Parallel Lecture A:
Infection Control in Orthopaedics

Thursday 24 March 11.55am Wellington

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I am accredited as a Medical Expert and a full member of The Academy of Experts.Have been providing medico-legal expert witness reports over last 7 years producing. 20 year's clinical experience in Infection specialities, Medical microbiology, virology, tropical medicine, and infectious diseases.

On GMC, NHS resolution and Medical Protection Society Expert Panels.

I am currently the Associate Medical Director at the Manchester University NHS foundation trust with a sub speciality interest in Infection control. I also lead the Bone and Joint MDT looking at prosthetic joint infections. I am also the regional medical lead for Infection prevention and control for NHS North West.

Feedback

Please remember to leave feedback for this presentation at:

https://bit.ly/InfectionControlinOrthopaedics

SCAN ME

Infection, Prevention and Control in Orthopaedics

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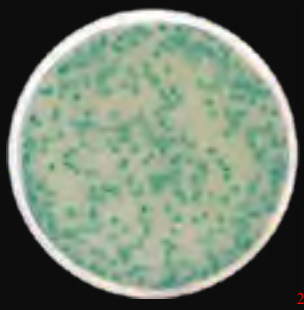
The Brief

- Bone and Joint infections
- Surgical site infections
  - Guidelines
  - Prevention including antibiotic prophylaxis
  - Treatment
- MRSA in orthopaedics
  - Incidence
  - Prevention
  - Treatment



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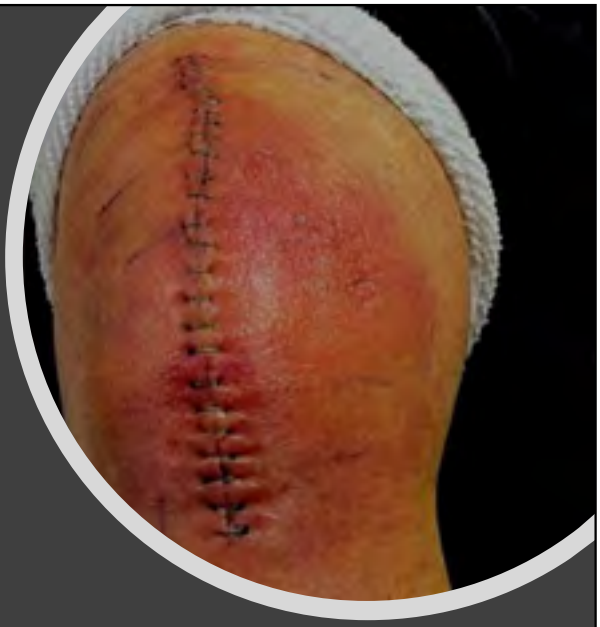
The Brief

- Implant and Joint infections
  - Prevention
  - Diagnosis
  - Treatment
- Microbiology/Infection input on an Orthopaedic ward
- Reviewing as an Expert Witness



MRSA

- Staphylococcus aureus that is resistant to Fluclox(Meticillin)
- About 30% of the UK population are colonised with *S. aureus*,and 1-3% of the total population are colonised with MRSA

Risk of MRSA acquisition

- Critical or chronic illness, if also elderly or debilitated.
- Presence of surgical wounds, open ulcers, intravenous lines and catheter lines.
- Presence of an infected pressure sore.
- History of MRSA colonisation or infection, or recent surgery.
- Recent discharge from hospital.
- Regular nursing home contact or a nursing home resident.
- Recent antibiotic use (especially cephalosporins, fluoroquinolones and macrolides).
- Dialysis.
- Presence of a permanent indwelling urinary catheter.
- HIV positivity (especially if young, male, recent incarceration in prison)

MRSA in Orthopaedics (source UKHSA)

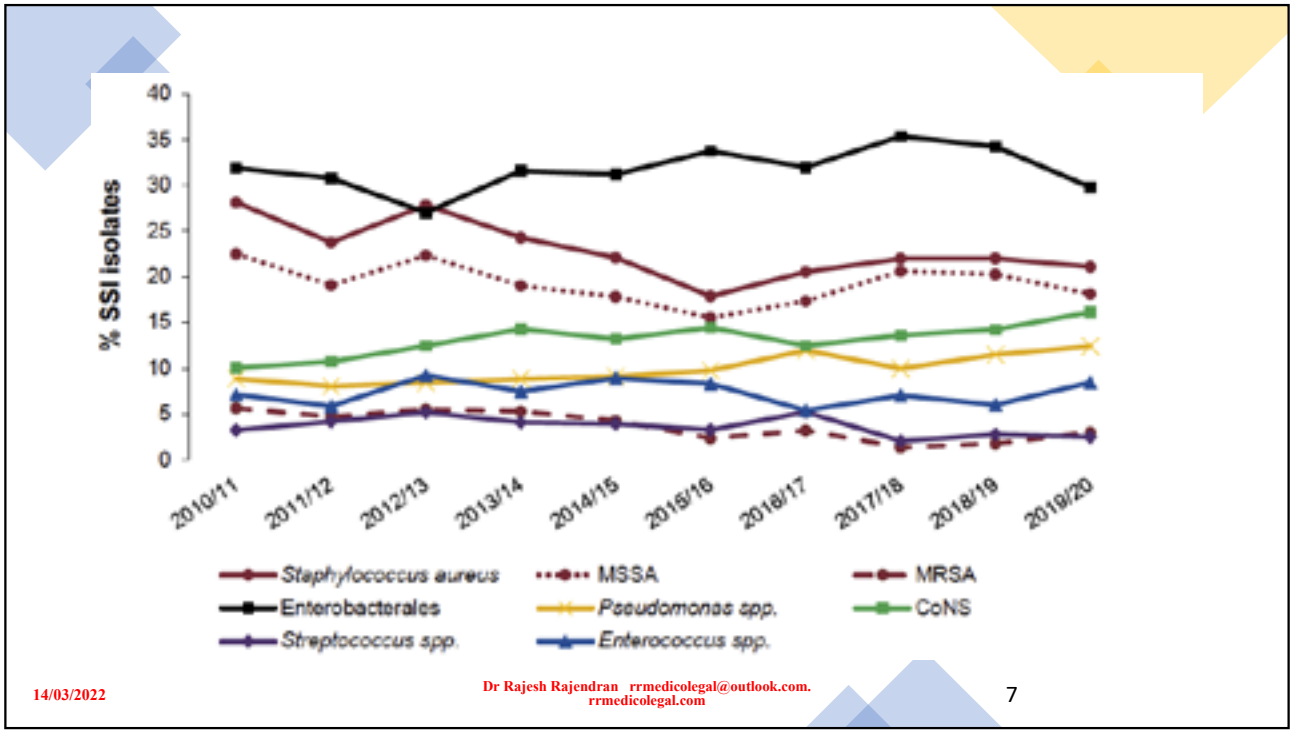
a) superficial SSIs only

Reported causative organism	Hip replacement No.	Hip replacement %	Knee replacement No.	Knee replacement %	Repair of neck of femur No.	Repair of neck of femur %
Methicillin-sensitive S.aureus	42	30.2	45	43.3	49	39.8
Methicillin-resistant S.aureus	6	4.3	5	4.8	12	9.8
Coagulase-staphylococci	30	21.6	23	22.1	14	11.4

b) deep incisional or organ/space SSIs

Reported causative organism	Hip replacement No.	Hip replacement %	Knee replacement No.	Knee replacement %	Repair of neck of femur No.	Repair of neck of femur %
Methicillin-sensitive S.aureus	153	32.3	184	40.7	76	21.8
Methicillin-resistant S.aureus	19	4.0	14	3.1	26	7.5
Coagulase-negative staphylococci	119	25.1	108	23.9	78	22.4

- MRSA bacteremia's increased by 3.6%
- 1.6% of all Orthopaedic admissions



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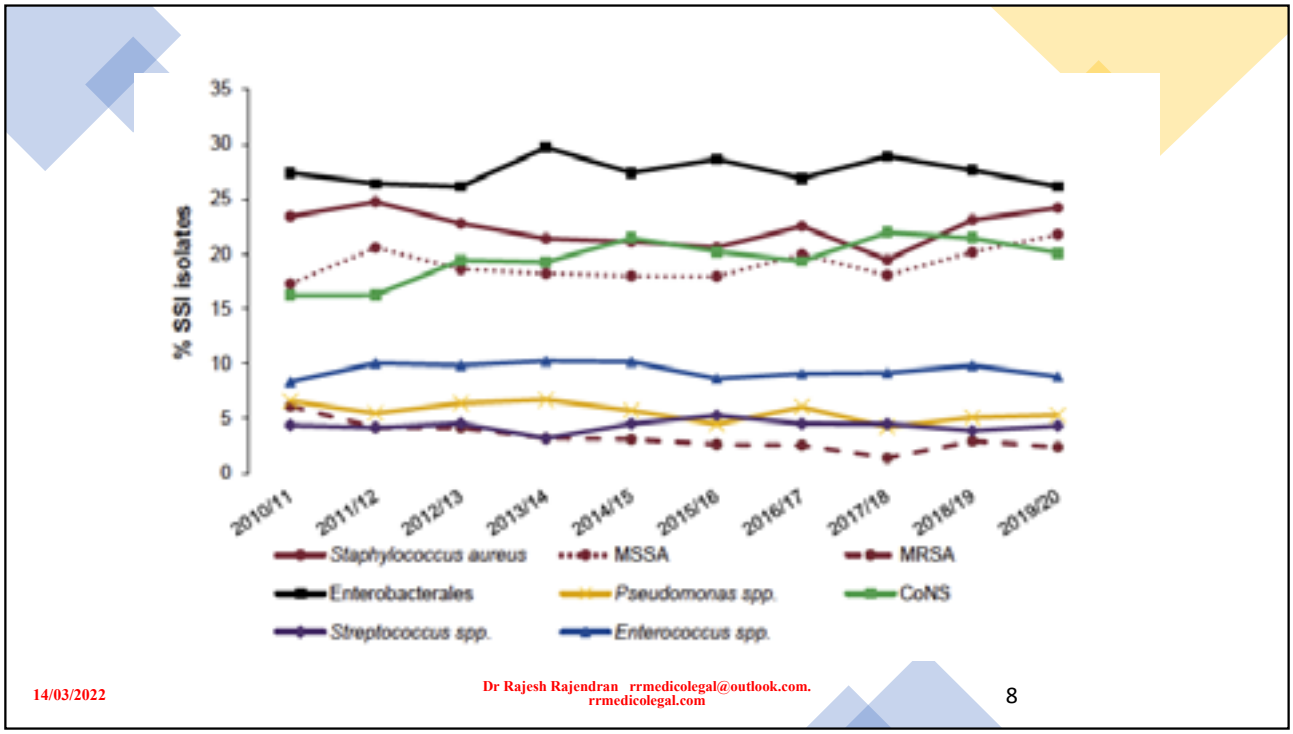

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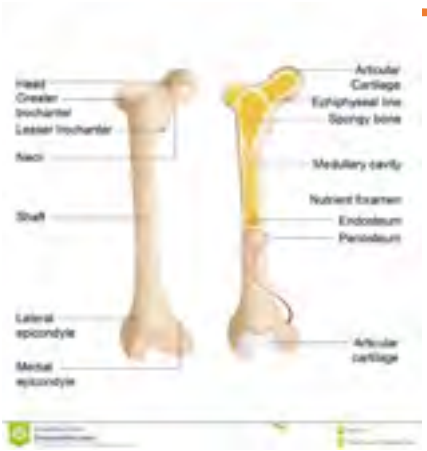
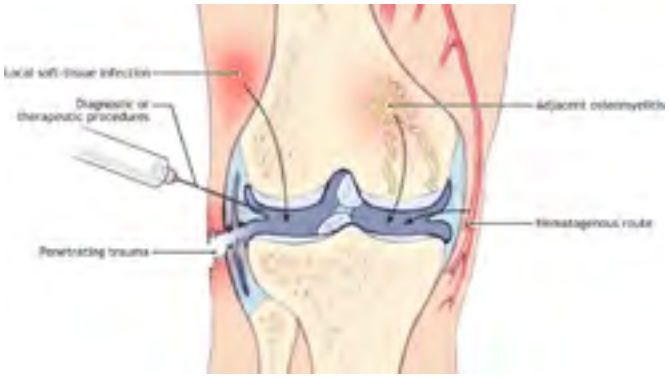
Bone and infections (challenges)

- Bone structure and blood supply
- Joint space
- Microbiology
- Treatment duration
  - 4-6 weeks
  - Morbidity
    - Length of stay
    - Duration of antibiotics – IV lines vs long lines
    - Increased risk of chronicity
  - Mortality

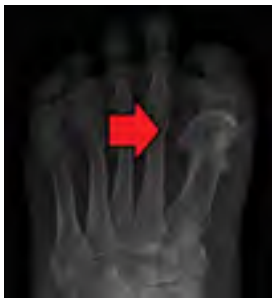
Bone vs Joint

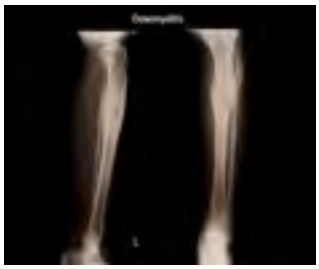


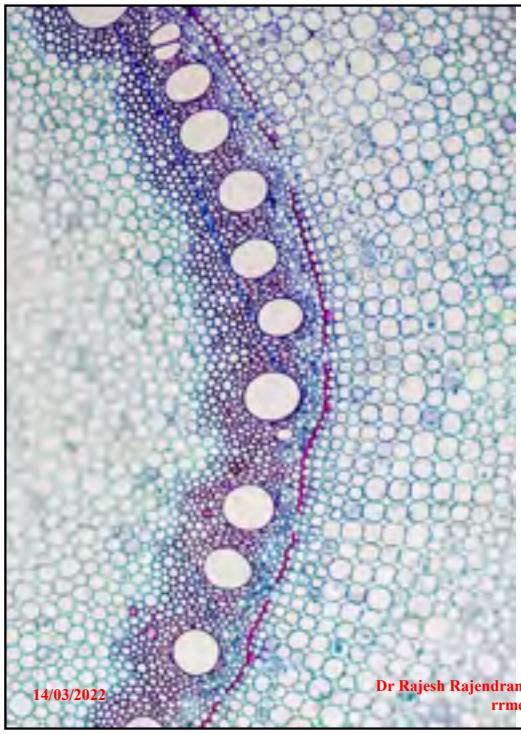


Orthopaedic Infections

- Native bone infections
  - Septic arthritis – Joint
  - Osteomyelitis
  - Infection of soft tissues
    - Myositis
    - Cellulitis
- Intervention related
  - Prosthetic Joint infection
  - Arthroscopy associated







How

Direct inoculation

- Surgery
- Trauma

Blood stream spread

- Secondary to bacteremia
  - Common site vertebra
- IV cannulation / other nosocomial routes.

Osteomyelitis

- Infection of the bone and bone marrow
  - Acute
  - Chronic
  - Prosthetic joint related

Acute osteomyelitis

Infection reaches the bone via direct spread

Neighbouring focus of infection → Mastoiditis

Direct spread from a leg ulcer

Organisms

- Gram Positive
  - Staph aureus -70%
  - Streptococcus
  - Pneumococcus
  - Coag Negative Staph→ PJI
  - Mycobacterium TB
- Gram Negative
  - Salmonella → SCD
  - Haemophilus >4 years age
  - Pseudomonas
  - Proteus

Clinical features

General manifestation

- Fever
- Night Sweats
- Loss of weight
- Anorexia

Local features

- Pain
- Oedema
- Tenderness

Diagnosis

- Lab markers
  - White cell count
  - CRP/ESR
  - Microbiology
    - Blood cultures + 50%
    - Wound culture
    - Intra –operative specimens
    - Aspiration of pus
    - PCR for specific organisms
- Radiology
  - X-ray
    - 1-2 weeks soft tissue oedema
    - Periosteal reaction
    - Lytic lesions
  - CT scan
  - MRI
    - High sensitivity and specificity positive within first few days
  - Radio isotope scan

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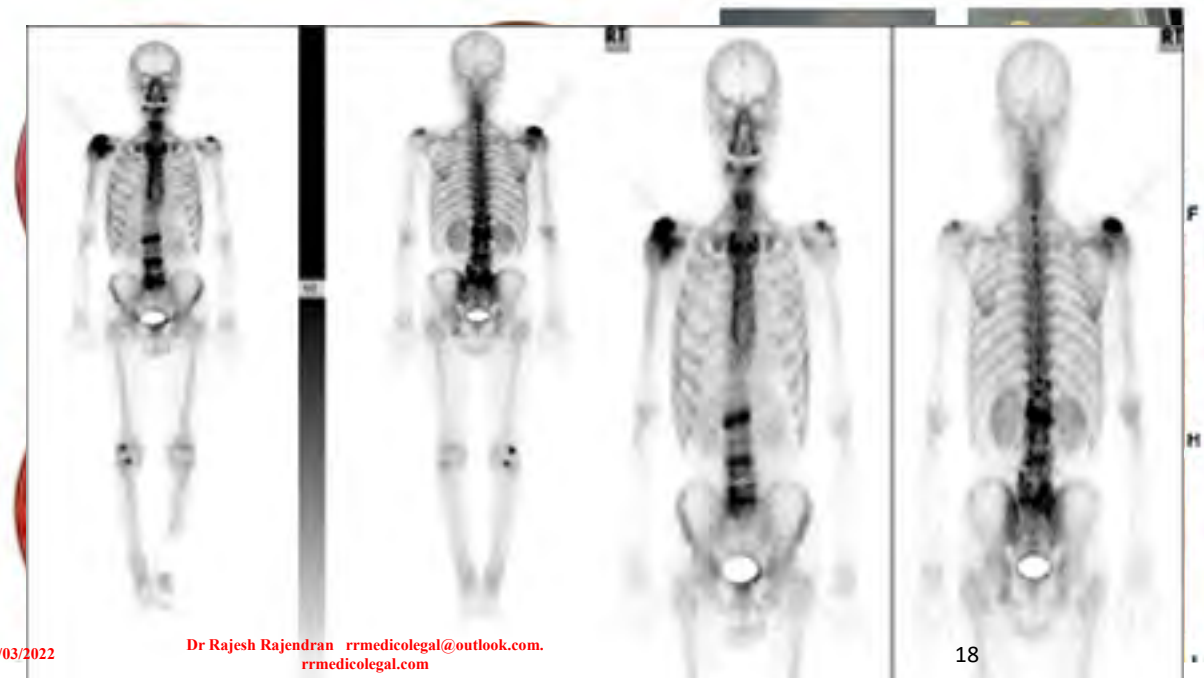

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Treatment

- Surgery once the pus is formed (osteomyelitis)
- Antibiotics
  - Target Staph aureus in all cases and then based on cultures
  - Flucloxacillin 2 grams four times a day / Vancomycin / Teicoplanin
    - Monitor LFTS
    - Duration of 6 weeks (OM) with monitoring with
      - CRP
      - WCC
      - Radiology

Septic Arthritis

Clinical manifestation

- Pain in the joint
- Swelling and tenderness
- Inability to move the joint
- Fever
- Malaise

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Investigations

- WBC
- CRP
- Synovial Fluid analysis
- Xray

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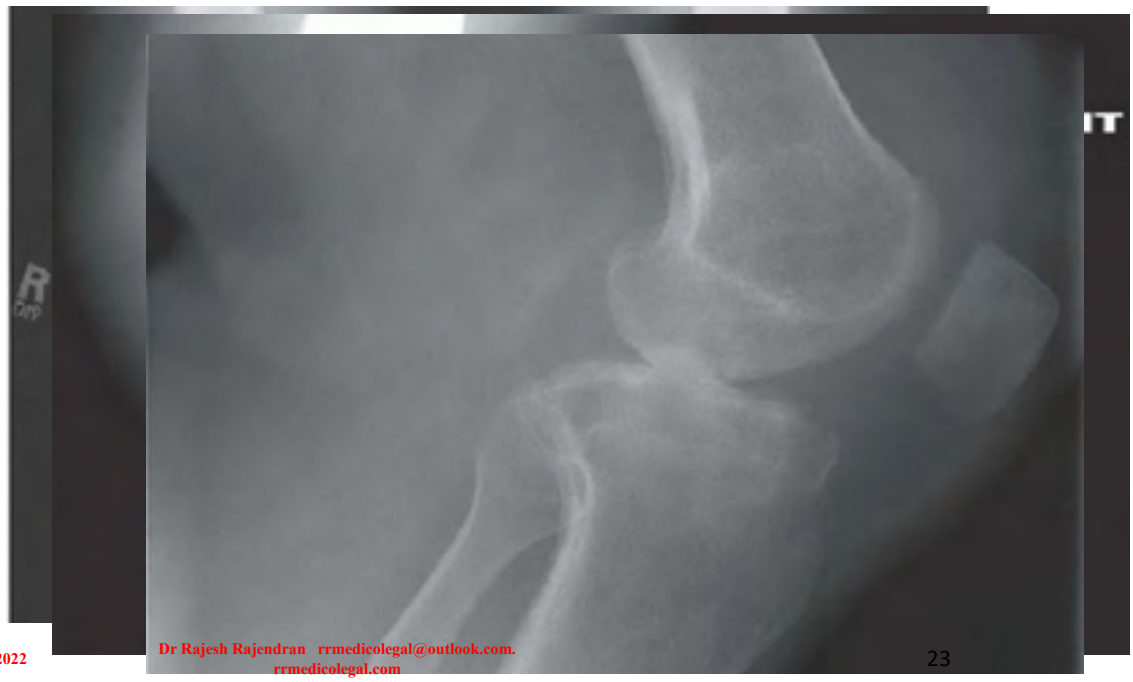

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Synovial fluid analysis

	WBC	Colour	Viscosity
Normal	<150	Colourless/Straw	High
Septic	>5000	Pus/Purulent	Mixed Positive for organisms

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Surgical Site infections

What is an SSI

- A surgical site infection is an infection that occurs after a surgery in the part of the body where the surgery took place.
  - Surgical site infections can sometimes be superficial infections involving the skin only.
  - Can involve tissues, organs, or implanted material.
    - https://www.cdc.gov/hai/ssi/ssi.html#:~:text=Related%20Pages,infections%20involving%20the%20skin%20only.

SSI in orthopaedics

- Post surgery wound infection
- Joint infection
  - Prosthetic Joint infection
  - Septic arthritis – post arthroscopy
- SSI incidence
  - Hip /Knee : 0.5%, 02-0.3/1000 bed days (source national SSI surveillance data 2019/2020

Guidelines

- WHO checklist
- NICE SSI guidance
- SIGN guidance
- CDC / WHO guidance
- BOA
- ESCMID

NICE Guidance 125 (August 2020)

https://www.nice.org.uk/guidance/ng125/chapter/Recommendations

Prevention Strategies

- Pre-op
  - Showering
  - Nasal decolonisation
    - Mupirocin and Chlorhexidine body wash
  - Hair removal when indicated
  - Patient and staff theatre wear

Surgical wound classification

- Clean: an incision in which no inflammation is encountered in a surgical procedure, and during which the respiratory, alimentary or genitourinary tracts are not entered.
- Clean-contaminated: an incision through which the respiratory, alimentary, or genitourinary tract is entered but with no contamination encountered.
- Contaminated: an operation in which there is a major break in sterile technique or gross spillage from the gastrointestinal tract, or in which acute, non-purulent inflammation is encountered, Open traumatic wounds.
- Dirty or infected: an incision undertaken during an operation in which the viscera are perforated or when acute inflammation with pus.

Antibiotic prophylaxis

- Indicated in all the above surgeries
- Antibiotic given at the start of anaesthesia
- Additional Doses depending on the duration of surgery
- Based on local formulary
- Need to target the organisms likely to cause infection

PJI (Prosthetic/Periprosthetic Joint infection)

Defined as infection involving the joint prosthesis and adjacent tissue.

Incidence of PJI ranges from 1% to 2% in primary procedures.

The mean of PJI from multiple national registry data is 0.97% for THA and 1.03% for TKA.

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Risk Factors

- Obesity- BMI >35
- Low BMI
  - Malnutrinion → low immunity → increased infection
- Diabetes:
  - perioperative hyperglycaemia at the time was associated with an increased risk, even in patients without diabetes mellitus
- Immune suppression
  - Rheumatoid arthritis etc
  - Drugs

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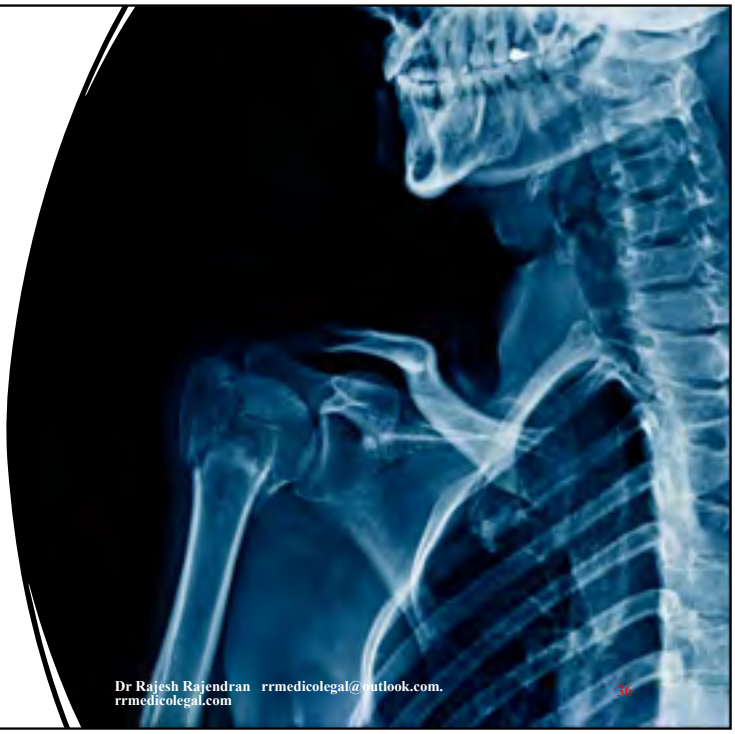
- Male gender
- Revision surgery / Joint Trauma
- Smoking
- Bacteremia in the preceding year
- Septic arthritis
- Infection in a distant site
  - UTI
  - Respiratory tract infection

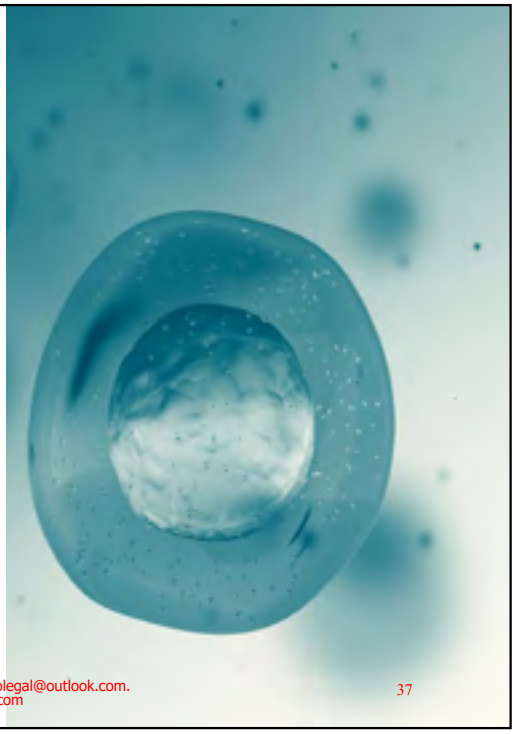
Clinical features

- Pain
- Joint swelling / effusion
- Redness
- Warmth
- Fever
- Presence of a sinus communicating with a joint



Biofilm

- Biofilms are complex communities of microorganisms embedded in an extracellular matrix that forms on surfaces.
- Single or multiple bacteria



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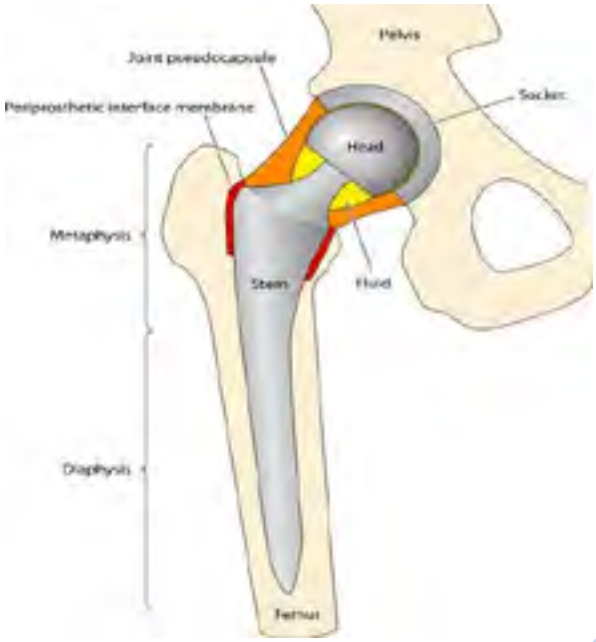

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Types

- Early onset – <3 months
  - Indicative of intraoperative contamination
  - More virulent organism
- Delayed Onset
  - 12-24 months
  - Less virulent organism
- Late onset
  - > 24 months
  - Likely to be blood borne

Pathogenesis

- Direct inoculation at the time of surgery
- Spread from a contiguous site
- Blood borne spread mostly Staph aureus

Organism → prosthesis → colonization of implant →Biofilm

Definitions

Infection unlikely

Infection likely

Infection Confirmed

Infection unlikely: (all signs negative)

There is a very clear explanation of patients symptoms

Synovial fluid analysis is normal

Normal CRP and White cell count

Sonication – negative

Microbiological specimens – negative

Negative bone scan

Infection Likely (2 or more)

- Radiological signs of Loosening – in 5 years
- Wound healing problems
- Recent Fever or bacteremia (bacteria in blood)
- Pus around the prosthesis
- Raised CRP
- Raised WCC in synovial fluid >1500, > 65% neutrophils

Infection likely

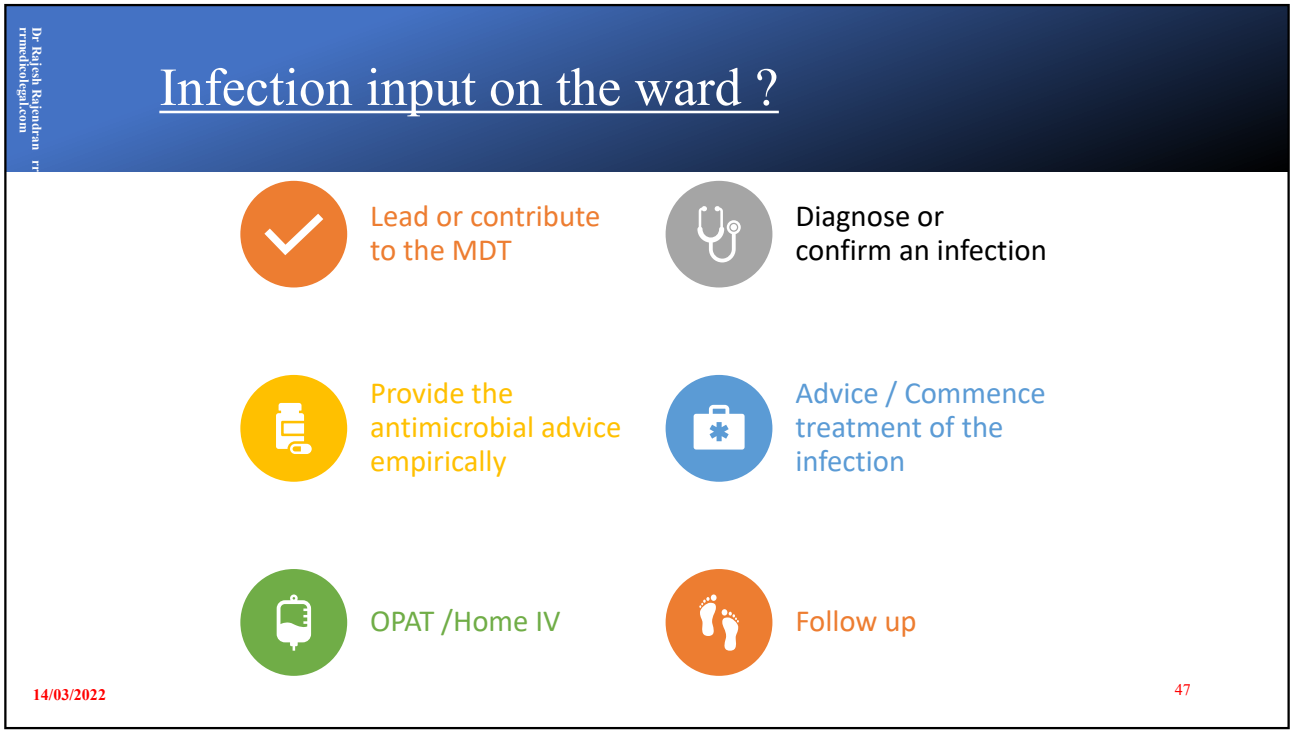
- Microbiology
  - Positive culture on aspiration
  - Positive intraoperative specimen culture
  - Positive (atleast 1 CFU) of sonification sample
- Histology
  - At least 5 neutrophils in a single field
- Positive white cell labelled scan.

Infection definite

- Presence of a sinus tract to the joint with a visible prosthesis
- Synovial fluid
  - >3000 WBC and > 80% neutrophils
  - Positive alfa-defensin
- Microbiology
  - 2 or more Positive intraop specimen
  - Sonication specimen
- Histology and WCC scan positive

Managing a PJI

- MDT approach
  - Infection specialists
  - Plastic surgeons
  - Orthopods
  - Pharmacists
  - Specialist nurses
  - Physiotherapists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Infection input on the ward ?
Lead or contribute to the MDT
Diagnose or confirm an infection
Provide the antimicrobial advice empirically
Advice / Commence treatment of the infection
OPAT /Home IV
Follow up
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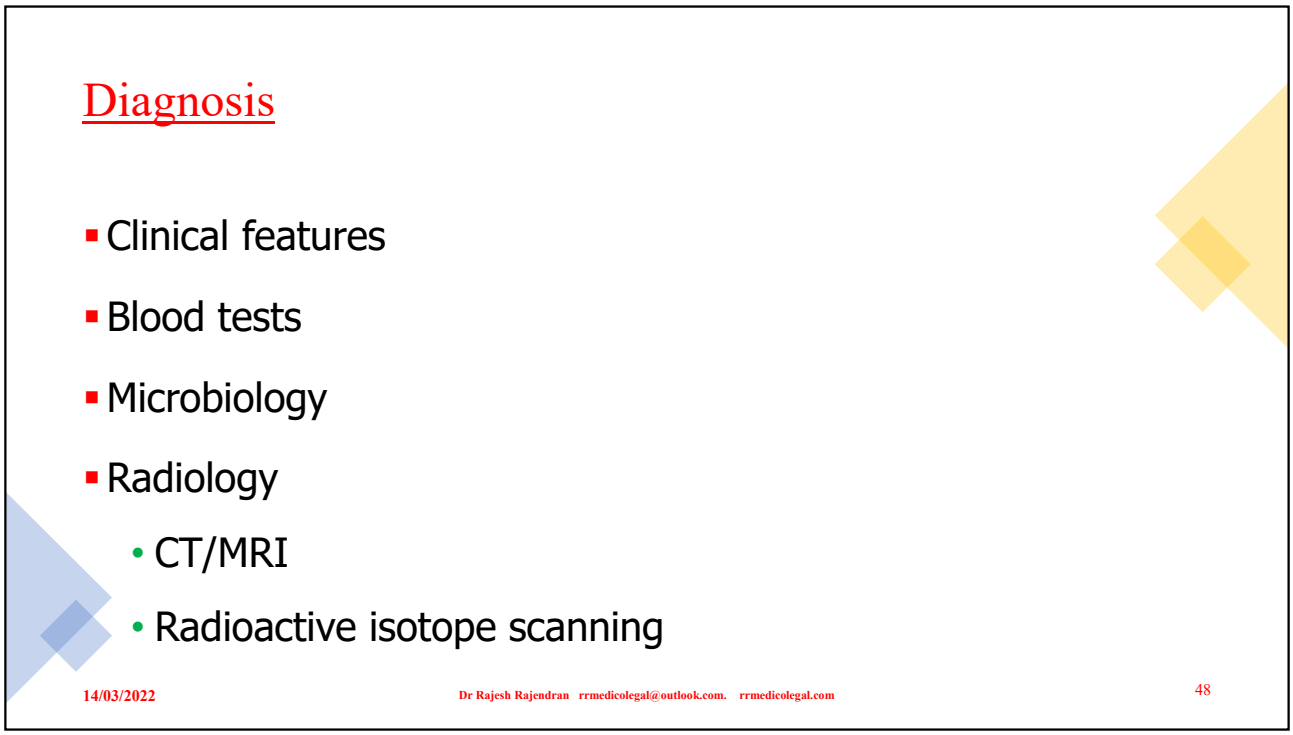
Diagnosis
Clinical features
Blood tests
Microbiology
Radiology
CT/MRI
Radioactive isotope scanning
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Intraoperative specimens

- 5 or more specimens
- Sensitivity of 80% and specificity of 97%
- Sonification of Removed prosthesis
- Synovial fluid analysis
  - WCC count and Gram stain
  - Culture
  - 16s PCR
- Histology

Treatment

- Goals
  - Eradicate infection
  - Restore function of the joint
  - Make it pain free

Types of surgery

- DAIR (Debridement, antibiotics and implant retention)
  - Removing pus
  - Removing the polythene liner or modular head
  - Open procedure
  - Success 30 -80%
    - 30% for knee and 50% for hip
  - Arthroscopic DAIR → 4 times failure rate
- One stage revision
- 2 stage revision (use of spacer)

Antibiotics

- Treatment
  - Antibiotics 2– 6 weeks IV upto 3 months with orals
- Suppression
  - Often lifelong in some cases
- Treatment failures
  - MRSA
  - VRE
  - Quinolone resistant gram negative
    - Eg E.coli resistant to ciprofloxacin

What do I look for

- Did the consent, factor in risk of infections was the risks conveyed ?
- Pre-op Assessment
  - MRSA Vs MSSA screening
  - Covid Screening and isolation
    - PCR vs lateral flow
- Perioperative
  - Operation time

- Antibiotics
  - Need to factor all possible organisms
    - Vancomycin/ teicoplanin + gentamycin (commonly used)
  - Timing
  - Dose
  - Post op
- Was all possible steps taken to avoid the infection
- Once infection is established
  - Suspected
  - Diagnosed in time
  - Appropriate help sought
  - Empirical vs actual antibiotics
  - Monitoring of side effects