Musculoskeletal Study Guide

Lecture 3: Juvenile Orthopedic Diseases

1. Recognize orthopedic conditions that occur in juvenile dogs
    a. Panosteitis
        i. Self-limiting disease, lameness/pain but NOT SICK
        ii. 5-12 months but can be 2 months to 5 years
        iii. Pathogenesis: Fat necrosis, vascular proliferation, bone formation, bone remodeling, replacement with fat
    b. Hypertrophic osteodystrophy
        i. These dogs have lameness/pain AND systemic signs (SICK)
        ii. Age 2-6 months
        iii. Pathogenesis: Zone of abnormal trabeculae bone in metaphysis, hemorrhage and hemosiderin deposits, inflammation and necrosis/fibrosis
    c. Osteochondrosis
        i. Disorder of endochondral ossification, focal or multifocal
        ii. 4-5 months
        iii. Overfeeding, high Ca^{+} and Vit. D, trauma, ischemia
        iv. Pathogenesis: Articular-Epiphyseal cartilage complex, thickening at the growth plate
        v. Locations: Femur (condyle and head) Humerus (head and medial humeral condyle) Tarsus (talus)
        vi. Prevention: Selective Breeding, control of energy and diets
    d. Retained cartilage core
        i. Core/cone of growth plate cartilage that projects from distal ulna growth plate into the distal metaphysis
        ii. 3-4 months of age
        iii. Typically affects the distal ulna and can lead to angular limb deformities as it affects growth

2. Apply diagnostic tools to properly identify diseases
    a. Panosteisis: Radiographs, +/- CT
    b. HOD: Radiographs pathognomonic sign lucent line metaphysis, periosteal and endosteal proliferation
    c. Osteochondrosis: Signalment, history, examination, radiographs, CT, MRI
    d. Retained Ulnar Cartilaginous Core: Lameness thoracic limb, radiographs

3. Describe medical and surgical treatments for young dog diseases
    a. Panosteitis: Palliative only, rest, pain relief, diet chang, good prognosis
    b. HOD: supportive treatment, fluids, NSAIDS, Opioids
    c. OC/OCD: Medical management, Surgery palliative, curettage, microfracture, OATS, periosteal graphs, synthetic implants
    d. Retained Ulnar Cartilaginous Core: Treatment is usually not necessary, osteotomy in severe cases

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Lecture 4: Patellar Luxation and Tarsal Conditions

Overview: Pelvic Limb Lameness Differential Diagnosis List

Patellar Luxation

Cranial Cruciate Ligament Rupture

Hip dysplasia with osteoarthritis

Tarsal OC with subsequent osteoarthritis

Calcaneal tendon rupture

Superficial digital flexor tenson luxation

1. Describe the common abnormalities present in animals with patellar luxation
    a. Medial Patellar Luxation
        i. Femoral varus, hypoplasia of medial condyle, shallow trochlear groove, internal rotation of tibia
    b. Lateral Patellar Luxation
        i. Femoral valgus, shallow trochlear groove, external rotation of tibia

2. Apply the patellar grading scheme to examination findings
    a. Grade 1: In (no surgery)
    b. Grade 2: Mostly in (may need surgery depending on age and clin. Signs)
    c. Grade 3: Mostly out (Likely needs surgery)
    d. Grade 4: Always out (Needs surgery)

3. Describe the basic surgical approach/concept for treatment of patellar luxation
    a. Physical examination, Radiographs, CT useful for surgery planning and evaluation of varus, valgus, and torsions
    b. 4 in 1 corrective technique
        i. Imbrication laterally (soft tissue reconstruction)
        ii. Medial release (soft tissue reconstruction)
        iii. Recession Trochleoplasty
        iv. Tibial tuberosity transposition

4. Describe the common orthopedic conditions affecting the tarsus
    a. Osteochondrosis/Osteochondritis Dissecans
        i. Medial > Lateral Talar ridge
    b. Calcaneal Tendon Rupture
        i. Can be a partial or complete rupture
    c. Superficial Digital Flexor Tendon Luxation
        i. Lameness similar to patellar luxation

5. Assemble a treatment plan for common tarsal diseases
    a. OC/OCD: Removal of flap, may need arthrodesis
    b. Calcaneal tendon rupture: Surgical disease, remove abnormal scar tissue, oppose tendon with suture
        i. Post-op care: Protect the repair for 6-8 weeks in extension, screw, ESF, orthotic
    c. SDFT Luxation: Surgical-suture the fascial attachments opposite of the luxation

Lecture 5: Hip Disease in the Juvenile Dog: Pathogenesis, Diagnosis, and Control of OA

1. Explain the facts of juvenile hip disease
    a. CHD is highly prevalent, leads to OA, and causes mild to severe pain
    b. Dogs with the severe form of CHD show clinical signs
    c. 76% of dogs with CHD never need surgery and 50% were considered normal by their owner
    d. Factors associated with increased lameness: Joint luxation and exercising <20 min per day
    e. Functional hip laxity leads to clinical signs and progressive hip OA
    f. Passive hip laxity is the #1 risk factor for developing OA later in life
    g. Environmental factors also play a role
    h. There are NO medical or surgical CURES for CHD – all are palliative
    i. No surgical procedures have been shown to prevent OA
    j. Medical/Surgical treatments have not been evaluated for indications and outcome in evidence-based studies
    k. Selective breeding is the BEST effective method to reduce frequency and severity of CHD

2. Cite proposed etiologies of hip disease
    a. Things that influence functional hip laxity
        i. High volume of joint fluid
        ii. Thickened ligament of femoral head (round ligament)
        iii. Pelvic muscle mass – less muscle mass is + correlated with more hip laxity in growing dogs
        iv. Hormones – relaxin increases laxity and early spay/neuter likely contributes
        v. Weight and growth
        vi. Nutrition

3. Illustrate diagnostic tools to properly identify hip disease
    a. Physical exam tests for laxity
        i. Barlow and Ortolani
            1. Barlow: Adducts hip to ID if a hip can be dislocated
                a. Shows the instability of the hip joint
            2. Ortolani: Abducts the hip to reduce it
                a. Shows the presence of a dislocated hip and its reduction
    b. Radiographs

i. Extended hips
ii. Lateral
iii. Frog-legged
iv. Single leg

c. Norberg Angle
    i. Angle connecting femoral heads to cranodorsal acetabular rim
        1. Smaller the # the greater the hip laxity (55-115°) normal is >105°
            a. NA cannot predict CHD or DJD
d. PennHIP
    i. Measures passive hip laxity
        1. DI 0 to >1
        2. Places dogs into a percentile and the recommendation is to use the top 50% of dogs for breeding
e. Dorsolateral subluxation
    i. Cannot measure functional laxity

*There are other radiographic methods used to evaluate the hips but none have been proven to correlate with DJD

4. Prescribe surgical treatments and efficacy of tx for juvenile hip disease
    a. Juvenile pubic symphosiodesis
        i. Needs to be done early 16-20 weeks of age, use PennHIP but the results may not be accurate at 16 weeks
        ii. Minimal difference in hip laxity via PennHIP at 2 years of age
    b. Triple/Double pelvic osteotomy
        i. Ok for patients with clinical signs of laxity and are skeletally immature, no degeneration, good ortolani sign
        ii. Complications may occur and are dependent on the skill of the surgeon and the owner compliance with recovery measures
    c. Femoral neck lengthening
    d. Intertrochanteric osteotomy
    e. BOP shelf arthroplasty
    f. Pectineal Myectomy

*Basically control breeding for best results!

Lecture 6: Hip Disease in the Adult Dog and Cat

1. Define hip diseases in adult dogs & cats
    a. Muscle atrophy, protrusion of greater trochanter dorsal and lateral, pain on hip extension or hip movement, decreased ROM, cerptius, ortolani sign
    b. Hip dysplasia and OA
    c. Aseptic necrosis of the femoral head (LCP disease)
    d. Coxofemoral denervation

2. Apply diagnostic tools to properly identify hip diseases
    a. Radiographs

i. Cranial-caudal
ii. Lateral
iii. Open leg lateral
iv. Frog-legged

3. Utilize medical treatments for hip diseases
    a. Weight management
    b. Exercise modification programs
    c. Physical rehabilitation
    d. Pain management
    e. Essential fatty acids

4. Describe surgical treatments for hip diseases
    a. Total hip replacement (THR)
        i. Technical and can have devastating complications
    b. Femoral Head and Neck Excision (FHNE)
        i. Needs rehab
        ii. Ideal for smaller patients

    *both are salvage procedures

5. Access efficacy of treatments for hip conditions
    a. THR candidates: Disability from hip OA
        i. Make sure there is not a concurrent cranial cruciate tear
        ii. NOT a radiographic decision
        iii. Can return to normal function
        iv. Overall outcome depends on experience and precision
    b. Femoral head and neck excision
        i. Removal of femoral head and neck for pain relief
        ii. Pseudoarthosis
        iii. Gait will NOT be normal, always ideal to restore the hip joint if possible

Lecture 7: Cranial Cruciate Ligament Disease in the Dog

List the 3 physiological functions of cranial cruciate ligament in canine stifle joint

1. Prevents cranial translation of the tibia
2. Prevents internal rotation of the tibia, *medial patella luxation and CrCL disease often occur together
3. Prevents hyperextension of the stifle

Explain 2 pathognomic orthopedic examination findings for confirming the presence of CCL disease.

1. Drawer's Test *Passive motion to detect tibial translation, check both in flexion and extension

2. Tibial compression test (indirect drawer) *Mimics standing position to detect tibial translation, physiologic

Explain 3 most common surgery treatment methods for cranial cruciate ligament diseases
-Lateral suture – Suture placed around the fabella and through a hole in the tibia *static stabilization. Close to a normal gait at a walk!

-Tight rope prosthetic ligament

-Osteotomies – eliminate cranial tibial thrust force during weight bearing, patient still have a cranial drawer motion after surgery

-Tibial tuberosity advancement: Patella tendon perpendicular to Tibia plateau angle eliminates cranial tibial thrust force (dynamic stabilization). Changes the direction of the patellar tendon

-Tibial plateau leveling osteotomy (dynamic stabilization): alters the angle of the tibial plateau to achieve stability

Explain the rationale behind meniscal release and meniscectomy surgery
-Transect the caudal meniscotibial ligament with the goal of preventing future meniscal injury

-Eliminates the hammock function of the meniscus along with the normal meniscal function

-Meniscectomy goal = remove the source of pain

-Medial meniscal injury is more common due to it's ligament attachments

Lecture 8: Shoulder Joint Conditions and Osteoarthritis

1. Describe the shoulder disease condition and the patient presentation
    a. OCD is the most common cause of shoulder lameness in young, large-breed dogs
    b. Glenoid dysplasia is more common in toy-breed dogs
    c. Shoulder instability – injury to the soft tissue stabilizers, incongruity of the joint
    d. Biceps brachii Tendinopathy
    e. Supraspinatus tendinopathy
    f. Infraspinatus contracture *think hunting/herding dogs
    g. Traumatic shoulder luxation

2. Interpret diagnostic tools to identify the shoulder condition
    a. Radiographs
    b. Physical exam
    c. Positive biceps test, shoulder drawer test, biceps retraction test, radiography, ultrasonography
    d. Radiographs, ultrasonography, MRI

3. Describe different treatment options for shoulder conditions
    a. OCD: conservative treatment can work but it is not effective if there is a flap
        i. Needs removal / debridement (arthrotomy / arthroscopic)
    b. Glenoid dysplasia: Salvage procedure arthrodesis/excisional arthroplasty)
    c. Medial instability: Conservative (shoulder hobbles and rest)
        i. Surgical fixation-transposition of biceps tendon, augmentation/imbrication of joint capsule, bone anchors
    d. Biceps brachii tendinopathy: Arthroscopy, conservative/medical management
    e. Supraspinatus tendinopathy: Conservative or surgical (removal of calcification in tendon)
    f. Infraspinatus contracture: Transection of tendon, rehabilitation -good to excellent prognosis
    g. Traumatic shoulder luxation: reconstruction, transarticular pinning or other devices, salvage procedures

4. Pathophysiology of OA (primary vs secondary)
    a. Changes in ALL tissue of the synovial joint
    b. Progressive loss of structure and function
        i. Water content increases, collagen network is damaged, cartilage stiffness is reduced
        ii. Inflammatory cytokines
            1. COX-2 and PGE_2
        iii. Pain with OA is due to C-fibers developing sensitivity which increases input into the spinal cord and causes central sensitization

    Primary OA is idiopathic and there is no identifiable underlying cause

    - Geriatric patients, commonly bilateral, multiple joints, and more often in cats

    Secondary OA is triggered by other underlying causes such as joint instability or abnormal pressure on the cartilage surface/trauma

    - More common in dogs, “mechanical osteoarthritis”
    - Developmental disease, joint insitability, joint trauma

5. Treatment options for OA
    a. Treat the underlying cause
        i. Developmental disease in younger dogs and joint instability
        ii. Obesity is a disease
        iii. Approach each aspect of the cycle – physiologic, physical, functional
        iv. Start conservation EARLY: weight management, exercise, drugs, nutraceuticals (EFA)

Lecture 9: Elbow conditions

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1. Recognize the typical signalment and clinical presentation of IOHC and HIF
    a. Incomplete ossification of the humeral condyle (Frenchies, Spaniels, Boston Terriers)
    b. Incomplete ossification > stress fractures or fissures, sclerosis
    c. Biphasic 3-6 months, 2-6 years
    d. In Frenchies, the median age is around 4 months (mostly lateral humeral condyle)
    e. Gait, abducted elbow, joint thickening/effusion, pain in the elbow joint, maximal flexion/extension, moderate flexion and firm supination, reduced ROM

2. Recall the 4 different components of elbow dysplasia
    a. OCD of medial humeral condyle
    b. Elbow incongruence
    c. Medial coronoid disease *Most common form of elbow dysplasia
        i. Cartilage disease
        ii. Micro-fracture
        iii. Fragmented medial coronoid process
    d. Ununited aconeal process (should fuse between 4-6 months)
        i. Can be secondary to growth disparity such as a long radius or small semilunar notch
        ii. Flexed lateral radiograph
        iii. Most common in German Shepherds and young dogs

3. Explain the rational of treatments and the prognosis for a given component of elbow dysplasia
    a. OCD: Debridement and resurfacing
    b. UAP: Proximal ulnar osteotomy or PUO and fragment fixation
    c. Medial Coronoid Disease: Arthrotomy (invasive and not recommended) arthrocopy
    d. If not fractured but clinically lame- prophylactic fixation with a larger size screw
    e. Fractured – anatomic reconstruction with rigid fixation

4. Summarize the treatment plan for a dog presented with a traumatic or congenital elbow luxation
    a. High energy trauma -shear forces with elbow flexed (90% lateral luxation)
        i. Abducted forearm, limited ROM, PAINFUL
    b. Flowchart
        i. Closed reduction (under GA) > stable > temporary stabilization in extension
            1. Not stable > open reduction, ligament reconstruction, fracture repair
        ii. Avulsion or articular fracture >48-72 hours > open reduction, ligament reconstruction, fracture repair
        iii. Severe OA or No $$ Salvage procedure arthrodesis/amputation
    c. Congenital elbow luxation
        i. Be proactive for closed reduction

ii. Early tx to maximize functional outcomes
iii. If there is good function, benign neglect
iv. If it is painful/bad function > arthrodesis/amputation

Elbow incongruence

Long Radius: could lead to an ununited aconeal process

Long Ulna: Can lead to coronoid process problems

Small ulnar notch: puts stress on the humeral condyles

Tight Shoe Analogy

Removing the fragment: Arthroscopy > pain relief

Good for UAP, Fair for FCP, Poor for OCD

Adjustment of the shoe

Ulnar osteotomy, may alter the disease progression

Lecture 10: Rehabilitation of patients with common orthopedic diseases

1. Aspects of rehabilitation
    a. Manual therapy
    b. Electrophysical modalities
    c. Therapeutic exercise
    d. Ergonomics
    e. *pain management, nursing care, strengthening, stretching, sensory stimulation

2. Exercise therapy ranked as the best treatment for knee osteoarthritis pain, followed by NSAIDS and opioids
    a. Anti-inflammatory measures
    b. Gate control theory
    c. Improving locomotion, posture
    d. Avoiding stress on healing tissues
    e. Edema control

3. Rationale for Vet PT
    a. Assessing the patient
    b. Protecting patients from slipping/falling/moving too fast/joint luxation/wound trauma
    c. Assisting patients
    d. Pain relief
    e. Providing nursing care
    f. Strengthening

   g. Stretching (exercise, splint/brace, manual therapy)
   h. Providing non-noxious sensory stimulation
   i. Providing training and educational material
   j. Identifying and managing high-risk patients

4. Optimal management requires a three-prong approach
   a. Medical
   b. Owner
   c. Patient
5. Clear candidate for physical rehabilitation
   a. Dogs who are non-ambulatory
   b. Dogs who may or will become non-ambulatory
   c. Patients who may lose joint motion
   d. Dogs who may develop irreversible changes to musculoskeletal tissues
   e. Patients who need a special form of protection after injury or surgery