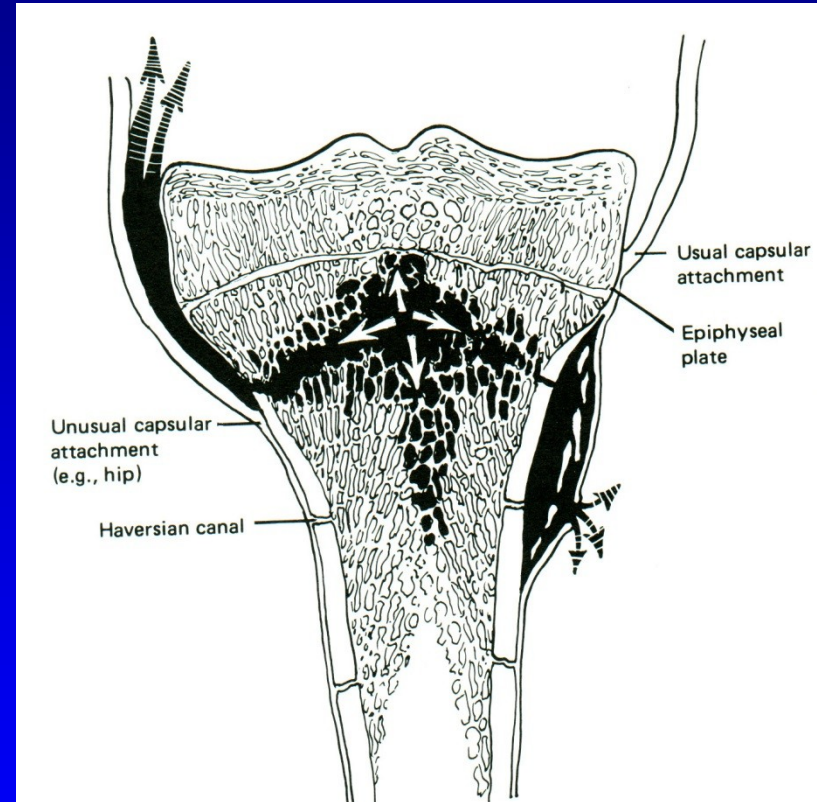
Sequestra of the whole diaphysis

- involucrum

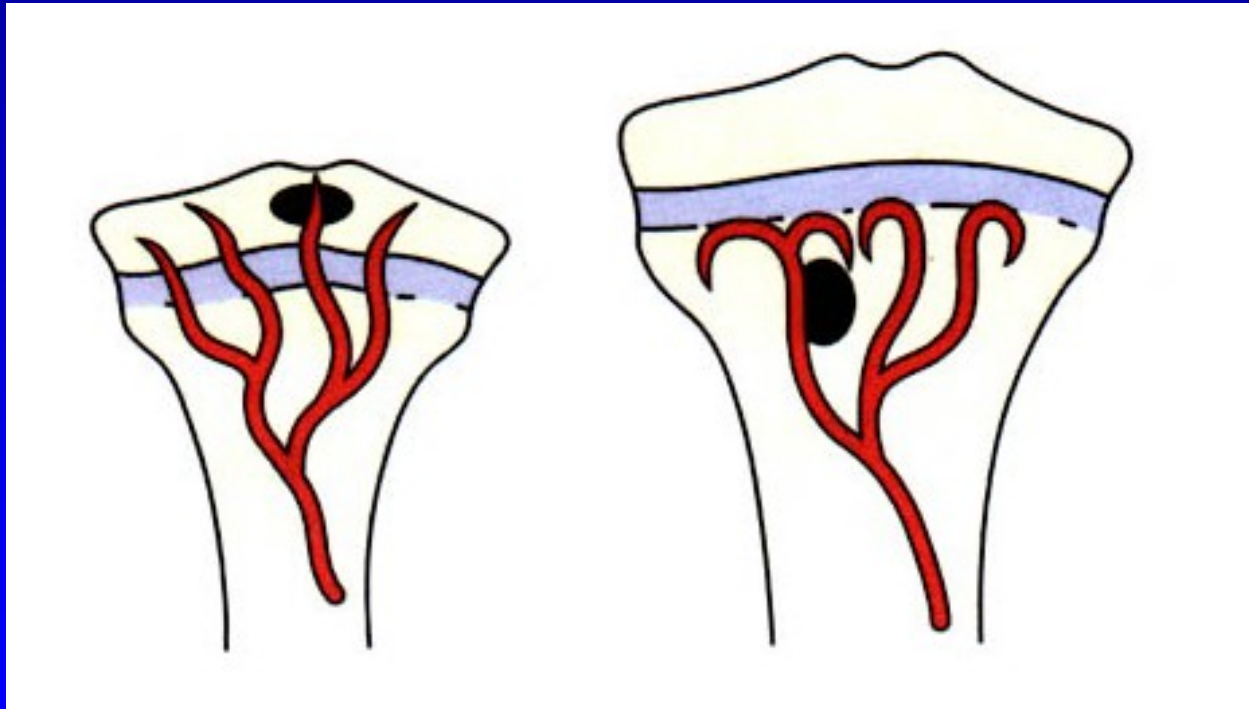
Destruction of growth plate

Spread into the lungs and other bones

Sepsis



In children up to six months: spreading through growth plate
In children above six months: growth plate is a barrier



0-6 months

more than 6 months

Local symptoms:

Rubor, calor, dolor, tumor, functio laesa
Tenderness, fistula, discharge

Systemic symptoms:

Fever (septic fever – two degrees between in the morning and in the afternoon)

Shivering

Fatigue

Tachycardia, tachypnoea, 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

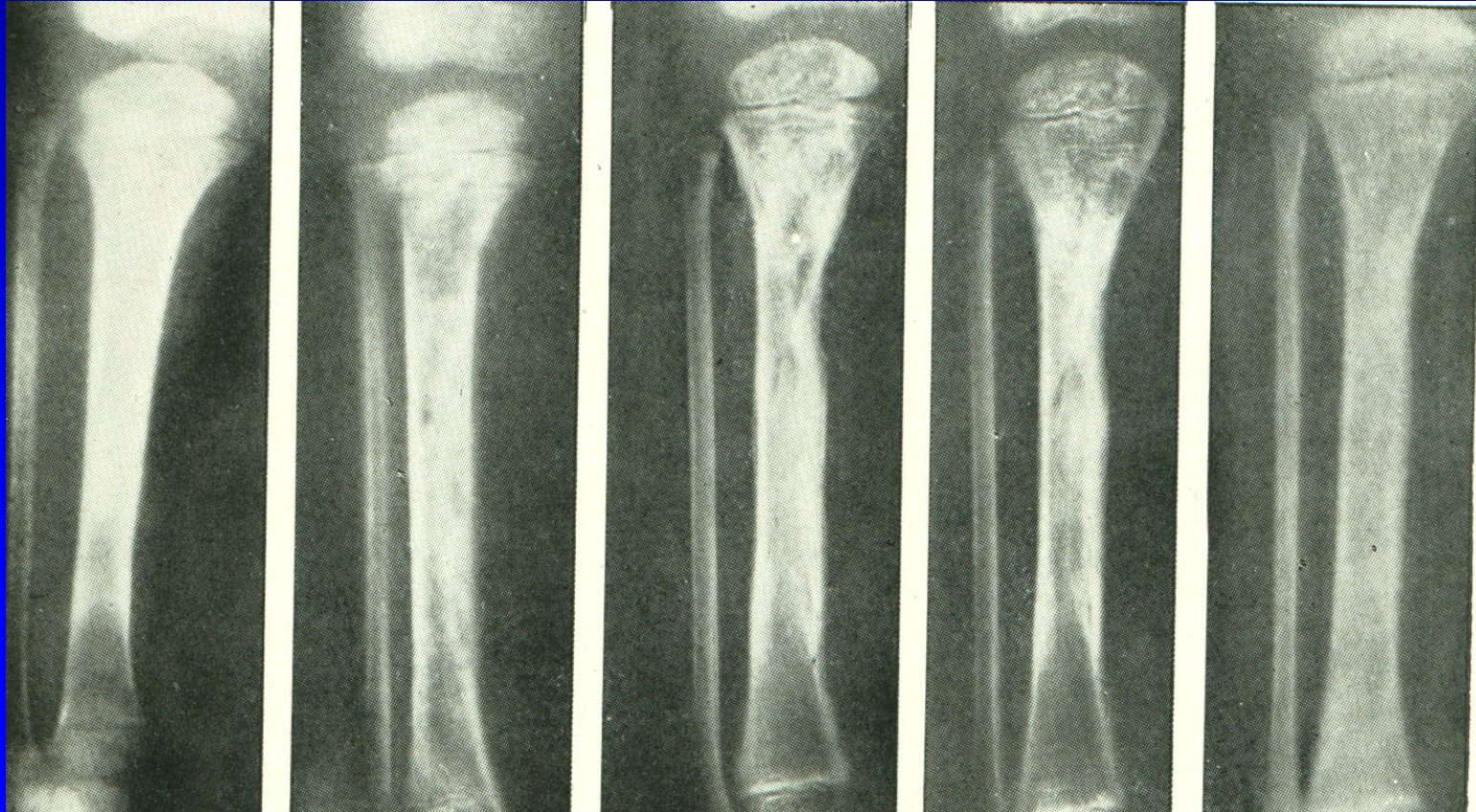
Swelling of soft tissue

Irregular rarefaction in bone

Osteolysis in the metaphysis

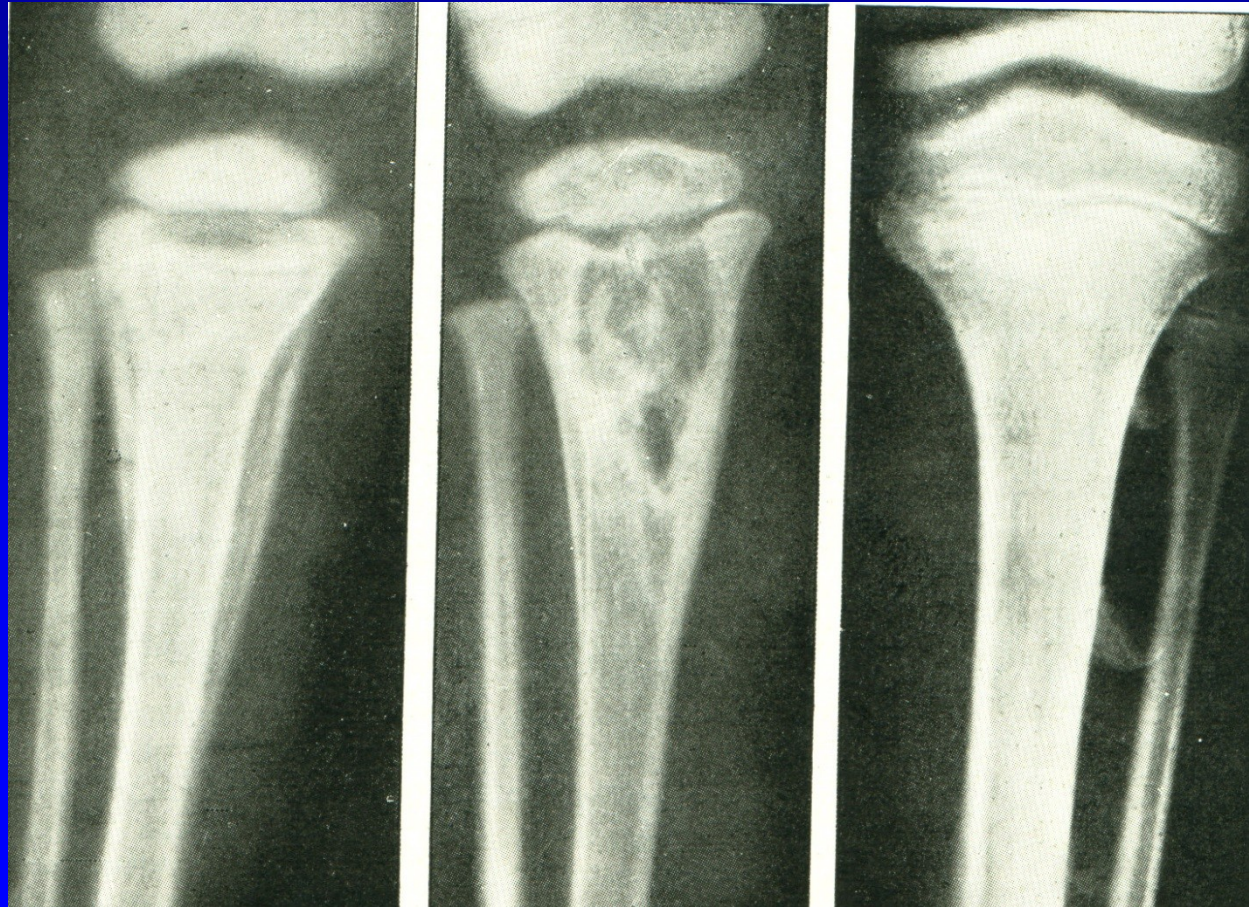
Elevated periosteum

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 orally 6-8 weeks

Amoxicilin/ ac. clavulanicum

Ciprofloxacin, cefalosporins, dalacin

Gentamycin

Vancomycin - MRSA infection

Change of antibiotics – according sensitivity
to bacteriological examination

Surgical treatment

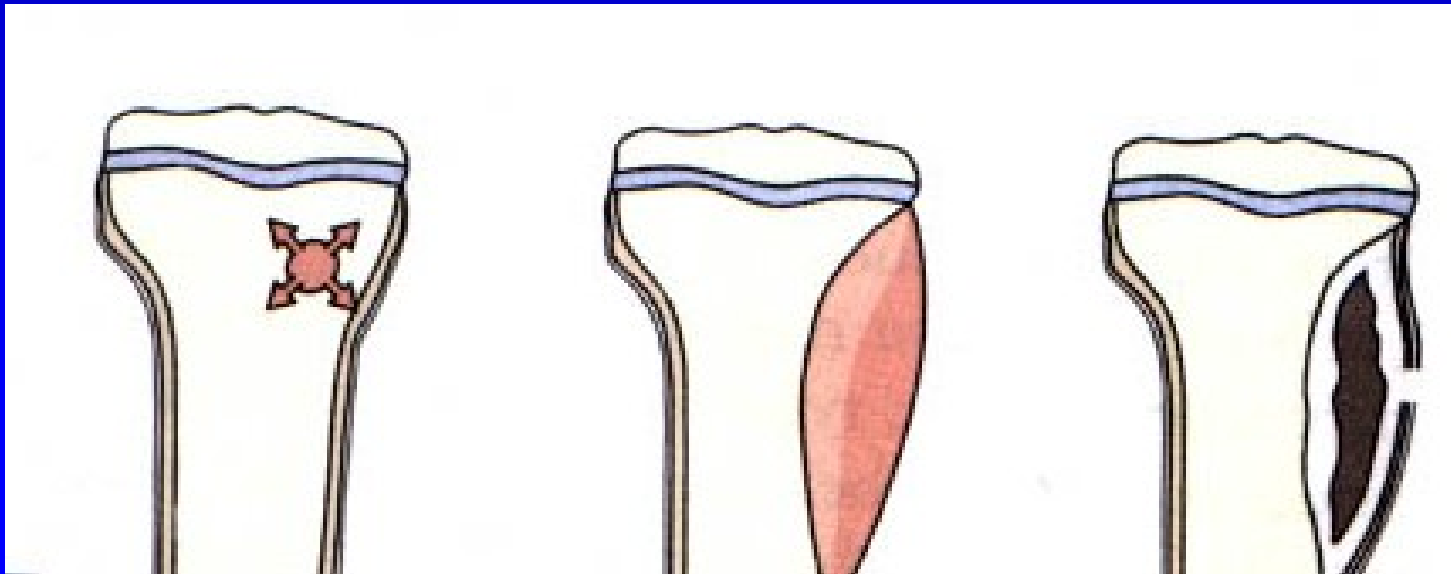
Aspiration of the abscess

Drilling of the bone and decompression, curettage

Drainage

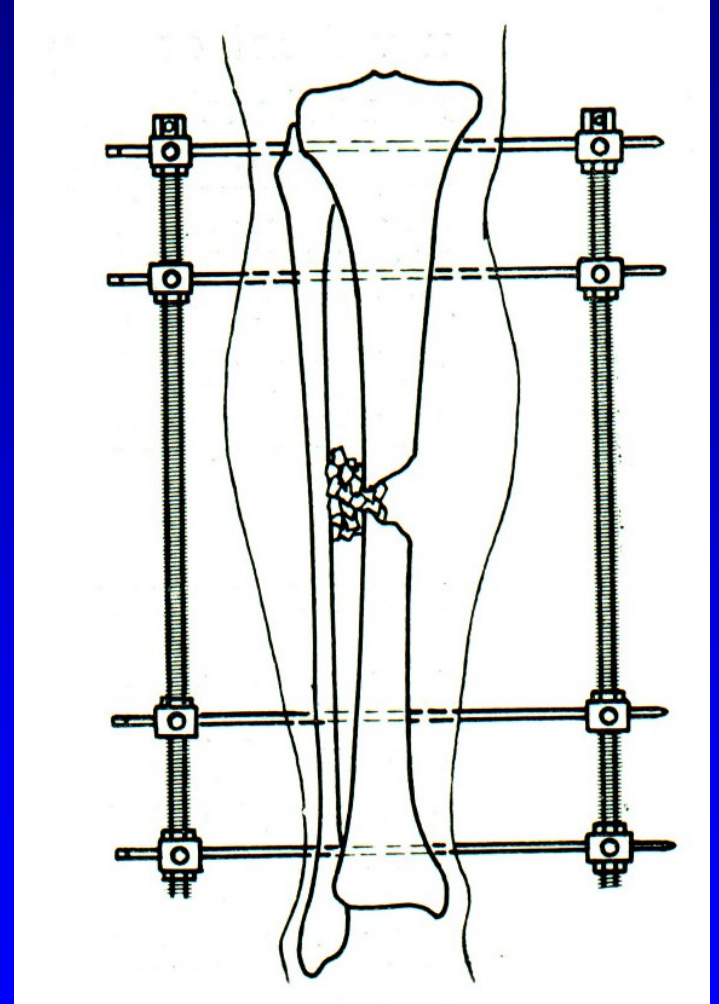
Local application of antibiotics

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: not successful treatment of acute stage
immunodeficiency
high virulent organism

Pathological anatomy

Sequestra

- necrotic bone surrounded by pus and granulation tissue

Pyogenic membrane

Sclerotic surrounding

- prevents revascularization and transport of antibiotics

Diffuse rarefaction and osteolysis



Symptoms

Pain, tenderness, limited function

Discharging sinuses with small sequestra

Recurrence of acute stage

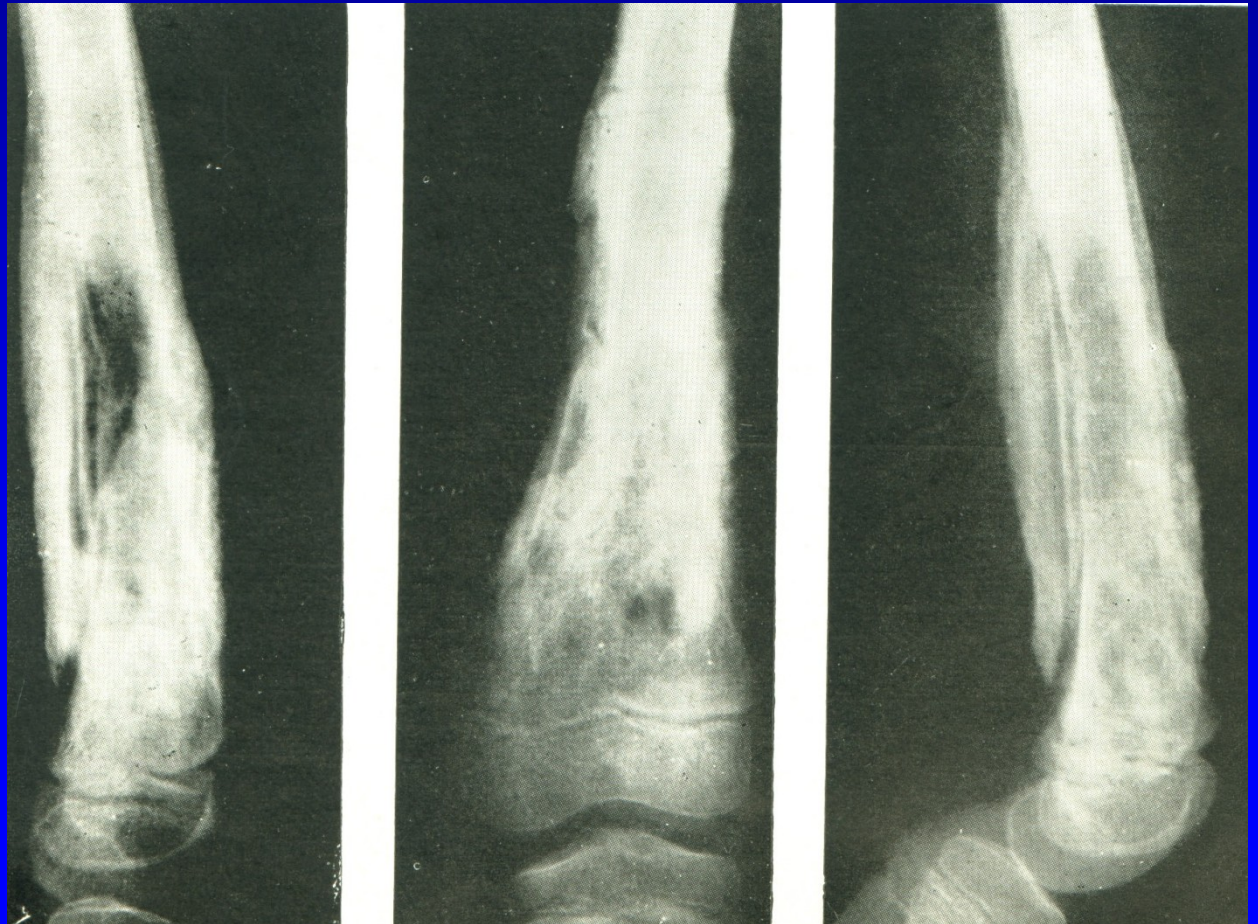
Fatigue

Cachexia

Combination of rarefaction 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



Chronic osteomyelitis



Sclerosis of bone

Management of chronic osteomyelitis

The rule: *ubi pus, ibi evacua* !

Sequestrotomy, lavage

Local antibiotics – garamycin

Systemic antibiotics

Support of immunity

Seldom: conservative treatment

Osteomyelitis of the vertebra - spondylodiscitis

Slow onset

Fever

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, orthosis

Antibiotics i.v., after 2-3 weeks orally 6-10 weeks

If not successful – aspiration from the abscess

Drainage, debridement, sequestrectomy

Antibiotics locally, orally

Differential diagnostics

Tumors

Tumor like lesions

Stress fractures

Entesopathies



Clostridium difficile

After antibiotic therapy- postantibiotic colitis

- aminopenicilins, fluoroquinolons, cefalosporins.

Toxin A- enterotoxin, effect 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

Streptococci

Enterococci

MRSA, MRSE

Polyresistant G- bacteria

to betalactam antibiotics

Planctonic and sessile forms

Bacteria- race for surface

- Glycocalyx (mucouse substance of glycoproteins)

Leads to high resistance to antibodies and antibiotics



Biofilm

Biofilm



Adhesion of
bacteria
- reversible

Exopolymers
- glycolalyx
- extracelular matrix
irreversible

Dispersal

Periprosthetic infection - diagnosis

Symptoms:- pain, oedema, redness, fistula
loss of function

Labor: CRP, leu, ESR
bacteriological ex.

X-ray- osteolysis, radiolucency

USG-soft tissues

Scintigraphy Tc-99

Perioperative finding- liquid, pus

Sonication of implant

Bacteriological examination

Prolonged cultivation 5-7 days



Therapy in THA

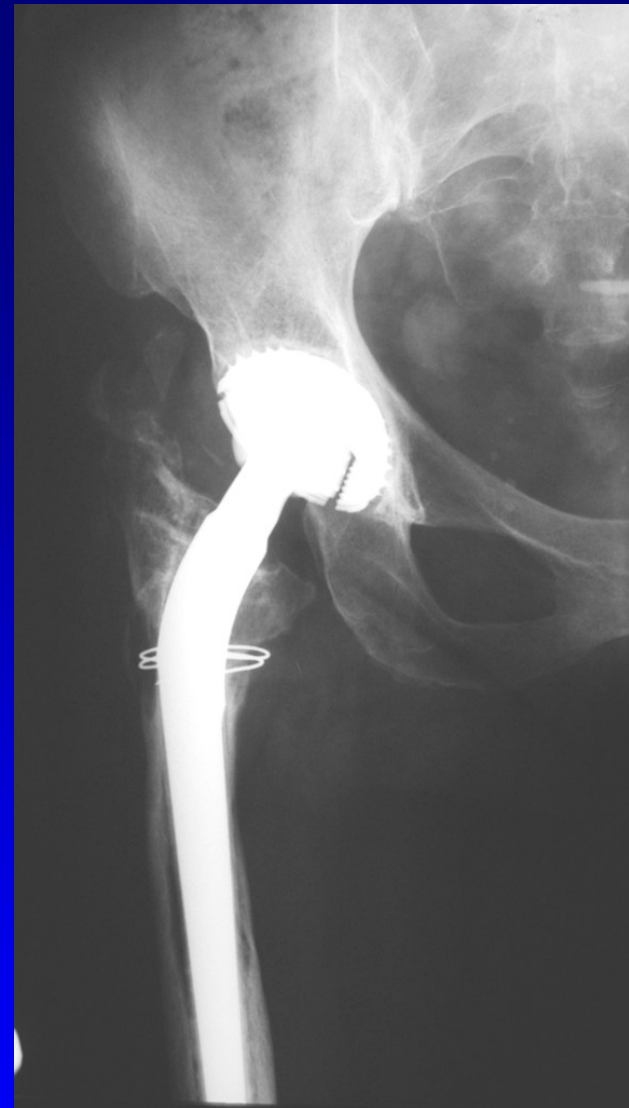
Debridement, synovectomy

One stage reimplantation

Two stages reimplantation (spacer)

Resection arthroplasty

Long antibiotic suppression



Spacers



Better movement

Better walking

Correct distance

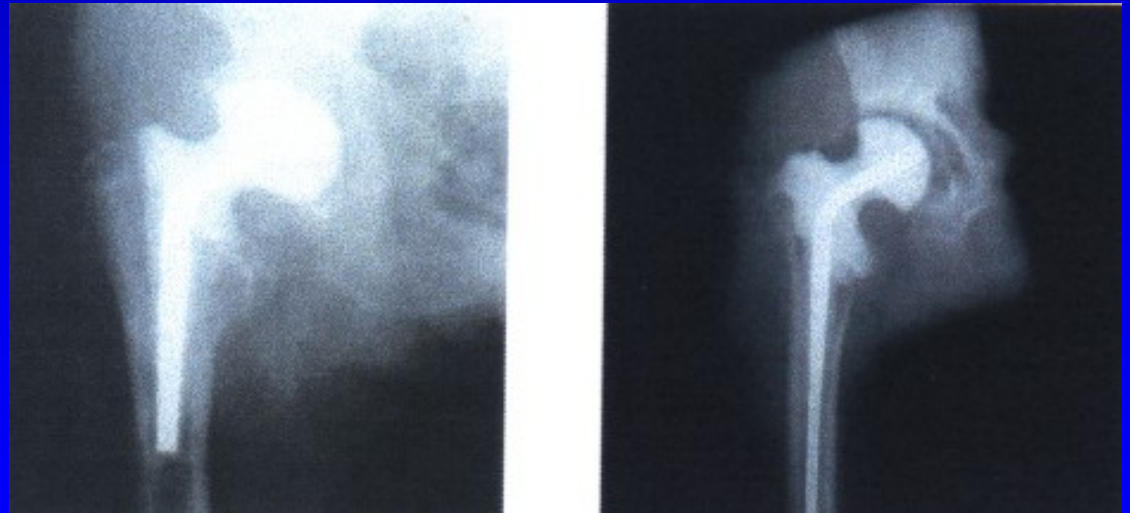
Release of antibiotics

- 90 % of all pathogens

+ MRSA, MRSA, Entero

+ Enterococci

Easier revision



Therapy in TKA

- Up to 2 weeks: debridement,
lavage, synovectomy

- Later: one stage revision
two stage revision

Prosthalac



Consequences of chronic inflammation of bone

Recurrence of infection

Growth arrest – shortening of the extremity

Weakness of muscles

Joint contracture

Septic arthritis

Amyloidosis

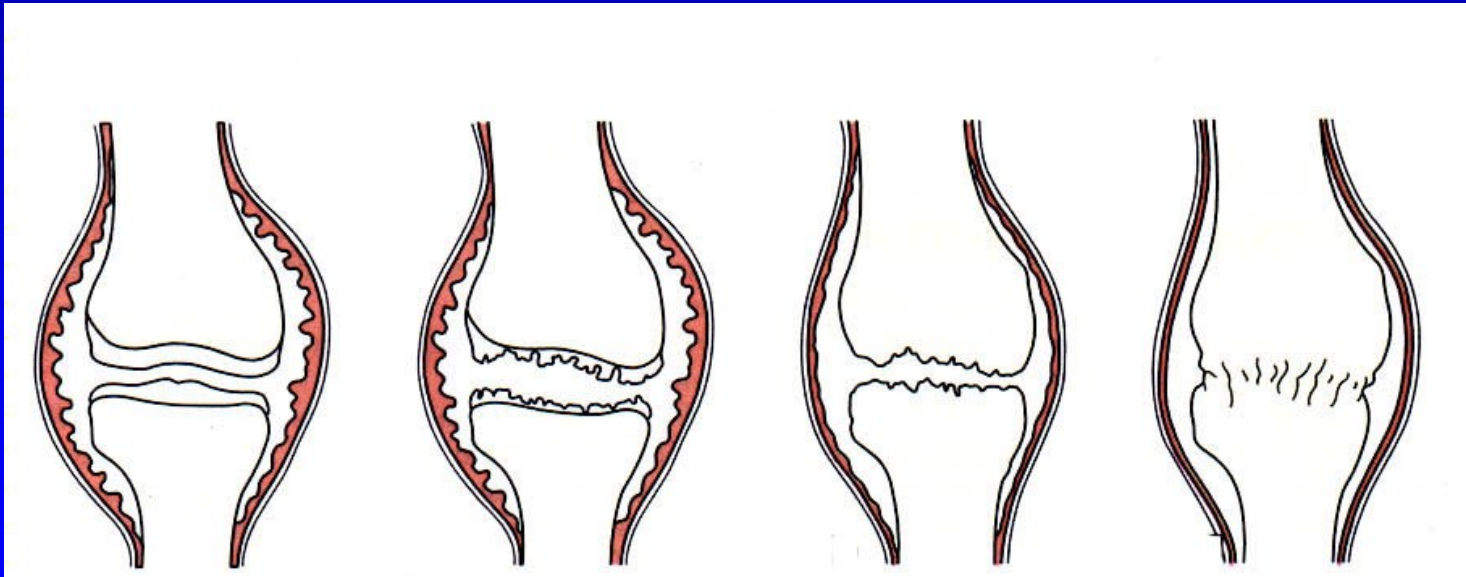
Epidermoid carcinoma

Pathological fracture

Sepsis

Pyogenic (septic) arthritis

Suppurative arthritis of the joint



Septic arthritis

- Gram +:
- Staphylococcus aureus
- Streptococcus pyogenes
- Staphylococcus epidermidis
- Haemophilus influenzae
- Gonococcus
- Pneumococcus

Septic arthritis

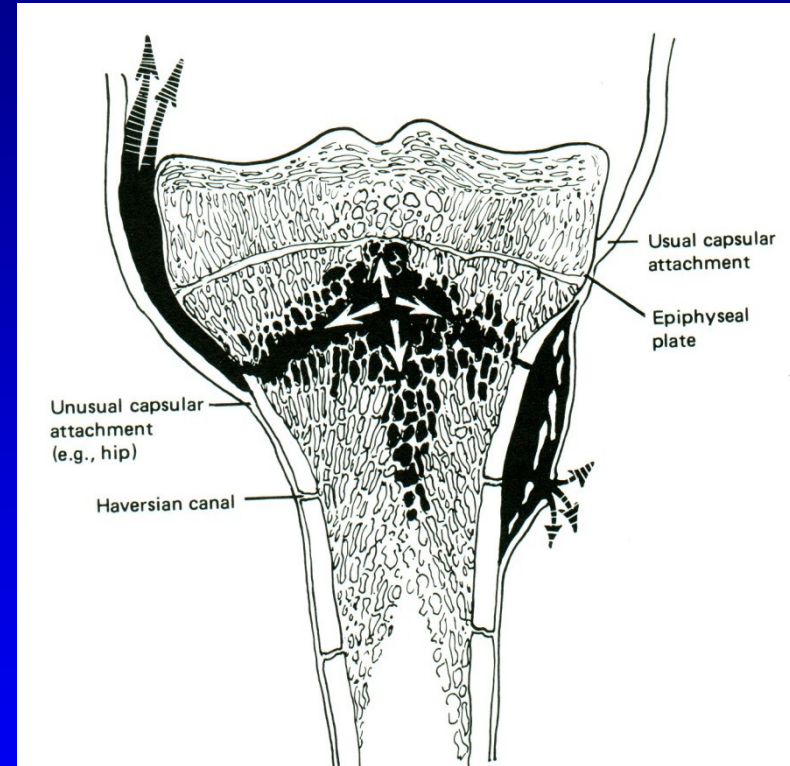
- Gram - :
- Escherichia coli
- Klebsiella
- Proteus Hauseri
- Pseudomononas aeruginosa
- Salmonella

The way of infection

Haematogenous seeding

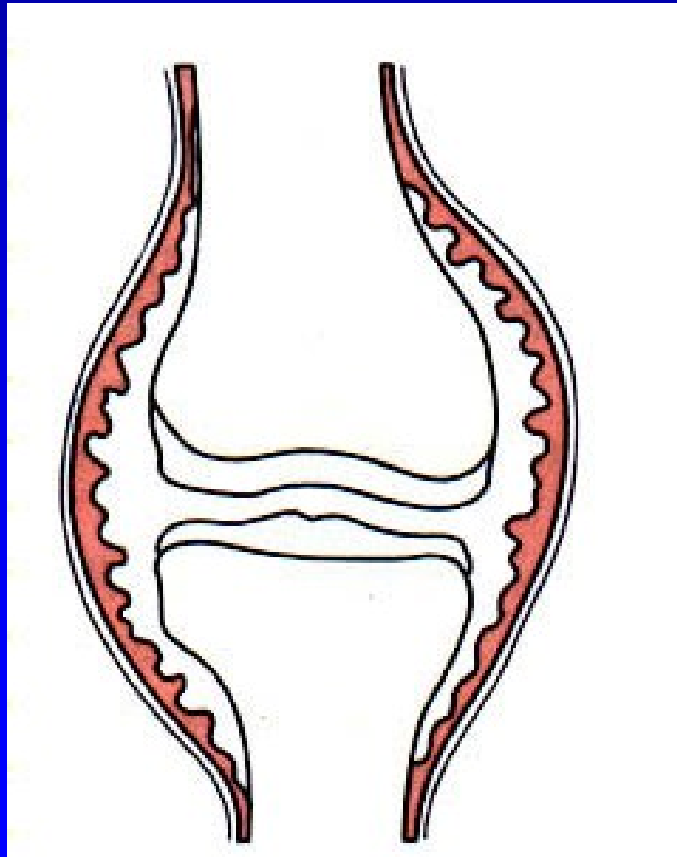
From metaphysis – hip, elbow

Direct way-
by aspiration, surgery, trauma



Pathological anatomy

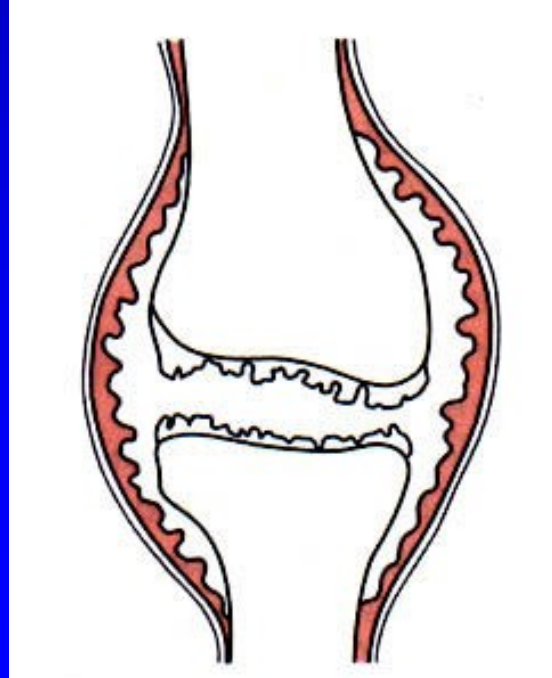
1. Synovitis purulenta
synovial membrane is thick, pus



Pathological anatomy

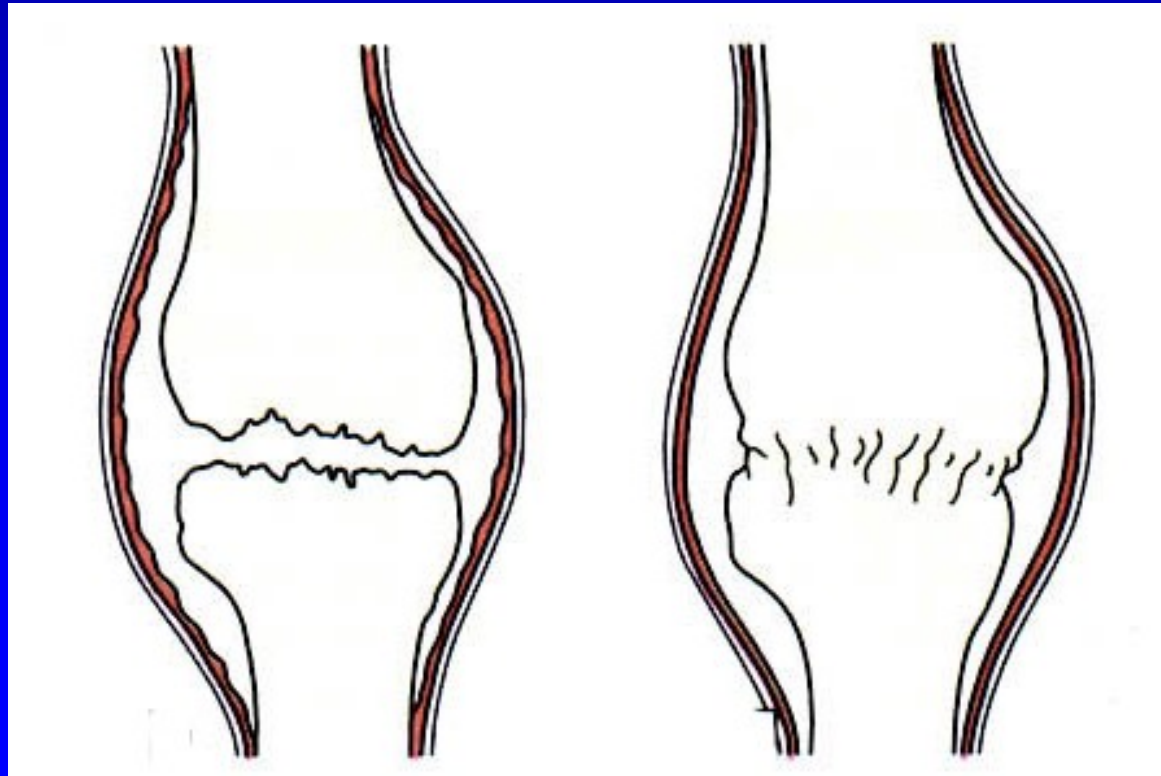
2. Phlegmone of joint capsule

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



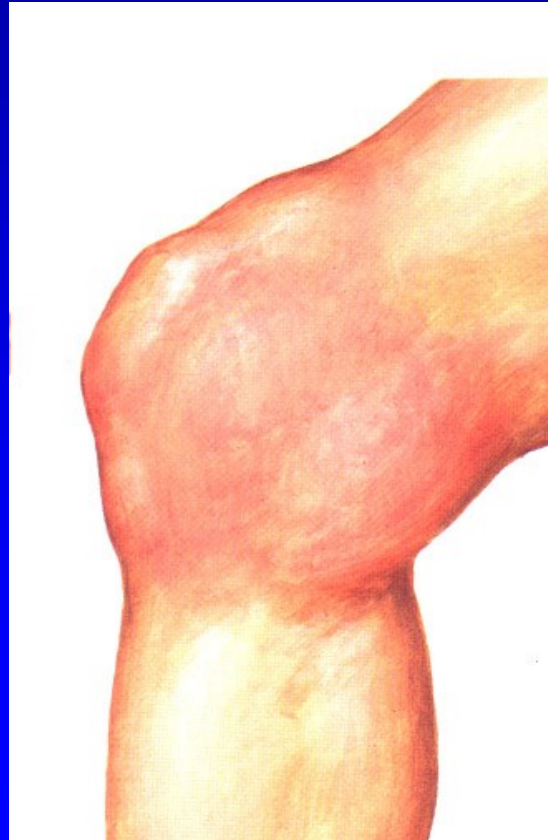
Pathological anatomy

3. Panarthrititis. Inflammation involves the joint and periarticular tissues, abscesses, destruction of cartilage, fibrous or osseous ankylosis



Local symptoms

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



Systemic symptoms

Fever (septic fever – two degrees between in the morning and in the afternoon)

Shivering

Fatigue

Tachycardia, tachypnoe, hypotension

Nausea, stomach problems

Newborn septic arthritis

X-ray:

Soft tissue swelling

Widening of joint space

Pathological subluxation

Periosteal thickening

Rarefaction of epiphysis
and metaphysis

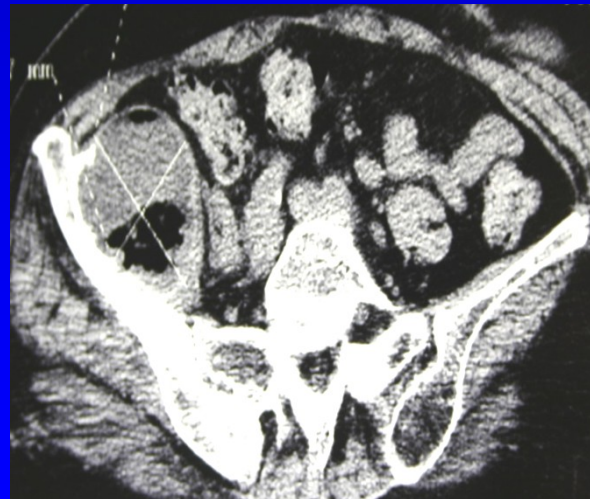
Later on narrowing
of joint space



Adult septic arthritis

X-ray:

- Soft tissue swelling
- Widening of joint space
- Pathological subluxation
- Periosteal thickening
- Rarefaction of epiphysis and metaphysis
- Later on narrowing of joint space



Laboratory tests

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

Management

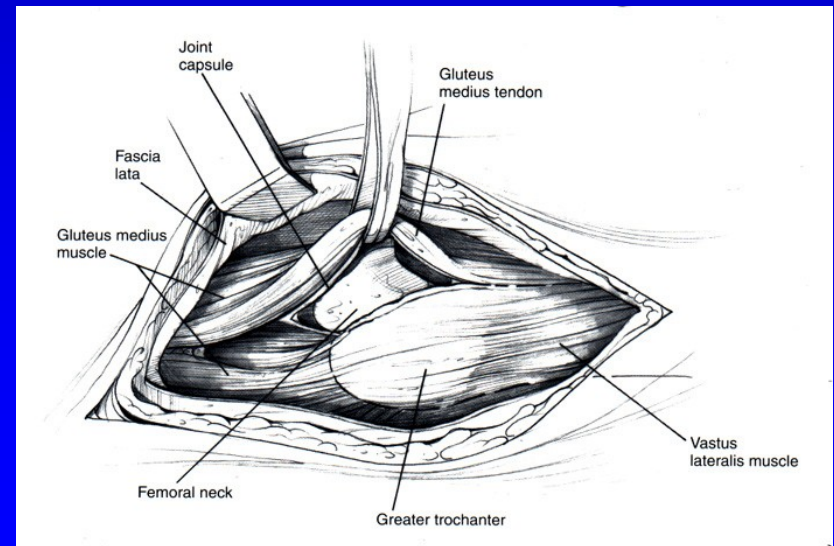
Aspiration

Splinting, analgetics

Antibiotics i.v., after 2 weeks orally 6-8 weeks

Arthroscopy and lavage

Incision and drainage



Consequences

Osteoarthritis

Epiphyseal destruction

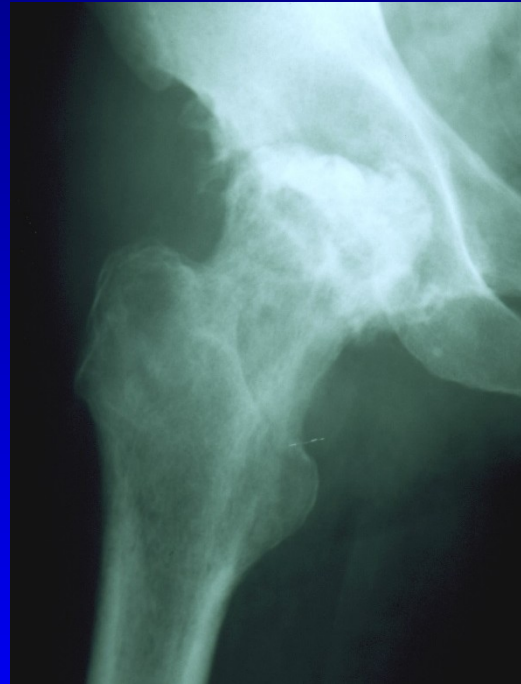
Necrosis

Disturbance of growth plate

Ancylosis

Subluxation or dislocation

Sepsis



Tuberculosis- TB

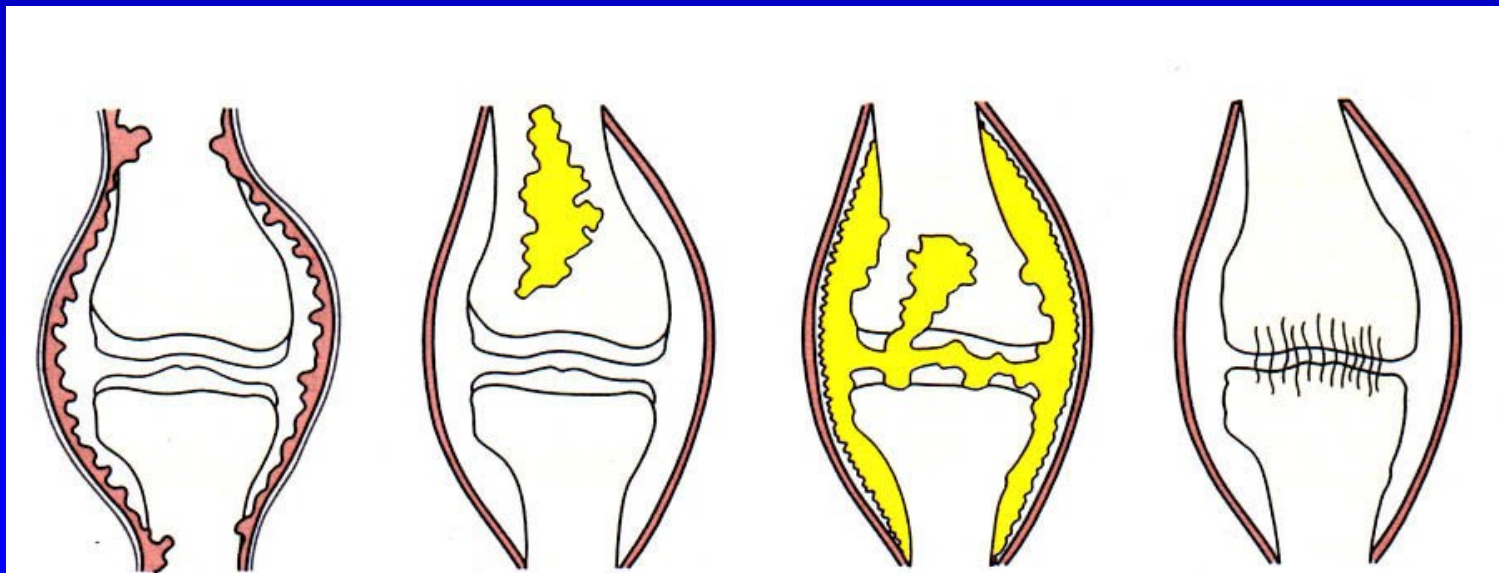
Granuloma formations

Nodes 1-2 mm connecting together

The cause- *Mycobacterium tuberculosis*

Mycobacterium bovis

Haematogenous seeding (from lungs)



Pathological anatomy

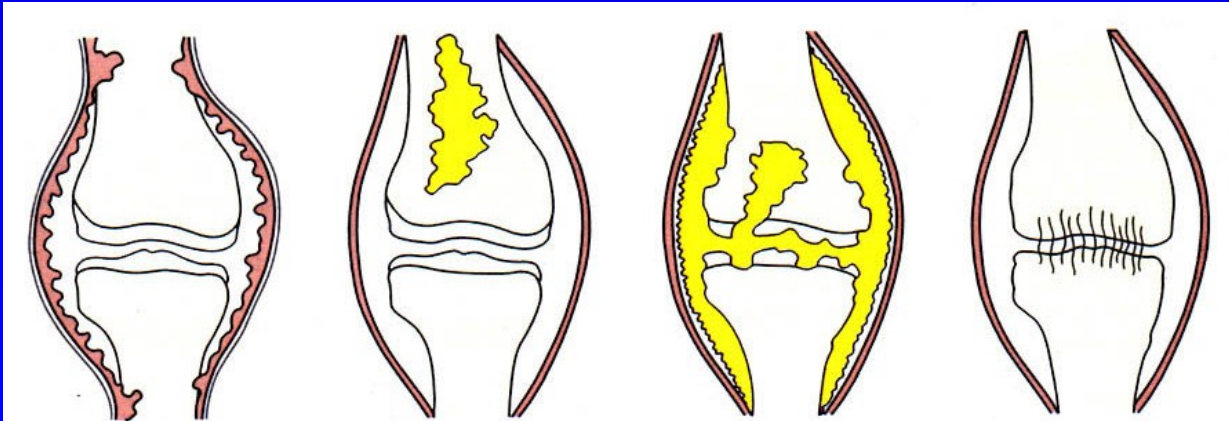
1. Proliferative form (tbc granuloma, fungus)
2. Exsudative form (caseation, hydrops, empyema)

Miliar TB nodes:

Langerhans cells (with Mycobacteria)

Epiteloid celles, lymphoid cells

Nodes form TB granuloma



Pathological anatomy

Cold absces

Hydrops

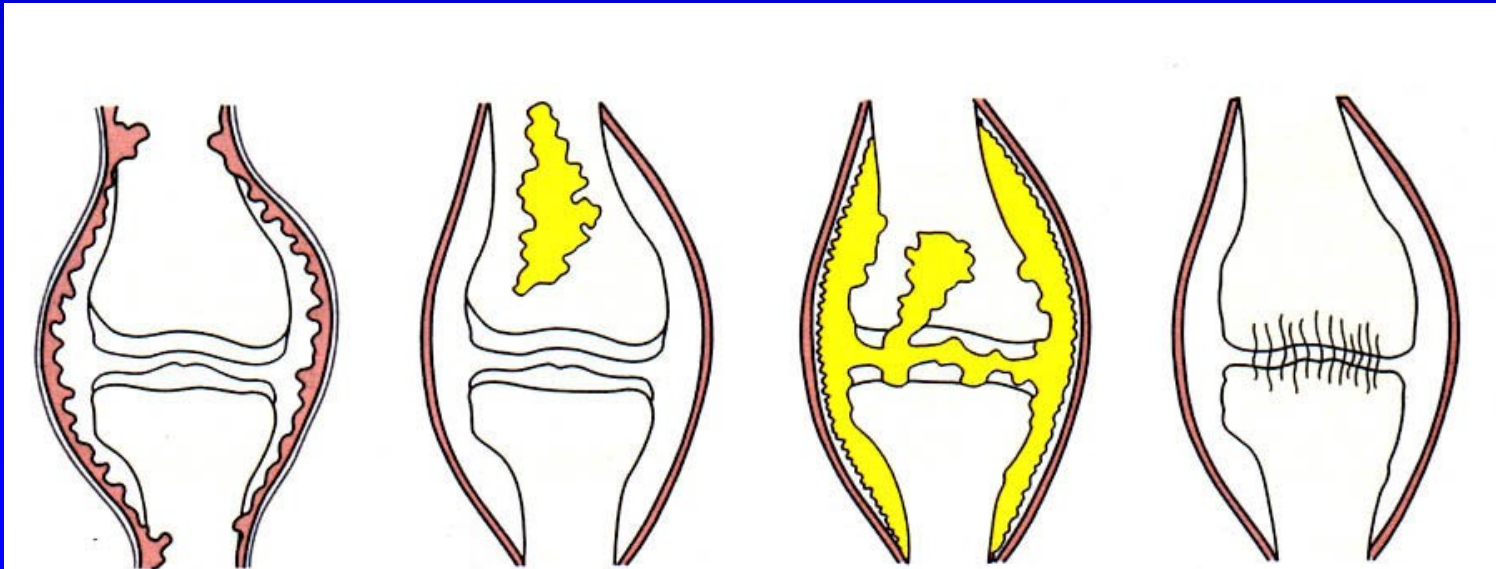
Fungus

Starts as synovitis or spreads from epiphysis

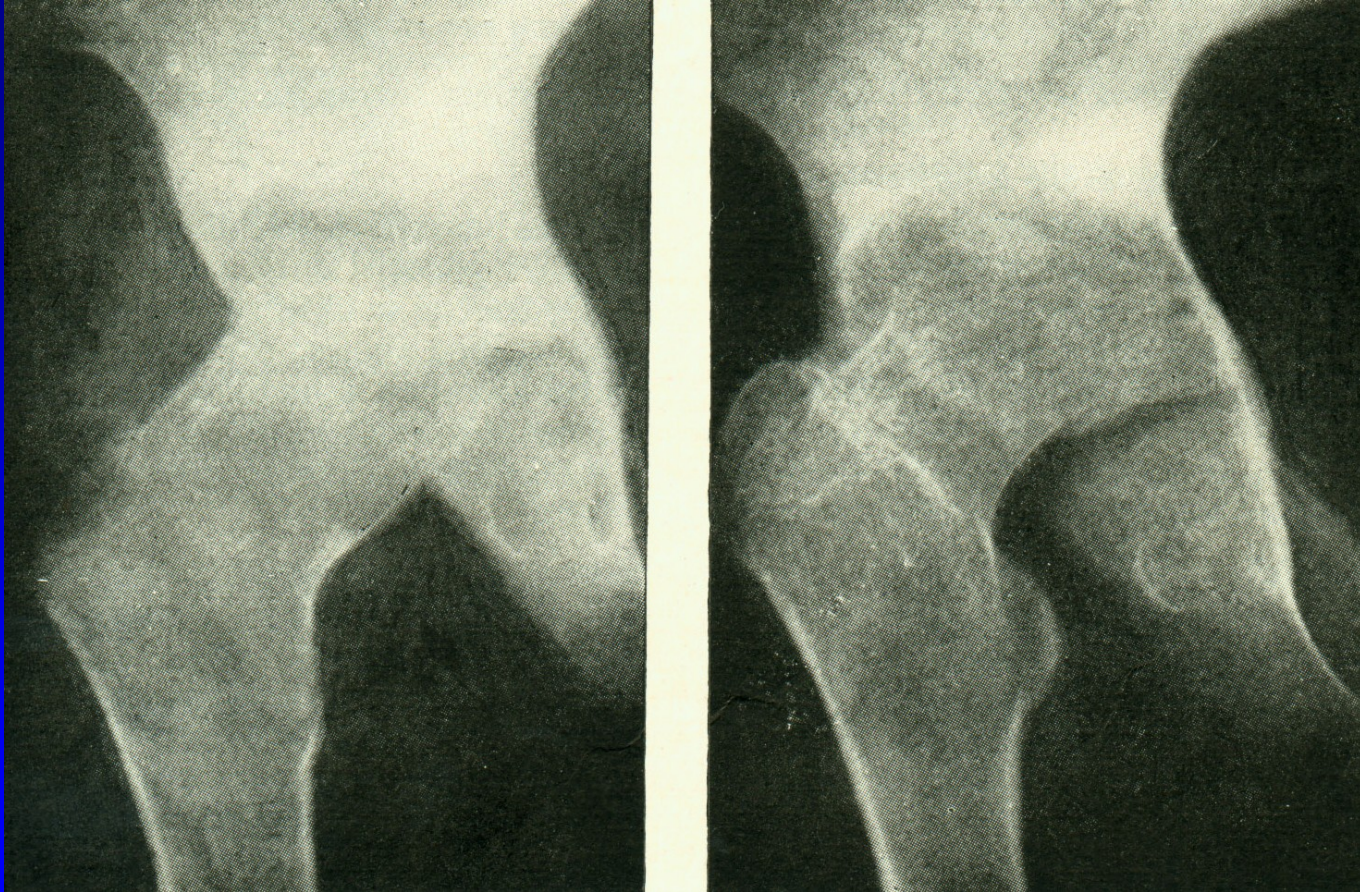
Slow progression

Destruction of cartilage

Fibrous or osseous ankylosis



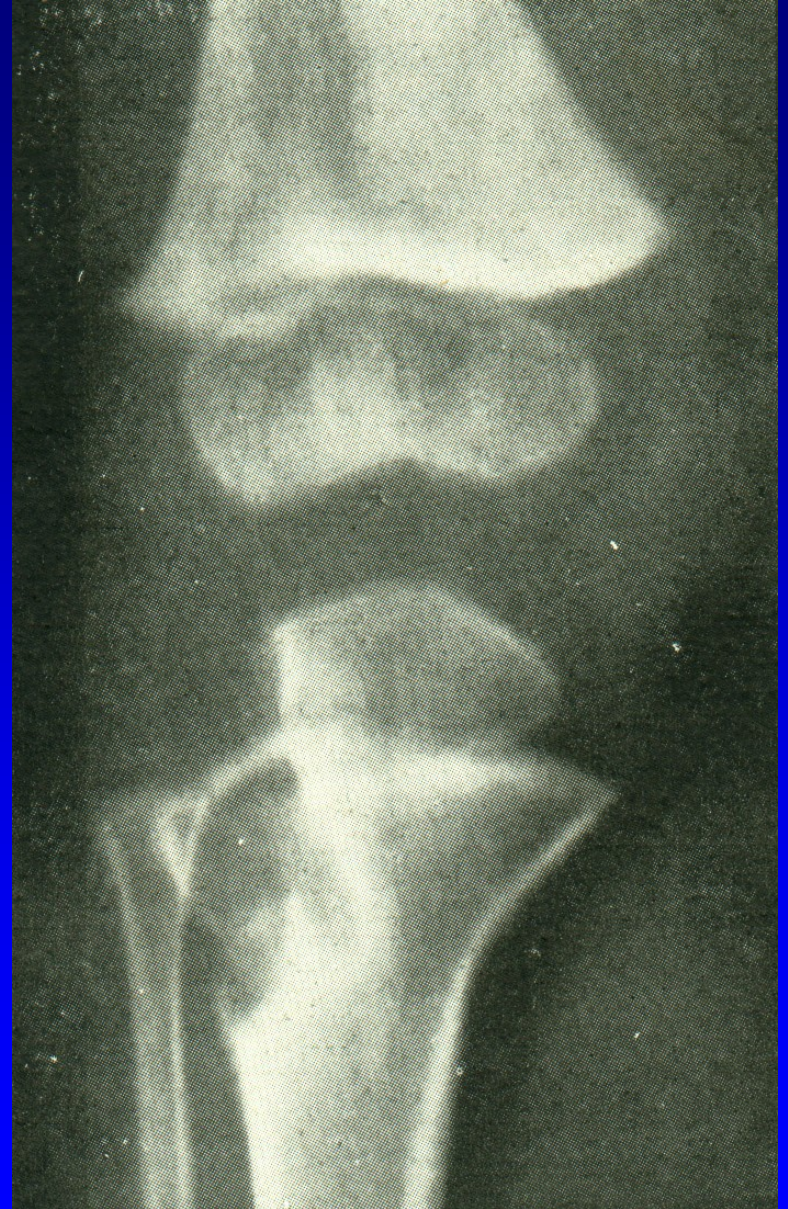
TB coxitis



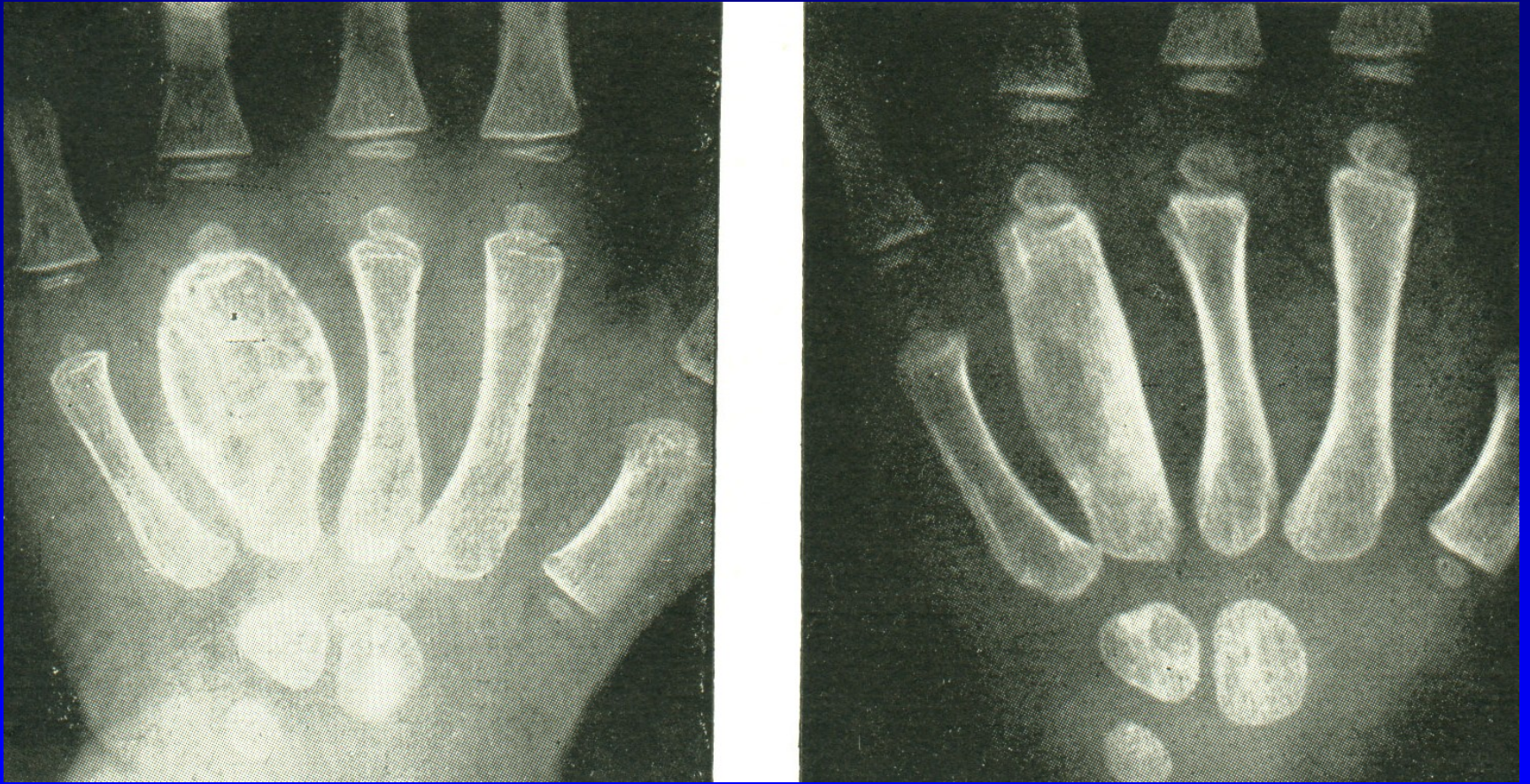
TB of the knee joint



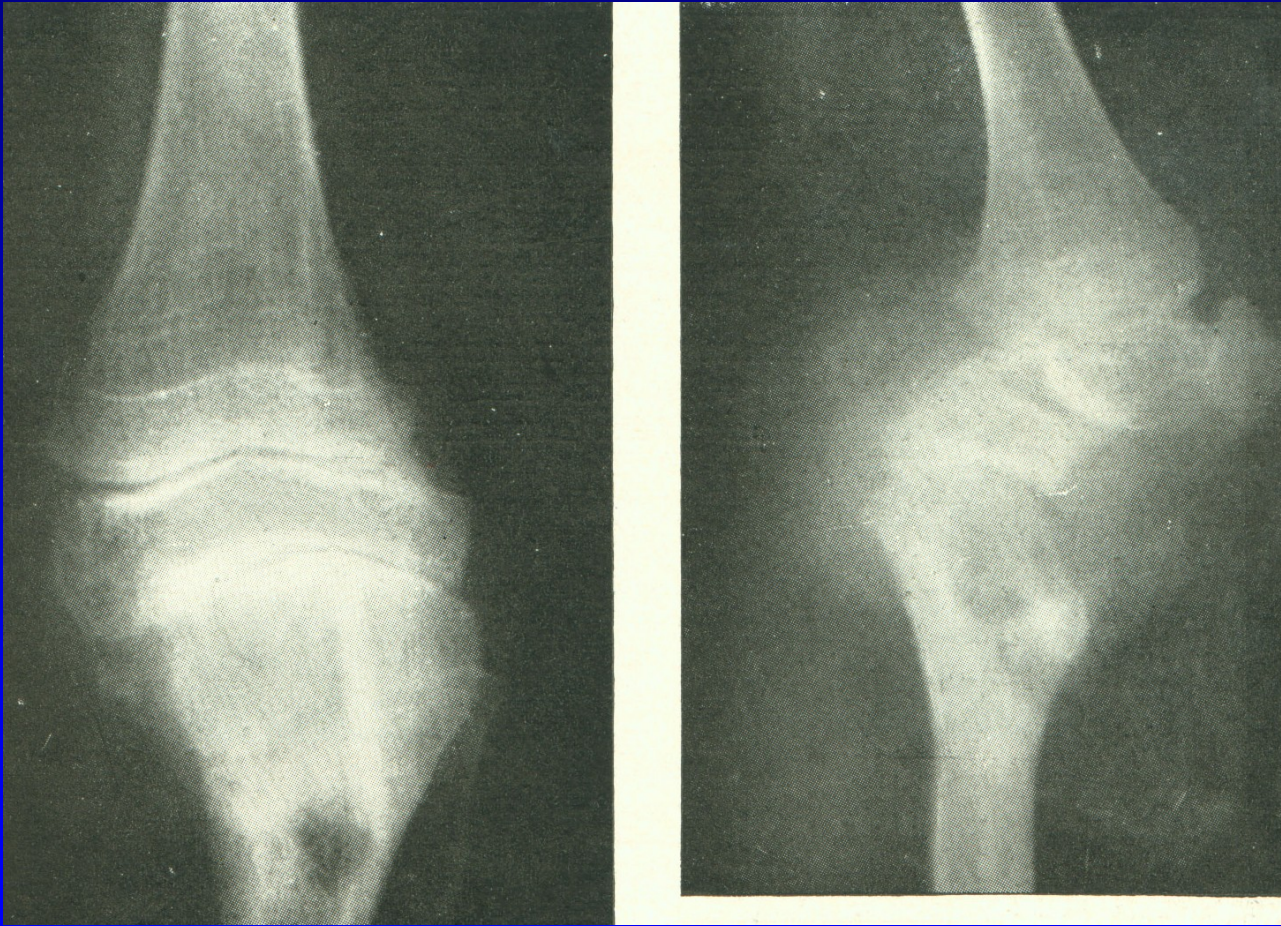
TB paraarticular
lesion in metaphysis



Spina ventosa



TB of the knee joint- subluxation



Diagnostics

Aspiration

Biopsy

Histology

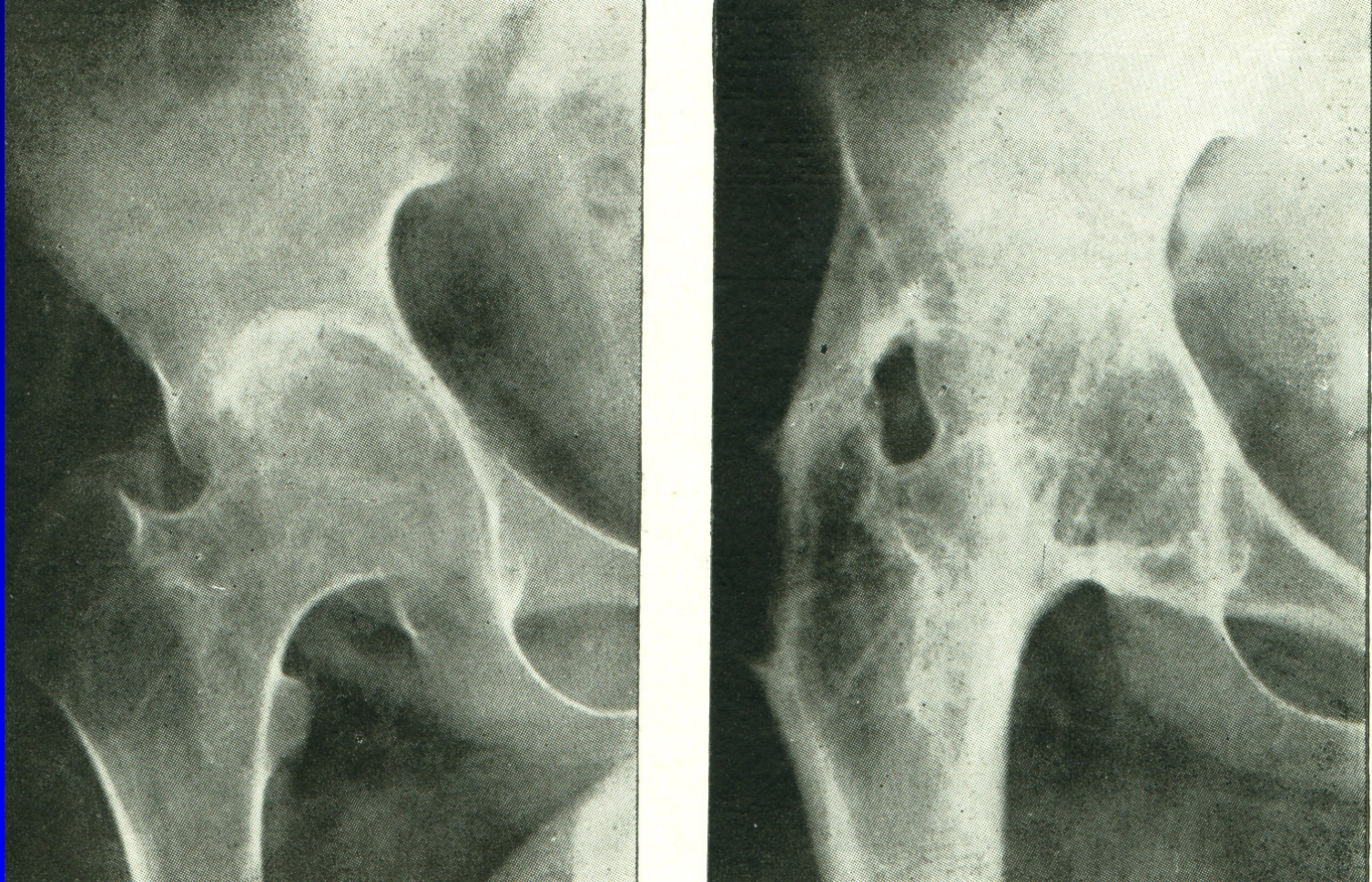
Mantoux II

PCR (polymerase chain reaction)

Serology: IgM, IgA, IgG

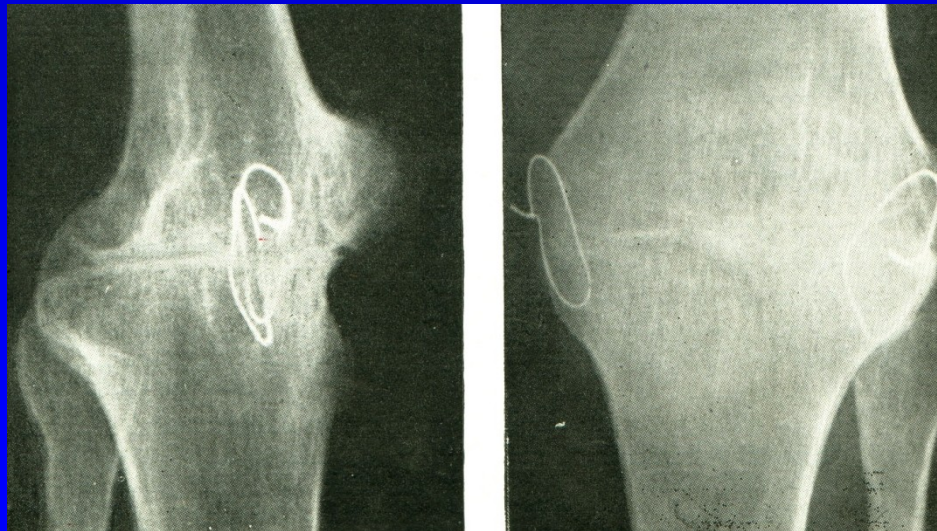
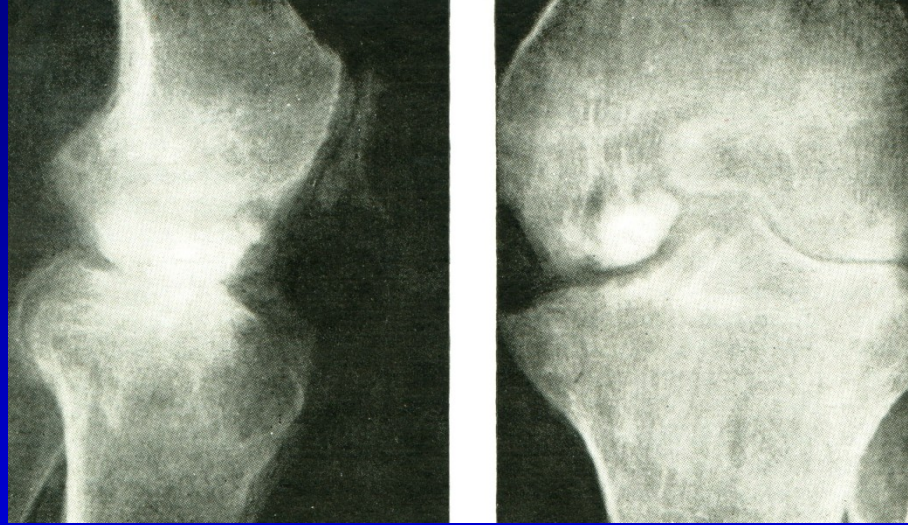
QuantiFERON –TB Gold

TB coxitis healed by extraarticular arthrodesis



TB arthrosis 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, orthosis

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

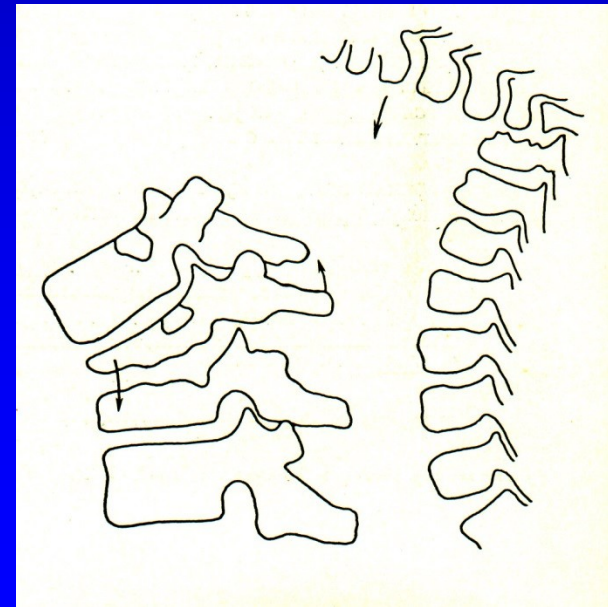
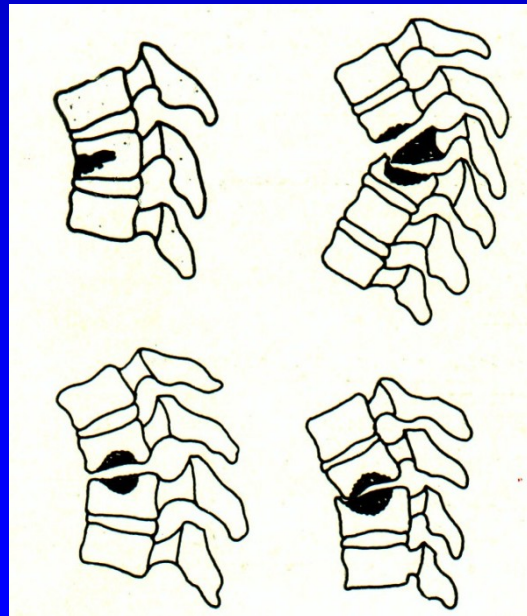
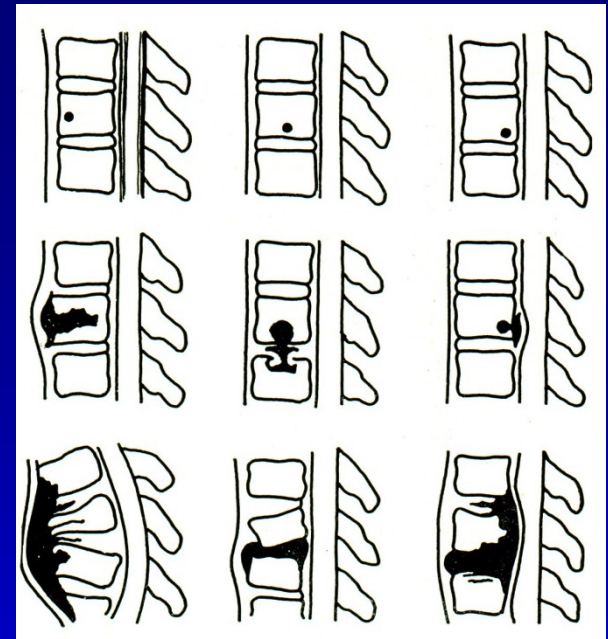
Sharp gibbus

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