



Radiology Corner

CT For Abdominal Imaging - It's Not Just Ultrasound Anymore

There have been some noticeable trends in veterinary abdominal imaging over the last few years, with increasing use of CT (computed tomography or CAT scan) to assess organs previously only imaged by ultrasound, or radiography. I would like to highlight a few of these newer techniques, show some recent cases we have imaged at OSVS, and review some recent manuscripts that have appeared in print.

Veterinarians have traditionally used radiography and ultrasound to assess the abdomen. These imaging modalities are limited in very large patients, as ultrasound is highly attenuated by fat, and some of the organs of interest (i.e. adrenal glands, pancreas) are too deep within the patient for optimal transducer frequency. In other patients with severe omental inflammation, or very large abdominal masses, ultrasound is of limited use to determine the origin of the problem. Abdominal radiographs are of limited use as well, as the X-ray techniques needed to penetrate large dogs create abundant scatter radiation which degrades image contrast. For CT, abundant intraabdominal fat is actually very helpful, as it separates organs of similar tissue attenuation such as the liver and pancreas. Assuming patients do not exceed the 350 pound weight limit of conventional CT tables, obesity or abdominal inflammation does not limit the value of CT imaging, as it does with ultrasound or radiography.

There are two general types of CT machines, those that acquire images one at a time, (single slice scanners, which is what OSVS has), and those that can acquire multiple slices in a volume (usually referred to as spiral or helical CT). Acquiring slices in a volume allows for more rapid scan times, tracing blood flow within the liver to document portosystemic shunts (Zwingenberger AL et al, VRUS 42, 2 117-124, 2004), and to assess contrast media flow through organs suspected to have neoplasia or inflammation. Both spiral and single slice scanners can also assess for neoplasia, by comparing the amount of contrast enhancement seen within a focal lesion. A recent manuscript (Fife, WD et al, VRUS 45, 4, 289-297, 2004) assessed the contrast enhancement in splenic mass lesions due to nodular hyperplasia and neoplasia.

Malignant masses were found to have lower attenuation values (thus be more black or lucent on CT images) prior to contrast administration, and also noted to accumulate less contrast material than nodular hyperplasia or splenic hematomas.

Adrenal gland imaging is a problematic area for ultrasound in large patients particularly. CT and MRI of the adrenal glands have been described, and the anatomic resolution that cross sectional imaging allows can be very helpful for surgical planning and subsequent patient monitoring. Pheochromocytomas in particular lend themselves to CT, as their vascular appearance and potential for caudal vena cava invasion can be identified preoperatively (Rosenstein DS, VRUS 41, 6 499-506, 2000). In Figure One, a CT image of a large pheochromocytoma of the left adrenal gland is shown. This patient did not have evidence of vascular invasion, although the tumor did cross midline and come in contact with the caudal vena cava.

Pancreas imaging is another troublesome area for ultrasound, particularly in cats where antemortem diagnosis of pancreatitis remains problematic, or in obese dogs where peripancreatic inflammation masks the underlying organ. The normal pancreas is very similar in appearance to the liver on both CT and ultrasound images, but is hypoattenuating to the liver after contrast administration. The CT appearance of an insulinoma was recently described in a pug, where the tumor enhanced with iodinated contrast particularly on arterial phase images (Iseri, T et al, VRUS 48, 4, 328-331, 2007). Peripancreatic inflammation can be seen as a wispy soft tissue opacity dissecting into normal fat planes, and the adjacent stomach, duodenum and portal veins provide anatomic landmarks for pancreas localization. We have had several pancreatitis/pancreatic abscess cases where ultrasound is limited due to marked abdominal inflammation. CT allows for easier identification of pancreatic abscesses, phlegmons, necrosis and free fluid, which may change the management of these cases to surgery versus

traditional medical care. In Figure Two, an image of pancreatitis with a pancreatic abscess is shown.

Another area where CT is very helpful is with large or very large mass lesions where definition of tumor planes is needed for accurate surgical planning. In Figure Three, a large body wall lipoma is shown which displaced much of the abdominal organs, but was actually outside of the peritoneal and retroperitoneal spaces. In Figure Four, a large hepatic mass lesion was imaged to assess for potential surgical resection options. The close association of the mass with the caudal vena cava was identified with CT, and could not be well appreciated with ultrasound due to the size of the mass. When neoplasia is imaged with CT, we frequently also image the thorax to assess for pulmonary metastatic neoplasia. Nodules as small as 5mm can be seen with CT, as opposed to the minimum size of 1 cm or more to be visualized with standard radiography. Because of this improved accuracy, in some veterinary teaching hospitals CT has completely replaced thoracic radiographs as the imaging choice for cancer staging of the thorax.

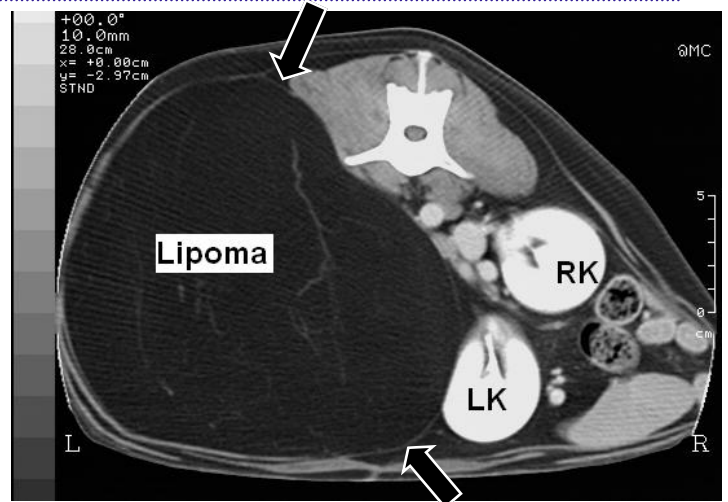


Figure 3: CT image of an invasive body wall lipoma which displaced the left kidney (LK) across midline. The thin capsule of the lipoma can be seen separating the mass from the peritoneal and retroperitoneal cavities (arrows).

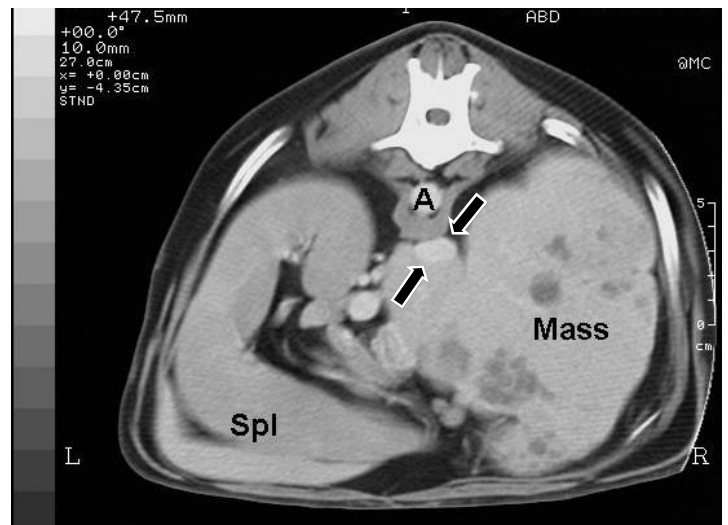


Figure 4: CT image of a large right liver mass with involvement of the caudal vena cava (appears as oval white structure between arrows). The mass is mixed in opacity with the darker regions being areas of necrosis. The spleen is identified in the left cranial abdomen, and the aorta (A) ventral to the spine.

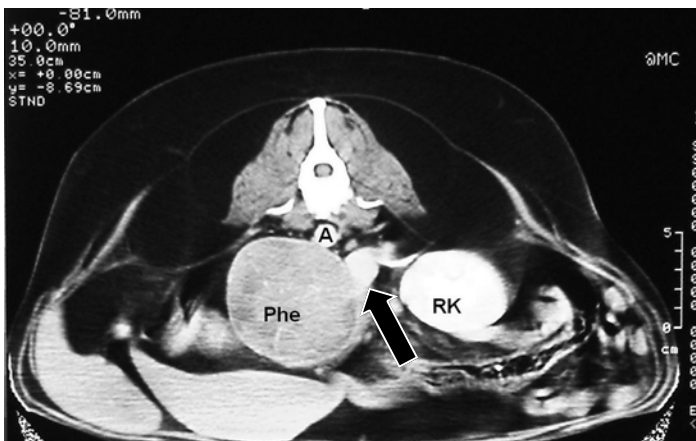


Figure 1: CT image of a pheochromocytoma (Phe) which originated from the left adrenal gland, and crossed midline to come in contact with the caudal vena cava (black arrow). Definitive vascular invasion was not seen. The aorta (A) and right kidney (RK) are identified.

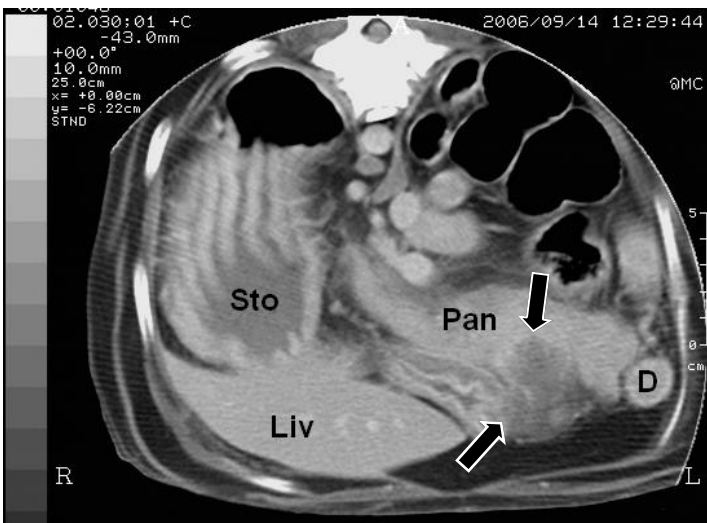


Figure 2: CT image of pancreatitis with pancreatic abscess. The pancreas (Pan) is hyperchoic and the margins are wispy due to inflammation with a poorly demarcated abscess noted near the head (arrows). The stomach (Sto), liver (Liv) and duodenum (D) are identified. The peripancreatic inflammation made identification of the abscess sonographically difficult.

Computed tomography is also used in combination with other contrast procedures such as myelography and excretory urography. In cases where spinal cord swelling is so severe so that the iodinated contrast columns are not visible on routine radiographs, CT can localize the exact site of disc herniation. CT has also been used to identify ectopic ureters, and we recently used CT to determine the cause of retroperitoneal fluid (urine leakage from the kidney or ureter versus hemorrhage) in a patient with suspected trauma.

Cost of CT is less than that of MRI at OSVS, and is \$500 alone (total package for a day case is \$600-650 which includes patient sedation, hospitalization, IV fluids etc). If additional sites are imaged (such as thorax for possible metastasis) an additional \$200 is added to the cost. Please do not hesitate to contact me if you have any questions regarding abdominal CT for your patients!

Susan M. Newell DVM, DACVR

Helpful Hints for the Avian Practitioner

H. Wietsma DVM, MS, DIP. ABVP-AVIAN

At times avian medicine can be very frustrating and confusing for the general veterinary practitioner. The goal of this article is to make the waters less murky. Below are ten very practical and basic tips to help reach a diagnosis with your avian patients.

1. A budgie comes in with white crusty pitted growths around the commissures of the mouth, the cere and the eyelids. The beak is pitted and malformed. There are not many pathognomonic diseases in avian medicine but this is one of them. You are dealing with Knemidokoptes (scaly face and leg) mites and a simple skin scrape will always confirm the diagnosis. Ivermectin is the treatment of choice but it is very easy to overdose if given orally. I treat these birds by placing 3-4 drops of ivermectin on a Q-tip and apply topically to the lesions. The treatment should be repeated 2 weeks later.
2. A female cockatiel comes in with a distended coelom. Remember you can sex most cockatiels by feather markings. This bird **MOST LIKELY** has reproductive disease (egg yolk coelomitis, salpingitis, ovarian cysts/neoplasia etc). Radiographs and blood work should help you confirm the diagnosis.
3. Any bird that has a white blood cell count above 30,000 is likely to have either chlamydiosis, aspergillosis, or mycobacterium. Radiographs, CBC's, serum electrophoresis, and serological testing are required to obtain a definitive diagnosis. DNA PCR tests are also very helpful (Research Associate Lab, Vet Molecular Diagnostics) especially when dealing with mycobacterium. Obviously, other disease states can cause profound leukocytosis but think of these 3 first.
4. Any bird (especially budgies, cockatiels) that presents with lameness should be examined carefully for gout trophi. Articular gout can appear as very small white pustular like swellings usually associated with the phalangeal joints. Aspiration and cytology of these swellings will reveal uric acid crystals microscopically. Any bird that has gout has renal disease, so a proper work up for kidney disease is needed.
5. You are presented with a 3 month old Eclectus parrot that the owner just purchased from a local pet store. The bird's physical exam is completely normal. Four days later the bird dies acutely and on necropsy you notice some mild hemorrhage of the pericardium. This bird died of polyoma virus and diagnosis can be confirmed by PCR testing. Polyoma virus typically causes problems in young birds (less than 4 months). High risk species include eclectus, macaws and conures. Cockatiels and budgies are notorious shedders of this virus.
6. A parakeet presents to you with the symptoms of lethargy, weight loss and regurgitation. Evidence of the regurgitation can be seen during your physical exam by observing dried seeds/ingest stuck to the feathers of the bird's head. One of the common diseases that will cause these symptoms is a yeast called *Macrohabdus orni-thogaster* (ie megabacterium). This disease is most common in lovebirds and parakeets. The diagnosis is confirmed by the presence of LARGE rod like organisms on a direct wet mount or fecal gram stain (stains gram positive). Treatment is oral amphotericin B. Another common disease which also has these same symptoms in the budgie is goiter.
7. If a radiograph of a bird reveals polyostotic hyperostosis (striking deposit of calcium in medullary bone) this bird most likely has reproductive disease. It is normal physiology for birds to lay down calcium in their long bones prior to egg laying but studies have revealed that approximately 75% of birds with these radiological changes have reproductive pathology.
8. Aspergillosis is a very common fungal disease of birds. At times diagnosis can be difficult but radiographs, complete blood counts and serum electrophoresis can be helpful. Aspergillosis antigen and antibody serological tests are available but their benefit is questionable. A new aid in diagnosing aspergillosis is the galactomannan assay. This assay run by the U. of Miami diagnostic lab tests for a dominant aspergillosis antigen called galactomannan and elevated levels appear to correlate with confirmed positive cases. Definitive diagnosis requires histopathology and cultures. The African Gray parrot appears to be very susceptible to aspergillosis, but remember that itraconazole should not be used in this species because it can be toxic.
9. Wart like lesions in the oral cavity and cloaca of birds commonly is papillomatosis. Macaws and Amazon parrots are high risk species and studies have revealed this disease is caused by a herpes virus. Diagnosis can be confirmed by histopathology or PCR testing. Treatment requires surgical debulking or cautery of the lesions.
10. Butorphanol and meloxicam are currently the recommended drugs for pain relief in birds. Pharmacokinetic studies reveal that avian doses are much higher than in mammals. Current recommended doses of butorphanol are 1-2mg/kg and 0.5 mg/kg for meloxicam.

OSVS Receives Award



On November 1, 2007 OSVS hospital administrator, Cheryl Rizzo accepted a certificate of appreciation from the U.S. Army. Ocean State Veterinary Specialists has provided Captain Spiros and several of his technicians advanced training in emergency medicine, oncology and ophthalmology.

Radio-Iodine Therapy

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Sue Newell DVM, Diplomate of the American
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Lunchtime Seminars at OSVS

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*Bring your troublesome (and not so troublesome)
cases, hobnob with your peers, and eat lunch!*

OSVS Announcements

As many of you may be aware, Jennifer Junk DVM, DACVIM recently left Ocean State Veterinary Specialists to move to Pennsylvania with her new husband, Hadley Bagshaw VMD. In July, Dr. Bagshaw began a residency in Radiology at the University of Pennsylvania. Dr. Junk has accepted a position at a private practice in Pennsylvania. We are currently interviewing several candidates to fill Dr. Junk's position. We will keep you updated on our search. In the meantime, Dr. Gary Block will handle our internal medicine caseload.

To all of you who have practices in the Northern RI and the East Bay area, please keep in mind that all of our surgeons rotate through our Swansea, Massachusetts practice. They see clients and perform surgeries at Bay State Veterinary Emergency Services on Monday and Tuesday of each week. This may be a more convenient option for your clients.

Finally, we'd like to send a big *adios amiga* to Doctor Sue Porter. Doctor Porter has been with us since the inception of Ocean State Veterinary Specialists. Doctor Porter has decided to take sabbatical from us and the country for what is a yet to be determined time frame. Doctor Porter has left for Placencia, Belize where she will be working as a scuba instructor. We wish her much happiness while she's literally "swimming with the fishes".

Specializing in Emergency and Critical Care

The Residency program at OSVS

In 2005, OSVS began offering a residency program in Emergency Medicine and Critical Care. This is a three year program during which the resident must fulfill a strict set of criteria as determined by the American College of Veterinary Emergency and Critical Care (ACVECC). These requirements include 60 weeks of direct supervision under the mentorship of Dr. Justine Johnson, our staff criticalist, as well as 60 weeks of clinic time with indirect supervision in critical care, and 22 weeks of study in associated specialties including surgery, medicine, radiology, cardiology, anesthesia, ophthalmology and others. In addition to clinical requirements, the residents must also attend and participate in over 200 hours of seminars and journal clubs, must attend over 50 hours of continuing education at emergency/critical care conferences, and must also complete over 25 hours of teaching in lecture and laboratory settings. They must publish a paper relevant to emergency and critical care in a refereed journal. At the end of the residency, they are qualified to sit for the board exams, in the hopes of becoming board-certified in Emergency and Critical Care.

Our first resident was Dr. Joshua Portner. Dr. Portner completed his DVM degree at Tufts University, and then an internship at Alameda East Veterinary Hospital in Denver (yes, the one featured on ER Vets on Animal Planet!). Dr. Portner has been an ideal “guinea pig” and has helped to shape the residency program to make it better for the participants who will follow. He has submitted a paper for publication which reviews hospital cleaning protocols and disinfectants, and is starting work on a study to validate a new site for measuring oxygen saturation in awake dogs. He will be completing his program in July, and hopes to take his exam in the fall of 2008.

Dr. Jennifer Kyes came to us as a mid-program transfer from another residency program which was being discontinued. She had graduated from Ontario Veterinary College and completed an internship at the Darien Animal Hospital in Connecticut. She recently presented a case report and a board-review seminar on hypertonic saline at the International Veterinary Emergency and



Dr. Jennifer Kyes, Dr. Rebecca Rader, Dr. Joshua Portner

Critical Care Society (IVECCS) conference in New Orleans. She is working on a review article on the applications of hypertonic saline for submission this fall.

Dr. Rebecca Rader completed her DVM degree at the University of Illinois, and an internship at Bay Area Veterinary Specialists near San Francisco. She has spent the summer learning the ropes here at OSVS and will be starting to work on teaching and research requirements this spring.

The residents play a vital role here at OSVS. They serve as the first line of support for our interns, helping the new doctors with case management and procedures. Because they are keeping up with the literature and cutting-edge presentations at conferences, they bring new ideas to the hospital and help keep us all current. The very presence of a residency program helps to keep us all committed to maintaining the highest Standards of Care for our patients and a didactic atmosphere for our doctors.

MRI & Neurology services at OSVS

OSVS continues to provide MRI services five days each week. A routine MRI includes IV catheter +/- IV fluids, anesthesia and monitoring, MRI procedure (one major site), contrast injection, day stay in hospital, and MRI interpretation by our radiologist.

We also have board-certified neurologists, Dr. Rick Joseph and Dr. Scott Schatzberg seeing appointments and performing MRIs when their schedules permit.

If you have any questions regarding neurology consults or to schedule an MRI, please feel free to call and speak with Dr. Sue Newell.

OCEAN STATE



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Surgical Intern

Trey Townsend DVM

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Joshua Portner DVM
Jennifer Kyes DVM
Rebecca Rader DVM

Hospital Manager

Cheryl Rizzo

Continuing Education Seminars

Ocean State Veterinary Specialists will offer additional RACE approved Continuing Education Seminars in 2008. If you have any topics you feel would benefit referring veterinarians in the area, please feel free to contact Betsy Hall via email at bhall@osvs.net or at (401) 886-6787.

Please look for your invitations in early 2008 or check our website www.osvs.net for a listing of upcoming seminars.