

# Introduction to Orthopaedic Surgery

Orthopaedic Surgery is a discipline of surgery that is concerned with the axial and appendicular skeleton and its related structures. There are various subspecialties or subdivisions including fractures, arthritides, soft tissue processes, tumors, metabolic conditions, congenital and acquired conditions. A medical student rotation exposes one to various aspects of Orthopaedic Surgery. This rotation should provide a variety of experiences ranging from operative, office and clinical practice and emergency room experience. There are various texts available for medical students interested in reading about Orthopaedic Surgery while on the rotation. These are included at the end of this handout. Many can be found in the WU library.

## **History, Physical Examination/Imaging:**

History: Onset, duration, and location of complaint. Character of pain. History of injury (if any), mechanism of injury—where, when and how. What makes it better or worse? Any related symptoms or complaints. Past medical history—medical conditions (i.e. Diabetes, CAD, etc.) previous injuries. Hand dominance. Occupation. Social history (tobacco, ETOH, drugs). Medications. Any previous treatment for current (including chiropractor).

Physical Exam: Full body exam and then focus on area of complaints. Localize the area of pain (one finger test—point of maximal tenderness). Inspect skin, soft tissue—note swelling, ecchymosis, color and texture of skin, condition of skin, areas of breakdown or skin laceration. Palpation—bony prominences, ligaments. Evaluate active and passive range of motion of joints. Evaluate vascular status—capillary refill, pulses, skin color. Evaluate neurologic status—motor function, sensation, deep tendon reflexes. Specialized physical exam when necessary (ant. drawer, Lachman, etc.). In an ER situation or with multiple injury patients, ABC comes first (airway and cervical spine, breathing, and circulation) followed by secondary survey to evaluate chest, abdomen, skull, spine and extremities. Always be on the lookout for multiple injuries, especially in unresponsive or intoxicated individuals. Always evaluate joint above and below injured area to rule out associated conditions/injuries. Think about mechanism of injury to get ideas of related injuries—certain injuries occur in a specified pattern or are associated (jump from height with calcaneus fracture—look for lumbar spine fractures).

Radiology: X-ray most commonly used for obvious reasons. Inspect bone—evaluate joints. Need at least 2 views of injured area for adequate evaluation. Other specialized tests include bone scan (for tumors or infection), CT (for bone and marrow), MRI (for soft tissues and muscles, including spinal cord), arthrogram (for intra-articular pathology). Always remember X-rays are a two-dimensional representation of a three-dimensional object.

X-ray Evaluation: Describe views given (i.e. “AP and lateral of left tibia”). Note if patient is skeletally mature or not (are physes open or closed). Then look for pathology. Fractures are described by location (epiphyseal, metaphyseal, diaphyseal, mid shaft, distal and proximal).

Fractures are also described by the fracture pattern (oblique, spinal, transverse, segmental); fractures resulting in more than two bony fragments are referred to as **comminuted**. A description of the amount of displacement (or separation of fragments from one another is also important)—these are often self-explanatory (non-displaced, minimally displaced); translation refers to a particular plane (i.e. “the distal fragment is anteriorly translated 50%”); fragments should be referred to as proximal or distal and anterior or posterior; medial and lateral translation should be also identified. Percentage refers to the amount of overriding of one fragment on the other. If a fracture is angulated the apex of the angulation should also be noted. Apex anterior and apex posterior are self-explanatory. Varus and valgus are terms used to refer to angulatory deformities in the medial/lateral plane. “Knock knees” are an example of a valgus deformity. Evaluation of the joint is important as well—dislocations occur at joint interfaces. Fractures can extend into joint surfaces—these are known as intra-articular fractures. All of these descriptive terms help identify important features of the fracture(s) as well as provide groundwork for possible treatment options.

Immobilization of the involved extremity, followed by elevation and icing to reduce swelling is standard initial care. Resting (or decreasing use of the extremity) is also important. This is the case with bony and many soft tissue injuries.

The following Objectives List should be utilized by the student as a study tool to allow for as complete coverage of relevant materials as possible. Appropriate text and literature references can be gotten from the individual faculty mentors. The student would be wise to pay special close attention to Objectives numbered 3, 4 and 16: Emergencies, the Effects of Aging and the Management and Diagnosis of Chronic Pain. A week will not go by in your medical life that will not include knowledge of relevant information from one or more of these three specific objectives.

## **OBJECTIVES LIST**

### **1. Demonstrate the ability to perform an appropriate musculoskeletal history and physical examination**

- a) Relevant considerations

- i) Chief complaint: acute/chronic, traumatic/atraumatic, mechanism of injury
- ii) Pain history: OPQRST (onset, pain, quality, radiation, severity-including visual analog scale and timing)
- iii) Chronology of illness, injury
- iv) Past medical history, allergies, medications, tobacco history & alcohol consumption, social and family history
- v) CLIPS: checking, locking instability, pain, swelling
- b) Pediatric considerations
  - i) Birth history, milestones, immunization history
- c) Physical examination
  - i) Basic concepts: Look, (inspection) feel, (palpation) move (active, passive, provocative-ROM)
    - Understand relevant topographical anatomy of each site.
  - ii) Spine
    - Standing, sitting, lying supine
    - Neurological exam
      - Motor (myotomes), sensory (dermatomes), reflexes, upper and lower motor neuron findings, pathologic reflexes
  - iii) Hip
    - Adult and pediatric examinations
  - iv) Knee
    - Surface anatomy
    - Ligament testing
    - Hip examination in pediatric population (referred pain)
  - v) Shoulder
    - Surface anatomy
    - Rotator cuff examination
    - Cardiac, visceral origin; cervical spine
  - vi) Elbow
    - Surface anatomy
  - vii) Hand
    - Surface anatomy
  - viii) Foot
    - Surface anatomy
  - ix) Gait
    - Surface anatomy

**2. Develop an organizational framework for the diagnosis and treatment of patients presenting with low back pain**

- a) Clinical presentation
  - i) History, physical examination of the spine and extremities (differentiation between mechanical LBP, inflammatory LBP, neurogenic LBP, extremity pain, malignant pain)
  - ii) Gait assessment
  - iii) Imaging Studies
    - Plain radiographs, CT scan, MRI, myelogram
  - iv) Laboratory blood tests
  - v) Electrodiagnostic studies (EMG, NCV)
- b) Pathophysiologic processes – “CINE TV DATE” for differential diagnosis.
  - Congenital
  - Infectious
  - Neoplastic
  - Endocrine
  - Traumatic
  - Vascular
  - Degenerative
  - Autoimmune
  - Toxic, etc.
  - i) Inflammation (spondyloarthropathies ie ankylosing sponoylitis)
  - ii) Infection
  - iii) Metastatic disease
  - iv) Osteoporosis
  - v) Intervertebral disc degeneration, facet and uncovertebral arthritis
- c) Medical Treatment

- i) Pharmacological
  - ii) Physiotherapy and occupational therapy
  - d) Non-medical treatment
    - i) Alternative therapies
    - ii) Physiotherapy and occupational therapy
  - e) *Other spinal conditions that a student should be able to discuss*
    - i) *Neck pain, spinal stenosis, spondylotic myelopathy, vertebral compression fractures*
- 3. Discuss the impact of aging on musculoskeletal health**
- a) Clinical topics
    - i) Epidemiology and morbidity/mortality of most common MSK problems of the elderly
    - ii) History and physical examination of specific for elderly patient with musculoskeletal disorder(s)
      - Giant cell arteritis and polymyalgia rheumatica
        - Surgical treatment of lower extremity fractures (femoral-neck, intertrochanteric) in the elderly; complications (AVN, nonunion)
    - iii) Altered gait mechanics in the elderly
    - iv) Metastatic disease of the axial and appendicular skeleton
    - v) The effects of co-existent medical conditions on musculoskeletal health (including medical complications of hip fractures & their treatment)
    - vi) The effects of polypharmacy on the elderly, as pertains to increased risk of falls, and axial or appendicular fractures
    - vii) Resisted weight lifting (both upper & lower extremities)
  - b) Pathophysiologic processes
    - i) Altered fracture healing in the elderly
    - ii) Common fractures in the elderly: spine, pelvis, hip, proximal humerus, distal radius
    - iii) Altered biomechanical and physiological properties of musculoskeletal tissues in the elderly
      - Normal and abnormal muscle, tendon and ligament biology and
        - a. biomechanics
    - iv) Local and systemic effects of metastatic disease
    - v) Osteoporosis: Prevention, diagnosis, imaging (bone densitometry), treatment (pharmacological and mechanical)
  - c) Medical Treatment
    - i) Pharmacological
    - ii) Medical treatment of osteopenia/osteoporosis
      - Anti-osteoclast agents, calcium supplementation
    - iii) Disease prevention
    - iv) Medical conditions with musculoskeletal manifestations
  - d) Social impact of musculoskeletal disease in the elderly
    - i) Utilization of resources
    - ii) Loss of independence, social considerations
    - iii) Integrated team approach to management, prevention
- 4. Recognize and initiate appropriate treatment for the following musculoskeletal emergencies: septic arthritis, necrotizing fasciitis, compartment syndrome, open fracture, cauda equina syndrome and joint dislocations**
- a) Prompt identification, diagnosis and treatment of patients with the aforementioned musculoskeletal emergencies
    - i) Understanding the adverse sequelae from a functional and pathophysiological standpoint that result from delayed or missed diagnosis
- 5. Develop an organizational framework for the diagnosis, initial management and definitive management of patients with fractures of the axial and appendicular skeleton**
- a) Appropriate immobilization, history and physical examination with a fracture of the axial or appendicular skeleton
  - b) Demonstrate the ability to describe a fracture pattern using appropriate plain radiographs
  - c) Principles of fracture care
    - i) Reduction, immobilization, rehabilitation, functional restoration
  - d) Pain control
  - e) Casting techniques, indications for surgical treatment
  - f) Stages of fracture healing
  - g) Intrinsic, extrinsic factors affecting fracture healing
    - i) Nutrition, smoking, obesity
  - h) Biomechanics of healing fractures, and of fracture alignment
  - i) Pathologic fractures
  - j) Response of cartilage, ligament tendon and skeletal muscle to trauma
- 6. Develop an organizational framework for the diagnosis and treatment of patients presenting with osteoarthritis**
- a) Clinical presentation
    - i) History, physical examination (appendicular skeleton and axial)

- ii) Imaging studies
  - Plain radiographs
- b) Pathophysiologic processes
  - i) Inflammation (rubor, tumor, calor, dolor)
  - ii) Cartilage degeneration, bony response to altered load
  - iii) Periarticular changes: ligament, tendon, joint capsule
- c) Medical treatment of joint pain and inflammation
  - i) Pharmacological
    - Acetaminophen, non-steroidal anti-inflammatory drugs, COX-2 inhibitors, corticosteroids (oral and intra-articular), analgesics
  - ii) Surgical
    - Osteotomy, arthrodesis, replacement, excision
- d) Non-medical treatment of pain and inflammation
  - i) Alternative medicine
  - ii) Lifestyle and activity modification, disease prevention
- e) *Other arthritides that a student should be able to discuss*
  - i) *Seronegative spondyloarthropathies, gout, pseudogout, septic arthritis (infant, child, adult, elderly, immunocompromised), autoimmune vasculitis*

**7. Develop an organizational framework for the diagnosis and treatment of patients presenting with rheumatoid arthritis**

- a) Clinical presentation
  - i) History, physical examination (appendicular skeleton and axial, joint specific examination, differentiation from sepsis)
    - Adult and Juvenile Rheumatoid arthritis
  - ii) Imaging studies
    - Plain radiographs
  - iii) Joint fluid analysis
    - Basic aspiration and injection techniques
      - Knee
    - Cell count, gram stain, crystals, culture if appropriate clinically
  - iv) Laboratory blood tests
    - Basic bloodwork
    - Erythrocyte sedimentation rate: usefulness, pitfalls
    - C.R.P.
  - v) Extra-articular
- b) Pathophysiologic processes
  - i) Inflammation (articular and extra-articular)
  - ii) Synovial pathology
  - iii) Cartilage, bone, ligament and tendon responses to stress and inflammation
- c) Medical management
  - i) Pharmacological
    - Acetaminophen, non-steroidal anti-inflammatory drugs, COX-2 inhibitors, corticosteroids
    - Sulfasalazine, hydroxychloroquine, other DMARDs
    - Biologic agents (Enbrel, Remicade)
    - Complications
  - ii) Surgical
- d) Non-medical treatment of pain and inflammation
  - i) Alternative medicine
  - ii) Lifestyle modification
  - iii) Physiotherapy and occupational therapy

**8. Develop an organizational framework for the diagnosis and treatment of patients presenting with crystalline arthritis: gout & pseudogout (calcium pyrophosphate)**

- a) Clinical presentation
  - i) History, physical examination: joint specific examination (“general” musculoskeletal examination)
  - ii) Joint fluid analysis
    - Basic aspiration and injection techniques
    - Cell count, crystal analysis (MSU & CPPD); gram stain and culture (if clinically appropriate)
  - iii) Imaging studies
    - Plain radiographs
  - iv) Management
    - Anti-inflammatory drugs

- Hypouricemic therapy (gout)
- 9. Develop an organizational framework for the diagnosis and treatment of patients presenting with sports injuries (both chronic overuse phenomena and acute injury)**
- a) Clinical presentation
    - i) Biomechanics and injury mechanism of acute and chronic sports injuries
    - ii) History and directed physical examination of the acutely injured Athlete
    - iii) History and directed physical examination of chronic injury
    - iv) Appropriate diagnostic imaging of the injured athlete
      - Plain radiographs, MRI (when to obtain each)
  - b) Pathophysiology
    - i) Inflammation of musculoskeletal tissues following acute or chronic injury
    - ii) Histopathology of chronic injury
  - c) Therapeutics
    - i) Medical treatment
      - Pharmacological treatment
    - ii) Physiotherapy and conditioning
    - iii) Immobilization after injury
    - iv) R.I.C.E.
  - d) Disease and injury prevention
  - e) *Sports injuries that a student should be able to discuss*
    - i) *Ankle sprains, anterior cruciate ligament & meniscal tears, stress fractures, special consideration of the female athlete*
- 10. Develop an organizational framework for the diagnosis and treatment of patients presenting with occupational injury (both acute & chronic overuse phenomena, and injury)**
- a) Clinical presentation
    - i) Work related history and physical examination of patient with chronic overuse conditions of the workplace
    - ii) Physical examination of the injured worker
    - iii) Imaging
      - Plain radiographs, nuclear studies
    - iv) Nerve conduction studies and electromyography
      - Indications, interpretation
  - b) Therapeutics
    - i) Medical
    - ii) Ergonomics
    - iii) Physiotherapy and occupational therapy
    - iv) Rehabilitation
  - c) Disease prevention
  - d) Conditions of overuse that a student should be able to discuss risk factors, presentation and evaluation of
    - i) Carpal tunnel syndrome, tennis elbow, tendonitis of the upper extremity including trigger finger and de Quervain's
- 11. Develop an organizational framework for the diagnosis and treatment of patients presenting with musculoskeletal infection**
- a) Clinical evaluation
    - i) History and physical examination
    - ii) Laboratory investigation
    - iii) Imaging studies
      - Plain radiographs, ultrasound, nuclear studies
    - iv) Collection of microbial specimens
    - v) Gram stain analysis
    - vi) Differential diagnosis
  - b) Pathophysiologic processes
    - i) Inflammation: Acute and chronic
    - ii) Ischaemia and infarction of tissues
    - iii) Microbe-specific infectious processes
    - iv) Immune and humoral response
  - c) Therapeutics
    - i) Medical
    - ii) Surgical
    - iii) Systemic disease with potential for the development of musculoskeletal sepsis
- 12. Develop an organizational framework for the diagnosis and treatment of patients presenting with musculoskeletal neoplasia (both primary and metastatic disease)**

- a) Clinical evaluation
  - i) History and physical examination
    - Pediatric vs. adult
    - Primary malignancy
    - Presentation as metastatic disease
    - Common benign MSK neoplasms
  - ii) Laboratory investigation
    - CBC, diff, ESR, serum immuno EP, Calcium, Phos
  - iii) Imaging studies
    - Plain radiographs, CT scan, MRI, chest x-ray, chest CT, abdominal CT, nuclear studies
    - Multiple myeloma: plain radiographs
  - iv) Biopsy
  - v) Common pathological lesions/diagnosis
- b) Pathophysiology
  - i) Local
    - Effects on bone, soft tissue
    - Bone loss mechanism
  - ii) Systemic
    - Metabolic changes
    - Bone loss mechanism
- c) Therapeutics
  - i) Medical
    - Chemotherapy, radiation therapy
    - Pain control (acute and chronic)
    - Metabolic dysfunction
  - ii) Surgical
    - Principles of surgical treatment
      - Decompression
      - Reconstruction
    - Role of prophylactic surgery
- d) Social implications of musculoskeletal malignancy

**13. Understand the relevant physiologic, pathologic and sociologic issues involved in the treatment of patients with spinal cord injury or stroke**

- a) Clinical evaluation
  - i) History
    - Injury
    - Change in neurological status
    - Bowel, bladder, social independence
  - ii) Physical examination
    - Neurological level (localize the lesion)
    - Motor tone and strength, sensation, reflexes
  - iii) Special considerations
    - Pressure sores, personal hygiene
    - Transportation
    - Imaging
- b) Pathophysiology
  - i) Neurological findings
  - ii) Bladder spasticity
  - iii) Neural degeneration, regeneration
  - iv) Disuse atrophy: muscle, bone, tendon, ligament
  - v) Parallel: manned space flight
- c) Therapeutics
  - i) Medical treatment of sequelae of SCI, stroke
  - ii) Surgical treatment of sequelae
- d) Non-medical treatment
  - i) Wheelchair, hospital bed
  - ii) Physiotherapy, occupational therapy, prosthetics, orthotics

**14. Understand the relevant physiologic, pathologic and sociologic issues involved in the treatment of children with myopathic or neurologic conditions; and complicating neuromuscular problems in adults with diabetes mellitus**

- a) Clinical topics
  - i) Differentiate between cerebral palsy, spina bifida, muscular dystrophy
  - ii) Understand the relevant details of the physical examination for each of the conditions
  - iii) Understand the role of gait analysis & footwear assessment in the surgical treatment of these conditions
- b) Pathophysiology
  - i) Differentiate between myopathy and neuropathic conditions
  - ii) Understand the natural history of aforementioned conditions
- c) Therapeutics
  - i) Medical
  - ii) Surgical

**15. Understand the relevant physiologic, pathologic and sociologic issues involved in the treatment of children with orthopaedic disorders**

- a) Clinical topics
  - i) History and physical examination of the limping child
  - ii) History of at-risk factors for DDH
  - iii) Physical examination of an infant for presence of a dislocated or a dislocatable hip
  - iv) Screening physical examination of the spine, lower extremities, neck, upper extremities and internal organs in a child at risk for congenital malformations.
  - v) Evaluation of the traumatized child
  - vi) Imaging
    - Plain radiographs, ultrasound, nuclear studies, MRI
    - Whole body x-ray series for child abuse
  - vii) Laboratory investigations
- b) Pathophysiology
  - i) Differential diagnosis and pathological processes at work in common paediatric hip conditions.
  - ii) Pathophysiology of epiphyseal osteonecrosis
  - iii) Basic embryology of the musculoskeletal system, as related to developmental abnormalities
  - iv) Pathology and molecular genetics of the skeletal dysplasias
- c) Therapeutics
  - i) Medical
  - ii) Surgical
- d) Critical Evaluation Parameters
  - i) Communication skills
  - ii) Early childhood developmental milestones
  - iii) Child abuse
  - iv) Multi-disciplinary approach to care for an injured or sick child
- e) *Other pediatric conditions with which the student should be familiar*
  - i) *In-toeing and out-toeing differential diagnosis, scoliosis, classification of physeal fractures, osteochondroses, birth injuries, congenital malformations*

**16. Display understanding of the diagnosis and treatment of patients suffering from chronic pain, and the interdisciplinary approach required for the treatment of this condition**

- a) Understand the basic pathophysiology of acute and chronic pain syndromes
  - i) Fibromyalgia
  - ii) Complex regional pain syndrome
  - iii) Chronic neck and low back pain
- b) Appreciate the multi-disciplinary approach to the diagnosis and treatment of this condition

**17. Understand normal and abnormal bone physiology, and the clinical presentation and treatment of patients with altered bone physiology**

- a) Clinical topics
  - i) Paediatric osteochondrodysplasias and metabolic bone disease
  - ii) Osteoporosis
    - Post menopausal
    - Steroid and other drug induced
  - iii) Paediatric diseases
  - iv) Laboratory investigation
  - v) Imaging
    - Plan xrays
    - Densitometry
  - vi) Biopsy

- Tetracycline labeling
- b) Pathophysiology
  - i) Demonstrate understanding of the paradigm of bone formation and remodeling, and its disruption in osteoporosis
  - ii) Differential diagnosis of an osteoporotic compression fracture of the spine
- c) Therapeutics
  - i) Medical
  - ii) Surgical
- d) Other
  - i) Disease burden on society
  - ii) Prevention
- e) *Other conditions affecting bone metabolism with which the student should be familiar*
  - i) *Sickle cell disease, osteomalacia, avascular necrosis, steroid-induced osteopenia and Addison's disease, Paget's disease, rickets*

### 18. Demonstrate understanding of the principles and practice of injury and disease prevention

- a) Understand and promote the use of appropriate protective equipment during athletic activity
- b) Car seats
- c) Effects of smoking and obesity on the musculoskeletal system
- d) Motor vehicle and pedestrian trauma
- e) Role and effect of societal violence i.e. alcohol abuse, war trauma

### Orthopaedic Urgencies:

**Open Fractures:** These involve an injury that breaches the skin and soft tissue and exposes the bone to the outside environment. There are “inside out” injuries (a bone spike pierces the skin and then goes back below the skin surface) and “outside in” injuries (a gunshot wound). Open fractures are graded I, II and III. Grade I open fractures have wounds less than 1 cm. in length. Grade II open fractures are wounds more than 1 cm. in length, but the wound is clean and there is no devitalized tissue. Grade III open fractures have contaminated wounds with devitalized tissue or have comminuted fractures with neurovascular injury. Grade III fractures are subdivided: IIIA have contaminated wounds with minimal periosteal stripping and no neurovascular compromise; IIIB are associated with significant periosteal soft tissue injury; IIIC have significant periosteal stripping/soft tissue injury with associated vascular compromise or nerve injury. Open fractures have a high incidence of complications including infection, nonunion and frank osteomyelitis.

**Septic Arthritis:** Acute onset of pain, inflammation of a single joint that rapidly increases in severity should alert the physician of a septic arthritis. If septic arthritis is present, early diagnosis and treatment is a necessity. Swelling of the involved joint, erythema, induration, pain with range of motion or weight bearing can be seen. History may include fever, chills, sweats. A history of an injury involving a breach of skin around the joint may be elicited (fight bite). Recent bacterial infection may be in the history. Recent sexual contact should alert one to the possibility of gonococcal arthritis. Patients with immunosuppressive disorders are at increased risk, as are patients on steroids. Arthrocentesis of the involved joint is done—the cell count gives the physician an idea of the white cell content and character of the fluid. If there is a truly septic joint it must be irrigated and debrided immediately to prevent damage to the articular surface from the pus. Treatment includes joint arthrocentesis, CBC, ESR, cultures of joint fluid; if fluid is suspicious for septic arthritis the patient undergoes I & D in the OR immediately and is placed on intravenous antibiotics.

**Compartment Syndrome:** This is caused by elevated hydrostatic pressure in a closed fascial compartment. The elevated pressure may be muscle injury and swelling, bleeding into a compartment, vascular injury. It is a complication that can be seen with fractures, soft tissue injuries, post-operatively, with crush injuries or venomous bites. As the pressure increases capillary beds collapse shunting blood through the compartment via larger arteries. Venous beds collapse as pressure increases and venous outflow is compromised. This results in increased swelling, higher pressure and resultant ischemia. Clinically one should always be suspicious of compartment syndrome in a patient who complains of intense increase in severity of extremity pain.

The primary physical sign is **increased pain**. One can also see **pain with passive stretching**—gentle motion of muscles in the compartment elicits great pain. **Paresthesia** is a fairly late sign—this indicates that the nerves in the compartment are being adversely affected by the ischemia. If the compartment syndrome is unrecognized or untreated this can eventually progress to a Volkmann's ischemia where the nerves are irrevocably damaged and the muscles become ischemic and necrose. **Firm, tense** compartments are another physical sign. Compartment pressures are measured with a manometer and provide objective evidence of increased pressure. **Pallor and pulselessness** of the extremity are often late signs. The treatment of compartment syndrome involves emergent surgical release of the compartment in the OR. Delayed primary closure of the skin may be done or the skin defect may be approximated with skin grafts with the swelling has resolved. Elevation of the involved extremity is used to reduce swelling.

### Orders/Notes:

Routine admission or post-operative orders follow a standard format. Some attending physicians have pre-printed post-op orders for procedures that are done routinely.

### Example of Admission Orders: Explanations or abbreviations in italics and parentheses

Admit to 7300—Dr. Ricci

Diagnosis: Left tibia fracture

Condition: Stable

Vitals: Routine with Q 2 hour neurovascular check to left lower extremity (LE)  
 Activity: Bedrest; strict nonweight bearing (NWB) left LE  
 Nursing: Ice to left leg  
 Diet: NPO after MN (for operating room in AM)  
 IVF: Heplock  
 Allergy: NKDA  
 Meds: Demerol 75 mg IM Q 3-4 prn (for pain)  
 Vistaril 25-50 mg IM Q 3-4 prn (for pain)  
 Tylenol #3 i-ii po Q 4-6 prn (for pain)  
 Tylenol 650 mg po Q 4-6 prn (for headache or fever)  
 Benadryl 25-50 mg po Q HS prn (to help with sleep)  
 Mylanta 30 cc po Q 6-8 prn (for indigestion)  
 Any routine meds the patient is on at home  
 Labs: CBC, SMA 7, PT/PTT, UA with micro, CXR. EKG, type and cross or type and screen (depending on procedure and age of patient)

Call HO (house officer—resident on call) for T>38.4, P>120<50, SBP>180<100, RR>20<10

**Example of Brief Operative Note:** This is a note that goes in the chart after an operative procedure—it briefly documents what was done and by whom.

BON (Brief op note)  
 Preop diagnosis: Left tibia fracture  
 Postop diagnosis: same  
 Procedure: ORIF left tibia  
 Anesthesia: Spinal  
 Surgeons: Ricci, McBeath, WUMS 3 (attending always goes first)  
 EBL (est. blood loss): 150 cc  
 IVF: 1500 cc  
 TT (tourniquet time): one hour and 15 minutes  
 Drains: none  
 Specimens: none  
 Complications: none  
 Dispensation: to PAR (post anesthesia recovery room) in stable condition  
 Signature

**Example Post-Op Orders:**

Admit 7300—Dr. Ricci  
 Dx: s/p ORIF L tibia  
 Condition: stable  
 Vitals: per post-op routine (can check with particular resident) with Q 2 hour neurovascular checks to L LE  
 Activity: Bedrest today: OOB to chair in AM with PT for NWB L LE with crutches  
 Nursing: Elevate L LE  
 Ice to L LE  
 Diet: Regular (if renal or diabetic patient change diet accordingly)  
 IVF: D5LR @ 80 cc/hr (fluid replacement rate varies with patient status and procedure)  
 May heplock IVF when pt. has good po intake  
 Allergy: NKDA  
 Meds: Demerol 75-100 mg IM Q 3-4 prn  
 Vistaril 25-50 mg IM Q 3-4 prn  
 Tylenol #3 i-ii po Q 4-6 prn  
 Tylenol 650 mg po Q 4-6 prn  
 Benadryl 25-50 mg po Q HS prn  
 Compazine 10 mg IM Q 6 prn (for nausea/vomiting)  
 Mylanta 30 cc po Q 6-8 prn  
 Labs: (depends on procedure performed)  
 Call HO (parameters same as for above orders)

**Example Post-op Check Note:** Patients are checked a few hours after surgery to make sure they are not having problems or complications.

Post-op check  
 Pt. without complaints  
 AFVSS  
 Chest CTA  
 CV RRR  
 Abd S/NT/ND  
 Extrem without c/c/e good capillary refill  
 sensation and motor intact  
 pulses intact  
 A/P: Pt. stable s/p ORIF L tibia  
 PT in am

Ice, elevate

Signature

### Example of Routing Daily Note:

– Dr. POD 2 (post operative day)

Pt. without complaints

AFVSS

Wound clean, dry, intact

DNVI (this is an abbreviation of distal neurovascular intact—this is shorthand for full sensory motor exam—**this all must be normal** to write DNVI—if there is any question or inconsistency, it must be noted in full—check with individual residents for this)

A/P: Pt. doing well with PT  
Plan discharge to home today  
F/U one week Ricci's clinic

Signature

### Example of Discharge Orders:

D/C to home (or rehab facility, on occasion)

s/p ORIF L tibia

Stable condition

Instruction: keep wound clean and dry  
NWB with crutches L LE

Prescription: Tylenol #3 i-ii po Q 4-6 prn

F/U in Dr. Ricci's clinic in one week—call 747-2500 for appointment

Signature (Ricci's)

Prescriptions are written on appropriate form by resident

*Of note: these orders are examples of orders specific to the orthopaedic surgery service. Although the format may be the same, the content will be different on the other services you will be on, especially as far as diet, fluids and medications. Before writing for any of this standard order protocol, check with the appropriate resident on your other services.*

### Suggested Reading Resources:

Bernstein: Musculoskeletal Medicine -For overviews of basic anatomy, pathoanatomy and physiology.

DeGowin: DeGowin's Diagnostic Examination - The perfect bridge book between physical exam textbooks and clinical reference books.

Hoppenfeld: Physical Examination of the Musculo-Skeletal System - A thin green book. It has terrific pictures and explanations.

Hoppenfeld: Surgical Approaches in Orthopaedics - Terrific for OR preparation; most of the residents have this.

Rispoli: Tarascon Pocket Orthopaedics. - Indispensable pocket reference.

\*\*\*If you have any suggestions, e-mail Dr. Boyer ([boyerm@wustl.edu](mailto:boyerm@wustl.edu))\*\*\*

### Internet Sites:

The following sites may be good starting points for links and for other information:

- [www.aaos.org](http://www.aaos.org) -The American Academy of Orthopaedic Surgeons [www.assh.org](http://www.assh.org) -The American Society for Surgery of the Hand  
[www.ejbs.org](http://www.ejbs.org) -Journal of Bone & Joint Surgery site

You can also use Google, search on ORTHOPAEDICS or, ORTHOPAEDIC SURGERY or, for the specific condition which you're interested.

### ORTHOPAEDIC TERMS:

**Abduction:** motion in sagittal plane—extremity moved away from midline  
**Adduction:** motion in coronal plane—extremity moved toward midline  
**Arthrocentesis:** aspiration of fluid from a joint  
**Arthrodesis:** fusion of a joint surgically  
**Comminuted:** Term used in regards to fractures indicating that there are several fragments of bone (more than two) – also: multifragmentary  
**Coxa:** refers to hip and prox. femur  
**Cubitus:** refers to elbow  
**Diastasis:** separation of bones that are attached by fibrous tissue (i.e. symphysis pubis). This is a distinct form of dislocation, which refers to a disruption of a diarthrodial joint  
**Dislocation:** complete disruption of a joint—loss of articular congruity  
**Genu:** refers to knee  
**Kyphosis:** Sagittal plane deformity with the apex posterior  
**Lordosis:** Sagittal plane deformity with the apex anterior  
**Scoliosis:** frontal plane curve in the spinal alignment  
**Subluxation:** disruption of a joint with partial loss of congruity of articular surfaces.  
**Valgus:** angulation in a coronal (frontal) plane—used in conjunction with a joint. Indicate that the extremity **distal** to the joint in question goes **away** from the midline. *Example: genu valgum—knock-knees*  
**Varus:** angulation in a coronal (frontal) plane—used in conjunction with a joint. Indicate that the extremity **proximal** to the joint in question goes **towards** the midline. *Example: genu varum—bow-legged*

### Commonly Used Abbreviations:

**AP:** anteroposterior (as in X-ray view)

**BON:** brief operative note

**CR:** closed reduction

**DF:** dorsiflexion

**DNVI:** distal neurovascular status intact. (*Must be completely intact for you to write this.*)

|               |   |
|---------------|---|
| <b>EBL:</b>   | estimated blood loss  |
| <b>EXFIX:</b> | external fixation   |
| <b>F/U:</b>   | follow up   |
| <b>GET:</b>   | general endotracheal  |
| <b>HO:</b>    | House officer or doctor on call for particular service  |
| <b>IM:</b>    | intramuscular or intramedullary   |
| <b>IVF:</b>   | intravenous fluids  |
| <b>LE:</b>    | lower extremity   |
| <b>LAC:</b>   | long arm cast   |
| <b>LLC:</b>   | long leg cast   |
| <b>NPO:</b>   | nothing by mouth (no food or liquid)---used prior to surgery  |
| <b>NWB:</b>   | non weight bearing (strict, absolutely no weight on affected extremity)   |
| <b>OOB:</b>   | out of bed  |
| <b>ORIF:</b>  | open reduction internal fixation  |
| <b>OT:</b>    | occupational therapy  |
| <b>PF:</b>    | plantar flexion   |
| <b>POC:</b>   | post operative check  |
| <b>POD:</b>   | post operative day number   |
| <b>PP:</b>    | pin prick or percutaneous pinning   |
| <b>PT:</b>    | physical therapy  |
| <b>PWB:</b>   | partial weight bearing (need to note amount: for example 25%-50% -- this is a percentage of body weight)                  |
| <b>SAC:</b>   | short arm cast  |
| <b>SLC:</b>   | short leg cast  |
| <b>TT:</b>    | tourniquet time (tourniquets are often used in surgery to decrease the amount of operative blood loss)                    |
| <b>TTWB:</b>  | toe touch weight bearing (this is the least amount of weight bearing possible – it is just touch down of toe for balance) |
| <b>UE:</b>    | upper extremity   |