SHOULD YOU INTERNALLY FIX EVERY DIAPHYSEAL FRACTURE?

NO
Diaphyseal Pathological Fractures

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How big is the problem?

- Carcinomas are 500 times more common than sarcomas.
- 50% of carcinomas develop bone metastases.
- 25% of bone metastases progress to pathological fractures.
- Axial > long bones.
- Femur is the commonest followed by humerus.
- Only 7% occur distal to the knee and elbow (usually lung and kidney).
Role of the orthopaedic surgeon

• Diagnosis of the pathological fracture and staging of patient.
• Management of pathological fractures.
• Management of impending fractures.
• Definition of pathological fracture

• How do you suspect a pathological fracture?

• How do you diagnose the cause of the pathological fracture?

• How do you treat the patient who sustained a pathological fracture?
Definition of a pathological fracture

• It is a fracture occurring in an abnormally weak bone.

• The cause of this weakness may be neoplastic, inflammatory, metabolic, etc.
How do you suspect a pathological fracture?

• History
• Xray
How do you suspect a pathological fracture?

*Patients could present to the orthopaedic surgeon with:*

- Pathological fracture.
- Impending fracture
- Pain only.
How do you suspect a pathological fracture?

**History:**

- Trivial trauma
- Pain (or limp) before the fracture
- Known history of cancer
- Symptoms suggestive of cancer (weight loss, heamoptysis, heamatemesis, bleeding PR, urinary ..)
- History of previous irradiation
How do you suspect a pathological fracture?

**Xray:**

• abnormal bone quality
• underlying lytic, blastic or mixed lesion
• other lesions in the same or adjacent bone
• abnormal fracture pattern
How do you diagnose & stage the cause of the pathological fracture?
• If it is a primary neoplasm, what type and what stage?

• If it is a secondary, where is the primary and are there other secondaries?

• If it is a non neoplastic cause, what is it?
• **General examination** for LN, scars of previous operations, abnormal pigmentations or deformities.

• Breast: clinical exam.  *If not mammography + US & duplex*

• Thyroid: clinical exam.  *If not U/S*

• Prostate: PR

• Rectum: PR
• Laboratory investigations:

• CBC, ESR, kidney and liver functions.
• Calcium, phosphorus, alkaline phosphatase, +/- acid phosphatase.
• Plasma protein electrophoresis and immunoelectrophoresis.
• CEA, CA 125 (ovary), CA 15-3 (breast), CA 19-9 (colon), B2 microglobulin (lymphoma)
• PSA
• Alpha feto protein.
• PTH.
• Chest & pelviabdominal CT.

• Bone scan. (false -ve in myeloma, lymphoma, histiocytosis. Extensive prostate mets .. Superscan looks normal but renal stealing)
• Local MRI *(includes the whole affected bone)*

It is essential for detecting the exact extension of the lesion and the presence of other lesions in the bone and thus allowing us to choose the most appropriate method of fixation/replacement
• Investigations reveal the cause.
• Investigations does not reveal the cause

Biopsy (core is preferable)

*diagnoses type of primary sarcoma and may give a clue to the site of primary carcinoma*
Hence, you reach a diagnosis:

- Non neoplastic cause
- Primary sarcoma and its stage
- Myeloma (solitary or multiple)
- Secondary
If the fracture is due to secondary carcinoma

*In addition to fracture management:*

- Is it solitary or multiple? Assess other lesions for impending fracture.

- Known primary or unknown? *Repeat investigations after 6 weeks.*

- Primary tumour treated or not yet treated? *Treat the primary*

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How do you treat a pathological fracture?

_in case of secondaries or myeloma_
Expectations!

- Level 1: normal unsupported ambulation
- Level 2: supported ambulation.
- Level 3: ambulation outside the bed.
- Level 4: comfortable mobilization in bed.

This goal is determined according to the underlying cause, general condition, fracture pattern, technical skills, economics...
Treatment options

- Non operative treatment
- Operative treatment
• Is surgery associated with high risk mortality?  YES

• Will surgery achieve the proposed goal (bearing in mind the available implants, instruments, operative setting and technical skills)?  NO
NON OPERATIVE TREATMENT
Non operative treatment

- Biphosphonates (Zometa)
- Radiotherapy
- Pain control
- Splints, traction, braces, etc..
- DVT control
- Ambulatory aids
Non operative treatment

Biphosphonates:
- blocks osteoclastic activity
- decreases the incidence of fracture
- decreases hypercalcaemia
- decreases pain
- reports on decreasing incidence of mets.

Zoladronic acid (Zometa): 4 - 8mg short infusion saline every 4 weeks.
Non operative treatment

Radiotherapy:
• partial pain relief in 80%
• complete pain relief in 20%
• it has a temporary effect.
• It has no effect on renal cell carcinoma mets, or sarcoma mets
Non operative treatment

- Hormonal therapy: e.g., tamoxifen in breast cancer and LHRH agonist in prostate cancer.
- Chemotherapy.
- Radioactive iodine in thyroid mets after thyroidectomy.
Non operative treatment

Pain control:
• NSAI, neuroleptics, ms relaxants, antidepressants
• mild then strong opioids
• Patient controlled analgesia (PCA)

+ biphosphonates
+ radiotherapy
Non operative treatment

DVT control:
• used cautiously as there are circumstances of increased bleeding tendency

Ambulatory aids:
• crutches, walker, wheelchairs
• splints, braces, slings

Vocational therapy
• Is surgery associated with high risk mortality?  
  
  NO

• Will surgery achieve the proposed goal (bearing in mind the available implants, instruments, operative setting and technical skills)?  
  
  YES
OPERATIVE TREATMENT
Things you need to know before operating !!

What is the difference between treating a regular fracture and treating a pathological fracture ?
• The underlying lesion may continue to erode bone and no healing will occur so mechanics will depend totally on the implant.

• Surgery should be followed by radiotherapy to halt the disease process.

• There may be other weak areas in the bone present at the time of fracture or may appear later on.

• Survival may be limited thus rapid results is required to improve quality of life.

• Usually high risk patients for anaesthesia and they are liable to more complications intraoperatively and postoperatively.
Prepare the patient:

- Proper staging
- Proper medical assessment and preparation

Prepare Yourself

- An array of various implant options and sizes
- Technically demanding
Operative treatment

Perioperative considerations:

• multidisciplinary anaesthesia, oncologist, orthopaedist to assess risk

• Cardiopulmonary high risk: recent MI, +ve stress, severe heart failure, uncontrolled BP, pulm functions <35%.

• 10/30 rule, minimum platelets 50000, INR <1.5, serum albumin >2g/dl, normal Ca, P, Na, K.
Adjunct procedures:

1. **Preoperative embolization:**
   - effective in 60 - 90%
   - gel foam, polyvinyl alcohol beads, coils..)
   - Operation should be done within 24 hrs if gel foam is used and 24 - 36 hrs if alcohol is used.
   - Complications (rare): muscle and skin necrosis, paresis, arrest.
   - Added value: decreases pain in inoperable cases!
Operative treatment

Internal fixation
(open reduction or minimally invasive)

OR

Replacement
(after wide, marginal or intralesional resection)
Internal fixation of fractures

- Preferably intramedullary fixation or else a long plate.
- Reconstruction nails are better for femoral fixation than the regular interlocking nails.
Internal fixation of fractures

**Precautions during operation:**

1. Narrow fluted reamers
2. Slow reaming
3. Regular suction of contents
4. Controlled insertion of implant
5. Careful attention to hemodynamics and oxygenation parameters during critical steps (anaesthesia).
Internal fixation of fractures

*When do you need to curette the lesion and cement it:*

- Big cavities needing reinforcement
- Lesions that you don’t expect to be responsive to adjuvant therapy.
- Whenever plates are used for fixation
Humeral lesions:

[Images of humeral lesions]
Resection and replacement

**Indications:**

- solitary lesions
- lesions that are expected not to respond to non operative treatment (RCC mets).
- Lesions close to a joint so that ORIF is not possible
- expendable bones which are problematic
- salvage of failed ORIF
General principles in decision making:

- The first procedure has the best prognosis so do more rather than less to eliminate the need for a second procedure.
- Replace as much of the destroyed bone.
- Do a procedure that will allow maximum functional restoration.
- Perform a wide surgical margin in resecting solitary metastases aiming at cure.
Male, 61 yrs, colectomy 2rs ago
Male 38yrs, previous nephrectomy

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Impending pathological fracture
or
Pain .... *Staging* .... Impending fracture

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Why do we need to do prophylactic fixation for impending fractures?

- In comparison to fixing complete fractures:
  - Less blood loss.
  - Less hospital stay
  - Faster ambulation
  - May require a less morbid procedure and a less expensive implant.
Treatment of impending fractures

- Indications for prophylactic fixation (Mirels):

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<6 = 0%, 12 = 100% incidence of fracture
Technique of prophylactic fixation for diaphyseal lesions

- Proper entry point
- Over reaming to avoid fracturing the bone and to allow rotation to adjust anteversion.
- Never use hammering for insersion
Radiotherapy

• If surgery is planned, radiotherapy should always be postop and not preop

• It has no effect on renal cell carcinoma mets, or sarcoma mets

• Some lesions (eg breast mets) may reconstitute after radiotherapy
Relationship of fracture healing and irradiation

- Irradiation affects chondrogenic phase of callus and not osteogenic phase.
- Higher incidence of healing with rigid internal fixation.
- Healing depends on type of tumour and expected survival (67% healing in myeloma, 37% in breast mets ..)
Post radiotherapy

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Suspect a pathological fracture
History
X-ray

Examination, Labs, Whole body scan, Bone scan, Local MRI

Underlying cause revealed
Diagnosis

Underlying cause not revealed
Biopsy

Diagnosis
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Non neoplastic
- Treat cause

Primary bone tumour
- Splint
  - Treat accordingly
- Fixation
  - chemo & radiotherapy

Myeloma

Secondary
- Manage fracture
  +

Multiple lesions

Unknown primary

Untreated primary
- Assess impending fractures
- Mirels score
- Repeat investigations after 6 weeks
- Treat primary
Management of pathological fractures due to secondaries

Radiotherapy
ORIF
Radiotherapy

Assess:
- Location
- Fracture pattern
- Radiosensitivity

Favourable
Not favourable

Expectations
- General condition
- Facilities, technical skills, economics

Favourable
Non operative treatment

Not favourable

ORIF
Replacement

Radiotherapy
Radiotherapy

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Managing pathological fractures requires the collaboration of:

- Orthopaedic surgeon
- General surgeon
- Clinical oncologist
- Radiotherapist
- Radiologist
- Pathologist
- Physiotherapist
SHOULD YOU INTERNALLY FIX EVERY DIAPHYSEAL FRACTURE?
Thank You