Principles of intramedullary nailing

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Basic Principles of Fracture Management for ORP
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Learning outcomes

At the end of this lecture you will be able to:

• Explain how an intramedullary nail works
• Discuss the design of different nails
• Describe the surgical technique
Indications

• Fractures of long bones
Objectives of treatment with a nail

- Restoration of **length** of limb
Objectives of treatment with a nail

- Restoration of length of limb
- Restoration of load axis
Objectives of treatment with a nail

- Restoration of **length** of limb
- Restoration of **axis** of limb
- Restoration of **rotation** of limb
Indirect bone healing—relative stability

Callus
Gerhard Küntscher (1900–1972)

- No interlocking of his original nails
Static and dynamic interlocking of nails

• What does it mean?

Static

Static (90°)

Dynamic
Dynamic interlocking

- Proximal and distal
  - With one bolt through longitudinal elliptical slots
  - Used in simple fractures
- Allows compression across fracture zone
- Still controls rotational instability
Dynamic locking screw hole
Dynamic interlocking

- Weight bearing encourages interfragmentary compression
Dynamic interlocking

- Weight bearing encourages interfragmentary compression
- Callus formation in fracture zone
Static interlocking

- Proximal and distal:
  - With two or more bolts
  - Used in severe fractures with rotational and/or longitudinal instability
- Reduces collapse in fracture zone
To ream or not to ream?

- In the reamed technique, intramedullary blood supply is compromised.
To ream or not to ream?

• Blood supply in **reamed** technique

• Blood supply in **unreamed** technique

Why reaming?

Unreamed

Nail-bone contact

Reamed

Permits larger, more stable nails
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<th>Reaming</th>
<th>Nonreaming</th>
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Reaming:
- Is preferable
- Respect contraindications

Type of nails

Design/form:

• Depends on anatomical region
Type of nails

Design/form:

- Depends on anatomical region

Femoral nail
Type of nails

Design/form:
• Depends on anatomical region

Tibial nail
Type of nails Example

Titanium elastic nails (TENs):

- For different anatomical regions
- Mainly in children

Courtesy: Dr. Teddy Slongo, Bern
Type of nails

Design:
- Cannulated
- Solid
- Hollow and slotted

Material
- Titanium
- Stainless steel
Surgical technique step-by-step

1. Reduction
2. Opening of canal
3. (Reaming)
4. Insertion of nail
5. Locking of nail
6. Final x-ray check
1. Reduction

- Indirect—closed:
  - Before operation
  - Traction table
1. Reduction

- Indirect—closed:
  - Before operation
    - Traction table
  - During operation
    - Large distractor
1. Reduction

- Indirect—closed:
  - Before operation
    - Traction table
  - During operation
    - Large distractor
    - Joysticks
1. Reduction

- **Indirect**—closed:
  - Before operation
    - Traction table
  - During operation
    - Large distractor
    - Joysticks

- **Direct**—open:
  - Small incision into fracture zone
  - Rarely used
2. Opening of canal

- Correct entry point depends on:
  - Anatomical region
  - Type of nail
2. Opening of canal

- Correct entry point depends on:
  - Anatomical region
  - Type of nail
  - Is crucial for success
2. Opening of canal

- Risks of incorrect entry:
  - Malalignment
  - Difficulty to insert the nail
  - Extension of the fracture
  - Problems with proximal locking
  - Articular damage
In this case of retrograde nailing, the entry point was too anterior and caused an additional femoral fracture.
1. Insertion of guide wire (tibia)

2. Opening of canal
1. Insertion of guide wire (tibia)

2. Opening of canal
2. Opening of canal

1. Insertion of guide wire (tibia)

2. Opening of canal
3. Reaming

• Insertion of reaming rod
  • Size and length depend on:
    • Type of nail
    • Reamer set
  • Used for reduction and for reaming
3. Reaming
3. Reaming

- First reamer head to be used is front-cutting
- Next reamer heads to be used are side-cutting (front is blunt)

Overream to 1mm larger than diameter of nail
4. Insertion of nail

• Determination of nail size:
  • Intramedullary:
    • Length—with 2 rods of same length
4. Insertion of nail

- Determination of nail size:
  - Intramedullary:
    - Length—with 2 rods of same length
  - Extramedullary:
    - Length
    - Size
4. Insertion of nail

- **Instruments needed:**
  - Handle
  - Connecting screw
  - Hammer

- **Image intensifier:**
  - To determine correct intramedullary insertion
5. Locking of nail

- Which bolt size? Which drill bit?
- Which bolt length?
5. Locking of nail

Proximal:

- Aiming arm
- Triple drill sleeve
- Drill bit
5. Locking of nail

Distal:

- Radiolucent drive
- Pointed drill bit
5. Locking of nail

Distal:

- Radiolucent drive
- Pointed drill bit
- Correct projection with image intensifier
5. Locking of nail

- Insertion of nail end cap
6. Final check

- **Reduction:**
  - Alignment
  - Angulation
  - Rotation

- **Fixation:**
  - Interlocking of bolts
  - Fracture pattern
Summary

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