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Part II

PODIUM ABSTRACTS (continued)

46 The Short Lateral Collateral Ligaments of the Tarsus in the Dog: A Functional Cadaveric Study

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INTRODUCTION: No studies have evaluated the function of the short lateral collateral ligaments (SLCL) of the canine tarsus in isolation from the long lateral collateral ligament (LLCL).

MATERIALS & METHODS: Eight canine cadaveric limbs were tested in 90° flexion of the tarsocrural joint for their changes of internal/external rotation and valgus/varus before and after transection of one or both SLCL. In group A, the fibulocalcaneal ligament was transected first, followed by the fibulotalar. In group B, the order was reversed. Angular changes between two k-wires were measured and compared.

RESULTS: External rotation increased significantly after transection of one or both SLCL ($p=0.009$ and $p<0.0005$), as did varus ($p=0.021$ and $p=0.001$). Lateral subluxation was possible when both SLCL were cut.

DISCUSSION/CONCLUSION: Unlike the LLCL, which stabilizes against subluxation away from it, both SLCL are major stabilizers against subluxation towards them. Their major function may be to facilitate a tight connection between fibula and talus/calcaneus, thus preventing subluxation. Results should be considered in clinical patients with isolated ruptures of the SLCL.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

47 Arthroscopic Treatment of Septic Arthritis in 12 Dogs

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INTRODUCTION: Synovial proliferations (SP) biopsies culture results and morbidity associated with arthroscopic lavage of septic arthritis have not been reported. Objectives of this study were to evaluate 1) culture results from arthroscopic SP biopsies 2) short-term morbidity 3) long-term results associated with arthroscopic lavage in dogs presenting with suspicious septic joints.

MATERIALS & METHODS: Patients with an arthroscopic lavage and culture of SP biopsies for suspicion of septic arthritis based on synovial fluid analysis or abnormal arthroscopic observation were retrospectively included. Culture results, short-term complications and long-term (> 6 months) outcome are described.

RESULTS: Twelve dogs (13 joints) were included. Ten dogs were discharged one day postoperatively, one dog two days postoperatively, and one dog with bilateral elbow septic joints four days postoperatively. No wound complications were observed. All SP cultures were positive. One dog died suddenly three days postoperatively while having improved significantly. One dog with fungal infection was euthanized 5 months postoperatively because of disease extension. Seven dogs were available for long-term follow-up. Six dogs were free of antimicrobial therapy for >4 months. One dog had recurrence of lameness suspect of septic arthritis.

DISCUSSION/CONCLUSION: Arthroscopic lavage of septic joints is associated with a low morbidity and no wound complications. Long-term re-

sults are comparable to other treatment modalities. One patient died suddenly for a reason probably unrelated to the surgical technique. Continuous irrigation doesn't seem to impair culture results. Selective biopsies potentially explain the high culture sensitivity.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

48 Morphologic MRI Features of Medial Compartment Disease in Canine Elbows Associated with Severity of Intra-Articular Changes Identified with Arthroscopy

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INTRODUCTION: A combination of magnetic resonance imaging (MRI) features has proven useful in human orthopedic MRI in predicting disease severity and potential value of surgical intervention. In managing canine medial compartment disease (MCD), some have hypothesized that patients with advanced cartilage loss may be less amenable to surgical intervention. Our objective was to evaluate the morphologic MRI features of MCD and determine if these correlated with arthroscopy.

MATERIALS & METHODS: MRI was performed on dogs ($n=16$) with MCD prior to arthroscopy. Subjective cartilage evaluation included a score of cartilage (0–5) on the medial coronoid process (MCP) and humeral trochlea (HT). Other morphologic features evaluated included MCP integrity (0–3), sclerosis (0–3), bone marrow hyperintensity (0–1), synovial proliferation and effusion (0–3), flexor enthesopathy (0–4) and osteophyte formation (3). The composite MRI score ($\text{max}=34$) was compared to summed arthroscopic scores for the MCP and HT.

RESULTS: MRI was prospectively performed on 28 elbows with MCD. Clinically significant Outerbridge scores (>2.5) occurred in 10 MCP and 7 HT (11 elbows total). Good correlation between the composite MRI and arthroscopy scores was identified, with $R^2=0.85$. Individual MRI features had fair to moderate correlation to arthroscopy ($R^2=0.22-0.61$), with flexor enthesopathy having highest correlation to arthroscopy.

DISCUSSION/CONCLUSION: No individual morphologic MRI feature better identified clinically significant MCD compared to arthroscopy, but a combination of the morphologic MRI features proved much stronger. This may represent a viable scoring system of MCD in the clinical setting.

ACKNOWLEDGEMENT: Lynn Reece, Lisa Reno, Ethan Karsted are greatly appreciated for technical assistance.

49 Revision of Dorsal Luxation after Total Hip Replacement (THR) Using a Triple Pelvic Osteotomy (TPO)

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INTRODUCTION: Luxation is one of the most frequently encountered complications of THR in dogs; however, clinical outcome following surgical revision for dorsal luxation of THR is rarely reported. Our objective was to report a novel approach for revision of dorsal luxation after THR.

MATERIALS & METHODS: Dogs that received a TPO for revision of a dorsal THR luxation at a single institution were identified. Angle of Lateral opening (ALO) was measured and corrected for pelvic rotation following THR and TPO. A paired t-test was performed to compare THR and TPO ALO measurements and statistical significance was set at $p\leq 0.05$. Functional outcome was assessed at revisit appointments and via telephone interview.

RESULTS: 14 dogs were identified and adequate radiographs were available for 11 cases. Open or closed hip reduction was unsuccessfully attempted in



six of the dogs prior to performing TPO. Nine dogs had an “open” acetabular cup with ALO > 45° after THR. Following TPO, four dogs had an ALO > 45°. Performing a TPO reduced the ALO by a mean of $19.4 \pm 12.8^\circ$ (range -38 to 10°, $p \leq 0.0005$). Ten dogs had an excellent or good outcome following TPO. Three dogs re-luxated; two of which had extreme reduction of ALO and luxated ventrally.

DISCUSSION/CONCLUSION: TPO with cup retention is an alternative to cup revision to treat dorsal luxation of cemented and cementless THR. TPO offers a revision option that preserves the implant-bone interface and significantly reduces ALO. Excessive reduction of ALO can lead to ventral luxation. **ACKNOWLEDGEMENT:** There was no proprietary interest or funding provided for this project.

50 Outcome and Complications Following Stabilization of Coxofemoral Luxations in Cats Using Mini Tightrope® System

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INTRODUCTION: Coxofemoral luxation in cats is common but there are limited studies investigating outcome and complications after surgical correction. The Mini TightRope® is a suture-toggle-system that was originally described to stabilize cranial cruciate ligament rupture but has been used as a toggle-pin-stabilization for coxofemoral luxation in dogs. We hypothesize that the use of Mini TightRope® for the stabilization of hip luxations in cats is a safe technique resulting in minimal complications and early return to function.

MATERIALS & METHODS: Medical records of cats presented to the Small Animal Hospital of the University of Berne and Zurich for coxofemoral luxation stabilized using the Mini TightRope® were reviewed. Surgical information, intra and post-operative complications and clinical outcome (orthopedic examination and validated owners questionnaire) were evaluated. Surgical variation included differently sized femoral canal and the use of either one or two suture strands.

RESULTS: 22 cats with 23 luxations met the inclusion criteria. Concurrent injuries were found in 10/22 cats including fractures, wounds and others. In two cases (8.7%) complications were noted. In specific, one single stranded and one double stranded suture of the Mini TightRope® ruptured 4 and 8 weeks post operatively, respectively. Clinical and owners assessed outcome were excellent in the remaining cases. One cat was euthanized one week after surgery.

DISCUSSION/CONCLUSION: Stabilization of coxofemoral luxations in cats using Mini TightRope® is a safe technique resulting in excellent outcome with a very low complication rate.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

51 A New Coaptationless Stabilization Technique for Feline Stifle Disruption- Surgical Technique and Initial Results

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INTRODUCTION: Stifle joint disruption is defined as complete dislocation of the stifle with multi-structural instability. Due to insufficient strong repair techniques postoperative immobilization of the stifle joint is recommended. The purpose of this report is to describe the initial results and clinical experience in cats with stifle disruption treated with mini TightRope and knotless anchors combined with polyblend suture.

MATERIALS & METHODS: Three cats with different degrees of stifle disruption were included. The tightrope procedure was performed as described by Cook and modified for the cat. Knotless anchors (Pushlock, Arthrex, Inc. Naples, FL, USA) combined with a polyblend suture were used at the femoral and tibial attachment of the medial collateral ligament for repair. No post-operative joint immobilization was used. All cats were examined regarding grade of lameness and stifle range of motion (ROM) one day postoperatively and at 8 weeks. Owners completed the Feline Musculoskeletal Pain Index (FMPI) at follow up.

RESULTS: Affected structures included the cranial (n=2), and caudal (n=1) cruciate ligament, the joint capsule (n=3), the menisci (n=3), and the medial collateral ligament (n=2). No intra operative complications were recorded. Postoperative lameness ranged from grade 2 to 3. At the 8 weeks follow up lameness ranged from grade 1 to not evident with normal to slightly decreases ROM. Results of the FMPI ranged from 0.95 to 1.

DISCUSSION/CONCLUSION: The initial clinical experience using a novel repair technique is promising, with the major advantage of not requiring postoperative joint immobilization. All cats showed good function without recurrence of instability at follow-up examination.

ACKNOWLEDGEMENT: None.

52 Radiographic and MRI Characterization of the Clinically Significant Patellar Tendinopathy in Dogs Following TPLO

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INTRODUCTION: Patellar tendinopathy (PT) is an uncommon complication following TPLO, but can produce clinically significant lameness. This study compared magnetic resonance imaging and radiographic findings in PT-affected to unaffected dogs to determine if discriminating features could be delineated.

MATERIALS & METHODS: Sixty-two client-owned dogs underwent MRI and radiography as part of a TPLO study. Radiographic evaluations were performed pre-op and at 4, 7, and 10 weeks (w) post-TPLO. Post-op MRI was performed at 4w. Cranial extrasynovial soft tissue thickness, tendon visibility, thickness (if discretely visible), and extrasynovial soft tissue swelling (STS) cranial and caudal to the plane of the tendon were evaluated on radiographs. Tendon thickness, cross-sectional area, signal intensity (SI), infrapatellar fat pad (IPFP) hyperintensity and peritendinous hyperintensity were evaluated with MRI. Clinically significant PT was determined by one surgeon.

RESULTS: The surgeon diagnosed clinically significant PT in 4/62 stifles whereas 32/62 stifles had patellar lesions on MRI. Peritendinous hyperintensity was significantly increased with PT. If tendon thickness, IPFP and peritendinous hyperintensity were collectively considered, the development of PT occurred in 3/5 cases. Radiographically, tendon thickness at 7w and 10w and cranial extrasynovial STS at 10w were significant features in dogs affected with PT.

DISCUSSION/CONCLUSION: PT is a low prevalence post-op complication following TPLO. Dogs with persistent lameness at 7w or more post-op, radiographic evidence of persistent STS centered on the patellar tendon with concurrent abatement of cranial extrasynovial STS and IPFP STS caudally, PT should be considered.

ACKNOWLEDGEMENT: AO Foundation for funding and Arthrex Vet Systems for equipment support. LR, FG, EK, LR, KH for technical assistance.



53 Clinical Utility of Preanesthetic Bloodwork Prior to Orthopedic Surgery

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INTRODUCTION: The clinical utility is not known in apparently healthy patients presenting for elective orthopedic surgery. The purpose of this study was to evaluate rate of abnormal bloodwork in healthy patients presenting for cruciate repair and the associated risk for anesthetic complications.

MATERIALS & METHODS: The records for 2015 were searched for all apparently healthy dogs presenting for surgery for cruciate disease. Age, body condition score (BCS), breed, procedure and surgeon were recorded. Bloodwork performed within 3 months prior to surgery was evaluated for abnormalities. Anesthetic complications, cancellations, additional diagnostics added, or changes to the anesthetic plan as a result of the abnormalities were recorded. The rate of bloodwork abnormality, rate of anesthetic complications, and odds ratio for bloodwork as a risk factor for anesthetic complication were calculated.

RESULTS: There were 126 dogs with a median age of 6 (range 1–12). The median BCS was 5 (range: 4–9). Abnormalities were present in 40.5% of dogs. The rate dropped to 12% when high PCV/TP or cholesterol were dropped as abnormalities. Only 2 cases (1.6%) had altered plans, but no cases required cancellation or large delays. Anesthetic complications occurred in 15.1% of cases. The odds ratio for abnormal bloodwork was insignificant 1.1 (P=0.77) (95% CI:0.44,3.02). The average cost of bloodwork was \$88 (range: \$18–\$129).

DISCUSSION/CONCLUSION: Based on these results, the utility of preoperative bloodwork in apparently healthy dogs undergoing elective orthopedic procedures is low. The information is retrospective and from a referral institution.

ACKNOWLEDGEMENT: There are no conflicts of interest.

54 Identification of the Middle Tibial Anatomic Axis in the Sagittal Plane in Several Breeds of Dogs

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INTRODUCTION: The purpose of our study was to determine if the middle tibial anatomic axis (MAA), commonly utilized during CORA based leveling osteotomy (CBLO) planning, could be approximated radiographically as a straight line in 3 dog breeds and to identify 2 easily locatable points to define the MAA.

MATERIALS & METHODS: Lateral tibial radiographs of Beagles, Labrador Retrievers and Yorkshire Terriers obtained at a veterinary referral center between 2005–2016 were evaluated. The MAA was approximated with a best-fit line through 10 mid-diaphyseal points, which were plotted to an X,Y coordinate system. Line goodness of fit was assessed with R-squared values.

The intersection of the MAA and a line connecting the patellar tendon insertion and the caudal aspect of the tibial plateau (CrCd Line) was identified (MAA-CrCd). The distance from this intersection to the patellar tendon insertion was the CrCd distance. The ratio of the CrCd distance over the CrCd Line was the CrCd Ratio.

RESULTS: The MAA best-fit line R-squared value was 0.95 +/- 0.1, 0.93 +/- 0.08, and 0.98 +/- 0.02, and the CrCd ratio was 0.40 +/- 0.05, 0.36 +/- 0.03, and 0.37 +/- 0.04 in Beagles, Labrador Retrievers and Yorkshire Terriers, respectively.

DISCUSSION/CONCLUSION: The MAA can be approximated using a straight line in Beagles, Labrador Retrievers and Yorkshire Terriers. A CrCd ratio reliably identifies a proximal point along the MAA. A second point to define the MAA was the mid-diaphyseal point at the level of the distal tibial crest.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

55 Factors Contributing to the Variability of a Predictive Score for Cranial Cruciate Ligament Deficiency in Labrador Retrievers

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INTRODUCTION: An equation has previously been published to predict CCLD in Labrador Retrievers, based on tibial plateau angle (TPA) and femoral anteversion angle (FAA). The aim of this study is to determine the variability of this score and the influence of each parameter on the variability of the CCLD score.

MATERIALS & METHODS: Limbs of normal dogs over 6 years of age with no history of CCLD were considered at low risk for CCLD. Limbs of dogs with CCLD were considered at high risk for CCLD. Radiographs of all pelvic limbs were evaluated independently by two investigators. Kappa statistics were used to determine the extent of agreement between investigators. Pearson's correlation and intraclass coefficients were calculated to evaluate the correlation between investigators and the relative contribution of each measurement to the variability of the CCLD score.

RESULTS: The correlation between CCLD scores calculated by investigators was good (correlation coefficient = 0.68 $p < 0.0001$). However, interobserver agreement with regards to the predicted status of limbs was fair (kappa value = 0.28), with 37% of limbs being assigned divergent classifications. Variations in CCLD scores correlated best with those of TPA, which was the least consistent parameter between investigators. Absolute interobserver differences were two times greater for FAAs ($4.19^\circ \pm 3.15$) than TPAs ($2.23^\circ \pm 1.91$).

DISCUSSION/CONCLUSION: The CCLD score reproducibility between investigators is fair and therefore warrants cautious interpretation. Future studies should focus on improving the reproducibility of TPA and FAA measurements, to improve the agreement between CCLD scores.

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56 Evaluation of a Novel Method of Calculating Radiographic Subsidence of Cementless Femoral Stem Prostheses: A Cadaveric Study

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INTRODUCTION: Variation in limb positioning affects the accuracy of radiographic measurement of femoral stem subsidence after THR. Use of a proportion to correct radiographic stem subsidence measurements may increase the accuracy of subsidence measurement. The purpose of this study was to compare the accuracy of radiograph measured femoral stem subsidence to proportion corrected stem subsidence in a cadaver model.

MATERIALS & METHODS: Cementless femoral stems were implanted in 8 cadaver femurs at 4 subsidence levels. Radiographs of implanted femurs were obtained at 0°, 10°, 20°, 30° & 45° angulation in the sagittal plane and at 0°, 15°, 30°, -15° & -30° rotation in the axial plane. A proportion including actual stem length, radiograph measured stem length, and radiograph measured stem position was solved for the corrected stem position. Radiographic, corrected, and actual stem position were compared with ANOVA tests.

RESULTS: Radiographically measured stem position was significantly different than the other groups. No differences were noted between the actual and corrected stem position except at the 14 mm subsidence level. Subsidence level, inclination, and rotation all exerted significant effects on apparent stem level in both the radiograph measured and corrected stem position groups.



DISCUSSION/CONCLUSION: These results confirm that femoral position affects radiographic measurement of stem subsidence and suggest that using a proportion to correct the measured stem position can improve the accuracy of stem subsidence measurement even when variation exists in femoral positioning.

ACKNOWLEDGEMENT: There was no proprietary interest or funding for this project. Biomedtrix Inc. provided femoral stem prostheses.

POSTER ABSTRACTS

57 Cora-Based Leveling Osteotomy (CBLO) for Stifle Stabilization in Skeletally Immature Dogs

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Two skeletally immature dogs presented for evaluation and surgical stabilization of cranial cruciate ligament ruptures. A CORA-based leveling osteotomy (CBLO) was performed. With this procedure, the axis of correction (ACA) is positioned at the anatomical center of rotation of angulation (CORA) such that the osteotomy does not interfere with the proximal tibial physis. Advantages identified in this procedure include: proximal tibial plate placement distal to the open physis, complete bone contact and osteotomy compression. Landmarks for position of the osteotomy and plate placement were based upon the distance from the insertion of the straight patellar tendon to a point where the saw blade crosses the cranial tibial cortex (D1), distance from the joint line to a point where the saw blade crosses the caudal tibial cortex (D2) and the distance from the joint line to the proximal tibial physis (D3). Correction of the CORA magnitude resulted in an osteotomy distal to the proximal tibial physes and postoperative tibial plateau angles (TPA) of 7 degrees (dog A) and 9 degrees (dog B). Client outcome assessment, orthopedic examination and radiographs were performed at 7 weeks and yielded excellent results. Evaluation revealed no lameness or pain elicited in the operated stifles. Cranial tibial thrust was negative with minimal cranial drawer. Radiographs showed complete healing with no abnormal limb angulation. Standing lateral radiographs showed the femoral condyles were centered on the tibial eminences with no detectable caudal subluxation. We concluded that the CBLO procedure is an excellent technique for stifle stabilization in skeletally immature dogs.

ACKNOWLEDGEMENT: No proprietary interest or funding was provided for this project.

58 Assessment of Accuracy of External Measurements of Three-Dimensional (3D) Printed Biomodels of the Canine Radius By Fused Deposition Modeling with Polylactic Acid As a Substrate

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INTRODUCTION: The goal of this study was to compare measurements of biomodels printed on a Fused Deposition Modeling (FDM) device with Polylactic Acid (PLA) based on a canine radius' (previously stripped from the soft tissues) computed tomography (CT) scan, to determine if the measurements were equivalent when compared with the original study's source.

MATERIALS & METHODS: Landmarks were marked prior to the CT scan. Precise measurements (1. Proximal circumference; 2. Distal width; 3. Mid-diaphyseal circumference; 4. Length; 5. Distance from proximal point to frontal Center of Rotation of Angulation (CORA) (CrCdP-CORA); 6. Distance from distal point to frontal CORA (CrCdD-CORA); 7. Circumference

at CORA) were taken from the original radius and the 3D printed biomodels. The measurements were compared to determine how precise and repeatable the results were, as well as to assess degree of scaling artifact when compared with the original model.

RESULTS: 10 radii were utilized. For the measured parameters, the range in the mean difference between biomodel and cadaveric parameters was an increase of 0.56% in CrCdP-CORA to a decrease of 1.21% in distal width of the radius. For all measured parameters, measurements for biomodels were statistically equivalent to their corresponding cadaveric bone ($P < 0.001$).

DISCUSSION/CONCLUSION: Poly-lactic acid biomodels produced by an FDM device are consistently similar in size to their original source and can be useful as accurate anatomic representations, suitable for the pre-contouring of orthopedic implants, and in the planning process for angular limb deformity correction, as well as multiple orthopedic applications.

ACKNOWLEDGEMENT: We thank Materialise® for providing the medical grade software.

59 Cora Based TPLO in a 17 Week Old Boxer Dog

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The center of rotation and angulation based tibial plateau leveling osteotomy (CORA Based-TPLO), is a procedure more recently developed to allow for the combined advantage of the TPLO and cranial closing wedge tibial osteotomy (CWTO).

A 17 week old boxer presented for a right pelvic limb lameness of 7–8 weeks duration. Right stifle effusion, drawer instability, and pelvic limb muscle atrophy were noted during examination.

Radiographs revealed an osseous defect of the right tibial plateau with effusion, suggesting ligamentous avulsion of the cruciate at its insertion.

Arthroscopic examination confirmed a complete avulsion of the cranial cruciate ligament at the insertion as well as several areas of chondromalacia. The cruciate was excised and a CORA based TPLO was performed as previously described by Castaneda and Bruecker.

Examination and radiographs at one, five, and ten weeks postoperatively noted increased gait improvements and comfort with complete healing of the osteotomy by ten weeks.

Six months later the patient represented with an audible click during ambulation. Physical examination noted limb circumduction but no palpable click. During sedated examination a click was noted in the medial stifle compartment. Arthroscopic assessment showed double level bucket handle tears at the caudal horn of the medial meniscus. A meniscectomy was performed and remnants attached to the joint capsule were released.

8 weeks after the meniscectomy the owners reported that the patient was improved.

This case demonstrates the utilization of a previously reported CB-TPLO as an alternative biomechanical alteration procedure in animals too young for a TPLO or TTA.

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60 Retrospective Comparison of Antebrachiometacarpal Arthrodesis to Pancarpal Arthrodesis in Dogs

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INTRODUCTION: We evaluated the indications, technical aspects, complications, and clinical outcomes associated with antebrachiometacarpal arthrodeses (ABMCA) and compare results to a cohort pancarpal arthrodesis (PCA) group.



MATERIALS & METHODS: Medical records, including radiographs, of dogs that underwent ABMCA and PCA were reviewed. Data was analyzed using a t-test: $p < 0.05$ was considered significant.

RESULTS: Four dogs had ABMCAs performed; eight dogs (10 PCAs) comprised the cohort group. Disease processes necessitating ABMCA included chronically infected fracture-luxation of the carpus (1) and severe carpal flexure contracture (3). Carpal bone excision was necessitated to allow the manus to be stabilized in a functional position in the dogs with contracture. Disease processes necessitating PCA included traumatic hyperextension injuries (7), antebrachial deformity (2), and osteoarthritis (1). All arthrodeses were grafted and stabilized with dorsal plates. The incidence of complications was significantly greater ($p=0.02$) for ABMCAs (4/4 vs 5/10). Implants stabilizing all ABMCAs and 5 PCAs were removed due to infection ($p=0.003$). All ABMCAs, while only 7 PCAs obtained complete osseous union ($p=0.04$). There were no significant differences in time to early osseous union between arthrodesis groups. All ABMCA dogs obtained acceptable function, while 2 PCA dogs had poor function necessitating revision arthrodesis.

DISCUSSION/CONCLUSION: While ABMCA provided acceptable long-term function, the procedure was fraught with a higher complication rate (100%) than PCA (50%). ABMCAs, however, obtained consistent osseous union and the high incidence of complications may reflect unique, challenging pathologies necessitating ABMCA.

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61 Biomechanical Comparison of the Use of a Kirschner Wire or a Plate As Adjunctive Epicondylar Fixation during Lateral Unicondylar Humeral Fracture Stabilization

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INTRODUCTION: Lateral unicondylar humeral fractures account for 36% of distal humeral fractures and 57% of humeral condylar fractures in dogs. In fractures with lateral epicondylar crest comminution, plating has been advocated in lieu of a supplemental Kirschner wire, however a direct comparison of the two techniques has not been reported. This study compared the biomechanical differences of using an interfragmentary 1.6 mm Kirschner wire or a 3.5 mm reconstruction plate as adjunctive epicondylar stabilization in simulated lateral unicondylar humeral condylar fractures stabilized with a transcondylar 4.5 mm cortical screw.

MATERIALS & METHODS: A simulated lateral unicondylar humeral fracture was created in paired humeri from 9 cadaver dogs. Humeri were stabilized with a transcondylar 4.5 mm cortical screw placed in lag fashion and alternately assigned (right vs. left humeri) to one of two supplemental fixation groups: a 1.6 mm Kirschner wire or a 3.5 mm reconstruction plate placed across the lateral epicondylar crest. Humeri were axially loaded to failure. Construct stiffness, yield load and load to failure were obtained from the load-deformation curves.

RESULTS: Mean stiffness, yield load, and load at failure were significantly greater for the reconstruction plate constructs than the Kirschner wire constructs.

DISCUSSION/CONCLUSION: Our results corroborate the recommendation of using an adjunctive epicondylar plate when stabilizing lateral unicondylar humeral fractures with lateral epicondylar crest comminution.

ACKNOWLEDGEMENT: Funding provided by the University of Florida Comparative Orthopaedics and Biomechanics Laboratory.

62 Management of Avulsion Fractures Using Modified Hook Plate Fixation in 3 Dogs and One Cat

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Avulsion fractures are frequently stabilized with Kirschner wires and a tension band wire. If the construct fails, revision surgery to stabilize the small proximal fragment can be challenging due to limited bone stock. A construct that counteracts the tension force generated by tendons is optimal for the stabilization of such fractures. The use of hook plates has been described in the veterinary literature to stabilize a small fragment where additional bone purchase was gained by hooks placed in additional drill holes. For the stabilization of very small fragments of bone, drilling three holes without creating fragmentation can prove a significant challenge. This is particularly true for revision surgeries where pre-existing holes are present from previously applied internal fixation. In this case series, the hook plate application differed from the original technique as the hooks engaged the bone via direct contact with the tips of the hooks rather than positioning the hooks in additional drill holes. One screw was also inserted in the proximal fragment through the plate. The technique was applied to four challenging cases. It was applied as the primary method of repair for two olecranon fractures in dogs with small proximal fragments. It was also employed as a revision strategy for one olecranon fracture in a cat and a tibial tuberosity avulsion fracture in a dog. The modified hook plate technique proved an effective technique with complete radiographic union and good clinical function achieved in all cases.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

63 Prospective Evaluation of the Use of the Minimally Invasive Reduction Instrumentation System for Facilitating Alignment and Reduction When Performing Minimally Invasive Plate Osteosynthesis in Three Dogs

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INTRODUCTION: We recently reported that the DePuy Synthes Minimally Invasive Reduction Instrumentation System (MIRIS) allowed for shorter reduction times while facilitating plate placement during minimally invasive plate osteosynthesis (MIPO) applications in simulated comminuted antebrachial fractures when compared to use of a two-ring circular construct. This case series reports our clinical results in three dogs in which the MIRIS was used to facilitate MIPO.

MATERIALS & METHODS: The MIRIS was used to facilitate reduction and align prior to plate application. Pre- and post-operative radiographs of the fractured and contralateral limb were reviewed to assess: fracture span, restoration of radial or tibial length, plate-bridging ratio, plate span ratio, frontal and sagittal plane angulation as well as progression toward union and complications.

RESULTS: Two comminuted crural fractures and one spiral antebrachial fracture were repaired in three, 11–19 kg dogs. The system facilitated efficient MIPO applications in all three fractures. Initial length was restored within 1% and angulation within 3° of normal. Fixation failed in one tibial fracture necessitating MIRIS-facilitated MIPO restabilization. Normal length was again restored; however, there was 3° valgus and 5° recurvatum. All three fractures obtained union without further complications by 10 weeks post-operatively with excellent functional outcomes.

CONCLUSIONS: The MIRIS was efficient in performing MIPO. Minor varus angulation induced during acute stabilization was ascribed to unilat-



eral distraction afforded by the system. Angulation present following revision surgery was attributed to soft tissue restrains inherent to a 9-day old fracture. **ACKNOWLEDGEMENT:** Instrumentation was provided by DePuy Synthes Vet, West Chester, PA.

64 Appendicular Fracture Management in Wild Florida Panthers (*Puma concolor coryi*): Six Cases (2000 – 2014)

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INTRODUCTION: The Florida panther (*Puma concolor coryi*) is a federally protected animal at risk of extinction. The objectives of this study were to describe the outcomes in free-ranging Florida panthers that underwent appendicular long bone fracture stabilization, evaluating methods of fixation, complications and long-term functional outcomes.

MATERIALS & METHODS: Florida panthers that underwent open reduction and appendicular long bone fracture stabilization at the University of Florida Small Animal Hospital between 2000 and 2014 were evaluated. The pre-operative status, surgical intervention, post-operative convalescence and complications, progression of the fracture toward union, and documentation of the panthers' release into the wild were reviewed.

RESULTS: Six panthers between 6 months – 4.5 years of age, weighing 20 – 70 kg were evaluated. There were three femoral fractures, one tibial and fibular fracture, and two radial and ulnar fractures. All fractures involved the diaphysis, two of which were open, and four closed. Five panthers survived the initial post-operative period and became sound on the operated limb. Fixation failure occurred in two cases necessitating revision surgery. One panther died two days following surgery due to pulmonary complications. Time to radiographic union of remaining fractures ranged from 8 – 36 weeks. The panthers were rehabilitated for 7 – 14 months before release into the wild.

DISCUSSION/CONCLUSION: Acute catastrophic failure of initial stabilization in two panthers exemplified the substantial mechanical demands imposed on implants. Orthogonal plating was performed in two femoral fractures and both the radius and ulna were plated in two antebrachial fractures providing successful outcomes.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

65 Perioperative and Long-Term Outcomes Following Plate Stabilization to Address Spontaneous Luxation of the Long Digital Extensor Tendon of Origin in Two Dogs

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INTRODUCTION: The long digital extensor (LDE) muscle originates in the extensor fossa on the lateral femoral condyle and the tendon is maintained in the sulcus extensorius on the proximal tibia by a restraining band of fibrous tissue. Spontaneous luxation of the LDE tendon of origin is an uncommon cause of pelvic limb lameness in dogs. This report describes the clinical abnormalities, surgical management utilizing plate stabilization and functional outcomes of two dogs ascribed to spontaneous luxation of the LDE tendon of origin.

MATERIALS & METHODS: Reduction of the luxation LDE tendon of origin was maintained using plate stabilization. Perioperative (surgery-12

weeks) follow-up was conducted with examination and radiographs. Long-term follow-up (>12 months) consisted of examination, force plate analysis, radiographs, goniometry and limb circumference measurements.

RESULTS: Luxation of the LDE tendon of origin was palpable in both dogs and confirmed intraoperatively; the restraining retinacular fibrous band could not be identified. Following groove sulcoplasty, a plate was contoured to bridge the sulcus. Both dogs had mild lameness 2 weeks post-operatively, but the luxation resolved. Lameness and recurrence of luxation was not present 4, 8 and 12 weeks post-operatively or on long-term follow-up (5 years) for dog #1.

DISCUSSION/CONCLUSION: Reduction of the LDE tendon of origin using plate stabilization is an effective technique. No recurrence of luxation or lameness occurred. Clinical outcomes were considered excellent in both dogs with direct long-term documentation of acceptable limb function in dog #1.

ACKNOWLEDGMENTS: Supported by discretionary funds from the UF Collaborative Orthopaedics and Biomechanics Laboratory.

66 Clinical and Radiographic Outcomes of Cortical Allograft Demineralized Bone Fibers for Fracture Management in Dogs

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INTRODUCTION: This prospective clinical case series evaluated the efficacy of Demineralized Bone Fibers (DBF™) (Vet Fiber Matrix™ K-9, TheraCell-Vet, Inc., Littleton, MA), a novel form of allogenic demineralized bone matrix, in promoting osseous union in dogs.

MATERIALS & METHODS: Dogs with high potential for delayed- or non-union received DBF™ at the time of fracture repair or corrective osteotomy. Dogs were required to return for monthly rechecks including repeat radiographs until radiographic union was documented.

RESULTS: DBF™ was used in 20 dogs but only 12 met our inclusion criteria: three dogs were euthanized for reasons unrelated to the study and five dogs did not return for follow-up evaluations. Two dogs had bilateral radial and ulnar fractures. DBF™ was used in 14 sites involving the radius/ulna (n = 8), tibia/fibula (n = 3), femur (n = 2), mandible (n = 1). There were seven acute fractures, three fracture revisions, and four angular limb deformities. Twelve cases achieved radiographic union by 1 month (n = 3), 2 months (n = 7), and 4 months (n = 2) post-operatively. One site had delayed union, healing at 6 months, while the other case experienced a non-union. Mean and median time to radiographic union was 2.4 months and 2 months, respectively.

DISCUSSION/CONCLUSION: Results are encouraging, although limited by the small sample size. The graft was convenient to use and had excellent handling characteristics. No adverse events were attributable to the use of DBF™.

ACKNOWLEDGEMENT: Drs. Kim and Lewis are members of the scientific review board for TheraCell-VET, Inc. which manufactures and distributes DBF™

67 Clinical Performance of Surface Modified Allograft Matrix with BMP-like Osteoinductivity

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INTRODUCTION: Engineered grafts with enhanced osteoinductive features, such as rhBMP-2, are an integral part of orthopedic surgery. Currently rhBMP-2 can migrate from the implantation site resulting dangerous side effects. This study evaluates an allograft surface treated with osteoinductive



growth factors bound to the graft surface enhancing healing and preventing migration, this product is called Fortigen™.

MATERIALS & METHODS: Osteoinductivity (OI) was measured using an Alkaline Phosphatase Assay. Cell viability studies were performed to assess adverse effect on cell survival. Studies were done to show cellular response localized to the device. The clinical performance evaluated in challenging compassionate use cases, both dental (13) and orthopedic (23).

RESULTS: Fortigen™ had significantly higher OI compared to negative controls (p-values=0.000; n=3) and similar to the positive control cultures (p-value=0.102 at a non-inferiority margin of 15%; n=3). These surface modifications result in substantial increases in OI in-vitro comparable to rhBMP-2. Radiographic success was seen in all dental cases. Median time to radiographic healing: 8 weeks (average 11.4±5.95). Radiographic data demonstrated successful healing in 17 of 23 orthopedic cases. Evidence of new bone formation was seen as early as two weeks. Median time to radiographic healing: 12 weeks (average 10.6±4.6). Outcomes comparable to the historical data seen with rhBMP-2 in similar cases and no device-related adverse events were reported.

DISCUSSION/CONCLUSION: This technology provides a potent and safe alternative to rhBMP-2. The data demonstrated an excellent safety and effectiveness profile despite the challenging study population.

ACKNOWLEDGEMENT: Study funded by Progenica Therapeutics and Veterinary Transplant Services.

68 The Effect of Cyclic Axial Loading on Fixation Wire Tension in Single Ring Circular External Skeletal Fixator Constructs

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INTRODUCTION: The objective of this study was to evaluate the effects of repetitive cyclic axial loading on residual wire tension in single ring circular fixator constructs. We hypothesized that there would be a significant decrease in wire tension in constructs subjected to cyclically loaded and that the majority of the drop in tension would occur during the initial loading cycles.

MATERIALS & METHODS: Five single 84 mm ring constructs with two 1.6 mm olive fixation wires were subjected to cyclical axial load of 200 N over 22,000 cycles. Wire strain values were recorded and analyzed to derive the mean percent of tension lost in the fixation wires over time.

RESULTS: The mean decrease in strain was 22.6% in the proximal wire and 7.5% in the distal wire after 22,000 cycles of loading. The majority of the decrease in wire tension occurred during the first 3,500 cycles (2 hours) of loading. Mean displacement at maximum load increased by 19% after 22,000 cycles than the displacement recorded during initial cycle of loading.

DISCUSSION/CONCLUSION: This reduction in wire tension was ascribed to slippage of the wires in the fixation bolts which secure the wires to the ring. An equation was developed, based on our data that would predict the potential decrease in wire tension (percentage) in a circular construct over time.

ACKNOWLEDGEMENT: Supported by IMEX Veterinary, Inc., Longview, TX and the UF Comparative Orthopaedics and Biomechanics Laboratory.

69 Effect of Fixation Method on Postoperative Complication Rates after Surgical Stabilization of Supracondylar and Bicondylar Humeral Fractures in Dogs and Cats

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INTRODUCTION: Supracondylar and bicondylar distal humeral fractures are uncommon in dogs and cats but can be associated with high post-operative complication rates. Our objective was to compare the post-operative

complication rate between fixation methods following internal fixation of bicondylar and supracondylar distal humeral fractures in dogs and cats.

MATERIALS & METHODS: 30 bicondylar and supracondylar fractures in 29 dogs and cats treated by internal fixation at a single specialty referral practice between Jan 2010 – Sept 2016 were retrospectively reviewed. Data recorded included signalment, fracture classification, method of fixation, and post-operative complications.

RESULTS: The total complication rate was 68.9%, with 5 patients (17.2%) suffering major complications. There was no significant difference in major complication rates between fixation methods. The highest complication rate (81.8%) was seen in fractures repaired with pins and a transcondylar-screw; however, the majority of these complications was minor and was mostly attributed to pin migration.

DISCUSSION/CONCLUSION: There were significantly more complications for fractures repaired with pins and a transcondylar screw than for other fixation methods. Most of these complications were minor and were mostly related to k-wire migration, which may be due to some ongoing fracture instability following fixation. For bicondylar and supracondylar fractures, the addition of an ESF or plate may increase the stability of the repair and lead to less complications overall.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

70 Non-Resectable Multilobular Tumor of Bone – 4 Cases Managed with Surgery and Novel Autologous Tumor Vaccine

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Multilobular tumor of bone (MTB) is an uncommon bone tumor frequently affecting the skull and less commonly the ribs or pelvis of dogs. These neoplasms are slow growing, locally invasive, and have the potential to compress/invade adjacent soft tissue structures. 6 cases of MTB, 3 located in non-resectable area of the skull, 1 each involved the sacrum, carpus and ischium, were managed for 6–46 months with multiple surgical procedures (3) an adjunctive autologous tumor vaccine (4) and application and administration of lysozyme and lactoferrin (1). Radiographs and CT evaluation demonstrated dense radiopaque masses, of the palatine bone, frontal sinus, sacrum, frontal/parietal bones. Histologically, the tumors were characterized by multiple lobules containing osteoid and cartilage, separated by a net of fibrous septae. This neoplastic pattern was consistent with Multilobular tumor of bone and based on clinical, radiographical, gross and microscopic findings the definitive diagnoses in all cases were made. All tumors were located in areas that precluded wide excision without unacceptable risk of significant morbidity or mortality. Aggressive tumor debulking was completed in all cases. Revision surgery was completed in 2 cases. Autologous vaccine production/administration (VetiVax) was utilized was completed in 2 cases and the use of lysozyme and lactoferrin intra-operative was utilized in one case.

ACKNOWLEDGEMENT: Dr. Dew is a principal of Torigen Pharmaceuticals producing VetiVax an autologous tumor vaccine.

71 Autogenous Cancer Immunotherapy. A Case Series Evaluating Safety and Preliminary Efficacy of a Novel, Tumor-Derived Anti-Cancer Vaccine

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INTRODUCTION: Immunotherapy based cancer treatment may complement surgery, radiation therapy and chemotherapy by generating specific adaptive immunity to tumor altered host tissue. Tissue vaccines produced di-



rectly from harvested tumor include an enormous menu of antigen targets optimizing potential immune-based tumor attack.

MATERIALS & METHODS: Seventy eight cases were evaluated for safety and preliminary efficacy. An immunotherapy preparation (VetiVax™, Torigen Pharmaceuticals Inc) was prepared from unfixed tumor and given subcutaneously to the animal in three weekly doses. A standardized safety scoring system was used (VCOG-CTCAE).

RESULTS: Fifty three of the 78 animals were observed through the full 3-month follow up period while the other 25 were followed through varying time points past the first injection. A total of five (5) adverse events occurred in three (3) animals (3.8%, 3/78). They included administration site warmth/erythema (2.6%, Grade 1, product related) and lethargy/fatigue (3.8%, Grade 1, possibly product related). All resolved without treatment. No clinically apparent autoimmune responses were observed.

DISCUSSION/CONCLUSION: Preliminary efficacy in animals completing 3-month follow showed 55% exceeded published mean survival time and a 78% survival rate. Enrollment in the post-market registry is continuing focusing on carcinomas where 62% exceeded published mean survival time.

The immunotherapy used in this case series has demonstrated safety and has shown an encouraging preliminary efficacy signal when used in combination with surgical resection alone. These results warrant further clinical investigation and combinatorial treatment approaches.

ACKNOWLEDGEMENT: All authors are principals in Torigen Pharmaceuticals, producers of VetiVax Autologous tumor vaccine. Funding was provided by Irish Innovation Fund and by authors

72 Sub-Bandage Pressure after Rigid Splint Application By Surgeons and 4th Year Veterinary Students

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INTRODUCTION: Splints and bandages are commonly used. It is difficult to teach inexperienced individuals the ideal pressure to apply a splint bandage, as it is subjective. The objective of this study was to identify sub-bandage pressures after a forelimb rigid splint was applied by experienced and inexperienced people.

MATERIALS & METHODS: Surgeons and 4th year veterinary students placed a rigid splint bandage on the right forelimb of a dog. A variety of bandage material was available. A pneumatic pressure device and transducers were used to measure sub-bandage pressure. Transducers were placed in 5 locations on the limb. Following bandage application, pressures were recorded at: 0, 1, 2, 3 and 4 hours. The bandage was removed after hour 4.

RESULTS: For surgeons, pressure decreased at early time points and then leveled off. For students, pressure remained the same over time. Pressure was significantly decreased at location 3 (accessory carpal bone pad) compared to the remaining 4 locations. At all transducer locations and all time points, the pressure from surgeon bandages was significantly greater than that from student bandages. There was a large range in sub-bandage pressures for both experienced and inexperienced people.

DISCUSSION/CONCLUSION: Inexperienced people apply a rigid splint looser than those with experience. We are uncertain if this decreased bandage pressure predisposes to a greater risk of complications. We found the technique described easy to use and plan to use the mean of the surgeon data for future student bandage teaching laboratories using the pneumatic pressure device.

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73 Translation of Activity Monitoring in Normal Dogs Towards Distance Travelled

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INTRODUCTION: There is a need for an improved outcome measure for dogs with disease that affects activity at home in order to accurately assess interventions. The Actical accelerometer has been previously validated as an activity monitor for dogs but has several limitations. The objective of this study was to explore mathematical models that explain the relationship between independent (dog size and activity rigor) and dependent (activity monitor output) variables.

MATERIALS & METHODS: Ten Labrador Retrievers and ten Beagles belonging to clients, staff, and students were prospectively enrolled to perform four activities in random order consisting of: walking/trotting on a treadmill at 1m/s, 1.5m/s, and 2m/s for a total distance of one kilometer at each speed, and trotting up and down 2 flights of stairs twice (168 steps total). Dogs wore both activity monitors (Actical, Omron) simultaneously, and data was collected from both devices.

RESULTS: There was no clinically relevant relationship between pedometer steps and activity counts ($R^2=0.02$). Dog size and treadmill velocity were significantly associated with pedometer steps and activity counts. The strongest statistical relationships were identified when mean dog stance length, treadmill velocity and mean pedometer steps ($R^2=0.70$) or mean activity counts ($R^2=0.78$) were evaluated.

DISCUSSION/CONCLUSION: Dog size and activity rigor significantly influence data reported by the pedometer and accelerometer tested. A mathematical model to estimate distance traveled in the individual looks promising and would be helpful translating statistical differences to clinical differences.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

74 Evaluation of the Efficacy of Bupivacaine Liposome Injectable Suspension As a Sole Therapy to Provide Postoperative Analgesia Following Hip Surgery in Dogs

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INTRODUCTION: This study was designed to evaluate the efficacy of tissue infiltration with bupivacaine liposome injectable suspension as sole postoperative analgesia therapy for a 72-hour period after hip surgery in dogs as assessed by a validated, categorical pain scale.

MATERIALS & METHODS: All patients received a short acting opioid as a premedication, were induced with propofol and maintained under anesthesia with isoflurane in oxygen; 10 dogs received a continuous rate infusion of fentanyl during surgery. Dogs received total hip replacement (THR) or femoral head and neck ostectomy (FHO) followed by tissue infiltration injection of all surgical layers with bupivacaine liposome injectable suspension (target dose of 5.3 mg/kg) as a sole postoperative analgesic agent. Patients were serially evaluated using the Glasgow Composite Measure Pain Scale – Short Form for 72 hours post injection. Patients with a score ≥ 6 were administered a rescue opioid but continued to be assessed.

RESULTS: Seventeen dogs (10 THR, 7 FHO) were included in the study. Five dogs were rescued a single time. Treatment with bupivacaine liposome injectable suspension was well-tolerated with few adverse events.



DISCUSSION/CONCLUSION: Our results suggest liposome-encapsulated bupivacaine can successfully provide postoperative analgesia after hip surgery in dogs for 72 hours. The investigators' impression is that in the cases requiring rescue analgesia, appropriate tissue distribution was not obtained during tissue infiltration with bupivacaine liposome injectable suspension.

ACKNOWLEDGEMENT: This study was funded by Aratana Therapeutics. Three co-authors are paid consultants for Aratana Therapeutics (CH, SA, AJ); two are employees of Aratana Therapeutics (JW & LR).

75 Implantable Mechanisms for Orthopedic Surgery: Validation Using Biomechanical Simulation and Cadaver Study in Chicken Foot

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INTRODUCTION: This paper seeks to validate the chicken foot extensor mechanism as a model for a tendon-transfer surgery that uses implantable passive mechanisms inserted between tendons to improve post-surgery differential action between digits. The chicken extensor mechanism is similar to the human hand flexor mechanism after the current surgery. Specifically, in both systems, multiple finger tendons are pulled by one muscle. This paper presents results from both a biomechanical simulation and a chicken-foot cadaver study that quantifies the advantage of using the implant-based procedure.

MATERIALS & METHODS: The chicken extensor mechanism, passive implant, and its movement is modeled in MATLAB as a spring system. The difference in the toe movement with and without the implant is reported as the differential action enabled by the implanted mechanism.

The same two conditions were studied in the cadaver study. N=6 chickens were used in each group. Motion-capture cameras were used to measure angular travel.

RESULTS: The biomechanical simulation showed 135% improvement in arc length change. In the cadaver study, the implanted mechanism allowed for 109% increase in angular travel of the lateral toe (Angular travel $22.36^\circ \pm 1.36^\circ$ for implanted feet, $10.67^\circ \pm 1.18^\circ$ for natural feet, $p < 0.05$, N=6 feet for each group). The lower percent improvement in the cadaver study can be explained due to friction that was not account for in the simulation.

DISCUSSION/CONCLUSION: The biomechanical simulation and the cadaver study show that the addition of passive implantable mechanism to the tendon network doubles the differential action of the toes when compared with the natural case.

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76 The Effects of Jump Height on Landing Kinetics of the Forelimbs in Agility Dogs

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INTRODUCTION: Dogs competing in agility often injure their forelimb. It is often recommended to decrease a dog's jump height to reduce the impact upon their forelimbs. The aim of this study was to evaluate the kinetics of jump landing on the forelimbs dogs using a single vertical jump. We hypo-

thesized that with greater jump height, there would be a greater force exerted on the forelimbs upon landing.

MATERIALS & METHODS: Ten healthy Border Collies experienced in agility were enrolled. An AKC regulation bar jump was placed over a previously validated pressure sensitive walkway. All dogs completed trials for both standard and preferred height efforts.

RESULTS: There was a trend towards a decrease in peak contact pressure (kPa) and peak force (N) after reducing the jump height when assessing the maximum values obtained for the initial contact limb ($P = 0.059$ and 0.06 , respectively). This decrease was statistically significant when evaluating the average of both forelimbs touching the ground ($P = 0.038$ and 0.044 , respectively).

DISCUSSION/CONCLUSION: The decrease in mean peak contact pressure and mean peak force was equivalent to approximately a 10% decrease in force applied to the forelimbs on landing. It is yet to be determined if a 10% decrease in landing force is clinically relevant. Additional studies will be needed to assess if recommending a decrease in jump height when making return to sport post recovery lessens orthopedic insult to the forelimbs.

ACKNOWLEDGEMENT: None

77 Short Term Complications Associated with TPLO in Giant Breed Dogs Using 3.5mm Locking Broad Plates

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INTRODUCTION: The purpose of this retrospective study is to evaluate the short term complications associated with the Tibial Plateau Leveling Osteotomy (TPLO) in giant breed dogs using the 3.5mm broad plate. We hypothesized that there would be a low rate of complication and that the use of a single 3.5mm broad plate would achieve sufficient stabilization of the osteotomy site.

MATERIALS & METHODS: Dogs were considered giant breed dogs if they weighed >45 kilograms. Medical records, immediate post-operative radiographs and follow up radiographs of 52 giant breed dogs (64 stifles) that underwent a TPLO using a 3.5mm broad plate were retrospectively reviewed to evaluate the short term complications associated with the use of 3.5mm broad TPLO plates in giant breed dogs.

RESULTS: 64 canine stifles were included in this study. 38 stifles went on to heal without any complication. Of the 33 complications in 26 stifles, only 2 (6%) complications were considered major and required surgical intervention. The remainder of the complications were considered minor and included mostly seromas that were resolved with aspiration of the fluid. In all cases, the TPLO osteotomy healed without loosening of the implants.

DISCUSSION/CONCLUSION: The findings of this study suggest that the use of a 3.5mm broad TPLO plate results in appropriate stabilization when used in giant breed dogs. This study also suggests that while the complication rate appears high (41%), the rate of major complications requiring additional surgery is minimal (2%).

ACKNOWLEDGEMENT: No proprietary interest or funding was provided for this project.

78 MRI Diagnosis and Arthroscopic Treatment of Medial Meniscal Injury in a Dog with Minimal Disruption to the CCL

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A 4-year-old neutered male Golden Retriever that participated in competitive agility developed a subtle pelvic limb lameness. Orthopedic and radiographic examinations confirmed the presence of stifle effusion but no stifle



instability could be palpated. Tibial plateau leveling osteotomy was recommended by two board certified surgeons. The owner elected non-surgical management with no improvement noted over 8 months of activity restriction, oral anti-inflammatories, laser therapy, and two platelet-rich plasma injections. Effusion persisted but the stifle remained stable. Magnetic resonance imaging (MRI) was performed and revealed a discrete full thickness longitudinal tear in the caudal meniscotibial ligament of the medial meniscus. Arthroscopic findings confirmed a full thickness tear of the medial meniscus with fraying of less than 5% of the cranial cruciate ligament (CCL). A partial meniscectomy was performed without any surgical treatment of the CCL or surgery to stabilize the stifle. Lameness resolved and the dog returned to competition agility with no limits to his activity. This case study demonstrates that the presence of stifle effusion and medial buttress is not pathognomonic for CCL disease and although rare, clinically relevant meniscal injury is possible in dogs with a palpably stable stifle. In addition, this case shows that MRI can be clinically useful for identifying meniscal injury in stable stifles in which full evaluation by arthroscopy may be problematic. Lastly, arthroscopic treatment of meniscal injury alone, in the absence of notable CCL pathology, can result in clinically relevant improvement without the need for stifle stabilization.

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79 Use of a Novel Extracapsular Bone Anchor System for Stabilization of Cranial Cruciate Ligament Insufficiency

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INTRODUCTION: The purpose of this study was to evaluate the early clinical experience using the novel Ruby system for stabilization of the cranial cruciate ligament deficient stifle in the dog and report short term outcome and complications. Our hypothesis is that the Ruby would demonstrate comparable short term outcome and owner satisfaction to previously reported methods and is a feasible extracapsular technique for treatment of cranial cruciate ligament insufficiency.

MATERIALS & METHODS: Seventeen canine patients with cranial cruciate ligament insufficiency were treated using the Ruby system. Patients were re-evaluated at 6 to 8 weeks post-operatively; minor and major complications were recorded. Subjective lameness assessments on a scale of 0 to 4 were performed pre-operatively and post-operatively. A visual analogue scale for lameness assessment was provided to owners at 6 to 8 months post-operatively.

RESULTS: Mean post-operative lameness was 1.18 (\pm 0.53) out of 4, compared to mean pre-operative lameness was 3.06 (\pm 0.9) out of 4. Owner assessment of lameness at 6 to 8 months post-operatively showed a mean lameness score of 4.10 (\pm 0.23) out of 5, with 1 being the most negative response and 5 being the most positive. Major complications occurred in one dog (5.9%), necessitating surgical intervention.

DISCUSSION/CONCLUSION: The Ruby system is a feasible method of extracapsular stabilization with comparable positive outcomes to previously reported methods. This may provide a cost-effective option for stabilization of the cranial cruciate deficient stifle with a lower complication rate.

ACKNOWLEDGEMENTS: Implants and instrumentation were provided by Kyon Veterinary Surgical Products.

80 Chevron Block Recession for Treatment of Medial Luxating Patellas

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INTRODUCTION: The Chevron Block Recession (CBR) is a minor revision to the Trochlear Block Recession (TBR) that helps prevent osteochondral

block fracture as well as preventing block migration and micromotion of the block. In the treatment of Medial Luxating Patellas (MPL). Although not well documented as complications in a TBR, the author has experienced intraoperative complications of a fractured trochlear ridge and more commonly fracture of the osteochondral block during the completion of the third osteotomy of the TBR.

MATERIALS & METHODS: Chevron Block Recessions were performed on twelve small breed dogs for correction of MPL. Patients were examined at 1 week, 1 month and 2 months postoperatively.

RESULTS: No osteochondral blocks were fractured. No evidence of migration of the chevron block noted on revisions or post-op monitoring. All patients had significant improvement of lameness postoperative.

DISCUSSION/CONCLUSION: The CBR is a safer modification to the traditional TBR and should be considered for further evaluation and studies. The locking mechanism of the CBR could also reduce micromotion of the osteochondral block and decrease pain and inflammation during the healing phase and later the production of osteoarthritis.

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81 Assessment of a Novel Jig Arm for Measurement of Tibial Plateau Angle during Tibial Plateau Levelling Osteotomy

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INTRODUCTION: Despite the abundance of research assessing the tibial plateau leveling osteotomy (TPLO), the method of intraoperative rotational measurement has not been comprehensively investigated. This study's aim was to test a new method of measurement using a novel tibial plateau leveling (TPL) jig arm called the Rotational Osteotomy Measuring Arm (ROMA) and to compare the results to the traditional method. We hypothesized that the ROMA would have similar accuracy to the traditional method in predicting final TPA.

MATERIALS & METHODS: A modified Slocum TPL jig with ROMA was placed on the tibia and a TPLO radial osteotomy was performed on cadaver hindlimbs (n=9). Based on preoperative radiographic TPA measurements, the proximal segment was rotated using the traditional method of marking points on the osteotomy a specified distance apart. After rotation, the predicted TPA was recorded based on the ROMA. Post-operative TPA was measured with radiographs.

RESULTS: The average final TPA achieved using the traditional method was 6.4° (range: 3.0–10.0°). The ROMA predicted a final TPA of 5.8° (range: 3.8–10.1°). No statistically significant difference was found between the accuracy of the traditional method and the ROMA method for predicting final TPA.

DISCUSSION/CONCLUSION: The ROMA may be an alternative to the traditional method of measuring proximal segment rotation during TPLO procedure. Performing a TPLO with the ROMA has potential to accurately predict post-operative TPA while eliminating the need for measuring chord length, making reference marks, or referencing TPA charts for various osteotomy blade sizes.

ACKNOWLEDGEMENT: A provisional patent has been acquired.

82 A Modified Technique for the Treatment of an Excessive Tibial Plateau Angle Utilizing a TPLO Plate and ALPS (Advanced Locking Plate System)

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OBJECTIVE: To describe a modified and simplified orthopedic approach for treatment of excessive tibial plateau angles by incorporating previously de-



scribe tibial plateau leveling osteotomy in combination with a cranial closing wedge osteotomy technique.

STUDY DESIGN: Case report

RESULTS: No complications were encountered intraoperatively. The plateau slope of 37 degrees was corrected with the combination of 25 degree TPLO and a 12 degree CCWO for a corrected tibial plateau slope of 5 degrees. Radiographs performed 1 month post-surgery revealed an almost completely healed osteotomy; with 2 months showing evidence of complete healing. Two months post-surgical intervention of the right limb; the left limb was addressed in the same fashion.

DISCUSSION: The advantages of the proposed technique include the following: 1) Alignment was constantly maintained during the CCWO. This was done by i) utilizing the preplaced TPLO jig for axial guide and stability and ii) leaving the blades in after the partial osteotomies were made. 2) For the CCWO only 2 complete osteotomies were created resulting in only two fragments having to be manipulated during the manual compression of the osteotomies. This resulted in constantly maintained alignment of the osteotomy fragments. Given the systematic approach the technique is repeatable with assured results. This notion is supported with comparing the preoperative planning done with the final results achieved. The measurements made on preoperative planning reflected the end results achieved.

ACKNOWLEDGEMENT: None.

83 Meniscal Click in Cranial Cruciate Deficient Stifles As a Predictor of Specific Meniscal Pathology

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INTRODUCTION: Cranial cruciate ligament disruption is a common orthopedic disease in dogs and often leads to meniscal damage. Undiagnosed or postliminary meniscal disease precludes successful treatment outcomes, despite appropriate stifle stabilization. Meniscal click has been tested as a predictor for presence of medial meniscal tears. We hypothesized that an audible or palpable click would be more accurate for predicting bucket handle meniscal tears than other tear morphologies.

MATERIALS & METHODS: All dogs presenting for stifle arthroscopy with clinical signs consistent with cranial cruciate ligament deficiency were enrolled. All stifles (n=65) underwent a standard examination for meniscal click before anesthesia (EBA) and during anesthesia (EDA). Presence or absence of a meniscal tear and diagnosis of tear morphology was confirmed with routine arthroscopic examination.

RESULTS: Positive meniscal click on EBA and EDA was significantly associated with the presence of a bucket handle meniscal tear ($P = <0.0001$ and $P = 0.0038$, respectively) but was not significantly associated with the presence of a non-bucket handle meniscal tear ($P = 0.50$ and $P = 0.51$, respectively).

DISCUSSION/CONCLUSION: These pilot data demonstrate that meniscal click is more likely to indicate the presence of bucket handle medial meniscal tear morphology than non-bucket handle tear morphology. The high specificity of meniscal click for all meniscal tears supports the results of previous studies. The findings of this study support existing evidence that surgical examination of the meniscus, ideally with arthroscopy, is necessary in order to accurately diagnose meniscal disease.

ACKNOWLEDGEMENT: There was no proprietary interest or funding provided for this project.

84 The Effect of Radiographic Femoral Positioning on the Measurement of Post-Operative Subsidence in Total Hip Replacements

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INTRODUCTION: Femoral stem subsidence is a complication of total hip replacements with potentially catastrophic consequences. Inherent radiographic positional variations of the femur cause measured subsidence to differ significantly from true subsidence. We hypothesize that variations in femoral angle relative to the radiographic cassette in the ventro-dorsal projection affect the measured subsidence of an implanted femoral stem. Also, artifactual errors in subsidence measurements where femoral angle varies between radiographs can be corrected using femoral stem length.

MATERIALS & METHODS: A biological fixation universal hip (BFX) femoral stem was fitted into a Sawbones' femur, and placed into a custom Plexiglas frame. Radiographs were obtained with the femur positioned parallel to the radiographic cassette, then at 10° increments of angulation. The femoral stem was then subsided at both 5mm and 10mm and radiographed through the same angles. Subsidence and femoral stem length were measured. Femoral angle was confirmed and artifactual subsidence measurements were corrected using a trigonometric calculation.

RESULTS: Femoral angle caused significant variability in femoral stem length and subsidence measurements. Greater femoral angles were associated with smaller femoral stem and subsidence measurements. Femoral angle and true subsidence was accurately calculated using changes in femoral stem length.

DISCUSSION/CONCLUSION: Uncontrolled variables between immediate post-operative and follow-up radiographs can cause significant changes to femoral angle. Variations to femoral angle caused artifactual changes to subsidence measurements, and the proposed formula was effective in correcting these changes using femoral stem length, confirming our hypotheses. Limitations are those inherent to an ex vivo study. Further in vivo studies are recommended.

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85 Influence of rhBMP-2 on Canine Adipose Derived Mesenchymal Stem Cells and Canine and Human Osteosarcoma Cells

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INTRODUCTION: Bone morphogenetic Proteins (BMPs) may be useful in situations where rapid bone healing is desirable following limb salvage. As with any biologic, the efficacy of an agent known to induce bone proliferation and the safety of its use in a setting where osteosarcoma may remain must be understood. We endeavored to explore the effects of rhBMP-2 at various concentrations on canine primary, metastatic, and human primary osteosarcoma cell lines as well as on canine adipose-derived mesenchymal stem cells (AdMSCs).

MATERIALS & METHODS: Mesenchymal stem cells derived from canine adipose tissue (AdMSCs), two canine and one human osteosarcoma cell lines (D17, Abrams, and SAOS respectively) were used for this study. Osteosarcoma cell lines and AdMSCs were separately cultured in 96 well plates. rhBMP-2 was added at increasing concentrations (10 ng/ml, 50 ng/ml, 100 ng/ml, 200 ng/ml, 400 ng/ml) to each cell line (1×10^3 cells/well). Proliferation or inhibition of growth was measured via Incucyte (Essen BioScience) over 120 hours. All experiments were performed in triplicate.

RESULTS: Concentrations of 100, 200, and 400 ng/ml rhBMP-2 were inhibitory to all Osteosarcoma (OSA) cell lines tested. At all concentrations tested, rhBMP-2 had a proliferative effect on AdMSC growth. The greatest proliferative effect was observed at 100 ng/ml.



DISCUSSION/CONCLUSION: These results suggest rhBMP-2 has an inhibitory effect on both canine and human osteosarcoma cell lines in low concentrations but has a proliferative effect on canine adipose derived mesenchymal stem cells in similar concentrations.

ACKNOWLEDGEMENT: Funded by Laboratory of Comparative Musculoskeletal Oncology and Traumatology and the Colorado State University Honors Program.

86 Synovial Fluid Cytokine Concentrations and Limb Function in Normal Dogs and in Dogs with Lameness from Spontaneous Osteoarthritis

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INTRODUCTION: Establishing patient specific outcomes in dogs to document severity of joint inflammation and pain at one or several times remains challenging. Cytokines responsible for inflammation and pain are present in synovial fluid and are available as biomarkers for OA. The objective of this study was to evaluate relationships between synovial fluid cytokine concentrations (substance P, bradykinin, MMPs, TIMPs, interleukins, TNF- α and severity of patient lameness in normal and abnormal dogs.

MATERIALS & METHODS: Normal dogs were free of orthopedic disease based on physical examination, radiographs and gait analysis (no asymmetry). Dogs with OA were enrolled if they had a history of lameness, abnormal physical exam, radiographic evidence of OA and abnormal gait analysis (limb asymmetry \geq 6%). Synovial fluid cytokines were measured using previously validated methods.

RESULTS: 12 normal and 26 OA affected dogs have been enrolled. In dogs with OA substance P, IL-6, IL-8, TNF- α , MMP-1 and TIMP-1 were significantly elevated; bradykinin and TIMP-4 were significantly decreased. Correlations between cytokines and degree of limb asymmetry were weak.

DISCUSSION/CONCLUSION: Increased concentration in synovial fluid cytokines from dogs with OA further validates consideration of these cytokines as markers to confirm a diagnosis of OA. Disease chronicity in the study population likely influenced the finding of decreased bradykinin concentrations. We found no relevant association between synovial cytokines and severity of lameness. While cytokine concentrations may not predict severity of limb lameness, we cannot conclude that cytokine concentrations will not indicate change in lameness over time (e.g. after an intervention).

ACKNOWLEDGEMENT: None.

87 The Effect of Platelet-Rich Plasma on Osseous Healing in Dogs Treated with Tibial Plateau Leveling Osteotomy

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INTRODUCTION: PRP has been investigated for its potential to improve osseous healing but results have been mixed. Our objective was to assess the efficacy of a well-characterized PRP for enhancement of osseous union in dogs treated with TPLO.

MATERIALS & METHODS: Sixty dogs treated with TPLO were randomly assigned to have an activated PRP gel or saline placed in the osteotomy at the time of surgery. All TPLOs were performed by one surgeon and all aspects of the surgery and post-operative care were consistent for all dogs. Healing was assessed post-operatively at 4, 7, and 10 weeks using radiography by a radiologist blinded to group allocation. Scoring of radiographs was performed

using both 5-point scale and 12-point scales. Potential differences in ages, weights, and genders between the PRP and control groups were evaluated using a T-test. The effect of treatment was assessed using a repeated measures analysis with both the 5-point and 12-point radiographic scoring scales.

RESULTS: There were no significant differences in age, body weight, or gender distribution between the PRP and control groups. Both time (4, 7, 10 weeks; $p < 0.0001$) and age ($p < 0.001$) were significant predictors of radiographic healing while body weight, gender, and treatment group all failed to have a significant effect ($p > 0.05$) on radiographic assessment of healing using either the 5-point or 12-point radiographic scoring systems.

DISCUSSION/CONCLUSION: The data generated indicate that use of this PRP does not speed osseous union with TPLO.

ACKNOWLEDGEMENT: AO Foundation for funding and Arthrex Vet Systems for equipment support. LR,FG,EK,LR,KH for technical assistance.

88 Medial Buttress as a Surrogate for Chondropenia in Canine Osteoarthritis

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INTRODUCTION: In this experimental model the hypothesis was that the degree of medial joint enlargement predicted the extent of cartilage loss, and this finding could be used to stratify dogs entering osteoarthritis trials.

MATERIALS & METHODS: This was a 100 day long study using 15 Foxhound type purpose bred dogs that underwent unilateral arthroscopic medial meniscotibial ligament release. Weekly lameness and physical assessments were done including palpation of the stifle joints for localized heat, effusion and enlargement. Medial buttress development was scored from 0 (normal) to 3 (severe). At the end of the study all dogs were euthanized and the stifle joints underwent microCT imaging and bone morphometry was conducted. A macroscopic assessment included scoring of osteophytes, erosions and India ink staining of the cartilage surfaces.

RESULTS: All but one dog developed an enlarged medial joint line. Of the remaining 14 medial buttress development was mild in five dogs, moderate in seven and severe in two. Cartilage erosions were present on the medial femoral condyle and tibial plateau surfaces of the operated limb. The degree of medial buttress development had a moderately good correlation with eroded cartilage area in the tibia ($r = 0.47$, $p < 0.07$); however, bone sclerosis measured by tissue mineral density (mg/cc) had an even stronger association with cartilage loss (correlation coefficient $r = 0.44$, $p < 0.02$).

DISCUSSION/CONCLUSION: While clinical assessment can be used to prognosticate in chronic OA, early OA is more difficult to stage. Stratification of dogs entering OA trials might be possible on the basis of bone sclerosis.

ACKNOWLEDGEMENT: Bruna Harada was supported by a Brazil-Canada student exchange program. The data reported here are a subset of results obtained in a study sponsored by Merial, Inc. We thank Dr. Sylvester Price for allowing access to these data.

89 Allogeneic Stem Cell Therapy and Joint Irrigation as an Intra-articular Adjuvant Therapy for Canine Osteoarthritis: A Safety and Efficacy Assessment

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INTRODUCTION: Allogeneic adipose derived stromal cells (ASCs) provide advantages over autologous ASCs for osteoarthritis. Objectives were assessing safety and efficacy of intra-articular allogeneic ASCs with joint irri-



gation. We hypothesize that if allogeneic ASC therapy is safe and effective, then treated dogs will show measurable clinical improvements with lack of increased adverse events.

MATERIALS & METHODS: 40 client-owned dogs with OA were recruited into this randomized, double-blinded, placebo controlled study. Dogs had force platform gait analysis at time 0, 6 and 12 weeks with intra-articular injections and irrigation at 0 and 6 weeks. The asymmetry index of the affected limb compared to the contralateral limb was calculated for peak vertical force (PVF) and vertical impulse (VI).

RESULTS: 34 dogs completed the study. Only two dogs withdrew for reasons related to the study: development of hematoma at the injection site and hypotension secondary to sedation. There were no reports of adverse events correlated with administration of allogeneic ASCs. Both groups had improvement of asymmetry indices. VI asymmetry of the placebo group was statistically improved ($p < 0.01$) compared to the ASC. The PVF and VI asymmetry indices were statistically improved ($p < 0.05$) in the placebo group between enrollment and all time points.

DISCUSSION/CONCLUSION: No adverse events correlated to ASC injections were encountered. Improvement may be associated with ASCs or irrigation of the joint. Investigation of joint irrigation warrants further investigation.

ACKNOWLEDGEMENT: The authors would like to thank Morris Animal Foundation for funding this study.

90 Bilateral C3-C4 Carpal Coalition Associated with Prematurity in a Neonatal Foal

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A premature filly was presented on the day of birth for treatment. The foal was unable to stand, due to tendon laxity and angular limb deformities. Over several days, the foal's condition stabilized; however, the foal was not able to ambulate without assistance.

Radiographs of both carpal joints showed normal ossification centers and no overt delayed ossification. Both carpal joints showed dramatic hyperextension, however. The foal's forelimbs were splinted and the filly was able to stand and walk with this support. The foal was euthanized 8 days after admission, due to severe persistent forelimb hyperextension.

At necropsy, the proximal articular surfaces of the third and fourth carpal bones were fused. The palmar intercarpal and carpometacarpal ligaments were also longer and less poorly defined. Transverse sections of the C3-C4 interface showed complete osseous fusion of the carpal bones proximally, with a partial cartilaginous septum more distally.

'Carpal coalition' refers to congenital carpal bone fusion in people. This condition usually involves the lunate and triquetrum bones in the proximal carpal row. This filly presented with a range of musculoskeletal problems, with the flexor tendon laxity and carpal hyperextension being most prominent. Failure of C3-C4 separation and overall dysfunction of the carpal joints indicate significant dysgenesis of the carpal bones. Joint specification and cuboidal bone development are primarily controlled by Bone Morphogenetic Protein (BMP) and Wnt signaling pathways. It is likely that this foal carried a BMP-linked mutation.

ACKNOWLEDGMENT: There were no proprietary interests, conflicts or funding for this project.

BVOA Autumn meetings 2017

“Introduction to fracture management using external skeletal fixation”

Pre conference CPD day
Date: 21st September 2017

BVOA are pleased to present a whole day combined lecture and practical (synbone) CPD event for veterinary surgeons who are interested in learning about using external skeletal fixation for the management of some common limb fractures in the dog and cat. Taught by RCVS specialists, Diplomates and AVP's, this course will run the day before the BVOA Autumn Scientific Meeting in Edinburgh. The event, heavily subsidised by BVOA and kindly sponsored

by Freelance Surgical offers high quality and practical CPD at a very affordable cost. Delegate numbers will be limited to maintain a high delegate / tutor ratio in the practical sessions and early booking is advised.

Whole day cost including lunch is £150

“Musculoskeletal oncology”

Main meeting
22–24th September 2017

Speakers: Sarah Boston, Jon Bray, David Killick, Gary Clayton-Jones, Andrew Parry, Michael Parry (human speaker)

A stimulating weekend in prospect covering many aspects of oncology affecting our orthopaedic patients. The latest understanding and treatment options of this expanding field will be discussed.

Michael Parry will give us an insight from the human world – always fascinating.

The social events include a visit to Edinburgh castle and a gala dinner at “Hub” in the city centre.

Venue for both meetings: The Grosvenor Hilton Hotel, Edinburgh EH12 5EF

Further details of both meetings are on: <http://www.bsavaportal.com/bvoa/Meetings/BVOAMeetings.aspx>

Text from BVOA

AOVET

AOVET Expands into Eastern Europe



Günter Schwarz

Broadening the global network of veterinary orthopedic surgeons is key to AOVET's success. With this, the first “Principles in Small Animal Fracture Management Course” will be hosted in Budapest, Hungary, from September 29–October 1, 2017. This course is the first of many events to be held on a regular basis in the Eastern European region going forward.

In line with AOVET's mission is to advance the practice of veterinary surgery of

the musculoskeletal system, the AOVET courses teach many principles and advanced techniques covering fracture management. Highly-experienced faculty members present the AO principles through lectures, while interactive small group discussions, and practical sessions enable the participants to apply their learning in clinical situations, and become familiar with veterinary surgery involving the musculoskeletal system. The

courses also provide the opportunity to network, share best practices, and develop one's career in veterinary orthopedics.

According to Dr. Günter Schwarz, Diplomate ECVS, “AOVET responded to the educational needs in the region by organizing the Budapest course in collaboration with 16 local and regional societies. This alliance establishes the basis for future coverage in the