Scapulohumeral joint luxation in alpacas: 10 cases (2003–2009)

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Objective—To describe the clinical findings, treatments, and outcome in alpacas treated for scapulohumeral joint luxation (SHJL).

Design—Retrospective case series.

Animals—10 alpacas.

Procedures—Medical records of alpacas with SHJL that were treated at 2 referral hospitals were reviewed. History, signalment, physical examination results, radiographic findings, treatments, complications, and outcome were evaluated.

Results—Records for 8 male and 2 female alpacas with 16 instances of SHJL were reviewed. Three male alpacas each had 2 recurrences of SHJL in the treated limb. The proportion of male alpacas treated for SHJL was significantly greater than the proportion of female alpacas treated for SHJL. Closed reduction was used in 2 female and 3 male alpacas; SHJL recurred in the 3 males. Stabilization by use of a lateral extracapsular tension band suture technique was performed successfully in 4 male alpacas; in another male alpaca, relaxation caused by self-inflicted trauma occurred postoperatively. In 2 male alpacas, arthrodesis was performed but residual lameness remained 1 year after surgery.

Conclusions and Clinical Relevance—SHJL should be considered as a differential diagnosis in alpacas with thoracic limb lameness. Luxation may occur more frequently in males. A closed reduction technique may be used successfully to treat acute luxations. Extracapsular stabilization by use of the lateral extracapsular tension band suture technique was successful for treatment of recurrent SHJL and SHJL that could not be reduced via closed reduction. (J Am Vet Med Assoc 2010;237:1186–1192)

Partial or complete luxation of the SHJ is an infrequent cause of lameness in large animal species (eg, cattle, goats, Himalayan tahr, horses, potbellied pigs, reindeer, sheep, and white-tailed deer) that can be associated with concomitant fracture of the glenoid cavity of the scapula. Diagnosis of SHJL is typically based on findings during physical examination and evaluation of radiographic images of the SHJ. Numerous treatments have been described for the treatment of SHJL in large animals, including conservative treatment, closed reduction, and open reduction and stabilization. Surgical techniques reported include transposition of the biceps brachii tendon, extracapsular stabilization by use of a lateral extracapsular tension band suture technique, and arthrodesis of the SHJ.

To our knowledge, there are 3 reports of SHJL in 5 South American camelids; all of those camelids were alpacas, and all were successfully treated by open reduction and stabilization of the SHJ. Extracapsular stabilization was achieved by use of an extracapsular tension band suture technique applied to the lateral aspect of the SHJ (3 alpacas), transposition of the biceps brachii tendon (1 alpaca), and arthrodesis of the SHJ by use of a dynamic compression plate (1 alpaca). We are not aware of any published information regarding the clinical signs, diagnosis, treatment, and outcome in a greater number of alpacas with SHJL. Furthermore, outcome of the closed reduction technique for correction of SHJL in alpacas has not been reported.

The purpose of the study reported here was to describe the clinical findings, treatments, complications, and outcome in alpacas treated for SHJL. We hypothesized that male alpacas would be more often treated for SHJL, compared with female alpacas. We also hypothesized that, in contrast to findings in large animal species (excluding horses), an acute simple SHJL could be successfully treated by use of a closed reduction technique.

Materials and Methods

Case selection—Medical records of alpacas with SHJL referred to the Veterinary Teaching Hospital at The Ohio State University between January 1, 2003, and May 31, 2006, or the Kansas State Veterinary Medical Teaching Hospital between June 1, 2006, and Sep-
Results

Signalment—Review of medical records identified 8 sexually intact male and 2 sexually intact female alpacas with SHJL for inclusion in the study. Age (mean, 3.6 years; median, 3.3 years; range, 9 months to 6.5 years) was recorded for 9 of 10 alpacas. There were two 3-year-old males (designated as A and B, respectively). Body weight (mean, 60.3 kg [132.7 lb]; median, 63 kg [138.6 lb]; range, 42.7 to 77 kg [93.9 to 169.4 lb]) was recorded for 7 of 10 alpacas. Compared with the overall population of alpacas treated at the 2 referral hospitals, a value of P < 0.05 was used to indicate significance for all analyses.

Treatments prior to admission to the referral hospitals—Treatments were administered to 8 alpacas prior to admission to the referral hospitals. Of those 8 alpacas, 5 received flunixin meglumine alone, 2 were administered flunixin meglumine and penicillin G procaine, and 1 was administered flunixin meglumine and dexamethasone. In addition, recommendations for stall rest were made for 2 alpacas. In those 8 alpacas, no improvement in clinical findings was observed after treatment and prior to admission.

Clinical findings and diagnosis of SHJL—Scapulo-humeral joint luxation was diagnosed 16 times in 10 alpacas. All alpacas were initially examined for lameness of the left (n = 6) or right (4) thoracic limb. The interval from the onset of the lameness in the thoracic limb until referral for lameness evaluation was 4 hours to 78 days (mean, 20.2 days; median, 4.3 days; n = 8). The duration of the lameness was not recorded for 2 alpacas (a 3-year-old male [alpaca A] and a male of unknown age); however, both of them had clinical and radiographic evidence of chronicity that was indicated by muscle atrophy and osteoarthritis (osteophyte formation, narrowing of the joint space, and dystrophic mineralization). Five of these alpacas were examined after an acute onset (< 7 days’ duration) of lameness. Eight alpacas had a non-weight-bearing lameness. Severity of lameness was not recorded for 2 alpacas. Other clinical findings at the time of referral included signs of pain upon manipulation of the affected thoracic limb (n = 5), muscle atrophy (5), localized tissue swelling (4), distortion of anatomic landmarks (ie, nonpalpable acromion and prominent greater tubercle [3], crepitus [1], and localized fibrosis [1]). Cause of the SHJLs was known or suspected to be associated with trauma in 4 alpacas (an injury from fighting in 1 male, injury from falling in 1 female, and suspected trauma inflicted by cohorts in 2 males housed with other sexually intact males).

Diagnoses of all 10 SHJLs were confirmed by use of radiography obtained after sedation of each affected alpaca with butorphanol tartrate (0.11 mg/kg [0.05 mg/lb], IV), xylazine hydrochloride (0.33 mg/kg [0.15 mg/lb], IV), or both. Unilateral SHJ subluxation associated with fracture of the caudal aspect of the glenoid cavity and severe osteoarthritis or unilateral simple SHJL without concomitant fracture were diagnosed in 1 (5-year-old male) and 9 (9-month-old and 3-year-old females; 2-, 2.5-, 3- [alpaca A], 3- [alpaca B], 4.5- and 6.5-year-old males; and a male of unknown age) alpacas, respectively. Of the 9 alpacas with unilateral simple luxations, 3 (3-year-old male [alpaca A], 6.5-year-old male, and a male of unknown age) and 1 (3-year-old male [alpaca B]) had radiographic evidence of mild to moderate osteoarthritis or severe osteoarthritis, respectively. The humerus was medially or laterally displaced in 1 (9-month-old female) and 8 (3-year-old female and 2-, 2.5-, 3- [alpaca A], 3- [alpaca B], 4.5-, 5-, and 6.5-year-old males) alpacas, respectively; information for the direction of displacement of the humeral head was unavailable for the remaining alpaca (male of unknown age) because of incomplete information in the medical record. Treatments were selected on the basis of history, results of physical examination, and radiographic findings.

Surgical procedures—Closed reduction of SHJLs was performed in 5 alpacas (9-month-old and 3-year-old females and 2-, 2.5- and 4.5-year-old males) with acute simple luxations. Closed reductions were attempted after each alpaca was sedated with xylazine (0.3 mg/kg, IV), butorphanol (0.1 mg/kg, IV), or both. In all 5 instances, reduction of the luxations was achieved by the placement of traction on the affected thoracic limb and manual pressure on the humeral head while simultaneously abducting and laterally rotating the limb. The SHJ remained reduced after flexion and extension of the joint articulation in all 5 alpacas. A Velpeau sling was modified to include a thoracic component to apply tension in a manner to promote medial rotation of the SHJ; this was accomplished by applying the bandage...
material from the medial aspect of the thoracic limb in a lateral and dorsal direction and maintaining tension across the dorsal midline and around the thorax. The sling was applied and maintained after the closed reduction procedure for 5 to 14 days (mean, 11 days; median, 14 days; n = 5). Flunixin meglumine (1.1 mg/kg [0.5 mg/lb], q 12 to 24 h for 1 to 6 days) was administered IV or SC in 4 alpacas (3-year-old female and 2-, 2.5-, and 4.5-year-old males) at the discretion of the attending clinician. In addition, a polysulfated glycosaminoglycan (1.1 to 2.2 mg/kg [0.5 to 1 mg/lb]) was administered IM in 2 alpacas (3-year-old female and 2.5-year-old male) as a chondroprotective agent. All 5 alpacas were discharged from the hospital 1 to 7 days (mean, 4.8 days; median, 6 days) after reduction of the luxation. Owners confined each of these 5 alpacas in a stall for 14 to 56 days (mean, 32 days; median, 30 days) after discharge from the hospital.

Open reduction with extracapsular stabilization of the left SHJ by use of lateral extracapsular tension band suture technique was performed in 3 alpacas (3-year-old male [alpaca A], 6.5-year-old male, and a male of unknown age) with chronic SHJ luxation. Radiography revealed evidence of mild to moderate osteoarthritis. Alpacas were administered flunixin meglumine (1.1 mg/kg, IV; n = 2 [3-year-old male [alpaca A] and 6.5-year-old male]) and ceftiofur sodium (2.2 mg/kg [1.0 mg/lb], IV; 2 [3-year-old male [alpaca A] and male of unknown age]) or a combination of penicillin G procaine (22,000 U/kg [10,000 U/lb], IM; 1 [6.5-year-old male]) and gentamicin sulfate (5 mg/kg [2.3 mg/lb], IV; 1 [6.5-year-old male]) before surgery. General anesthesia was induced via IV administration of xylazine (0.11 to 0.22 mg/kg [0.05 to 0.1 mg/lb]), ketamine hydrochloride (3 to 5 mg/kg [1.5 to 2.5 mg/lb]), and guaifenesin guacolate (50.6 to 99 mg/kg [23 to 45 mg/lb]) and then maintained by the administration of isoflurane vaporized in 100% oxygen by use of a semiclosed rebreathing circuit system. Each alpaca was positioned in right lateral recumbency. The surgery site was aseptically prepared and a cranilaterral approach to the SHJ was performed, as described.19 In all 3 alpacas, the joint capsule and insertion of the infraspinatus tendon were intact. An arthrotomy was performed, and reduction of the SHJL was achieved by the combined placement of坚强的SHJL并保持在内侧的肋骨。在手术过程中，局部麻醉被施用于xylazine (0.11到0.22 mg/kg [0.05到0.1 mg/lb]), ketamine hydrochloride (3到5 mg/kg [1.5到2.5 mg/lb]),和guaifenesin guacolate (50.6到99 mg/kg [23到45 mg/lb])和然后通过使用isoflurane的蒸发来维持由100%氧气通过使用半封闭的呼吸回路系统。每个驼鹿被定位在右侧的侧卧位置。手术部位被无菌地准备，并在SHJ的纵向方向和围绕胸腔。手术切口被缝合。在所有3只驼鹿中，关节囊和旋前方肌腱的插入是完整的。一个关节切口在SHJ的纵向方向和围绕胸腔。手术切口被缝合。在所有3只驼鹿中，关节囊和旋前方肌腱的插入是完整的。一个关节切口在SHJ的纵向方向和围绕胸腔。手术切口被缝合。
fixed position to aid arthrodesis of the SHJ. Incisions in the joint capsule and surrounding muscles were closed by use of 2-0 or size 0 polidioxanone suture in a simple continuous pattern. The skin incision was sutured by use of size 2 polypropylene suture or surgical steel staples. Intravenous or SC administration of cefiofur sodium (2.2 mg/kg, q 12 h) was continued in both alpacas for 5 or 10 days after surgery. In the 3-year-old (alpaca B) alpaca, pain and inflammation were treated after surgery by the PO administration of etodolac (10 mg/kg, q 24 h for 7 days); in the 5-year-old alpaca, a fentanyl transdermal patch (supplying 25 μg of fentanyl/h for 72 hours) was applied and flunixin meglumine (1.1 mg/kg, q 24 h) was administered IV for 3 days and then replaced with treatment with phenylbutazone (4 mg/kg [1.8 mg/ kg], PO, q 24 to 48 h) on days 4 through 14 after surgery. No short-term complications were observed in the alpacas prior to discharge from the hospital.5 (3-year-old male [alpaca B]) and 11 days (5-year-old male) after surgery. Skin sutures were removed 14 or 21 days after surgery.

Follow-up information and outcome assessments—Owners were contacted by telephone 1 year after the treatment of luxations in both male alpacas that underwent arthrodesis of the SHJ. Both males continued to have a residual gait abnormality, and owners of both alpacas thought this was caused by pain. Neither male was able to be used for breeding. Outcome was considered poor for this treatment.

Follow-up examination 1 year after repair of SHJLs by the application of tension band sutures in the 3 male alpacas revealed a mild gait abnormality. However, all 3 alpacas had returned to previous use. Therefore, outcome for this treatment was considered good.

Follow-up examination 1 year after closed reductions of SHJLs in the 2 female alpacas revealed no gait abnormality and a return to use for breeding; therefore, outcome for this treatment was considered excellent.

Reluxation occurred 5 times between 41 and 442 days (mean, 158 days; median, 90 days) after closed reduction in the 3 male alpacas (2-, 2.5-, and 4.5-year-old males) that underwent closed reduction of SHJLs. In all 5 instances of reluxation, the type and direction of the displacement were similar to the initial luxation. Two (2.5- and 4.5-year-old) of the 3 males were housed with other male alpacas at the time of the initial luxations and relaxations. A closed reduction technique was performed at the time of first reluxation in the 2-year-old male alpaca 3 months after the first procedure. This alpaca was not treated after the second reluxation because in a retrospective case series of 14 animals with unilateral SHJLs, 3 animals (1 goat, 1 calf, and 1 potbellied pig) were treated by use of a closed reduction procedure and closed reduction was successful only in the goat. Of the other 11 instances of SHJL, 5 were in horses and closed reduction was not attempted because of concurrent injuries.1 In that study, 8 of 14 SHJLs were in animals <1 year old. This contrasts to the results of our study in which 8 of the 9 affected alpacas for whom the age was known were adult alpacas.

In the present study, closed reduction was easily achieved after the alpacas were sedated and resulted of tension band sutures after the second reluxation (5 months after the first reluxation) despite a third successful closed reduction technique at that time. Similarly, although the luxated SHJ was successfully reduced with a closed reduction procedure, extracapsular stabilization by use of the lateral extracapsular tension band suture technique without arthrotomy was used to treat the 4.5-year-old male alpaca that had reluxation 41 days after the initial closed reduction technique. Perioperative drug administration as well as the surgical approach and extracapsular stabilization were similar, as described previously. Radiography was used to confirm reduction of the joints during surgery. A modified Velveau sling was applied and maintained for 8 (2.5-year-old male) and 10 (4.5-year-old male) days after surgery, and alpacas were hospitalized for 2 (2.5-year-old male) and 8 (4.5-year-old male) days. Short-term complications were not reported for either alpaca during or after hospitalization. Follow-up examination of the 2.5-year-old male 3 years after surgery revealed no gait abnormality and a return to use for breeding; therefore, outcome for this treatment was considered excellent. In addition, this male had been continually maintained in isolation in a pasture and paddock when not used for breeding. The 4.5-year-old male alpaca had a self-inflicted traumatic luxation of the SHJ 79 days after repair of the joint by use of the lateral extracapsular tension band suture technique. This alpaca made an unsuccessful attempt to climb over a gate during which the gate fell on the alpaca while the surgically repaired thoracic limb was in abduction. The owner did not elect to pursue surgery. A closed reduction technique was successfully used to repair the luxated SHJ. The male was maintained in isolation for 4 months and then returned to use for breeding. At 17 months after closed reduction of the second reluxation, the male continued to be in use without a gait abnormality; therefore, the outcome for this treatment was considered excellent.

**Discussion**

On the basis of the findings of the study reported here, acute simple luxation of the SHJ in alpacas can be successfully treated by closed reduction. However, outcome for closed reduction of luxations may be better in female alpacas, compared with outcome in males. This may be because trauma inflicted by cohorts and mounting behaviors, which are possible risk factors for repeat injury, are more common in males. A review of the literature revealed 8 clinical reports of successful treatment of SHJL by closed reduction procedures in horses. This is likely an overrepresentation of the success of this procedure because in a retrospective case series of 14 animals with unilateral SHJLs, 3 animals (1 goat, 1 calf, and 1 potbellied pig) were treated by use of a closed reduction procedure and closed reduction was successful only in the goat. Of the other 11 instances of SHJL, 5 were in horses and closed reduction was not attempted because of concurrent injuries.1
in a joint that was stable during flexion and extension. Apparent stability of the SHJ after a closed reduction procedure is an essential prerequisite for continuing conservative treatment. Surgical intervention should be recommended when stability is not apparent. Closed reduction for SHJls of acute duration should be attempted only after ruling out concurrent fracture of the scapula and proximal portion of the humerus via radiography or other imaging techniques. In addition, closed reduction should be recommended only if the owner is able to maintain the alpaca in isolation during the healing process. Following closed reduction of an SHJL, isolation and restricted activity of horses for a period ≥ 2 months has been suggested4; however, on the basis of the timing of reluxations in the male alpacas in the present study, we suggest a period of 3 to 4 months of isolation and restricted activity in alpacas.

Extracapsular stabilization of SHJL has been reported and has had an excellent short-term and long-term outcome in 5 goats in 1 study13 and a steer and 4 alpacas in another study.14 In the present study, extracapsular stabilization was selected instead of a bicipital tendon transposition procedure because extracapsular stabilization is less invasive, can be readily applied, and requires less surgical time. The application of an extracapsular prosthesis as described in the present study was modified from a technique used in alpacas.14 Suture anchors or a screw equipped with a washer were used in the present study as proximal points of fixation, compared with proximal fixation by use of scapular bone tunnels or a screw equipped with a washer.14

The use of suture anchors is becoming increasingly more popular for the fixation of soft tissues (eg, ligaments, tendons, and joint capsules) to bone for temporary stabilization of an injured joint and facilitation of periarticular fibrosis development.19 The application of suture anchors requires less dissection of soft tissue structures than does the creation of bone tunnels. Suture anchors used in the present study have similar pullout strengths to those of orthopedic screws of similar size20 but cause less abrasion of the surrounding soft tissues than do screws. Suture anchors are used for fixation of prosthetic sutures to bone for surgical stabilization of shoulder luxation in dogs.19 The size and weight of alpacas are similar to those of large-breed dogs; therefore, we estimated that the use of suture anchors would be feasible during surgical stabilization of SHJLs in alpacas.

To our knowledge, the insertion of suture anchors in the bones of alpacas has never been reported. Results of the study reported here suggest that the use of suture anchors as proximal points of fixation in combination with size 5 braided polyester suture or 18-gauge orthopedic wire for lateral SHJ tension band sutures would be appropriate for use in alpacas. However, further in vitro and in vivo biomechanical testing is necessary to determine the optimum specifications of anchor-suture combinations to be used in extracapsular stabilization by use of a lateral extracapsular tension band suture technique for alpacas. This need is supported by the traumatic luxation in the 4.5-year-old male alpaca. Alpacas with acute SHJL treated by extracapsular stabilization had no gait abnormalities at long-term follow-up.14

In the present study, alpacas treated by extracapsular stabilization by use of the lateral extracapsular tension band suture technique were able to return to their previous use. A mild residual gait abnormality was expected to be observed in the 3 alpacas that underwent surgical repair of chronic SHJL because of osteoarthritis. Thus, acute simple SHJL14 or uncomplicated chronic SHJL with mild osteoarthritis in alpacas treated with extracapsular stabilization by use of the lateral extracapsular tension band suture technique has an overall good to excellent outcome.

A modified Velpeau sling was applied to the affected limb to immobilize and protect the joint during the healing process after closed reduction or extracapsular stabilization with the lateral SHJ tension band suture technique. The suggested duration of immobilization in small animals is 1 to 3 weeks after surgical repair or a closed reduction procedure.21 Velpeau-type slings have not been recommended in instances of lateral SHJL in dogs because of increased lateral rotation of the humeral head. However, a modified Velpeau sling was applied in the alpacas of the study reported here to prevent or minimize weight bearing during healing. The Velpeau sling was modified to include a thoracic component so that lateral and dorsal tension could be applied by the sling. This modified Velpeau sling was thought to assist healing, as previously reported,14 by protecting the surgical site and facilitating recumbency.

Arthroscopic examination of the SHJ after a closed reduction procedure has been suggested4 for assessing cartilage injury, performing debridement as necessary, and enabling more accurate prediction of outcome. Arthroscopy was not considered necessary and was not performed in any alpaca in the study reported here. We do not believe that the lack of use of arthroscopy adversely affected the likelihood for reluxation on the basis of the intervals that lapsed between treatment and reluxation and the absence of signs indicative of osteoarthritis in the SHJ of the affected alpacas. During extracapsular stabilization with the lateral SHJ tension band suture technique, the affected joints were not explored via arthrotomy in instances of acute or recurrent SHJLs. This intraoperative decision was made to avoid iatrogenic damage to the cartilaginous surfaces of the glenoid cavity and humeral head. Medial cartilage defects on the humeral head have been associated with lateral SHJLs.6,14 Tearing of the joint capsule is also possible,6 but not always present,14 and does not require repair unless damage to the joint capsule is extensive. Open surgical exploration of the SHJ is indicated when there is evidence of subchondral bone damage, osteoarthritis, or both. In a retrospective case series17 in which investigators studied lateral SHJLs in 4 alpacas, the subchondral bone of the humerus was not affected and debridement was not required.

Arthrodesis is considered a salvage procedure used to treat debilitating and advanced degenerative disease of the SHJ. In another study10 of complications of orthopedic surgeries in alpacas and llamas, 2 alpacas underwent arthrodesis of the SHJ by application of a dynamic compression plate. To our knowledge, the present study is the only other report of SHJ arthrodesis in alpacas. Arthrodesis by use of the transarticular lag-
screw technique in the study reported here was similar to a transarticular cortical screw fixation in lag-fashion technique used for arthrodesis of the proximal interphalangeal joint in horses. To prevent failure (bending) of the transarticular screw and improve lateral stabilization of the joint, application of a tension band wire was also used. Cancellous bone screws were used because intraoperative assessment of the bone revealed diminished holding power of cortical screws by bone that was assumed to have been associated with chronic disuse of the limb. Curettage of the cartilaginous surfaces was performed to promote arthrodesis of the joint, and a single cancellous bone screw was inserted in lag fashion to compress the congruent SHJ. The transarticular lag-screw technique was selected because it is less invasive and expensive and easier to apply than a dynamic compression plate. This transarticular lag-screw technique is best suited for use in joints that have a limited range of motion. However, we believed that the transarticular lag-screw technique, when combined with a lateral tension band suture, could be used in the SHJ of alpacas because of their body weight and tendency to remain recumbent for prolonged periods and our ability to apply a sling that does not allow the alpaca to bear weight on the affected thoracic limb. Owners reported that alpacas treated with this method had a residual gait abnormality that they thought was associated with pain. Although the nature of the gait abnormality and the presence or absence of pain were not assessed, arthrodesis by application of the transarticular lag-screw technique is not currently advocated.

In general, widening of the SHJ observed in a lateral radiographic view concurrent with clinical findings of lameness is suggestive of SHJL. Two orthogonal radiographic views are necessary to confirm a diagnosis of SHJL and rule out concomitant fractures. However, radiography may not reveal SHJL in some alpacas because of spontaneous reduction of the luxation during positioning for radiography. This may be facilitated by muscle relaxation that is secondary to sedation or anesthesia. In the study reported here, radiographic findings confirmed SHJL in all alpacas. However, displacement of the humerus was not always evident on the lateral radiographic view when the luxated limb was positioned in the lateromedial plane.


References

From this month’s AJVR

Influence of kidney function on urinary excretion of albumin and retinol-binding protein in dogs with naturally occurring renal disease

Jens Raila et al

Objective—To evaluate excretion of urinary albumin (UAlb) and urinary retinol-binding protein (URBP) in dogs with naturally occurring renal disease.

Animals—64 client-owned dogs.

Procedures—Dogs were assigned to groups according to plasma creatinine concentration, urinary protein-to-urinary creatinine ratio (UP:UC), and exogenous plasma creatinine clearance (P-CrCl) rates: group A (n = 8), nonazotemic (plasma creatinine < 125 µmol/L) and nonproteinuric (UP:UC < 0.2) with P-CrCl rate > 90 mL/min/m²; group B (26), nonazotemic and nonproteinuric with P-CrCl rate 50 to 89 mL/min/m²; group C (7), nonazotemic but proteinuric with P-CrCl rate 53 to 98 mL/min/m²; group D (8), azotemic and borderline proteinuric with P-CrCl rate 22 to 45 mL/min/m²; and group E (15), azotemic and proteinuric (P-CrCl not evaluated). The UAlb and URBP concentrations were measured via ELISA; UAlb-to-urinary creatinine (UAlb:UC) and URBP-to-urinary creatinine (URBP:UC) ratios were determined.

Results—UAlb:UC and URBP:UC did not differ between groups A and B. Increased UAlb:UCs and URBP:UCs were paralleled by increased UP:UCs in groups C, D, and E relative to values from groups A and B, independent of azotemia. There were significant positive correlations of UP:UC with UAlb:UC and of UAlb:UC with URBP:UC (r = 0.82 and 0.46, respectively). However, UP:UC, UAlb:UC, and URBP:UC were not significantly correlated with P-CrCl rate.

Conclusions and Clinical Relevance—UAlb and URBP concentrations were paralleled by urinary protein concentrations and may be useful in assessing renal management of plasma proteins. Determination of urinary protein, UAlb, or URBP concentration was not sufficiently sensitive to detect reduced P-CrCl in nonazotemic dogs. (Am J Vet Res 2010;71:1387–1394)