Dislocation of the Shoulder

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**HISTORICAL CONSIDERATIONS**
Shoulder luxation first appeared in the small animal veterinary literature in 1934. At that time, Schroeder, the preeminent orthopaedist, presented a paper describing cases of shoulder luxation and their treatment using his namesake, the Schroeder-Thomas splint. Since that time numerous articles and texts have dealt with treatment of shoulder luxation in small animals.

**SURGICAL ANATOMY**
The canine and feline shoulder, unlike other major appendicular joints, does not possess collateral ligaments. The anatomical structures that support such a function are the medial and lateral glenohumeral ligaments (Figs. 21-1 and 21-2). In point of fact, they are merely capsular thickenings and do not add collateral support to the joint.

In small animals, as in humans and other primates, joint stability is maintained by the "rotator cuff" muscles. These are four muscles that originate on the scapula and insert on the proximal humerus. By their short tendons of attachment spanning the shoulder, they afford collateral support. The cuff muscles are the supraspinatus muscle, the infraspinatus muscle, the teres minor muscle, and the subscapularis muscle. The biceps brachii muscle certainly originates in an excellent location to assume such a role also; however, since it does not insert on the proximal humerus but goes through a tendon sheath, it cannot be considered adequate collateral support.

When approaching the shoulder surgically, the muscle of major importance is the acromial head of the deltoideus muscle. It must always be retracted or dealt with surgically to visualize the shoulder. To avoid major nerves, the surgeon should also be aware of the location of all peripheral nerves emanating from the brachial plexus.

**SURGICAL APPROACHES**

The shoulder can be approached by acromial osteotomy(18,25) and deltoid reflection, by deltoid retraction craniolaterally, by deltoid splitting laterally, or by deltoid head separation caudolaterally. The medial approach necessitates severance of the insertion of both heads of the pectoral muscle. All these techniques have been discussed more completely in Chapter 20.

**CLASSIFICATION OF SHOULDER LUXATION**

**CONGENITAL LUXATION**

Congenital dislocation has been recognized in the dog since it was first reported by Hickman in 1964.(11) Since then, two other authors have reported 15 additional cases.(4,7) Congenital shoulder luxation occurs predominantly in miniature breed dogs and has been reported in nine miniature poodles, two Chihuahuas, one Pomeranian, one griffon, one miniature pinscher, one wire-haired fox terrier, and one King Charles spaniel. The predominance in miniature poodles, several from similar breeding, has been interpreted by one author to suggest a hereditary predisposition. There seems to be an equal sex distribution. The luxation may be right or left sided, or bilateral; in all reported cases luxation has been medial.

Congenital shoulder luxation usually manifests itself as a shoulder lameness and is first apparent to owners when the dog is 4 months of age. Although some animals are older when they first present with this problem, the majority reported were between 3 and 8 months old.

Clinically, dogs present with shoulder lameness. Palpation will demonstrate the medial position of the humeral head in relation to the glenoid. Further palpation will demonstrate a limited range of motion, primarily a loss of extension, pain or discomfort, and the inability to be manually reduced to a normal anatomical position. With chronic luxation, the supraspinatus muscle, infraspinatus muscle, and pectoral muscles atrophy.

Radiography will prove the position of the luxation and may demonstrate a flattened or convex glenoid cavity. No reference is made in the literature to the abnormal shape of the humeral head.

Clinical management of congenital shoulder luxation usually involves restriction of activity or use of analgesics. No cases of surgical correction have been reported. The surgical correction, as performed in acquired luxation assumes that the bony components of the shoulder are anatomically normal. Since this is not the case in congenital shoulder luxation, surgery would necessitate reshaping the glenoid prior to reduction and stabilization. Using presently available surgical methods, this technique would invariably lead to ankylosis or painful arthritis. Arthrodesis could be used to correct congenital luxation if pain were a major complaint. Glenoid excision may also be considered.

Congenital subluxation, characterized by joint laxity, flattened humeral head, and shallow glenoid has also been described. In this case, the components continue to articulate and surgery is not beneficial.
Acquired dislocation is the result of direct trauma to the shoulder region. While automobile trauma is the usual cause, animals also have been traumatized in falls from heights or by twisting injuries to the shoulder. Since trauma is the basic injury, no breed, age, or sex differences are pertinent; any dog or cat is at risk. In current literature there are 46 cases of acquired shoulder luxation; 5 were cranial, 15 lateral, and 26 medial. Included in the 15 lateral luxations were the only 2 luxations reported in cats. While unilateral luxation is far more common, bilateral luxation can occur (Table 21-1).

### Table 21-1 Reported Shoulder Luxations in 62 Dogs and 2 Cats

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year</th>
<th>Species</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schambeke</td>
<td>1932</td>
<td>Dog</td>
<td>1</td>
</tr>
<tr>
<td>Millman</td>
<td>1934</td>
<td>Dog</td>
<td>1</td>
</tr>
<tr>
<td>Hoffmann</td>
<td>1945</td>
<td>Dog</td>
<td>1</td>
</tr>
<tr>
<td>Vanlau</td>
<td>1956</td>
<td>Dog</td>
<td>6</td>
</tr>
<tr>
<td>Carpenter</td>
<td>1966</td>
<td>Dog</td>
<td>5</td>
</tr>
<tr>
<td>Safford</td>
<td>1967</td>
<td>Dog</td>
<td>2</td>
</tr>
<tr>
<td>Schambeke</td>
<td>1968</td>
<td>Dog</td>
<td>2</td>
</tr>
<tr>
<td>Hohn</td>
<td>1973</td>
<td>Dog</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cat</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>58</td>
</tr>
</tbody>
</table>

In addition to complete luxation, animals may have acquired subluxation. This results from trauma that is sufficient to create joint instability but not enough to result in total luxation. Subluxation often leads to chronic instability, degenerative arthritis, and progressive disuse.

### MEDIAL SHOULDER LUXATIONS

#### PRESENTING SIGNS

Animals present with obvious shoulder lameness, usually carrying the affected limb in flexion, abduction, and external rotation. Palpation demonstrates the prominence of the scapular acromion. It is usually impossible to fully extend the shoulder, and while attempting the extension, crepitus is palpable. With chronicity, there may be varying degrees of supraspinatus and infraspinatus atrophy and progressively more bony crepitus as the medial glenoid rim becomes worn.

### RADIOGRAPHY

Standard mediolateral and cranial-caudal radiography will demonstrate the medial position of the humeral head relative to the glenoid cavity (Fig. 21-3). Two views are necessary, since a lateral view with complete shoulder extension may reduce the shoulder or allow for positioning that appears to be reduced. Typically on a lateral view, the glenoid should overlap the humeral head. Care should be taken to observe the fractures of the medial glenoid rim. Such fracture probably will preclude closed reduction. Arthrography can be used to document a torn joint capsule.

![FIG. 21-3 Cranial-caudal (A) and mediolateral (B) radiographs of a medial luxation of the canine shoulder. (Courtesy of R.B. Hohn, DVM)](https://example.com/figure213.png)

### COMMONLY ASSOCIATED SOFT TISSUE INJURIES

Usually medial shoulder luxation occurs without other associated soft tissue trauma. However, it is possible to find brachial plexus injury or intrathoracic trauma if the injury resulted from an automobile accident.

### CLOSED REDUCTION AND FIXATION

Under general anesthesia, reduction of the acute luxation can usually be accomplished with ease. The surgeon extends the shoulder manually while lifting the humeral head into position with his free hand. If this is not accomplished easily, it may reflect a capsular flap that has fallen between the humeral head and glenoid, thus preventing reduction of an older luxation that has an organized hematoma or fibrous mass occupying the glenoid cavity. In either of the latter instances, open reduction will be necessary.

In some animals recurrent medial shoulder luxations can be easily reduced with or without general anesthesia. In these
animals fixation by closed methods proves futile. In another group of animals chronic medial luxation will have progressed to muscle contracture, fibrosis, and severe lack of motion. In these dogs closed reduction is impossible.

Closed fixation of medial shoulder luxation is accomplished using a Velpeau sling(24) Care must be taken that the sling holds the shoulder in a stable position. Too much internal rotation of the humeral head will cause redislocation. The most stable position is that of the forepaw rotated sufficiently to be near the opposite shoulder, thus promoting lateral positioning of the humeral head. Animals should remain immobilized in this fashion for 2 to 3 weeks. Long-leg coaptation splints or Schroeder-Thomas splints, which maintain the limb and shoulder in a normal weight-bearing position, may also work well if converted to a spica to totally immobilize the shoulder.(8,9,16)

OPEN REDUCTION AND FIXATION
Open reduction and surgical fixation has been used extensively. Many techniques have been proposed as suitable to restabilize the dislocated joint.

SHOULDER TRANSFIXATION
In cases of extreme instability, the shoulder can be reduced to a normal anatomical position and held in reduction with a Steinmann pin driven from cranially below the greater tubercle, through the humeral head, across the joint space, and anchored firmly in the glenoid. Such a technique will hopefully hold reduction while joint capsule and regional muscles scar sufficiently to support the joint. This technique is the least desirable, since even when the pin is removed in 3 to 4 weeks, assuming the joint remains reduced, severe damage has been inflicted in the joint components. Decreased range of motion, arthritis, and subsequent pain or disuse may be expected. This technique should be reserved for salvage or as a last resort.(17)

METHOD OF ALEXANDER
The technique of Alexander was the first attempt to anatomically reconstruct "collateral ligament"-like structures that would give support to the shoulder. While the method seems better suited to give support for a lateral luxation, it was intended to be used for either problem. The following description is taken, with minor modifications from Alexander(1)

The skin is incised over the spine of the scapula around the point of the shoulder and down the cranialateral aspect of the humerus. The proximal end of the humerus is exposed by blunt dissection between the deltoideus muscle and lateral head of the triceps muscle. A hole is drilled through the shaft of the humerus from a point beneath the origin of the brachialis muscle to a point below the medial tuberosity. A band of Teflon (3/8 in wide) is threaded through the hole and is anchored on the lateral side of the humerus with a screw and interrupted sutures. The supraspinatus muscle is identified and elevated close to its insertion on the humerus to permit passage of the band beneath this muscle. The spine of the scapula is exposed for a distance of one inch from the acromion and the supraspinatus muscle is elevated to form a channel to the scapular notch. The ligature is threaded through the scapular notch, beneath the muscle, and through a hole drilled through the spine of the scapula. A loop is passed beneath the acromion and the Teflon is anchored upon itself with a knot and interrupted sutures. The long end of the implant is brought down over the lateral aspect of the joint and is fixed by means of the screw previously inserted in the humerus, thus forming a lateral ligament (Fig. 21-4). Teflon is sutured with as many interrupted sutures of 3-0 silk as possible to prevent loosening of the ligature. Closure is routine. Exercise should be limited but use of the limb is not discouraged.


METHOD OF VAUGHAN
A method of internal fixation of lateral shoulder luxations was proposed by Vaughan in 1967; however, it was soon used also for medial shoulder luxation. Essentially it is similar to Alexander's technique but uses skin rather than Teflon. The following description is taken, with minor modifications, from Vaughan.(28) Once the shoulder exposure has been completed the
dislocation is reduced. An opening is drilled in the spine of the scapula near its junction with the blade, 1/2 inch from its distal extremity using a 9/64 inch drill bit. A tunnel of the same diameter is drilled obliquely downward and forward in the lateral ridge of the humerus approximately 1/2 inch below the summit of the tuberosity. A strip of whole thickness skin 1/8 inch wide and 3 1/2 to 4 inches long is cut from one edge of the skin wound. The skin is threaded in such a way that one end passes through the tunnel in the humerus ascending beneath the acromial part of the deltoid and behind the shoulder joint, passing through the opening in the scapula and descending in front of the shoulder to meet the other end at the lateral tuberosity (Fig. 21-5). Skin is drawn taut and the two ends are anchored together and secured to the local fascia with fine stainless steel wire sutures. The joint capsule is repaired with fine catgut and this material is also used to reappose the displaced muscles and the subcutaneous fascia. The skin is sutured routinely.

External support is not provided by Vaughan, but the owner is advised to confine the animal for the first week and, in the case of dogs, to restrict exercise to walking on a leash for two additional weeks.

METHOD OF BALL
Ball found that the method of Vaughan failed to prevent medial luxation when the shoulder was flexed and proposed another modification. It should be remembered that while many clinicians were using Vaughan's technique to repair medial shoulder luxations, it had, in fact, been proposed for lateral luxations. The following description is taken, with minor modifications, from Ball.(2)

Surgically, the joint is approached laterally and canals are drilled in the base of the scapular spine and in the proximal extremity of the humerus exactly as described by Vaughan. Quarter-inch nylon tape is chosen as the supportive material because it can be easily passed through the drilled canals and yet be spread out to form a band as it crosses over the joint. Prior to its insertion, the tape is heavily impregnated with procaine penicillin. When threaded by Vaughan for lateral dislocation, it failed to prevent medial dislocation when the limb was flexed. The tape was therefore rethreaded in the manner shown in Figure 21-6. It was passed craniocaudally through the base of the scapular spine, around the caudal border of the scapular spine, around the caudal border of the scapula, forward over the medial aspect of the joint to pass mediolaterally through the humeral canal to be tied just cranial to the acromion process and the origin of the deltoid muscle. This modification more effectively braced the medial joint capsule and rendered dislocation impossible within normal functional limits. Muscle and skin repair were effected with monofilament nylon.

METHOD OF CAMPBELL
The final modifications of the above techniques were proposed by Campbell in 1968.(2) He employed Vaughan's technique but used both skin and nylon for the prosthesis and then described two other methods of prosthesis placement.

Campbell's most successful modification involved fixation by means of a skin and nylon prosthesis passed through a tunnel in the neck of the scapula just cranial to the acromion process and brought back laterally through a tunnel drilled straight across the humerus from lateral to medial surface just cranial to the deltoid crest (Fig. 21-7).
The prosthesis is secured by tying the nylon portions and suturing the skin together and to surrounding heavy fascia.

**BICIPETAL TENDON TECHNIQUE**

A modification of technique aimed at replacing collateral support is the technique of Hohn.(13-15,19) It uses, instead of synthetic or skin prosthesis, the tendon of origin of the triceps brachii muscle to support the medial side of the shoulder joint. This technique is highly successful. The following description is taken, with minor modifications, from Hohn. (13,14)

Surgically, a craniomedial parahumeral incision is made, beginning 4 cm dorsal to the shoulder joint and extending to a point midway down the humeral shaft [Fig. 21-8A]. The skin and subcutaneous tissues are then reflected, and the medial border of the brachiocephalicus muscle is separated from the superficial pectoral muscle for the length of the incision and is retracted laterally. This exposes the superficial and deep pectoral muscles, the supraspinatus muscle, and the distal communicating branch of the cephalic vein [Fig. 21-8B]. The insertion of the superficial pectoral muscle is transected down to the border of the distal communicating branch of the cephalic vein and is retracted medially to expose the deep pectoral muscle, which is incised in a similar manner along the length of its insertion on the humerus [Fig. 21-9]. This muscle is then retracted medially. The fascial attachment between the supraspinatus and deep pectoral muscles is also incised to allow full medial exposure of the shoulder joint [see Fig. 21-3].

At this point the tendinous insertion of the subscapularis muscle, crossed by the tendon of the coracobrachialis muscle, is visible, as is the medial aspect of the joint capsule [Fig. 21-10]. The insertion of the subscapularis is elevated and detached from the lesser tubercle and is reflected medially. The tendon of the coracobrachialis muscle lies craniomedially and is retracted with the subscapularis. The tissues over the bicipital groove and the intertubercular ligament are transected, and the dorsal aspect of the joint capsule surrounding the bicipital tendon is incised to allow mobilization of the bicipital tendon from the intertubercular groove [Fig. 21-10]. At this point the joint may be inspected.
A crescent-shaped osteotomy is made in the lesser tubercle, with the bottom of the crescent following the curve of the humeral head. The flap of bone is lifted, the hinged portion of the flap being at the anterodorsal aspect of the lesser tubercle. A small amount of cancellous bone is curetted beneath the bone flap, the luxation is reduced, and the bicipital tendon is lifted over and fitted into this groove beneath the bone flap on the lesser tubercle. The bone flap is replaced over the tendon and held with two 0.045 inch Kirschner wires [Fig. 21-11] which are drilled through the flap into the head of the humerus.

The medial aspect of the joint capsule is reefed and closed with size 00 gut sutures. The subscapularis muscle is tightened by advancing its free end anteriorly toward the crest of the greater tubercle of the humerus. It is sutured near the insertion of the deep pectoral muscle. The deep pectoral muscle is then closed over the greater tubercle to the fascia on the lateral surface of the crest and the deltoid insertion with interrupted gut sutures [Fig. 21-12]. The brachiocephalicus muscle is closed to the superficial pectoral muscle. The subcutaneous tissues and skin are closed routinely. The leg is placed in flexion in a modified Velpeau dressing for two weeks.

Recently a technique has been described that uses the existing anatomical structures, the supraspinatus tendon, and a reefing of the medial joint capsule.(5) Extensive reports of this technique have not yet been published, and it is wise to await further results before drawing any conclusion as to the usefulness of this technique.

POSTOPERATIVE CARE
Any open reduction of a medial shoulder luxation will do best if placed in external fixation for a period of 2 to 3 weeks. This will allow initial healing of the joint capsule and give some internal support to the prosthesis. Without external support the repair may tear out easily. Use of the Velpeau dressing is very successful following open reduction and fixation.

PROGNOSIS
If given proper postoperative support, open reduction and fixation of medial shoulder luxations has a good prognosis for success and return to normal function of the shoulder. Likewise successful closed reduction and fixation, when possible, has the same prognosis.

COMMON COMPLICATIONS
The most common complication is the formation of a seroma along the suture line. Usually the problem is untreated and the seroma resorbs within 10 to 14 days. A serious complication is redislocation, which may occur if animals are not externally immobilized properly or for long enough after either open or closed fixation.
LATERAL SHOULDER LUXATION

PRESENTING SIGNS
Dogs or cats with acute lateral shoulder luxation usually present with the affected limb flexed, adducted, and with internal rotation. Animals do not bear weight on the affected limb. Vaughan described an alternative method of presentation of lateral luxations in which animals hold shoulders in extension and flex the carpus while dragging the limb.

Palpation by the examiner will reveal crepitus on flexion or extension and the prominence of the greater tubercle. Most likely the acromion will not be palpable.

With chronicity, a lateral shoulder luxation will become progressively less mobile and may eventually become ankylosed in the semiflexed position. As fibrous ankylosis becomes more complete, stability is acquired and the animal may use the limb.

RADIOGRAPHY
Radiography in the lateral view will demonstrate superimposition of the humeral head over the glenoid. A craniocaudal view will confirm that the humeral head is, in fact, lateral to the glenoid (Fig. 21-13). The examiner should examine films carefully for evidence of glenoid rim fracture, which could greatly alter the method of treatment or the end result.

ASSOCIATED SOFT TISSUE INJURIES
Trauma causing lateral shoulder luxation usually rotates the limb and forces abduction at the shoulder. Extremes of the same abduction can easily stretch or avulse nerves of the brachial plexus. Neural competency should be assessed in any animal with lateral shoulder luxation.

CLOSED REDUCTION AND FIXATION UNDER GENERAL ANESTHESIA
The luxation can usually be reduced in a method similar to that for medial luxation. The shoulder is extended and the surgeon's free hand forces the humeral head back into a reduced position. Inability to reduce the humeral head indicates superimposition of soft tissues or hematoma or fibrous tissue in the glenoid. The best results in acute luxation will be achieved only within the first 3 to 4 days postluxation. Thereafter, muscle contracture and hematoma will prevent easy reduction.

Following reduction, closed fixation can be performed, although not as easily as for a medial luxation. Most Velpeau slings position the limb in internal rotation sufficient to relaxate the humeral head. If a Velpeau sling is used, it must flex the shoulder without rotating the shoulder, an action difficult to accomplish. Most clinicians find that long-leg coaptation with a spica is the best form of external fixation.

OPEN REDUCTION AND FIXATION
Open reduction is necessitated when joints have been chronically luxated or when closed reduction of the acute lateral luxation is unsuccessful. Following shoulder exposure and debridement of the hematoma or fibrous tissue from the glenoid, the joint is reduced manually. Internal fixation methods can then be employed to strengthen or create lateral support to prevent subsequent lateral redislocation.

METHOD OF ALEXANDER, VAUGHAN, OR CAMPBELL
The techniques of Alexander,(1) Vaughan,(28,29) and Campbell(4) have been employed with equal success for lateral
luxation as well as for medial luxation. All three techniques have been described above.

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**LATERAL IMBRICATION TECHNIQUE**

Following proper joint reduction, the lateral structures of the shoulder, which may have been stretched or torn, are tightened. Specifically the cranial and caudal lateral capsules are imbricated using stainless steel sutures in a Lembert pattern. Secondly, the tendon of insertion of the teres minor muscle is either shortened using suture material or it is transected and reattached more distally in an attempt to tighten the lateral side of the joint. Finally, Lembert sutures are placed ventrally in the acromial head of the deltoid muscle to further "reef" the joint. Routine fascia and skin closure follows. Since this technique relies solely on sutures for support, it is essential to use external immobilization for 2 to 3 weeks to prevent the sutures from cutting out of the tightened lateral tissue.

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**GREATER TUBERCLE OSTEOTOMY AND BICIPITAL TENDON TRANSPLANTATION**

The technique of greater tubercle osteotomy and bicipital tendon transplantation(13,14,20) mimics the method used for medial luxation; however, here the biceps tendon is repositioned on the lateral side of the shoulder joint to provide lateral "collateral" support. The following description is taken, with minor modifications, from Hohn(15)

The skin incision and retraction of the superficial tissues are the same as for medial luxation. The brachiocephalicus muscle is retracted medially, exposing the cranial aspect of the proximal humerus and the insertions of the supraspinatus, deltoideus and superficial and deep pectoral muscles [Fig. 21-14]. The insertion of the superficial pectoral muscle is transected down to the border of the distal communicating branch of the cephalic vein, and the muscle is retracted medially, exposing the insertion of the deep pectoral muscle. The deltoideus muscle is transected in a similar manner [Fig. 21-15]. The exposed insertion of the deep pectoral muscle is elevated from the humerus and retracted medially, exposing the biceps brachii muscle and tendon in the intertubercular groove [Fig. 21-16]. The intertubercular ligament is incised, and the biceps tendon is freed from the surrounding fascia and joint capsule. The greater tubercle is osteotomized so as to reflect dorsomedially the intact tendon of the supraspinatus muscle. The joint capsule is incised dorsally to free the full tendon of the biceps brachii to facilitate translocating it laterally on the opposite side of the osteotomized greater tubercle [Fig. 21-17]. The cut portion of the greater tubercle is replaced and fixed in position with two or three Palmer-Stille nails or 0.062 inch Kirschner wires [Fig. 21-18]. The dorsal joint capsule is closed and the capsular attachments near the intertubercular groove are sutured with 00 chronic gut. Several sutures are placed through the bicipital tendon and the tendinous insertions of the supraspinatus, infraspinatus and teres minor muscles to immobilize the tendon. The muscles are reattached routinely as in the medial luxation. The wound is bandaged, but external fixation is not usually applied to the limb as in medial luxation because a Velpeau sling tends to displace the humeral head laterally. Cage rest is recommended for eight to ten days. If external fixation is necessary, long-leg coaptation with a spica is useful.

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**FIG. 21-14 Cranial view of the shoulder joint and overlying musculature following the superficial incision and retraction of the brachiocephalic muscle medially.** (Hohn RB, Rosen, H, Bohning RH et al: Surgical stabilization of recurrent shoulder luxation. Vet Clin North Am 1, No. 3:537-548, 1971)

**FIG. 21-15 Cranial view of the shoulder shows the transection of the insertions of the superficial pectoral and the deltoid muscles.** (Hohn RB, Rosen H, Bohning RH et al: Surgical stabilization of recurrent shoulder luxation. Vet Clin North Am 1, No. 3:537-548, 1971)
CRANIAL SHOULDER LUXATION
Cranial shoulder luxation is rare, having been reported only five times in the veterinary literature.

PRESENTATION
Animals present with shoulders flexed and are unable to bear weight on the affected limb. Further palpation will demonstrate crepitus, decreased range of motion, and the malplacement of the humeral head. Radiographs confirm the cranial placement of the humeral head.

CLOSED REDUCTION AND FIXATION
Under general anesthesia the shoulder can be reduced by traction and manipulation of the joint. External fixation must be selected to prevent anterior movement of the humeral head, thus Velpeau slings are unsuccessful. Long-leg coaptation and spica combinations are the best methods.

OPEN REDUCTION AND FIXATION
Although very few animals have been operated on for cranial shoulder luxation, there appears to be one good method of fixation. Again, it relies on proper placement of the biceps tendon of origin. It probably represents a modification of the Nicola technique,(23) in which the biceps tendon is transected and passed through a tunnel in the greater tubercle and reattached to the scapular tuberosity. In the one instance in which the Nicola technique was tried in the canine, it failed.

Greater tubercle osteotomy and biceps tendon transposition(67) is another method of fixation. The following description is taken, with minor modifications, from DeAngelis.(7)

For open reduction of the scapulohumeral joint, a craniomedial incision is made from a point approximately level with the acromion distal to the mid-humeral area. The subcutaneous tissue and superficial fascia overlying the cranial aspect of the greater tubercle and proximal end of the humerus are incised and the cranial portion of the deltoideus muscle is reflected laterally. The cranial portion of the insertion of the deep pectoral muscle is then severed to facilitate exposure of the area and the dislocation reduced.
The intertubercular ligament is incised and the tendon of the biceps brachii muscle exposed. The greater tubercle is cut obliquely in order to maintain the integrity of the humeral head and the insertions of the infraspinatus muscle and supraspinatus muscle. The joint is exposed by reflecting the cut tubercle proximally and incising the joint capsule approximately 1 cm medially and laterally from the osteotomy site. A narrow osteotome is used to create a trough in the cut surface of the humerus and the biceps tendon is placed in this groove [Fig. 21-19]. In this position the tendon effectively eliminates any tendency of the humerus to luxate. The greater tubercle is replaced over the tendon and fixed with two Stille nails. The surgical field is thoroughly flushed with physiologic saline solution prior to closure. The closure is routine.

Following surgery, the limb should be placed in external fixation for 2 to 3 weeks. A Velpeau sling works well following surgical repair. If properly reduced and fixed using either closed or open technique, the prognosis is good.

CAUDAL LUXATION
Caudal luxation of the shoulder is possible but has never been described. The mass of the supraspinatus muscle and its short, broad tendon of insertion apparently prevent posterior displacement of the humeral head.

SUBLUXATION OF THE SHOULDER
Animals may present with either an acute or chronic history of shoulder discomfort. Palpation will demonstrate that the joint is capable of easy subluxation in either a medial or lateral direction. While the humeral head obviously subluxates onto the medial or lateral glenoid rim, complete dislocation never occurs.

Treatment usually begins with the use of a Velpeau sling in the hope that prevention of weight bearing will allow for capsular healing or tightening. Should a conservative approach fail and analgesics prove unsuccessful, surgical intervention may be necessary. At open repair, the joint capsule on the appropriate side must be tightened using horizontal or vertical mattress sutures of a nonabsorbable material. Should this prove insufficient, the biceps tendon should be transposed to whatever position affords the most support.

RECURRENT SHOULDER LUXATION
A small population of dogs exists in which recurrent medial or lateral shoulder luxation occurs. Often the joint will be luxated and relocated by the animal many times a day. Frequently the examiner can relocate the shoulder without anesthesia or any obvious discomfort in the dog. Closed reduction is very simple; however, closed fixation is unsuccessful. Open reduction and fixation with an appropriate joint capsule imbrication and tendon transposition technique is necessary. In one instance, such a joint was further stabilized by moving the greater tubercle distally to tighten the supraspinatus muscle, thus forcing it to serve as a collateral ligament (12) Proper postoperative external immobilization is also necessary.

CHRONIC SHOULDER LUXATION
Chronic luxation implies an animal with a shoulder luxation of a long-standing nature. The animal may present with either lateral or medial luxation; usually the limb is carried in a fixed flexed position and may or may not exhibit pain on manipulation.

Animals presenting without pain but with obvious gait abnormality because of joint ankylosis can best be handled by benign neglect. They probably have as good a result as can be expected with this condition.

Dogs with evidence of pain may need surgery and complete relocation and appropriate internal stabilization. The most difficult part of the surgery is removing the binding scar tissue and releasing contracted muscles and tendons. If surgical
relocation and stabilization are accomplished, a fair prognosis for return to normal function is possible. If relocation is not possible or the glenoid shows severe wear or defect, the only recourse is arthrodesis or glenoid resection. Arthrodesis, although difficult, is preferable, since it assures a pain-free result.

FRACTURE/DISLOCATION OF THE SHOULDER

Fracture of the glenoid rim or the scapular tuberosity accompanied by soft tissue tearing may result in fracture/dislocation of the shoulder, loss of the medial glenoid, resulting in medial luxation of the lateral rim, or lateral luxation. Before shoulder reduction or fixation is possible, the fracture must be reduced to gain adequate glenoid depth and to properly hold the humeral head again. Because the glenoid fragments are usually small, replacement with multiple Kirschner wires is generally most successful. Fractures of the scapular tuberosity are best fixed using a lag screw as a tension band wire. Following fracture fixation appropriate steps may be taken to stabilize the shoulder luxation.

In rare instances in which glenoid fragments are critical to stability but too small to handle or comminuted, bone grafts from the ilial wing may be used to replace the lost fragment or fragments. In severe fracture/dislocation, shoulder arthrodesis or glenoid resection may be the only alternative.

REFERENCES


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