Contracture of the Infraspinatus Muscle in the Dog

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Summary

A tentative diagnosis of contracture of the infraspinatus muscle was made in a dog with a foreleg shoulder lameness causing a positional deformity and characteristic abnormal gait in the affected limb. Contracture of the infraspinatus muscle most commonly involves hunting breeds, particularly actively working dogs.[6] A definitive diagnosis required an exploratory arthrotomy of the affected shoulder. Surgical correction with tenotomy of the infraspinatus muscle was necessary to regain normal conformation and motion in the affected limb.

In recent years contracture of the infraspinatus muscle has been reported as a clinical syndrome causing shoulder lameness in hunting dogs.

Frequently it is reported that the dog develops pain in one shoulder, often without the owner's knowledge of any previous trauma. For a short time, one to two weeks, the dog is reluctant to bear weight on the affected foreleg. Local pain is evident at this time but will subside along with the acute lameness. In the following two weeks a persistant deformity of the limb develops as the dog begins bearing full weight on the affected foreleg. The foreleg is abducted with the elbow held against the thoracic wall and the paw rotated outward. In the standing position the affected foreleg is hyperextended. As the foreleg is drawn forward there is a marked lateral circumduction of the distal limb with a carpal flip occuring just before the paw touches ground. There is no evidence of pain as is seen earlier in the first two weeks of lameness. Upon manipulation, even under anesthesia, there is marked restriction of shoulder motion, especially when attempting to adduct the limb. Radiographs of the shoulder and elbow joints often reveal no abnormalities. Moderate atrophy of the supraspinatus, infraspinatus and spinous part of the deltoideus muscles may be palpable.

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Case Report

A seven year-old Golden Retriever was referred to the Small Animal Teaching Hospital, Iowa State University, with the primary complaint of a left shoulder lameness of one year duration. The dog became acutely lame in the left front leg while hunting with the owner about one year ago, although the owner did not see any injury occur. The dog was seen by a veterinarian at that time. Clinical signs and radiographs revealed slight soft tissue swelling of the left shoulder region. Ten months later the dog was re-examined by the referring veterinarian due to persistent lameness and abnormal gait of the left foreleg. After physical examination and radiographs, a tentative diagnosis of contracture of the deltoid muscle was made and the dog was referred to the Small Animal Teaching Hospital for evaluation.

The dog was presented to the teaching hospital October 30, 1978. Upon physical examination, marked reduction in movement of the left shoulder joint was noted. Weight was borne on the leg with no evidence of pain. In the standing position the left foreleg was hyperextended. The elbow was adducted against the thoracic wall and the paw was rotated in an outward direction. Adduction of the affected limb was very restricted upon manipulation. Slight atrophy of the

supraspinatus, infraspinatus and spinous part of the deltoideus muscles was present. The forward stride was characterized by a swinging of the left foreleg in an outward arc rather than directly forward, with a carpal flip occuring just prior to weight bearing. Temperature, pulse, and respiration were within normal ranges. Hematology revealed a physiological leukocyte response. Serum glutamic-pyruvic transaminase levels were 27.8 IU/L. Urinalysis was normal. Anesthesia was used to facilitate positioning of the affected limb during radiographic examination. Radiographs of the left shoulder revealed exostosis and new bone production in areas of attachment of the infraspinatus and deltoideus muscle. The articular surface of both the shoulder and elbow joints appeared radiographically normal. On the lateral projection of the elbow joint, a small bony projection was evident on the distal aspect of the medial epicondyloid crest of the humerus with no evidence of soft tissue swelling. A tentative diagnosis of contracture of the deltoideus and/or infraspinatus muscle was made.

A definitive diagnosis of contracture of the infraspinatus muscle was made during an exploratory arthrotomy of the left shoulder joint. A curved incision beginning at the middle of the scapula and following the scapular spine distally was extended, crossing the scapulo-humeral joint, and continuing over the lateral surface of the humerus on the affected forelimb. Incision of the deep fascia at the cranial edge of the scapular spine allowed the omotransversarius and trapezius muscles to be reflected cranially.

An acromion osteotomy was performed to aid in visualization of the shoulder joint. Fibrous adhesions were noted over the lateral aspect of the shoulder joint, adhering to the joint capsule and appeared to blend in with the distal aspect and insertion of the infraspinatus muscle. The medial aspect of the acromial part of the deltoideus muscle was involved to a lesser extent. The joint capsule appeared slightly thickened due to these fibrous adhesions. No abnormalities of the joint surfaces were found. Immediately following transection of the tendon of insertion of the infraspinatus muscle and surrounding connective tissue, functional movement of the shoulder was greatly improved. The distal aspect of the infraspinatus muscle was dissected loose from its insertion on the scapula to allow for adequate retraction of that muscle.

Tissue from the tendonous insertion of the infraspinatus muscle was taken for histopathology. The acromion process was reattached to the scapular spine with an intramedullary pin and figure eight tension band. The remaining muscles and deep fascia were closed with chromic gut in a simple interrupted pattern. The skin was closed with stainless steel in a simple interrupted pattern.

Histopathology revealed variable degrees of degenerative changes throughout the tissue. A few areas of necrosis were evident and a slight infiltrate of fibroblasts and mononuclear cells was noted. The tissue submitted was primarily composed of dense fibrous connective tissue and no evidence of skeletal muscle tissue was found.

The following day postoperatively, the dog began to bear weight on her leg. Other than lameness procured through surgically induced pain, the dog walked with a normal gait. When standing, the limb was held in a normal position.

The dog was walked one-fourth mile, three times daily, for the next two days. Physical therapy, consisting of extending and flexing the shoulder four to six times daily, was given. At the end of two days, the dog was trotting without much evidence of pain. The dog was released from the teaching hospital on the third postoperative day with instructions to continue the physical therapy and walking. Thirty thousand units of penicillin V potassium[a] was given three times daily for seven days postoperatively. At the end of two weeks the owners reported no signs of lameness. Two and one half months later the dog was still clinically normal.

Discussion

The lateral shoulder muscles in the dog consist of the deltoideus and teres minor muscles superficially with the supraspinatus and infraspinatus muscles occupying the scapular fossa. The shoulder joint is capable of movement in any direction, but its primary motion is that of extension and flexion in the dog. The tendons of insertion of the supraspinatus, infraspinatus, teres minor, and subscapularis muscles all cross the joint

[a]Penicillin VK, Bristol-Myers Co., Syracuse, N.Y.

surface and are actually considered active ligaments of the shoulder joint. For this reason dislocation of the shoulder is rarely seen in domestic animals.[5] The tendon of the infraspinatus muscle passes over the joint capsule and inserts ventral to the cranial portion of the major tubercle of the humerus, functioning as a lateral collateral ligament.[1] Medial to the tendon and lateral to the joint capsule lies the infraspinatus bursa. Occasionally in larger dogs a second smaller bursa may be present as well, just proximal to the larger infraspinatus bursa.[3] The supraspinatus muscle extends the shoulder joint and foreleg, with the teres minor and deltoideus muscles acting as flexors of the foreleg. The infraspinatus muscle can rotate the foreleg externally, as well as extend or flex the shoulder, depending on the position of the shoulder joint at the time of muscle contraction.[5] With the use of a cadaver, it has been shown that traction on the supraspinatus tendon only causes extension of the shoulder joint whereas traction on the infraspinatus muscle abducted the foreleg, rotated the proximal humerus in an outward direction, and resulted in a standing hyperextension of the affected forelimb, thus mimicking the condition seen with contracture of the infraspinatus muscle.[7] The outward rotation of the proximal humerus resulted in an inward rotation of the distal humerus and thus adduction of the elbow.[3]

The exact cause of contracture has not been established at this time. In 1972, a report of contracture of the infraspinatus muscle associated with suprascapular nerve paralysis in the dog led to the hypothesis that nerve paralysis may play a role in contracture development.[7] However, later reports of infraspinatus contracture did not seem to be associated with any nerve paralysis.[3,4]

In 1978 pathophysiologic studies indicated that nerve paralysis was not the initiating factor in infraspinatus contracture. Electromyograms and compound action potential recordings performed on four affected dogs were more compatible with a primary muscle disorder than a neuropathy. Direct nerve stimulation indicated that the suprascapular nerve and its nerve roots, primarily C_6, were functionally normal. Histological studies showed no significant changes in peripheral nerves innervating the affected muscles.[6]

The tendon of insertion of the infraspinatus muscle originates from the central axis of the muscle belly as it crosses over the joint capsule.[5] No evidence of skeletal muscle tissue was found in histological sections taken from this region of the muscle belly in the clinical case recently seen at ISU. Local foci of necrosis was evident with dense fibrous connective tissue replacing skeletal muscle tissue. A recent study similarly described degeneration of skeletal muscle fibers with connective tissue replacement.[6] The inflammatory response was minimal in six reported cases, as well as the clinical case described in this report.[6] Severe muscle fibrosis and atrophy of the infraspinatus muscle has been a common histological change observed.[6]

Recent reports and the clinical case described suggest that contracture was secondary to muscle damage and not neruogenic in origin.[6] Trauma, causing incomplete rupture of the infraspinatus muscle, leading to fibrosis and contracture appears to be the most plausible hypothesis at this time.

There are few clinical syndromes in the dog that mimic contracture of the infraspinatus muscle. In the dog, osteochondritis dissecans is a shoulder lameness commonly seen in larger breeds, similar to infraspinatus contracture. Often a history of trauma is reported previous to the onset of lameness.[2] Disuse atrophy of the shoulder muscles may occur in osteochondritis or infraspinatus contracture. Even with these similarities there are several clinical signs that allow one to easily differentiate the two syndromes. With infraspinatus contracture the dog shows no signs of pain, even upon manipulation of the shoulder. With osteochondritis, pain is frequently elicited when the shoulder is fully extended or flexed.[2] Osteochondritis is usually first seen at four to eight months of age.[2] Infraspinatus contracture does not appear to have any age predilection. Osteochondritis is often bilateral, where as bilateral infraspinatus contracture would be rare. In osteochondritis dissecans, radiography will show irregular rarefaction or detached pieces of cartilage from the caudal aspect of the joint surface of the humeral head.[2] With infraspinatus contracture, the articular surface of both the shoulder and elbow joints is within normal radiographic

limits, although one must use caution, as infraspinatus contracture can occur concurrently with osteochondritis dissecans.[7]

Fractures of the scapula and proximal humerus, or shoulder dislocation may also cause shoulder lameness in the dog. However, signs of pain upon manipulation of the shoulder, radiographic findings, and the absence of weight bearing on the affected limb should help in rendering a clinical diagnosis.

Atrophy of the supraspinatus and infraspinatus muscles can result from trauma to the suprascapular nerve as it passes around the cranial edge of the scapula. However, suprascapular nerve paralysis alone cannot account for the restricted shoulder motion and histological changes seen in infraspinatus contracture.

In the majority of clinical cases, the characteristic gait with weight bearing on the affected limb and restriction of shoulder motion, even under anesthesia, should help rule out most clinical syndromes that could be confused with infraspinatus contracture. The production of excess connective tissue and fibrous adhesions between the infraspinatus muscle and joint capsule, visualized on exploratory myotomy, will confirm a diagnosis of infraspinatus contracture.

Surgical correction, with tenotomy of the infraspinatus tendon, is the preferred treatment for infraspinatus contracture.[4] The surgical approach used to isolate the infraspinatus tendon may differ slightly, depending on the degree of exposure desired by the surgeon.

In the case described in this report, an acromion osteotomy was performed, reflecting the acromial part of the deltoideus muscle distally. The spinous part of the deltoideus muscle was dissected free of the scapular spine and retracted caudally. This approach gave excellent exposure to the insertion of the infraspinatus and teres minor muscles. The lateral aspect of the joint capsule may be examined as well. The major disadvantages of this approach was the prolonged recovery time required due to increased surgically induced pain associated with the acromion osteotomy and the extra time required to reattach the acromion process with a small intramedullary pin and figure eight tension band.

In another approach, adequate exposure was obtained by simply dissecting the fascial plane dividing the acromial and spinous part of the deltoideus muscle, caudal to the acromion process, separating these muscles distally.[4] An incision through the fascia along the caudal aspect of the scapular spine allowed caudal retraction of the spinous part of the deltoideus muscle. The acromial part of the deltoideus muscle was dissected free from the greater tubercle allowing for cranial or caudal retraction to visualize the entire tendon of insertion of the infraspinatus muscle.[3,4] With this approach, surgically induced trauma was kept at a minimum while sacrificing the degree of exposure obtained.

Regardless of the approach used, once the infraspinatus muscle is identified, tenotomy near the point of insertion and the removal of any adhesions to the joint capsule is required. Normal joint motion should now be evident.

For the first few days postoperatively, the dog may not bear weight on the leg, depending on the amount of surgically induced pain present. However, lateral deviation of the foreleg and adduction of the elbow should be absent immediately post-surgery.[3]

In one reported case, only 7/8 of the infraspinatus tendon was severed due to the importance of the infraspinatus muscle in functioning as a lateral collateral ligament of the shoulder.[7] The dog walked normally but still showed slight circumduction when running, therefore complete tenotomy is probably required to correct the abnormal gait.

Physical therapy is important for the next three to four weeks postoperatively to prevent reformation of fibrous adhesions between the infraspinatus tendon and joint capsule, causing reoccurence of the abnormal gait. Physically flexing and extending the shoulder four to six times daily and walking the dog one-fourth mile three to four times daily, should continue to break down any adhesions that may form. It is also important to inform the owners to restrict the dog's exercise as little as possible for the next four weeks.

Full use of the leg should return in four to ten days. The infraspinatus muscle may remain atrophied, but other shoulder muscles should regain normal size if their atrophy is due to disuse.

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