ULTRASOUND BASICS

- Medical ultrasound machines generate and receive ultrasound waves.
- Ultrasound waves are emitted from the piezoelectric crystals of the transducer.
- The waves then will interact with objects of different densities and then white, black and varying degrees of gray are produced on the screen.
- The ultrasound is typically set in B-mode (brightness mode) which gives you a 2-D image.
ULTRASOUND BASICS

- Ultrasound is made of mechanical waves that can transmit through different materials like fluids, soft tissues and solids.
  - Liquid = black
  - Gas = white
  - Solids = bright white and depending on the solid can have a black shadowing beneath (stones)
  - Grays = soft tissue (liver, spleen, kidney, etc)
ULTRASOUND PROBE OPTIONS

- There are numerous different types of transducers that we can use to get better images of different objects (organs vs. joints vs. ligaments vs. muscle)
ULTRASOUND USES

- Diagnostic tool for numerous illnesses
  - Bladder stones
  - Liver disease (gall bladder, masses, hepatophathy)
  - Kidney disease
  - IBD vs. lymphoma in cats
  - Pancreatitis
  - Echocardiograms for heart disease
- Diagnostic tool for musculature issues
  - Iliopsoas tears/strains
  - Hamstring injuries
- Diagnostic tool for joint issues
  - CCL tears/Meniscal tears
  - Medial shoulder instability
  - Lateral and medial collateral ligaments
- FAST scan for emergency situations
  - Hemoabdomen
  - Splenic masses
NORMAL ULTRASOUND FINDINGS

• Normal Liver and gallbladder
NORMAL SPLEEN
ABNORMAL SPLEEN

Splenic mas with hypoechoic pockets → most likely Hemangiosarcoma
NORMAL KIDNEYS

- Right kidney is more cranial than the left kidney
- Middle portion is the renal pelvis
- Renal medulla with renal pyramids
- Renal cortex (outer layer)
ABNORMAL KIDNEYS

Kidney mass

Kidney stones
NORMAL URINARY BLADDER
ABNORMAL URINARY BLADDER

Bladder stone

Bladder mass
Ultrasound can detect fetal heartbeats at 22-23 days.

**Average Gestation Times**
- Cats/Dogs = 61 days
- Rabbit = 31 days
- Horses = 336 days
- African Elephant = 675 days
- Opposum = 12 days
MAISIE!!!
PYOMETRA

- Pyometra = Infected uterus (pus filled)
  - Open pyometra = drains (less dangerous)
  - Closed pyometra = does not drain (emergency surgery)
- Reason we recommend spaying animals as this is an emergency surgery
- Best preventative = spay
THE REST

- Pancreas
- Prostate
- Adrenal Glands
- Lymph nodes
- GI Tract
  - Cats with IBD vs. Lymphoma ➔ send out VDI
ECHOCARDIOGRAM

- Dr. Sayer referral or Dr. Tidwell to do in-house
NORMAL CARDIAC BLOOD FLOW

- Pulmonic valve
- Tricuspid valve
- Mitral Valve
- Aortic Valve
ECHOCARDIOGRAM
ABNORMAL ECHO’S

Pericardial Effusion

DCM

Feline Hypertrophic Cardiomyopathy
....SWITCHING GEARS
DIAGNOSTIC MUSCULOSKELETAL ULTRASOUND (MSK)
WHY IS ULTRASOUND NECESSARY?

• Agility dogs are the #1 subject for diagnostic ultrasound.
• Able to palpate muscular abnormalities but cannot see them with radiographs or even MRI/CT.
• Can see ligament and muscular tears and damage
• Can combine modalities such as stem cell and PRP therapy to inject into these areas to speed up the healing process
ILIOPSOAS INJURY

- Most common injury we see here at Atrium and from our agility dogs
- Grade 1-3 strains noted
- Recovery time is about 9 months depending on the severity of the strain (faster with stem cells)
  - Need to follow a rehab plan
<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>“Mild strain”, no loss of function, &lt;5% muscle involvement, focal edema and hemorrhage</td>
</tr>
<tr>
<td>Grade 1-2</td>
<td>Same as above but mild fascial tearing</td>
</tr>
<tr>
<td>Grade 2</td>
<td>“Moderate strain”, decreased strength of musculotendinous unit, mild fiber rupture, increased hemorrhage and edema</td>
</tr>
<tr>
<td>Grade 2-3</td>
<td>Same as above but with fascial tearing and mild fiber disruption</td>
</tr>
<tr>
<td>Grade 3</td>
<td>“Severe strain”, significant fascial tearing, complete muscle fiber disruption, significant edema and hemorrhage</td>
</tr>
</tbody>
</table>
GRADE 2 ILIOPSOAS STRAIN

Circle = Core lesion     Arrow = Adductor muscle
GRADE 3 ILIOPSOAS STRAIN
SHOULDER ANATOMY

Supraspinatus

Biceps brachii tendon

Teres minor

Infraspinatus

Canine Forelimb Anatomy
Left, Lateral View

Supraspinatus

Infraspinatus

Triceps Lateral Head cut

Triceps Long Head

Triceps Accessory Head

Triceps Medial Head

Biceps
SUPRASPINATUS TENDINOPATHY

- Agility dogs!!
- Supraspinatus tendon can become inflamed and press on the bicipital bursa
- **Ultrasound Findings:**
  - Hyperechoic: scar tissue or calcification
  - Hypoechoic: edema/fluid – active tear
  - Mix: acute on chronic injury
- **Clinical Signs** = Pain with flexion of the shoulder and pain with direct palpation of the tendon and insertion
  - Decreased range of motion
  - Muscle atrophy (supraspinatus)
Supraspinatus muscle belly “egg”
STIFLE ULTRASOUND

- Meniscal tears (medial and lateral)
  - Feel these through palpation and have a classic “click” with range of motion
  - Can see hypoechoic tears in the meniscus with ultrasound

A = Normal meniscus                    B= Abnormal hypoechoic meniscus
NORMAL CRANIAL CRUCIATE LIGAMENT
PARTIAL CRANIAL CRUCIATE LIGAMENT TEAR

Uneven CCL contour and hyperechoic stump

Joint effusion and cranial displacement of fat pad
ACHILLES TENDON (COMMON CALCANEAL TENDON)

- Common Calcaneal Tendon (Achilles)
  - Made of three separate muscles that come into one tendon and attach on the calcaneous
    - Gastrocnemius
    - Superficial digital flexor
    - Common tendon (biceps femoris, gracilis and semitendinosus muscles)
ACHILLES ULTRASOUND
ACHILLES TENDON INJURY
OTHER INJURIES

- Hamstring
  - Semitendinosus
  - Semimebranosus
  - Biceps femoris

Collateral ligaments
STEM CELL/PRP USE

- Once we have located an injury/injuries we can use stem cells to inject into the area with ultrasound.
- Some areas do not require ultrasound to be injected but you will need to use it for the tiny areas and areas of insertion.
- Can be used for partial CCL tears vs. surgery.
- Full CCL tears need surgery but use PRP’s/Stem cell with the TPLO to get the best recovery.
- Stem cell injections will speed up healing by months.
  - For example: Iliopsoas tears can be healed in 3 months vs. 9+ months.
REHAB POST-REGENERATIVE MEDICINE

• No therapeutic ultrasound, cryotherapy and no TENS
• K-laser therapy only 1-2 times per week for the first 8 weeks
  • INTRA-ARTICULAR INJECTIONS -- HOLD LASER 2 WEEKS POST-INJECTION AS IT INCREASED BLOOD FLOW AND CAN MOVE THE CELLS OUT OF THE JOINT
  • Must be on lower setting 500-1000mW or less (go into settings and manually lower power for first 8 weeks
    • 3B lasers are less than 1000mW so are safe
QUESTIONS?

People will stop asking you questions if you answer back in interpretive dance.