Musculoskeletal/Integument (MSI)
Bone/Joint Learning Objectives by Learning Session

Structure, Function & Growth of Skeletal Tissues

Pre-session Learning Objectives
(students should study these LOs prior to session)

1. Cartilage & Bone

1.1. Connective Tissue (Introduced in MCM)

1. Review the extracellular matrix, including collagen, elastic and reticular fibers, their structure, function, locations, staining and morphological appearance.

2. Review cell adhesion molecules and how they anchor cytoskeletal structures to specific components of the extracellular matrix, including the basement membrane.

3. Review the synthesis of the glycosaminoglycans and proteoglycans found in connective tissue and synovial fluid.

4. Review the biochemical properties of glycosaminoglycans and proteoglycans that give rise to the physical properties of cartilage and synovial tissue in joints.

5. Review the fundamental structure of collagen and the function of the major types of collagens.

6. Review collagen biosynthesis, including required cofactors and the specific enzymes that modify and cross-link collagen chains.

7. Review structural and functional differences between collagen and elastin fibers and differences in their association with other extracellular matrix components.

1.2. Cartilage

8. Review the general structure of cartilage including cell types, extracellular matrix, surfaces, lining structures, perichondreum and blood supply.

9. Review the three types of cartilage and describe the structure of the extracellular matrix of each. Discuss the structure-functional relationship for each type of cartilage.

10. Recall the locations of each type of cartilage in the body.

11. Review turnover, nutrition and regeneration in cartilage.

12. Review the distinguishing features of the three types of hyaline cartilage: “regular” hyaline cartilage, bone precursor cartilage and articular cartilage.

1.2.1. Differentiation & Growth of Cartilage

* LOs in italics represent content covered in a previous course.
13. Describe the histogenesis and differentiation of cartilage.

14. Identify the cells responsible for the growth of cartilages and describe their locations in cartilages. Distinguish appositional and interstitial growth.

1.3. Bone

15. Describe the general structure of bones including cell types, extracellular matrix, surfaces, lining structures, periosteum, bone marrow and blood supply.

16. Distinguish compact and spongy (cancellous, trabecular) bone.

17. Distinguish the functions of the different bone cells (osteoblasts, osteocytes, osteoclasts).

1.3.1. Ossification

18. Describe the process of endochondral ossification; identify the bones of the body (or regions of the skull) that ossify through endochondral ossification.

19. Describe the process of intramembranous ossification; identify the bones of the body (or regions of the skull) that ossify through intramembranous ossification.

20. Describe the mechanism of calcification (mineralization) of bone matrix.

21. Distinguish crystal nucleation and crystal propagation. Describe the role of matrix vesicles.

Potential Resources:
Junqueira's Basic Histology
   Chapter 5: Connective Tissue
   Chapter 7: Cartilage
   Chapter 8: Bone

2. Growth of the Skeletal System

22. Discuss the significance of endochondral ossification to elongation of long bones during growth.

23. Describe the regulation of growth of long bones by circulating hormones and local factors.

24. Identify the growth plates of the upper and lower limbs, describe their sequence of closure and their relative contribution to overall limb growth.

25. Identify which drugs affect the immature growth plate and should be avoided in pediatric patients.

26. Describe the role of sutures in the expansion of the neurocranium and facial capsules.

27. Compare the growth sutures with that of synchondroses and other “growth cartilages” of the skull. List the principal growth cartilages of the skull.

28. Describe the process of periosteal bone formation in the growth of bones.
2.1. Developmental Defects in Skeletal Growth

29. Describe the genetic basis and clinical presentation of achondroplasia and craniosynostosis.

30. Compare and contrast the clinical presentations of achondroplasia and thanatophoric dwarfism.

Potential Resources:
   Junqueira’s Basic Histology
   Chapter 7: Cartilage
   Chapter 8: Bone
   Jorde et al. Medical Genetics pp. 195-197
   Lecture(s): Moyer/McCollum?: “Skeletal Growth & Aging”

3. Calcium and Phosphate Metabolism

3.1. General Concepts

31. Describe the functions of the osteoblasts and the osteoclasts in bone remodeling and the factors that regulate their activities.

32. Describe the recruitment, maturation and activation of osteoclasts by osteoblasts.

33. Identify the mechanisms regulating osteoblast and osteoclast function.

3.2. Vitamin D Synthesis (Introduced in MCM)

34. Review the pathway for synthesis and activation of vitamin D in the skin, liver and kidney. Discuss PTH control of 1,25-dihydroxy vitamin D production in kidney and its feedback regulation of PTH production.

35. Review the target organs and cellular mechanisms of action for vitamin D.

3.3. Calcium and Phosphate Balance

36. Identify the normal range of dietary Ca2+ and phosphate intake, major storage pools of Ca and phosphate, and major routes of Ca2+ and phosphate loss from the body. Describe the regulation of plasma Ca2+ by calcitonin and phosphate by parathyroid hormone.

37. Calculate the normal filtered load of Ca2+. Identify the tubular sites of Ca2+ reabsorption. Calculate the normal filtered load of phosphate. Identify the tubular sites of phosphate reabsorption.

38. Describe the renal regulation of Ca2+ and phosphate transport by PTH, calcitonin, and 1,25-dihydroxy vitamin D (calcitriol), and distinguish from other factors that alter their transport (ECF volume, acid-base disorders).

39. Describe the role of the kidney in the production of 1,25-dihydroxy vitamin D (calcitriol).

Potential Resources:
   Ganong’s Review of Medical Physiology Chapter 23: Hormonal Control of Calcium &
Suggested Bone/Joint Session Learning Activities:

- Session Pre-test – clicker or written MCQs to ensure adequate preparation for session
- Histology image correlations – exercises that reinforce structure/function relationships of cartilage and bone
- Image/radiograph correlations – exercises that relate normal tissue structures to their appearance in radiographs
- Interpret/predict underlying cause of abnormal bone seen in radiographs
- Interpret/predict pattern of fracture healing expected with different types of fractures
- Correlate treatment plans to different types of fractures
- Predict skeletal outcomes of a variety of different genetic and metabolic conditions
- Cases to highlight session’s objectives:
  - Achondroplasia
  - Osteogenesis imperfecta
  - Osteopetrosis
  - Paget disease
  - Rickets and osteomalacia
  - Renal osteodystrophy
  - Osteonecrosis
  - Osteomyelitis

**Post-session Learning Objectives**

(Having completed the session, students should now complete the following additional LOs)

1. **Bone Fractures**

40. Define each of the following types of fractures, including common locations and potential complications where applicable: simple, greenstick, displaced, comminuted, open, stress, compression.

41. Describe the morphological sequence of bone repair following fracture of a long bone. Indicate the way(s) in which age, mobility, nutritional state and infection influence the repair process.

42. Be able to distinguish bone fractures from epiphysial plates in CR images of children and adolescents.

43. Describe the different type of growth plate fractures seen in children and the implications on growth.

44. Identify the primary causes of growth plate fractures in children.

45. Identify the fractures indicative of child abuse. Identify their typical causes.
46. Define a fibrous cortical defect and identify its clinical and radiographic features. Formulate a treatment plan for this condition.

47. Discuss the incidence and potential complications of slipped capital femoral epiphysis.

1.2. Treatment of Bone Fractures (including stress fractures)

48. Describe the significance of immobilization in the healing of fractures or sprains.

49. Describe the wound considerations in the treatment of open fractures.

50. **Need additional objectives**

Potential Resources:
Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
Radiology 101: Chapter 5: Musculoskeletal System

2. Osteonecrosis

51. Define osteonecrosis. Describe the morphology and clinical course of osteonecrosis.

52. Build a differential diagnosis for common causes of osteonecrosis.

53. Discuss the anatomical basis of avascular necrosis (AVN) of the femoral head. Describe the clinical presentation of patients with AVN of the femoral head.

54. Identify systemic diseases, drugs and injuries that predispose patients to AVN of the femoral head. Identify the surgical intervention to treat AVN of the femoral head.

55. Identify bones at risk for avascular necrosis following fracture.

56. Define Legg-Calve-Perthes disease and explain how the blood supply to the femoral head changes during growth.

57. Describe Panner’s syndrome of the elbow.

Potential Resources:
Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
Radiology 101: Chapter 5: Musculoskeletal System

3. Osteomyelitis

58. Distinguish pyogenic or suppurative, tuberculous and syphilitic osteomyelitis in terms of epidemiology, causative agents, morphological changes and stages of infection, clinical course and complications.

59. Build a differential diagnosis of common causes for osteomyelitis.

60. Describe the classic location of pediatric long bone infections and indicate how their etiology and location differ from adult bone infections.
61. List the best clinical and radiological studies to perform in the work up of a possible pediatric bone infection.

**Potential Resources:**
- Robbin's Basic Pathology Chapter 21: The Musculoskeletal System
- Radiology 101: Chapter 5: Musculoskeletal System

5. Connective Tissue Disorders

5.1. Collagen Genetics *(introduced here or in MCM?)*

5.2. Collagen Disorders

62. Discuss the following disorders of collagen structure in terms of etiology, pathogenesis, morphology and clinical presentation: osteogenesis imperfecta, Marfan syndrome, Ehlers-Danlos syndrome and scurvy.

5.3. Bone Metabolism Disorders

63. Discuss the following non-neoplastic bone disorders in terms of etiology, pathogenesis, morphology, clinical findings and course: osteopetrosis, osteoporosis and Paget disease.

64. Discuss vitamin D deficiency as expressed in rickets and osteomalacia in terms of vitamin D metabolism, pathophysiology of vitamin D deficiency, morphology and clinical findings.

65. Compare and contrast the skeletal changes of vitamin D deficiency with those of vitamin C deficiency, with regard to pathogenesis and morphology.

**Potential Resources:**
- Junqueira’s Basic Histology Chapter 5: Connective Tissue
- Jorde et al. Medical Genetics: pp. 17-18; 70-71
- Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
- Harrison’s Online
  - Chapter 356: Bone and Mineral Metabolism in Health & Disease.
  - Chapter 357: Heritable Disorders of Connective Tissue
  - Chapter 347: Diseases of the Parathyroid Gland & Other Hyper- and Hypocalcemic Disorders
  - Chapter 349: Paget Disease and other Dysplasias of Bone
- Radiology 101: Chapter 5: Musculoskeletal System

**TBL Session 3**

**Pre-Session Learning Objectives:**

**Inflammatory Arthritis Application**
(Janet Lewis, Michelle Barr, Don Innes, Chris Burns)

1. Synovial Joint Disorders

1.1. Osteoarthritis
66. Discuss osteoarthritis (degenerative joint disease) in terms of age and sex of incidence, etiology, pathogenesis, laboratory findings, morphologic findings, clinical findings and course.

67. Describe the typical symptoms of osteoarthritis of the hips and knees. Identify the indications for hip and knee joint replacement.

68. Compare rheumatoid arthritis with osteoarthritis in terms of age and sex of incidence, etiology, pathogenesis, laboratory findings, morphologic findings, clinical findings and course.

1.2. Rheumatoid arthritis

69. Describe the role of the immune system in the pathogenesis of rheumatoid arthritis and juvenile idiopathic arthritis.

70. Compare rheumatoid arthritis and juvenile rheumatoid arthritis in terms of age and sex of incidence, etiology, pathogenesis, laboratory findings, morphologic findings, clinical findings and course, and systemic involvement.

71. Describe the immunological features, etiology, immunopathogenesis, diagnosis and treatment of systemic lupus erythematosus (SLE). Describe the role of defective apoptosis and clearance of damaged cells in SLE.

72. Vasculitis, in our system or elsewhere?

1.3 Seronegative Spondyloarthropathies

73. Discuss the following seronegative spondylarthropathies in terms of age and sex of incidence, etiology, pathogenesis, findings and clinical course: ankylosing spondylitis, Reiter syndrome, psoriatic arthritis.

1.4. Infectious Arthritis

74. List the organisms commonly involved in suppurative arthritis and compare the age and sex incidence of each. Identify the common clinical findings of suppurative arthritis.

75. Discuss the following forms of infectious arthritis in terms of age and sex of incidence, etiology, pathogenesis, findings and clinical course: tuberculous, lyme, viral.

1.5. Gout & Pseudogout

76. Define and use in the proper context the following conditions: gout, pseudogout and tophus.

77. Outline the sequence of pathogenetic biochemical and morphological changes in gout.

78. Compare and contrast acute and chronic gout in terms of age and sex of incidence, etiology, pathogenesis, morphology and site of lesions, symptoms, signs and laboratory abnormalities, clinical course, and complications.

79. Compare and contrast primary and secondary gout in terms of age and sex of incidence, etiology, pathogenesis, morphology and site of lesions, symptoms, signs and laboratory abnormalities, clinical course, and complications.
1.6. Arthritis Associated with Systemic Disease

**Potential Resources:**
- Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
- Harrison’s Online:
  - Chapter 325: Approach to Articular and Musculoskeletal Disorders
  - Chapter 314: Rheumatoid Arthritis
  - Chapter 326: Osteoarthritis
  - Chapter 327: Gout and Other Crystal Arthropathies
  - Chapter 328: Infectious Arthritis
  - Chapter 330: Arthritis Associated with Systemic Disease and other Arthritides
- Radiology 101: Chapter 5: Musculoskeletal System

2. Pharmacological Treatment of Synovial Joint Disorders

### 2.1. Agents Used to Treat Rheumatic Disorders *(Introduced in MCM)*

80. Review the likely mechanisms of antirheumatic action of the disease modifying anti-rheumatic drugs (DMARDs).

81. Review the molecular mechanism of action of all nonsteroidal anti-inflammatory drugs (NSAIDs).

82. Review the pharmacodynamics, pharmacokinetics, therapeutic uses and adverse effects of the following nonselective COX inhibitors used in the treatment of rheumatic disease: aspirin, ibuprofen, naproxen, celecoxib.

83. Review the pharmacodynamics, therapeutic uses and adverse effects of glucocorticoids. Identify the uses of the following glucocorticoids in the treatment of rheumatoid disease: methylprednisolone, prednisolone, prednisone.

84. Review the pharmacodynamics, therapeutic uses and adverse effects of the following disease-modifying antirheumatic drugs: azathioprine, methotrexate, cyclophosphamide, chlorambucil, cyclosporine, mycophenolate mofetil, chloroquine, hydroxychloroquine, penicillamine, leflunomide, sulfasalazine, abatacept, and rituximab.

85. Outline the use of NSAIDs and DMARDs in arthritic disorders.

86. Describe the pharmacodynamics, therapeutic uses in the treatment of arthritis, and adverse effects of the immunopharmacological agents that inhibit tumor necrosis factor (TNF): infliximab, etanercept, adalimumab.

87. Describe the pharmacodynamics, therapeutic uses and adverse effects of the immunosuppressant drug anakinra.

### 2.2. Gout Drugs
88. Describe the mechanism of action, pharmacodynamics, pharmacokinetics, therapeutic uses, adverse effects, contraindications and drug interactions of the following agents used in the treatment of gout: colichicine, allopurinol, probenecid, sulfinpyrazone.

89. List the gout drugs that interfere with the renal excretion of uric acid.

90. Describe the mechanism of gouty flare-up associated with the treatment of chronic tophaceous gout.

91. Differentiate the use of gout drugs in the treatment of acute gout attacks and as prophylactic therapies.

Potential Resources:
Harrison’s Online:
Chapter 314: Rheumatoid Arthritis
Chapter 327: Gout and Other Crystal Arthropathies
Chapter 328: Infectious Arthritis
Chapter 330: Arthritis Associated with Systemic Disease and other Arthritides

3. Joint Replacement

92. Need objectives

3.1. Prosthetic Joint Infections

93. Describe the risk of prosthetic joint infections after dental procedures.

94. Describe the evaluation of a patient with a prosthetic knee replacement who presents with a 2-day history of a swollen painful knee without history of trauma.

Potential Resources:

4. Related topics

3.1. Neisseria gonorrhoeae (Introduced in Microbes)

95. Need objectives appropriate for MSI System, including treatments

3.2. Borrelia (Introduced in Microbes)

96. Need objectives appropriate for MSI System, including treatments

Potential Resources:

Clinical Anatomy Application
(Bobby Chhabra, Mary Bryant, Michelle Barr, Paula Barrett, Sue Brown, Melanie McCollum)
Femoral Neck Fracture due to Osteoporosis

1. Bone & Joint Health

97. Discuss the critical life stages of bone and relate the stages to maintenance of bone health by nutrient absorption and physical activity.

98. Identify the types of exercise most beneficial to bone health and the general guidelines for adult physical activity.

99. Assess the changes with increasing age for the adequate intake (AI) for calcium and Vitamin D and the recommended daily allowance (RDA) for phosphorus. Identify major food and supplemental sources for calcium and Vitamin D and note the recommended method of intake for ensuring effective nutrient absorption.

100. Identify nutrients, aside from calcium, vitamin D and phosphorus, that benefit bone and also identify dietary components that may negatively impact bone health.

101. Need objectives on joint health

Potential Resources:


2. Osteoporosis

102. Classify the major clinical types of osteoporosis. List risk factors for osteoporosis.

Need more objectives

Potential Resources:

Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
Harrison’s Online Chapter 348: Osteoporosis
Translational Endocrinology & Metabolism – Osteoporosis Update
Chapter 1: Clinical Management of the Patient with Osteoporosis

3. Agents Affecting Calcification and Bone Turnover

103. Describe the mechanism of action of each of the following drugs used to treat abnormalities in bone mineral metabolism: calcium supplements, vitamin D analogs, calcitriol, PTH analog, cinacalcet, bisphosphonates (etidronate, alendronate), corticosteroids (prednisone), furosemide and plicamysin.

104. Identify the possible adverse side-effects of CT, 1/25-(OH₂)D₃ and calcium supplements.

105. Describe the chronic toxicity associated with long-term use of sodium fluoride.

106. Identify the available preparations of CT and 1/25-(OH₂)D₃ and calcium supplements and their clinical uses.

107. Compare and contrast the treatment of hypo- and hyperparathyroidism.
108. Discuss the clinical value of bisphophonates and CT in the treatment of the following disorders: hypercalcemia, Paget disease, osteoporosis.

**Potential Resources:**
- Harrison's Online Chapter 348: Osteoporosis
- Translational Endocrinology & Metabolism – Osteoporosis Update
  - Chapter 1: Clinical Management of the Patient with Osteoporosis
  - Chapter 4: Bone Biology Underlying Therapeutic Approaches

4. **Femoral Neck Fracture**

109. List the six principal movements allowed at the hip joint and the muscles involved in each. Identify the innervation of these muscles.

110. Distinguish intracapsular fractures from extracapsular fractures. Identify the artery at risk of injury in intracapsular fractures and the consequences of such an injury in adults.

111. Describe the typical presentation of an individual who has suffered a femoral neck fracture.

112. Need objectives re: surgical & nonsurgical treatments for common hip injuries.

**Potential Resources**
- High-Yield Gross Anatomy Chapter 21: Lower Limb
- Gross Anatomy Lab Manual

**Below-the-Knee Amputation (BKA) due to Diabetic Neuropathy**
(Bobby Chhabra, Mary Bryant, Michelle Barr, Melanie McCollum)

1. **Gait**

2.1. **General Concepts**

113. Describe the concept of base of support. Explain the difference between single-limb and double-limb support.

114. Define running and walking.

115. Define and use in proper context the following terms used to describe the gait cycle: step, stride, swing phase, stance phase, cadence.

116. Describe how the gait cycle changes with aging and indicate how these changes interact with other musculoskeletal disorders to increase fall risk in the elderly.

117. Identify the percentage of the gait cycle a single limb is spent in stance phase and in swing phase.

118. Describe the following abnormal gait patterns: circumduction, hip hiking, and vaulting.

119. Define antalgic gait and recognise why it is used.
120. Describe how an ankle foot orthosis (AFO) helps the gait pattern in a patient with foot drop.

2. The diabetic foot

Need objectives

Potential Resources:

3. Amputation

121. Need objectives on the following topics:

   - Significance with respect to diabetes
   - Best practice methods?
   - Etc.

4. Assistive Devices

122. Describe how the concept of base of support influences the choice of assistive device for ambulation.

123. Explain why a cane is used on the sound side of the body.

124. Identify the factors which must be considered in fitting patients with canes and crutches. Identify the injuries that can result from improper fitting of crutches.

Need additional Objectives

5. Prostheses

125. Need additional objectives re: choice of prosthetic and when prosthesis is indicated.

126. Describe the increase in energy required for ambulation with a below knee amputation prosthesis and compare it to above the knee amputation prosthesis.

127. Describe the importance of the need of adequate soft tissue coverage of a lower extremity amputation stump.

Potential Resources:

6. Impairment and Disability

   6.1. General Concepts

128. Define impairment, disability and handicap.
6.2. Psychosocial and Economic Considerations

129. Define the concept of body image and discuss how loss of limbs and function can impact it.

130. Identify the clinical signs and symptoms of depression.

131. Outline questions that can be used in your history taking to help evaluate a patient with a chronic disability for depression.

132. Identify the conditions under which a disabled individual should be referred to a psychologist, neuropsychologist or psychiatrist.

133. Discuss the incidence/prevalence of chronic back pain (CBP) and the loss of revenue and jobs due to CBP.

134. List the benefits offered through the Workers’ Compensation system.

135. Describe how the Medicare system applies to patients with chronic disabling conditions.

136. Describe the purpose of Americans with Disabilities Act.

Potential Resources:

*Neoplasms of the Musculoskeletal System & Dermis Application*
(Don Innes, Michelle Barr, Mary Bryant)

1. Bone and Soft Tissue Lesions

   1.1. Bone and Cartilage Forming Tumors

137. Discuss the following bone-forming tumors in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis, cell type and site of origin, morphologic and radiographic features, and clinical findings and course: osteoma, osteoid osteoma, osteoblastoma, osteosarcoma.

138. Describe predisposing conditions for the development of primary bone sarcomas.

139. Describe limb preservation methods.

140. Discuss the following cartilage-forming tumors in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis, cell type and site of origin, morphologic and radiographic features, and clinical findings and course: osteochondroma, chondoma/enchondroma, chondroblastoma, chondromyxoid fibroma and chondrosarcoma.

141. Discuss the Ewing sarcoma, primitive neuroectodermal tumor (PNET) and giant cell tumor of bone in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis, cell type and site of origin, morphologic and radiographic features, and clinical findings and course.
142. Discuss metastatic malignancy of bone in terms of pathways of spread and common sources of origin. Distinguish those carcinomas that are lytic to bone from those that are blastic.

1.2. Soft Tissue Tumors & Tumor-like Lesions

143. Discuss the following skeletal neoplasms composed of fibrous elements in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis, cell type and site of origin, morphologic and radiographic features, and clinical findings and course: fibrous cortical defect/nonossifying fibroma, fibrous dysplasia, fibrosarcoma, malignant fibrous histiocytoma.

144. Discuss rhabdomyosarcoma in terms of etiology, age incidence, morphology and prognosis.

145. Discuss the following soft-tissue tumors and tumor-like lesions in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis, cell type and site of origin, morphologic and radiographic features, and clinical findings and course: myositis ossificans, nodular fasciitis, fibromatosis, lipoma, liposarcoma, leiomyoma, leiomyosarcoma, synovial sarcoma.

146. Discuss soft tissue sarcomas in terms of appropriate surgery for initial diagnosis and indications for limb preservation.

147. Discuss the roles of chemotherapy, surgery and radiation therapy in the treatment of soft-tissue tumors. Describe the specific medical treatment available for gastrointestinal tumors.

1.3. Tumor and Tumor-like Lesions of Joints

148. Discuss the following neoplasms of joints in terms of cell type and site of origin, morphology and clinical course: ganglion, synovial cyst, pigmented villonodular synovitis.

1.4. Tumors of the Dermis

149. Discuss the following dermal neoplasms in terms of biology (neoplastic vs. non-neoplastic, benign vs. malignant), age distribution, etiology and pathogenesis: dermatofibroma, dermatofibrosarcoma (DFSP).

Potential Resources:
Robbin’s Basic Pathology Chapter 21: The Musculoskeletal System
Harrison’s Online Chapter 94: Soft Tissue and Bone Sarcomas and Bone Metastases
Radiology 101: Chapter 5: Musculoskeletal System

5. Cancer Chemotherapy of Bone, Soft Tissue and Dermal Sarcomas (Reviewed from MCM)

150. Review the pharmacodynamics, pharmacokinetics, toxicities and therapeutics of the following drugs used in the treatment of the major sarcomas of bone and soft tissues: cyclophosphamide, ifosfamide, mesna, vincristine, cosorubicin, filgrastim, etoposide, dacarbazine, cisplatin, methotrexate, bleomycin and dactinomycin.

Potential Resources: