Iliopsoas Injuries

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Introduction
Acute, stretching-induced muscle injuries are estimated to account for over 30% of injuries seen in a typical human sports medicine practice and have been reported to be the most common injury seen in human general practices. Acute muscle injuries have rarely been reported in small animal veterinary literature, and discussion of chronic muscle disorders in dogs is limited to a handful of classical syndromes or inflammatory conditions. However, in recent years, awareness of musculotendinous injuries in our small animal patients has been on the rise. As a result, veterinarians are beginning to identify specific muscular and tendinous injuries in canine companions and athletes alike. New diagnostic and therapeutic options are becoming available and allowing us to achieve successful outcomes for these patients.

Iliopsoas Injuries
Once the veterinarian is aware of how to diagnose this issue, iliopsoas injuries are seen with some regularity in canine athletes and companions. The iliopsoas is a muscle formed by the psoas major and iliacus muscles. The psoas originates from the transverse processes and bodies of the lumbar vertebrae. The iliacus arises from the ventral aspect of the ilium and joins with the psoas major to insert on the lesser trochanter of the femur. This muscle is an important stabilizer of the hind limb and lumbar spine. It functions to adduct and externally rotate the femur. Important neurovascular structures, such as the femoral artery and nerve, lie adjacent to the iliopsoas muscle and can become affected as well.

Traumatic incidents that result in active, eccentric muscle contraction, such as slipping into a splay-legged position, jumping out of a vehicle, aggressive agility training, or roughhousing with other dogs are often behind an acute lameness. Working dogs or agility dogs are especially prone to acute traumatic muscle injuries. This may be due to an imbalance between muscle groups or due to weak core muscles that would help stabilize the body during athletic activity. Dog with iliopsoas strains may also have other concurrent orthopedic problems, or may have recently undergone surgical treatment for another orthopedic condition, such as cranial cruciate ligament rupture. Altered kinematics and kinetics, or the way a dog moves, results from concurrent injuries and may alter the strains placed on the iliopsoas muscle group, increasing the risk of injury here. If iliopsoas injuries go undiagnosed, they can lead to chronic, recurrent hind limb issues.

Clinical Signs
There is a continuum of iliopsoas injuries, with the mildest form being delayed onset muscle soreness (DOMS), which is typically a self-limiting process and resolves after a few days of rest. Strains most commonly occur at musculotendinous junctions and are graded from grade I to grade III, with grade III being the most severe. The most severe injury is a complete tear with loss of function of that muscle. Myofascial pain and muscle contracture are other forms of muscle injury that do not fit well into the above classification scheme.

Dogs with other orthopedic injuries may also have concurrent iliopsoas pathology. In an attempt to limit discomfort in a painful joint, such as the knee, hip or lower spine, dogs will limit the range of motion of that joint. As a result, the iliopsoas muscle is constantly contracting, which fatigues the muscle and increases the potential for injury.

Changes in gait can be subtle in these patients or they can present as a severe, toe-touching lameness. Patients can be affected on one or both sides and lamenesses can be acute, chronic or recurrent. Dogs with chronic injury are typically seen for a low-grade, recurrent lameness that is non-responsive or partially responsive to non-steroidal anti-inflammatory drugs (NSAIDs). A shortened stride in the affected hind limb is often noted due to decreased hip extension. Agility dogs may have a tucked appearance and may knock bars, take wide turns or exhibit a lack of drive from the rear when weaving.

Diagnosis
Patients may be acutely uncomfortable with hip extension and internal rotation, as this places the iliopsoas muscle under tension. Direct palpation of the origin at the cranioventral aspect of the ilial wing or insertion at the lesser trochanter may elicit a pain response. Palpation of the muscle body may also cause discomfort, especially if the femoral nerve is compressed as a result of the injury. If fibrosis has occurred, a tight band will be palpable ventral to the ilium.

Radiographs
Pelvic radiographs are typically unremarkable, but occasionally changes can be seen. Iliopsoas tendon avulsions can be noted at the insertion on the lesser trochanter and chronic injuries may have mineralization at
Iliopsoas Injuries

Ultrasound
Ultrasound is extremely useful in diagnosing iliopsoas injuries and can be used to follow healing and response to therapy. Typically, dogs at VOSM undergo ultrasound if a severe injury is suspected, a chronic injury is present, or they do not respond adequately to appropriate rehabilitation therapy. Ultrasound offers several advantages over other diagnostic techniques, including the non-invasive nature and ability to image the area without the need for general anesthesia. The cost-effective nature of ultrasound also allows for repeated monitoring of the area to follow healing. It can also be used to guide delivery of therapeutic agents (see below for details). During the ultrasound, dogs are placed onto their back and the muscle body, origin and insertion are visualized in the groin area. Acute injuries are seen as swollen areas with a potential combination of edema, hemorrhage, or inflammation that are hypoechoic, or darker than expected. More chronic injuries typically have areas of fibrosis or mineralization, which show up on ultrasound as brighter, or hyperechoic, areas. Large focal areas of damage within the center of the tendon, also known as core lesions, can be identified on ultrasound as well. These lesions can be measured and followed over time to assess response to therapy.

MRI/CT
Other advanced imaging, such as CT or MRI, are not used as frequently due to the high cost of these modalities and the need for general anesthesia. In our experience at VOSM, iliopsoas muscle injuries are poorly identified on these modalities. Anecdotally, the potential for inconsistent results and false negative results are higher with these modalities versus ultrasound examination. However, these have been reported as potential diagnostic tools and may be beneficial for diagnosis of concurrent neurologic conditions.

Conservative Treatment
An overwhelming majority of iliopsoas injuries are treated conservatively, that is, without the need for surgery. Rest and rehabilitation therapy are critical for successful management of an iliopsoas injury. Iliopsoas strains resulting from other conditions may persist even after resolution of the inciting cause, highlighting the importance of targeted rehabilitation and muscle strengthening after an injury.

A typical course of conservative management consists of 8-12 weeks of physical therapy and can include several modalities, such as laser therapy, manual therapy, therapeutic ultrasound with or without phonophoresis and underwater treadmill therapy or swimming. Medications include muscle relaxants, pain medications, and anti-inflammatories (NSAIDs) for acute injuries. Chronic injuries do not have a large inflammatory component, and NSAIDs are contraindicated in these patients.

Regenerative Therapy
Patients that have severe injuries (grade II or III strains) seen on ultrasound or patients who fail conservative management may benefit from regenerative medicine therapies. Regenerative therapies include ultrasound-guided injections of platelet-rich plasma (PRP), stem cells, or a combination of both. These regenerative therapies help to re-initiate the inflammatory response which is lacking in these chronic patients. By stimulating blood flow to this area and providing precursors for healing, we are able to promote remodeling and regeneration.

Muscle healing can progress along two paths: fibrosis or regeneration. Which path is followed typically depends on
Iliopsoas Injuries

With minor strains, muscle has the ability to remodel and regenerate to reform functional muscle fibers. Fibrosis occurs when the injury heals by forming scar tissue, which is weaker than normal muscle or tendon tissue and prone to re-injury. Fibrosis can also impede muscle regeneration and interfere with muscle contraction and relaxation, leading to lameness and loss of function. Physical therapy and controlled rehabilitation can promote appropriate muscle and tendon healing. Additional modalities, such as laser therapy, increase circulation to the area and promote healing. Regenerative medicine therapy provides precursors and factors that tip the balance of healing towards regeneration, and creates better functional outcomes in these severely affected patients.

**Regenerative Treatments at VOSM**

A standard course of treatment using regenerative medicine includes a diagnostic ultrasound of both iliopsoas muscle/tendon units. Patients require light sedation for ultrasound as the limb needs to be fully extended to view the entire muscle, which can be an uncomfortable position for the painful patient. If PRP is used, blood is collected from the patient and processed here at the VOSM Regenerative Medicine Lab. Sample processing takes approximately 15 minutes, and then the PRP is injected into the affected areas using ultrasound guidance. This is generally performed using a “twilight” sedation.

If stem cells are required, there are two options for sample processing. The first option is in-house processing of bone-marrow derived stem cells in the VOSM Regenerative Medicine lab. For in house-processing, your pet would be placed under general anesthesia. A sample of the bone marrow is obtained, usually from the femur (thigh bone), processed in house, and re-injected during the same anesthesia. The second option for stem cell processing is through Virginia Tech University. VOSM has established a partnership with the Marion duPont Scott Medical Center at Virginia Tech to culture stem cells derived from bone marrow or adipose tissue (fat). Samples for bone marrow are collected as previously described and sent to Virginia to be cultured. For adipose-derived stem cells, a sample of fat is obtained from your dog’s abdomen through a small incision, done under general anesthesia. This sample is then cultured and expanded to increase the number of stem cells. Samples from either source take approximately 2-3 weeks to process. Once the cells are ready, your pet is brought back to VOSM for injection of the cells, again under a “twilight” sedation. Patients are typically discharged the same day.

At VOSM, we have seen tremendous response to regenerative medicine therapies. Serial evaluation of tendon lesions have shown complete healing of core lesions and reestablishment of a normal fiber pattern in patients treated with stem cells and PRP. Many patients are able to return not only to normal activity, but can get back to high-level agility and performance. Appropriate physical therapy and muscle building activities are critical to successful healing and prevention of re-injury.

**Surgical management**

Rarely, patients that fail conservative and regenerative therapies may require surgical management. Surgical options include transection of the tendon or reattachment of the iliopsoas. This results in rapid improvement of clinical signs and discomfort, but does cause some degree of decreased performance. Our goal is to return patients to full function without the need for surgical intervention whenever possible.

**Conclusion**

Iliopsoas injuries are common in both pet and performance dogs and awareness of this soft tissue injury is increasing. Through appropriate diagnostics as well as conservative and regenerative treatment plans, VOSM is able to successfully return patients to full function.

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