BONE TUMOURS

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- Tumours, tumour-like lesions and cysts are considered together
- Similar clinical presentation
- Definitive classification of bone tumours - still evolving
- Classification: Based on the dominant tissue in the lesion
- Commonest malignant lesions in bone- metastatic tumours

Revised WHO classification:

Predominant tissue	Benign	Malignant
Bone forming	Osteoma Osteoid osteoma Osteoblastoma	Osteosarcoma: central peripheral parosteal
Cartilage forming	Chondroma Osteochondroma Chondroblastoma ?Chondromyxoid fibroma	Chondrosarcoma: central peripheral juxtacortical clear-cell mesenchymal
Fibrous tissue	Fibroma Fibromatosis	Fibrosarcoma
Mixed	?Chondromyxoid fibroma	
Giant-cell tumours	Benign osteoclastoma	Malignant osteoclastoma
Marrow tumours		Ewing's tumour Myeloma
Vascular tissue	Haemangioma Haemangiopericytoma Haemangioendothelioma	Angiosarcoma Malignant haemangiopericytoma
Other connective tissue	Fibroma Fibrous histiocytoma Lipoma	Fibrosarcoma Malignant fibrous histiocytoma Liposarcoma
Other tumours	Neurofibroma Neurilemmoma	Adamantinoma Chordoma

AGE - GENDER DISTRIBUTION

- Distribution- varies considerably with age
- Most benign bone lesions, osteosarcoma and Ewing's sarcoma occur in the second and third decade of life.
- Giant cell tumour usually occurs in the third or fourth decade.
- Multiple myeloma, chondrosarcoma, fibrosarcoma, and metastatic bone tumours frequent the older ages.

ETIOLOGY

Genetic:

- Hereditary multiple exostoses
- Osteogenesis imperfecta

Pre-existing conditions:

- Osteochondroma
- Ollier’s disease (Multiple enchondromas)
- Maffucci’s syndrome
- Paget’s disease
- Fibrous dysplasia

CLINICAL PRESENTATION

HISTORY

- Prolonged history
- Initially asymptomatic
- Progressive and unremitting pain
- Swelling/ Lump
- Neurological symptoms- paraesthesia/ numbness (due to stretching of peripheral nerves)

CLINICAL PRESENTATION

PATHOLOGICAL FRACTURE

- May be the first (and only) clinical signal.
- Suspicion is aroused if the injury was slight
- In elderly people, whose bones usually fracture at the cortico-cancellous junctions, any break in the mid-shaft should be regarded as pathological until proved otherwise.

LABORATORY TESTS

- Complete blood count and Erythrocyte sedimentation rate- helpful in excluding diseases such as myeloma, leukemia and infection.
- Calcium and phosphorous determination are useful in determining the presence of metabolic bone disease
- Hypercalcemia also occurs in patients with secondaries, osteosarcoma, lymphoma or Ewing's sarcoma.
- Serum immunoelectrophoresis & urine Bence Jones protein helps to determine cases of multiple myeloma.

IMAGING

X-rays

- Most useful of all imaging techniques
- Cortical thickening/ discrete lump/ cyst/ ill-defined destruction
- Location: in the metaphysis/ diaphysis/ epiphysis
- Solitary or multiple lesions
- Margins well-defined or ill-defined

- Cystic lesion boundary - sharply defined if benign

  - hazy & diffuse if malignant

- Stippled calcification inside a cystic area is characteristic of cartilage tumours.

- Bone surface - periosteal new bone formation

  - soft tissue extension (in malignant lesions)

- Soft tissue - distortion of muscle planes

  - calcification

QUESTIONS TO ASK WHEN STUDYING AN X-RAY

Is the lesion solitary or are there multiple lesions?

What type of bone is involved?

Where is the lesion in the bone?

Are the margins of the lesion well- or ill-defined?

Are there flecks of calcification in the lesion?

Is the cortex eroded or destroyed?

Is there any periosteal new-bone formation?

Does the tumour extend into the soft tissues?

- **X-ray Chest**: to rule out metastasis in suspected malignant conditions

RADIONUCLIDE SCANNING

- Technetium 99 scan
- Assess activity of the lesion relative to its bone production and blood flow
- Determines bony lesions at other site- skip lesions/silent secondaries
- Eosinophilic granuloma, simple bone cyst and multiple myeloma may show normal activity in bone scan

COMPUTERISED TOMOGRAPHY

- Superior in the detection of lesional mineralization and cortical abnormalities
- Reliable method to detect pulmonary metastasis

MRI

- Valuable in the assessment of tumour spread: (a) within the bone, (b) into a nearby joint and (c) into the soft tissues.
- Tumour relationship with blood vessels well defined
- Useful in assessing soft-tissue tumours and cartilaginous lesions.

BIOPSY

NEEDLE BIOPSY

- Should be performed either by the surgeon planning definitive treatment or by an experienced radiologist
- Ultrasound/CT scan guided
- Large bore biopsy needle, such as a Jamshidi or a Trucut needle
- Biopsy should be carried out in the line of any further surgical incision so that the tract can be excised at the time of definitive surgery

OPEN BIOPSY

- More reliable
- Performed if needle biopsy would place the neurovascular structures at risk or if a diagnosis has not been made after needle biopsy
- Block of tissue is removed – ideally in the boundary zone, so as to include normal tissue, pseudocapsule and abnormal tissue.

EXCISIONAL BIOPSY

- For tumours that are almost certainly benign
- The entire lesion is removed

DIFFERENTIAL DIAGNOSIS

- Soft tissue haematoma
- Myosotis ossificans
- Stress fracture
- Bone infection
- Gout
- Bone island

STAGING

Enneking system

- Incorporates clinical, radiographic (anatomical) and histological data to categorize lesions based upon their aggressiveness

Enneking system for staging benign tumours of bone

Stage	Definition	Behaviour	Example
1	Latent	Remains static, may heal spontaneously	Enchondroma
2	Active	Progressive growth, limited by natural barriers	Chondroblastoma
3	Aggressive	Progressive growth, not limited by natural barriers	Giant cell tumour

Enneking system for staging malignant tumours of bone

Stage	Grade	Site	Metastases
I–A	G1 (low)	T1 intracompartmental	M0 (none)
I–B	G1 (low)	T2 extracompartmental	M0 (none)
II–A	G2 (high)	T1 intracompartmental	M0 (none)
II–B	G2 (high)	T2 extracompartmental	M0 (none)
III	G1 (low) or G2 (high)	T1 or T2 intra/extracompartmental	M1 (regional or distant)

Adapted from Enneking WF, Spanier SS, Goodman MA. A system for the surgical staging of musculoskeletal sarcomas. *Clinical Orthopaedics* 1980;**153**:106–20.

METHODS OF TREATMENT

Tumour Excision

- More aggressive the lesion the more widely does it need to be excised

- **Intracapsular (intralesional) excision and curettage:**

  - incomplete forms of tumour ablation

  - only for benign lesions

  - adjunctive treatment (acrylic cement) after curettage decreases the risk of local recurrence

- **Marginal excision:**

  - goes beyond the tumour, through the reactive zone

  - significant risk of recurrence (up to 50 per cent) for malignant lesions

  - Suitable method for benign lesions

- **Wide excision**

  - dissection is carried out well clear of the tumour, through normal tissue

  - appropriate for low-grade intracompartmental lesions (grade IA)

  - risk of local recurrence <10%

- **Radical resection**

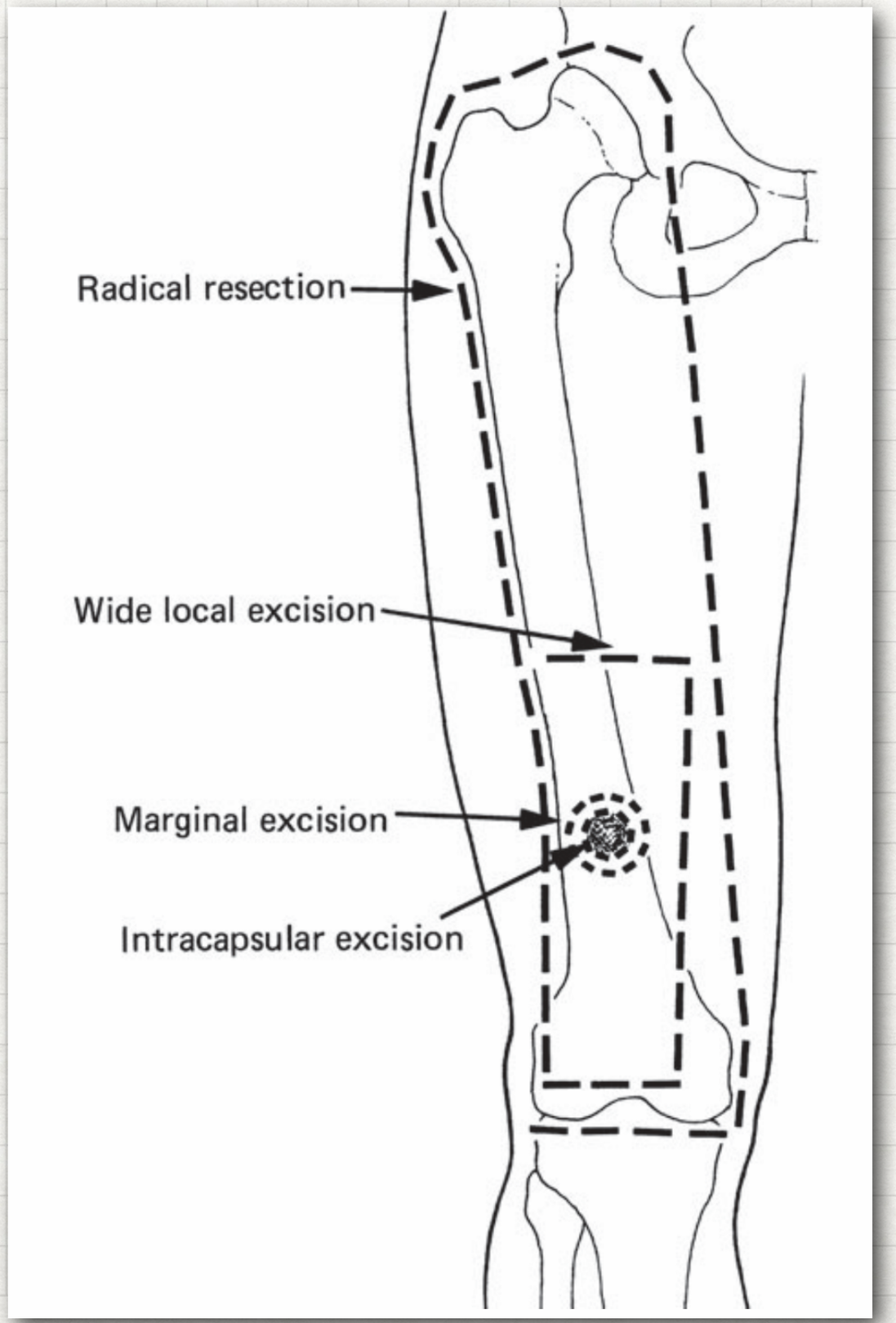
  - the entire compartment in which the tumour lies is removed en bloc without exposing the lesion

  - it may be possible to do this while still sparing the limb, but the surrounding muscles, ligaments and connective tissues will have to be sacrificed

  - in some cases a true radical resection can be achieved only by amputating at a level above the compartment involved

  - this method is required for high-grade tumours (IIA or IIB)

Tumour Excision



Limb Salvage

- considered only if:

    - the local control of the tumour is likely to be as good as that obtained by amputation

    - if it is certain that there are no skip lesions

    - if a functional limb can be preserved

- First step consists of wide excision of the tumour with preservation of the neurovascular structures

Limb Salvage..(continued)

- resulting defect is then dealt with

  - vascularized or non-vascularized bone grafts.

  - custom-made implants

  - large allografts

  - endoprostheses

  - allograft–prosthetic composites

  - extendible implants (in children)

Amputation

- Preferred option:

    - Considering the difficulties of limb-sparing surgery

    - if there is doubt about whether the lesion is intracompartmental

- Preoperative planning and the definitive operation are best carried out in a specialized unit, so as to minimize the risk of complications and permit early rehabilitation.

Multi agent Chemotherapy

- Neoadjuvant and adjuvant treatment for malignant tumours
- reduce the size of the primary lesion
- prevent metastatic seeding
- improve the chances of survival

Radiotherapy

- High-energy irradiation used to destroy radiosensitive tumours or as adjuvant therapy before operation

- For highly sensitive tumours (such as Ewing's sarcoma) it offers an alternative to amputation; it is then combined with adjuvant chemotherapy.

- Also used as adjunctive treatment for high-grade tumours, for tumours in inaccessible sites, lesions that are inoperable because of their size, proximity to major blood vessels or advanced local spread, for marrow-cell tumours such as myeloma and malignant lymphoma, for metastatic deposits and for palliative local tumour control where no surgery is planned.

- Complications of Radiotherapy:

  - post-irradiation spindle-cell sarcoma

  - pathological fracture in weight bearing bones

THANK YOU