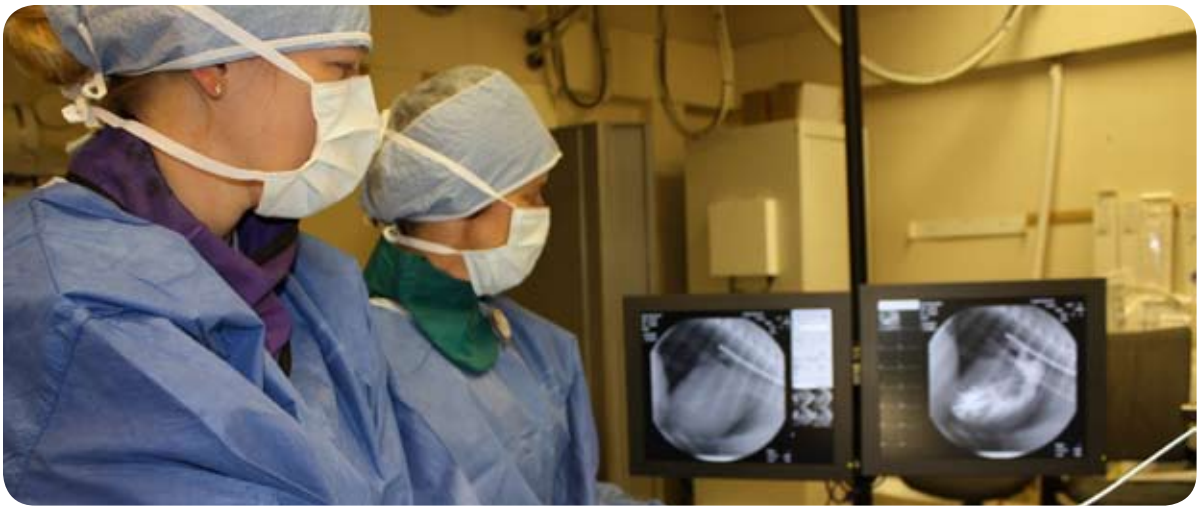
angell® partners in care

Veterinary Referral News from Angell Animal Medical Center

Summer 2010
Volume 4:2



↖ Dr. Rebecca Quinn and Dr. Nancy Laste of Angell's Cardiology service.

Interventional Cardiology

by Nancy J. Laste,
DVM, DACVIM (Cardiology)

WHAT IS INTERVENTIONAL CARDIOLOGY?

As the name would imply, interventional cardiology refers to that subset of cardiology patients who are having some type of surgical procedure. Although this would include all patients having any type of open thoracic surgery, thorascopic surgery or catheter-based surgery, it is most typically the term used to describe interventions performed in the cardiac catheterization laboratory.

WHAT EXACTLY IS A CARDIAC CATHETERIZATION?

Cardiac catheterizations were commonly performed on veterinary patients with either congenital or acquired cardiac disease prior to the development of cardiac ultrasound. While echocardiography has abolished the need for routine catheterization, cardiac catheterization remains an important diagnostic test in patients with complex congenital disease. Although it can bring important information to any patient with cardiac disease, cardiac catheterization is now generally reserved for those patients who will have a therapeutic intervention of some sort (balloon catheterization, PDA closure, etc.).

The advances in pediatric equipment and the continued development of minimally invasive, catheter-based techniques in the past 10 years have led to greater success in a wider scope of patients with congenital heart disease than ever before.

Cardiac catheterization is performed under general anesthesia. In patients 10 kg or larger, catheter introducers are placed in the femoral artery/vein or both vessels. (In smaller animals, the jugular vein and/or carotid artery may need to be used.) Catheter introducers allow easy exchange of different catheter types through the vessels and

> Continued on Page 6

Inside

Courtesy Consultations

We encourage our referring veterinary partners to call or e-mail our Angell specialists to consult on difficult cases.

Angell specialists are available for consultation Monday–Friday 9:00 a.m.–5:00 p.m.

Additionally, Angell emergency doctors are available for consultation on weekends and after hours (7:00 a.m.–11:00 p.m.).

Please see the back cover of this newsletter for full contact information.

Clinical Trial: Head Trauma in Dogs

Dear Doctors,

The Angell Animal Medical Center Emergency and Critical Care service is participating in a multi-institutional (seven participating centers), IACUC-approved, clinical trial funded by Cornell University (ACVIM and Emergency Critical Care Society grants) to further understand factors affecting outcome in dogs with head trauma. Head trauma is a common emergency in dogs and there are limited veterinary studies on this topic. We are evaluating blood glucose (sugar) concentrations and other values in dogs presenting to the hospital after experiencing head trauma. Prognosis in these cases can be very difficult to predict, and the results of this study may allow us to better inform clients whose pets sustain head trauma about their pets' likelihood of recovery. After identification and determining the significance of the biomarkers, the hope would be to identify new therapeutic targets for these patients.

Megan Whelan, DVM, DACVECC

Dr. Whelan is leading Angell's participation in this clinical trial.

This is a prospective, observational study. Specifically, the purpose of the study is to determine the prognostic significance of the following biomarkers (blood glucose, cardiac troponin I, blood pH, sodium and hemoglobin) in patients with moderate/severe traumatic brain injury (TBI). The hypothesis is that in canine patients with moderate to severe TBI, deviations and degree of changes to the biomarkers are associated with the MGCS (Modified Glasgow Coma Score), mortality, cost and length of hospitalization. The inclusion criteria for a case consist of a history of head trauma in the prior eight hours, physical evidence of head trauma (hemorrhage/abrasions/fractures) and an MGCS of <15. Owners would need to be willing to treat his/her pet as an inpatient and sign the client consent form. There is no additional cost to owners, but they would need to be willing to have a small amount of blood taken from the patient according to a schedule. The patient would be serially scored via Animal Trauma Triage (ATT) and MGCS. Disqualified dogs would include those with a prior diagnosis that may cause derangements in glucose metabolism (sepsis, diabetes mellitus, Cushing's), those who have received drugs that affect glucose metabolism (insulin or corticosteroids), hypoglycemia requiring dextrose supplementation, or those with newly or previously diagnosed primary heart disease (a murmur greater than a II/VI) or history of CHF.

The goal is to enroll 60 dogs. If you would like to refer a case for possible enrollment, you can send the patient through our Emergency and Critical Care service: call Eleanor Cousino, our Referral Coordinator, at **617 522-5011**.

If you have any questions or would like to discuss a case, please feel free to call **617 522-5011** and have me paged, or e-mail *mwhelan@mspca.org*.

Sincerely,

Megan Whelan, DVM, DACVECC
Angell Emergency and
Critical Care service

Interesting New Reads

Two recently published books authored by Angell doctors are now available in bookstores and online.

ATLAS OF SMALL ANIMAL WOUND MANAGEMENT AND RECONSTRUCTIVE SURGERY, THIRD EDITION

by Michael Pavletic, DVM, DACVS, is a full-color atlas that maintains the surgical focus of earlier editions while now presenting essential information about basic principles of wound healing, wound management and common wound complications. The new edition presents a wider variety of topics including skin-fold disorders, urogenital surgery, new flap techniques and an expanded chapter on facial reconstruction. It also features 40 new plate illustrations, new sections on bandage and splint techniques and significant updates on wound-healing physiology, equipment and dressing materials.

Dr. Pavletic is the Director of Surgical Services at Angell Animal Medical Center. He specializes in soft-tissue surgery and is a leading authority in the subspecialty area of small-animal plastic and reconstructive surgery. The Third Edition of his book can be purchased at major veterinary conferences, through *wiley.com* or other book vendors including *amazon.com*. To consult with Dr. Pavletic on a particular case, please e-mail ***mpavletic@angell.org*** or contact him by phone via Referral Coordinator Eleanor Cousino at **617 522-5011**.

LOVE IS THE BEST MEDICINE: WHAT TWO DOGS TAUGHT ONE VETERINARIAN ABOUT HOPE, HUMILITY, AND EVERYDAY MIRACLES

by Nicholas Trout, MA, VET MB, DACVS, DECVS. From *New York Times* bestselling author Dr. Nick Trout comes another touching and heartfelt story from the front lines of veterinary medicine — the story of two dogs who forever changed the way he thought about life, death, fate and love. *Love Is the Best Medicine* immerses you in the true-life drama of much-loved pets whose lives hang in the balance. Every page underscores the profound bond we have with the animals in our lives and the incredible responsibility veterinarians carry as their healers. Certainly Dr. Trout has an impressive array of fancy equipment,

> Continued on Page 6

Shockwave Therapy

by Cathy Reese, DVM, DACVS

↗ Non-Invasive Regenerative Extracorporeal Shockwave therapy is a new treatment modality that is currently available at Angell.

Non-Invasive Regenerative Extracorporeal Shockwave Therapy (ESWT) is a fairly new treatment modality that has been used at Angell Animal Medical Center for the past year. Many of the applications for ESWT are conditions that have been previously frustrating to treat, and the results so far have been promising, with pain relief often evident after the first treatment.

Shockwaves are focused, high-energy pressure waves that have a high peak pressure (typically 50 Megapascal) with a short life cycle. This fast initial rise in pressure followed by a decrease in pressure causes a cavitation effect in the treated tissue, which causes the formation and collapse of vapor bubbles. These in turn result in secondary, localized shock waves. The focused wave energy and cavitation effects result in the generation of substantial compressive and tensile forces at the cellular level. These forces result in microcellular trauma and the release of proteins from the affected cells. Some of these proteins are cytokines, which may return a chronic condition such as tendonitis to an acute condition and thereby allow the healing response to occur. ESWT treatments have been shown to cause proliferation of growth factors which result in neovascularization, as well as bone-morphogenic proteins which can help bone healing. ESWT may also disrupt biological biofilm, resulting in a bactericidal effect. This may help in the healing of chronic wounds.

It is a non-invasive form of therapy in which the affected area is shaved, cleaned with alcohol and covered liberally with ultrasound gel for good contact between the shockwave applicator and the patient. The patient must be sedated due to some mild discomfort and a fairly loud noise made by the machine. We generally use a Dexdomitor/butorphanol combination followed by an Antisedan reversal. The procedure generally takes about 10 minutes. Three treatments are recommended, separated two

> Continued on Page 6

Canine Hepatopathies; When, Why and How Should We Biopsy?

by Erika de Papp, DVM, DACVIM

What do we do with the middle-aged or geriatric canine patient who presents for an annual exam with no clinical complaints, and has an incidental finding of mildly elevated liver enzymes on routine lab work? What about the patient who is referred due to weight loss, poor appetite, elevated liver enzymes and signs of liver dysfunction on lab work, as indicated by alterations in BUN, bilirubin, albumin, cholesterol or glucose? This latter case is straightforward; it needs a work-up for liver disease. However, all too often if you trace the medical history back to when the dog was feeling well, you will find that the ALT was mildly to moderately elevated for a year or more before the dog became ill. By the time this dog is icteric, it may be too late to help.

I would argue that we should pursue dogs with non-clinical liver enzyme elevations more aggressively. It can be very difficult to convince clients to pursue US and liver biopsy for a dog who is completely healthy as far as they can see, but I think it is our job as veterinarians to convince them that it is better to be proactive with these cases and find out if there is significant liver pathology that we can treat, and more importantly, treat early.

Common liver diseases for which a dog may present early in the course of the disease with minimal to no signs of illness include reactive hepatopathies, vacuolar hepatopathies, nodular hyperplasia, chronic hepatitis and even certain hepatic neoplasias. A US exam will help determine if there is a mass, but cannot differentiate an adenoma from adenocarcinoma, and cannot definitively evaluate nodules to determine if they are benign or malignant. Dogs with reactive hepatopathies develop these as a sequela to an underlying disease, and often present with clinical signs referable to another organ system. For example, dogs with inflammatory bowel disease can have mild inflammation from uptake of GI toxins, and typically present with vomiting and/or diarrhea. Dogs with vacuolar hepatopathies and nodular hyperplasia are often asymptomatic, unless the vacuolar change is associated with hyperadrenocorticism, in which case they commonly present with the typical clinical signs of polydipsia, polyuria and polyphagia. Dogs in the early stages of chronic hepatitis are often clinically well, which is why modest liver enzyme elevation is often ignored or just monitored, with no further investigation.

The first stage of the work-up includes repeating the liver enzymes to see if the abnormalities persist. In a clinically well dog, I recommend repeating values in one month. If the values are still abnormal, the next step is abdominal US. Assuming a thorough history and PE as well as the remainder of the CBC, general profile and UA do not turn up any underlying disease or iatrogenic reasons for the elevations (e.g., steroid therapy), liver biopsy is recommended.

Even if the US reveals a normal-appearing liver, or only subtle changes such as a coarse echotexture or hyperechogenicity, this tells us very little about the true pathology. A diagnosis of vacuolar hepatopathy is markedly better than a diagnosis of chronic hepatitis, and should be treated very differently. If ALP is the only liver enzyme which is elevated, then I am less likely to pursue a liver biopsy rapidly in these cases, as this is a very common finding in middle-aged and older dogs. However, once there is elevation of ALT and/or AST, we need to know what is going on at a histopathologic level.

Once we have decided that a biopsy is necessary, the next question is how do we obtain it? We recommend obtaining all liver biopsies via laparoscopy, assuming the dog does not need a laparotomy for other reasons. Angell has both standard-sized and pediatric equipment, so no dog is too small for the procedure. It has been well documented that laparoscopic samples are far superior to US-guided needle biopsies. Surgical samples are also acceptable; however, the morbidity associated with laparoscopy is much less than that of surgery, and most of our patients go home the evening of the procedure. We can easily obtain enough liver tissue for copper analysis in addition to our biopsy samples, and we routinely obtain bile for culture. It has been demonstrated that bile yields more bacterial growth than liver tissue, so whenever possible we aspirate the gall bladder to obtain samples for aerobic and anaerobic cultures.

In summary, liver biopsy is a very useful tool for further defining liver disease in our canine patients, as well as guiding appropriate therapy. Dogs with advanced disease and cirrhosis have a very poor prognosis, many of them having one month to live or less. The earlier we can intervene in the cases of hepatitis, the better outcome we are likely to achieve. However, we cannot make the diagnosis without a liver biopsy, and with the use of laparoscopy we are able to obtain excellent-quality samples with low morbidity. Also, the cost of laparoscopy is only a few hundred dollars more than a US-guided biopsy, making it a cost-effective option for most clients.

For more information about Angell's Internal Medicine service, please visit ***angell.org/internalmedicine***. Angell's Internal Medicine doctors are available for consultation via phone or e-mail ***(internalmedicine@angell.org)*** Monday–Friday 9:00 am–5:00 pm. To reach an Angell internist by phone or to refer a patient to the Angell Internal Medicine service, please call Referral Coordinator Eleanor Cousino at **617 522-5011**. ■

Treatment of Autoimmune Diseases of the Central Nervous System of Dogs

by Allen Sisson, DVM, MS, DACVIM (Neurology)

Several inflammatory, primary central nervous system (CNS) diseases of dogs have been described:

1. Granulomatous Meningoencephalomyelitis (GME)
2. Necrotizing Encephalitis of Pug, Maltese, and Yorkshire terrier dogs
3. Corticosteroid-Responsive or Neutrophilic Meningitis
4. Eosinophilic Meningoencephalomyelitis
5. Idiopathic Tremor Syndrome or Cerebellitis

It is now suspected that these idiopathic diseases are due to abnormal immune system function (an autoimmune disorder).

Depending on where in the CNS these diseases start, they can cause a wide variety of signs such as:

1. Progressively worsening central vestibular signs
2. Progressively worsening seizures and behavior abnormalities
3. Progressively worsening neck and/or back pain
4. Progressively worsening para- or tetraparesis often mimicking a disc herniation
5. Progressively worsening generalized severe-intention tremor
6. Acute onset of blindness

These signs can progress at various rates, but they are often acute (1–2 days) to peracute (8–12 hours) in duration. In the peracute form these CNS diseases are emergencies. If rapid neurologic deterioration is noted, immediate referral to a 24-hour emergency center or aggressive immunosuppressive therapy should be started until a spinal fluid analysis and advanced CNS imaging can be done to confirm the diagnosis. Since abnormal spinal fluid can be normalized within 24 hours of starting prednisone therapy, referral for diagnostic testing as soon as possible after initiating therapy is best.

High-dose, low-term immunosuppression is the key to successful therapy for all autoimmune diseases of the CNS. For this reason it is important that infectious causes of CNS inflammation be ruled out by diagnostic testing, since immunosuppressive therapy would worsen these conditions.

Corticosteroids, primarily prednisone, are the drugs of choice and are sometimes used as the sole therapy for neutrophilic meningitis. It is important that immunosuppressive doses be used initially, and therapy be sustained at high doses, very gradually tapered over many months, or relapses are likely to occur.

Prednisone causes many adverse effects. When these adverse effects are severe, they may require the prednisone dose be reduced or even stopped and another immunosuppressive drug to be used in its place or combined with a reduced prednisone dose. In addition, when immune-mediated encephalitis or myelitis is present, it is unlikely that prednisone therapy alone can lead to permanent remission. For this reason the neurology service at Angell Animal Medical Center now treats all immune-mediated CNS diseases with combination immunosuppressive therapy.

Dogs with immune-mediated meningitis are treated with prednisone and with the immunomodulatory drug leflunomide, which is a once-daily oral medication given for one year or in some cases longer. This drug inhibits T and B lymphocyte proliferation and function and is very effective. It is a bone-marrow suppressor and requires monthly CBC monitoring and initial dose adjustment based on leflunomide blood levels. Treated this way it is rare for immune-mediated meningitis cases to relapse, with most cases achieving permanent remission and coming off of all therapy within one year.

Most dogs with GME are treated with a combination of prednisone, leflunomide and monthly cytarabine injectable therapy given over a 48-hour period. This three-drug combination leads to long-term remission in over 90% of dogs after one to 1.5 years of therapy.

Pug dogs, Maltese and Yorkshire terriers that have necrotizing encephalitis are given a combination of prednisone, leflunomide, cytarabine, lomustine and cyclosporine modified. The cytarabine and lomustine are given monthly 14 days apart, since both drugs cause leukocyte nadirs 6 to 14 days post-treatment so that they cannot be given at the same time. The use of these two chemotherapy drugs in combination requires CBC monitoring twice a month, to be sure that neutrophil and platelet numbers are adequate before each therapy. Cyclosporine modified is given BID orally and requires dose adjustment based on blood level measurement. With this five-drug therapy for 1.5 years, about 80% of dogs with necrotizing encephalitis achieve complete remission.

For more information, please visit ***angell.org/neurology***. Angell's Neurology doctors are available for consultation via phone or e-mail ***(neurology@angell.org)*** Monday–Friday 9:00 am–5:00 pm. To reach an Angell surgeon by phone or to refer a patient to the Angell Neurology service, please call Lisa Canale at **617 541-5140**. ■

> Shockwave Therapy (Continued from Page 3)

weeks apart. Applications at Angell have been primarily for shoulder tendonopathies (biceps, supraspinatus), but they have also been recommended for patellar tendonitis post-TPLO; osteoarthritis; chronic back pain due to spondylosis, disc disease or lumbosacral instability; non-union or delayed union fractures; and chronic non-healing wounds such as lick granulomas. It has been used in humans for diabetic foot ulcers, and in equine medicine for suspensory ligament injuries, stress fractures, osteoarthritis and tendonitis. Cost per treatment (not including sedation or hospitalization) is $250 for new cases, or $150 for patellar tendonitis cases that have had the TPLO done at Angell.

If you have any questions or cases that you think might benefit from shockwave therapy, feel free to e-mail me at **creese@mspca.org**.

For more information, please visit ***angell.org/surgery***. Angell's surgeons are available for consultation via phone or e-mail ***(surgery@angell.org)*** Monday–Friday 9:00 am–5:00 pm. To reach an Angell surgeon by phone or to refer a patient to the Angell Surgery service, please call Referral Coordinator Eleanor Cousino at **617 522-5011.** ■

> Interesting New Reads (Continued from Page 3)

training and skills at his disposal, but his most important tool is a fundamental belief in the power of hope, humility and grace.

Wry, charming and intensely affecting, *Love Is the Best Medicine* is a one-of-a-kind story only the engaging Dr. Trout could deliver and is destined to become a favorite for animal lovers.

Dr. Trout is a staff surgeon at Angell, specializing in both orthopedic and soft-tissue surgery. His work includes tibial plateau leveling osteotomy (TPLO), tibial tuberosity advancement (TTA), hip replacement and arthroscopic surgical procedures. Dr. Trout's book is currently on display in bookstores and available at *amazon.com*. To consult with Dr. Trout on a particular case, please e-mail ***ntrout@angell.org*** or contact him by phone via Referral Coordinator Eleanor Cousino at **617 522-5011**. ■

> Interventional Cardiology (Continued from Page 1)

into the cardiac chambers. In a full cardiac catheterization, both the right and left heart are catheterized. Dye-contrast injections are made into the left and right ventricles (subsequently) and the anatomy defined on cinematographic playback. Pulse-oximetry samples are taken from the cranial and caudal right atria, the right ventricle, the pulmonary artery, the aorta and the left ventricle. This will identify any area of suspected shunting (ASD, VSD). Pressure tracings may be obtained on the right side (pullback tracing from the pulmonary artery-right ventricle-right atrium) to detect any evidence of pulmonary hypertension, pulmonic stenosis or tricuspid stenosis. Pressure pullback across the aortic valve on the left side will identify any degree of subaortic or aortic stenosis. These defects would have already been identified on Doppler and two-dimensional echocardiography, so pressure tracing is mainly for teaching purposes and to help identify the degree of improvement after balloon dilation. We do a full cardiac catheterization (catheterization of both sides of the heart, bilateral contrast angiography and a full oximetry "run") to define all anomalies in patients with complex congenital disease. Most commonly, we do limited cardiac catheterization to perform a catheter-based intervention (Amplatz ductal occlusion, balloon dilation of pulmonic stenosis, aortic stenosis).

WHAT ARE SOME COMMON INTERVENTIONAL PROCEDURES?

Patent ductus arteriosus: For over 10 years, the closure of a patent ductus arteriosus (PDA) could be accomplished in some patients using catheter-based delivery of embolization coils. However, many patients still required thoracotomy for ductal ligation, as only smaller PDAs with an appropriate tapering morphology were good candidates for coil embolization. In addition, the placement of coils could be tricky and sometimes resulted in embolization of a coil into the pulmonary arterial circulation. Patients who had unsuccessful procedures required a thoracotomy. Various occlusion devices are available for use in human patients for PDA closure. Although these systems were sometimes used successfully in canine patients, their shape and design were not ideal for the canine ductus and the pricing of the devices remains high. In 2007 Infiniti Medical commercially released the Amplatz canine ductal occluder (ACDO). This device was specifically designed for the canine species. The device comes in a variety of sizes ranging from 3 mm to 14 mm. The ACDO has facilitated closure of most canine PDA sizes and shapes in the cardiac catheterization lab. Although the device is not inexpensive $650 USD), the pricing was made as veterinary-friendly as possible. Procedural simplicity has reduced anesthesia time, offsetting the equipment expense. Obviously, avoiding thoracotomy significantly reduces recovery time and intensity of post-operative management and expense. When presented with a patient with a PDA, the ductal size and shape are determined echocardiographically, paying close attention to measurements of the pulmonic ostium (where the ductus connects with the main pulmonary artery). This allows approximate determination of occluder size and associated delivery catheters. A full range of device sizes is stocked, as the angiographic measurements do not always correlate perfectly with those taken from the echocardiogram. Once the patient is under general anesthesia, vascular entry is achieved from the femoral artery. A calibration catheter is positioned into the ascending aorta and a contrast injection is made to evaluate the size and shape of the ductus. This allows precise measurement and selection of the proper device size, the most critical part of the procedure. The ACDO is delivered through a catheter directed through the ductus into the main pulmonary artery. The ACDO is advanced until the proximal phalange is deployed. The catheter is then pulled back into the ductus until the phalange engages at the pulmonic ostium. The second phalange is then deployed into the ductal ampulla where, if sized and positioned appropriately, it will be in a stable, secure position. Complete closure of the ductus is generally noted within 15 minutes of placement. Procedural morbidity is very low, and we have not had any unfavorable outcomes to this procedure thus far.

The main limitation for the use of the ACDO has been the size of the patient as the delivery devices range in size from 6 to 8 French outer diameter (quite large compared to the small vessel size in some patients). Patients ranging in size from 3 kg to 32 kg have been successfully treated using the conventional ACDO, making this the preferred therapeutic option for most patients with patent ductus arteriosus. While size limitation posed challenges in patients below 3 kg, a prototype device is now being tested which will have a very low collapsed profile, enabling delivery via a 4 French catheter, which will allow use of the same technique in even the smallest patients. Precise sizing and clean angiographic anatomical definition continue to be the biggest factors in procedural success. We are fortunate to have state-of-the-art C-arm digital cinematography allowing multi-plane imaging which, when coupled with high-pressure auto-injection, provides precise anatomical delineation.

Balloon dilation of pulmonic stenosis: The development of small-profile, high-pressure balloon catheters ensures a high degree of success with balloon dilation of pulmonic stenosis. Here success is predicated on appropriate patient selection (patients with valvular pulmonic stenosis without significant valve dysplasia or pulmonary artery hyperplasia), having a wide variety of equipment inventory to choose from and, most importantly, lots of experience. Every patient is different so, to achieve success, we often have to vary approaches as we go along. With our cumulative experience approaching 30 years, we are fortunate to be realizing very high success with this procedure. Procedural morbidity is very low and mortality is extremely rare with this procedure. Ventricular arrhythmias during the procedure are the main complication and may have to be managed with antiarrhythmic therapy. Successful dilation seems to be well-maintained and re-stenosis seems to be extremely uncommon in our patient population.

Balloon dilation of aortic and subaortic stenosis: Valvular aortic stenosis is similarly amenable to balloon dilation but procedural morbidity and mortality are higher. It can also be difficult to maintain the balloon catheter in place with the high-velocity flow across the stenotic lesion. Nonetheless, many patients have benefited greatly from balloon dilation. The use of balloon dilation for subaortic stenosis (SAS) remains controversial. Although several studies have had some procedural success with SAS (25–50% reduction in preoperative gradient), none has thus far shown a long-term benefit. Most discouraging with respect to SAS have been the results of open-heart surgery in patients with SAS where, even with the gradient eliminated with removal of the stenotic area, these patients still died at the same rates as non-operated dogs. Recent information presented at the 2010 ACVIM conference suggests a combination of cutting balloons (balloons where razor-like, linear blades protrude with balloon inflation) and high-pressure balloon catheters may increase the success of gradient reduction (gradients reduced more than 60% in most patients). However, long-term follow-up on these patients will be required to determine any survival benefit. These patients did appear to have relief of clinical symptoms, where present. A limitation to the cutting balloons is that they are only available up to 10 mm in diameter, much smaller than the aortic root of a large dog. It is unclear whether the cutting balloon/high-pressure balloon combination would be more beneficial than the use of high-pressure balloons alone.

Other catheter-based interventions: VSD and ASD closure can be done using occlusion devices developed for human patients. These procedures are optimally performed using both transesophageal and three-dimensional echocardiography, so they may require referral to a specialized center (Texas A&M).

WHO SHOULD I REFER FOR INTERVENTIONAL SERVICES?

Although patients with PDA, PS, AS and SAS are the most common referrals for cardiac catheterization, we welcome all patients with either simple or complex congenital heart disease. We approach these patients as a team and review all materials (examination findings, thoracic radiographs, ultrasound findings, ECG) together before making final decisions about a treatment or intervention plan. All cardiac catheterizations are attended by all members of the cardiology team. This allows us to make full use of our many talented individuals and to share ideas. We are excited to expand these programs as the high caseload allows us to continue to sharpen our skills.

HOW DO I REFER A PATIENT?

For more information, please visit ***angell.org/cardiology***. Angell's cardiologists are available for consultation via phone or e-mail ***(cardiology@angell.org)*** Monday–Friday 9:00 am–5:00 pm, Saturdays 9:00 am–3:00 pm. To reach an Angell cardiologist by phone or to refer a patient to the Angell Cardiology service, please call Sandra Russo at **617 541-5038** or feel free to use our Emergency and Critical Care service as needed. ■

We encourage you to e-mail Angell's specialists with questions. We hope you will use Angell as a resource, and we look forward to working with you as we continue our legacy of providing compassion and care for animals.

350 South Huntington Ave.
Boston, MA 02130
Main Phone: 617 522-7282
Veterinary Referrals:
617 522-5011

Chief of Staff

Ann Marie Manning,
DVM, DACVECC
amanning@angell.org

Avian & Exotic Animal Medicine

Jennifer E. Graham,
DVM, DABVP (Avian/Exotic Companion Mammal), DACZM
jgraham@angell.org

Connie J. Orcutt,
DVM, DABVP (Avian/Exotic Companion Mammal)
corcutt@angell.org

Cardiology

Nancy J. Laste,
DVM, DACVIM (Cardiology)
nlaste@angell.org

Rebecca I. Malakoff,
DVM, DACVIM (Cardiology)
rmalakoff@angell.org

Clinical & Anatomical Pathology

Patty Ewing,
DVM, DACVP
pewing@angell.org

Pamela Mouser,
DVM, MS, DACVP
pmouser@angell.org

Dentistry

William Rosenblad, DVM
wrosenblad@angell.org

Curtis A. Stiles,
DVM, DAVDC
cstiles@angell.org

Dermatology

Kathy Tater,
DVM, DACVD
dermatology@angell.org

Diagnostic Imaging

Jessica Basseches,
DVM, DACVR
jbasseches@angell.org

Kathy A. Beck,
DVM, DACVR
kbeck@angell.org

Joan Regan,
VMD, DACVR
jregan@angell.org

Emergency & Critical Care Medicine

Kiko Bracker,
DVM, DACVECC
kbracker@angell.org

Jennifer Holm,
DVM, DACVECC
jholm@angell.org

Megan Whelan,
DVM, DACVECC
mwhelan@angell.org

Internal Medicine

Doug Brum, DVM
dbrum@angell.org

Maureen Carroll,
DVM, DACVIM
mccarroll@angell.org

Erika de Papp,
DVM, DACVIM
edepapp@angell.org

Jean Marie Duddy, DVM
jduddy@angell.org

Shawn Kearns,
DVM, DACVIM
skearns@angell.org

Susan O'Bell, DVM,
MPH, DACVIM
sobell@angell.org

Chris Rollings,
DVM, DACVIM
crollings@angell.org

Neurology

Andrew Farabaugh, DVM
afarabaugh@angell.org

Allen Sisson,
DVM, MS, DACVIM (Neurology)
asisson@angell.org

Nutrition

Rebecca I. Remillard,
PhD, DVM, MS, DACVN
rremillard@angell.org

Oncology

Christine Anderson,
DVM, MS, DACVIM (Medical Oncology), DACVR (Radiation Oncology)
cranderson@angell.org

Jennifer Mahoney, DVM
jmahoney@angell.org

Carrie Wood, DVM,
DACVIM (Medical Oncology)
cawood@angell.org

Ophthalmology

Daniel J. Biros,
DVM, DACVO
dbiros@angell.org

Martin Coster,
DVM, MS, DACVO
mcoster@angell.org

Pain Medicine

Lisa Moses, VMD,
DACVIM, CVMA
lmoses@angell.org

Surgery

Sue Casale,
DVM, DACVS
scasale@angell.org

David W. Knapp,
DVM, DACVS
dknapp@angell.org

Michael M. Pavletic,
DVM, DACVS
mpavletic@angell.org

Catherine J. Reese,
DVM, DACVS
creese@angell.org

Nicholas J. Trout,
MA, VET MB, MRCVS,
DACVS, DECVS
ntrout@angell.org

REFERRAL CONTACT INFORMATION

Cardiology Service

Referral Liaison: Sandra Russo
Referral Line: 617 541-5038
Referral Fax: 617 989-1653
E-mail: cardiology@angell.org
Website: angell.org/cardiology

Dermatology Service

Referral Liaison: Rebecca Stlaske
Referral Line: 617 524-5733
Referral Fax: 617 989-1613
E-mail: dermatology@angell.org
Website: angell.org/dermatology

Emergency Service

Referral Line:
617 522-7282 press 1
Referral Fax: 617 989-1633
Website: angell.org/emergency

Neurology Service

Referral Liaison: Lisa Canale
Referral Line: 617 541-5140
Referral Fax: 617 989-1666
E-mail: neurology@angell.org
Website: angell.org/neurology

Oncology Service

Referral Liaison: Gary Vanasse
Referral Line: 617 541-5136
Referral Fax: 617 541-5130
E-mail: oncology@angell.org
Website: angell.org/oncology

Ophthalmology Service

Referral Liaison: Sandra Russo
Referral Line: 617 541-5095
Referral Fax: 617 989-1647
E-mail: ophthalmology@angell.org
Website: angell.org/eyes

Pain Medicine Service

Referral Liaison: Lisa Canale
Referral Line: 617 541-5140
Referral Fax: 617 989-1666
E-mail: painmedicine@angell.org
Website: angell.org/painmedicine

For all other referrals, please contact Eleanor Cousino, Angell Referral Coordinator, at 617 522-5011, or by fax at 617 989-1635.

Are your clients new to Angell? Send them to angell.org/directions for detailed directions to our location. Ample free parking on site.

angell®

350 South Huntington Ave.
Boston, MA 02130

angell.org/specialties

**Nonprofit Org.
US Postage
Paid
Permit No. 56959
Boston MA**