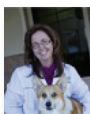


## CT for Surgical Planning

By Victoria Heffelman, DVM, DACVR

Radiology at Desert Veterinary Medical Specialists, PC



Dr. Heffelman received her Doctor of Veterinary Medicine degree from Colorado State University in 2004, where she quickly discovered her love for all things in radiology. She is board-certified with the American College of Veterinary Radiology. Her special areas of interest include abdominal ultrasound, CT, and nuclear medicine.

At Arizona Veterinary Specialists, we often do pre-operative CTs for potential surgical cases to help determine 1) if surgery is possible and 2) to aid the surgeons in their surgical approach and so they can better prepare the client for prognosis and aftercare of their pet. For various reasons listed below, abdominal ultrasound was not adequate for pre-operative imaging. I wanted to highlight a few recent cases in which CT was very helpful in making those decisions.

### CASE 1: Adrenal mass

The big questions with adrenal masses are always which adrenal gland is affected, the size of the mass, and whether it invades into adjacent vasculature or other abdominal organs. The right adrenal is usually located more craniodorsal than the left, making for a more complicated surgical approach (it all sounds scary to me!!). Unfortunately, most adrenal masses seem to have a proclivity for the right adrenal gland. The size of the mass can also complicate surgery as it can make visualizing adjacent structures (such as that pesky aorta!) more difficult as the surgeon carefully exteriorizes the organs. Image 1 is an example of a left adrenal gland mass where CT was able to confirm its location and size and that, while

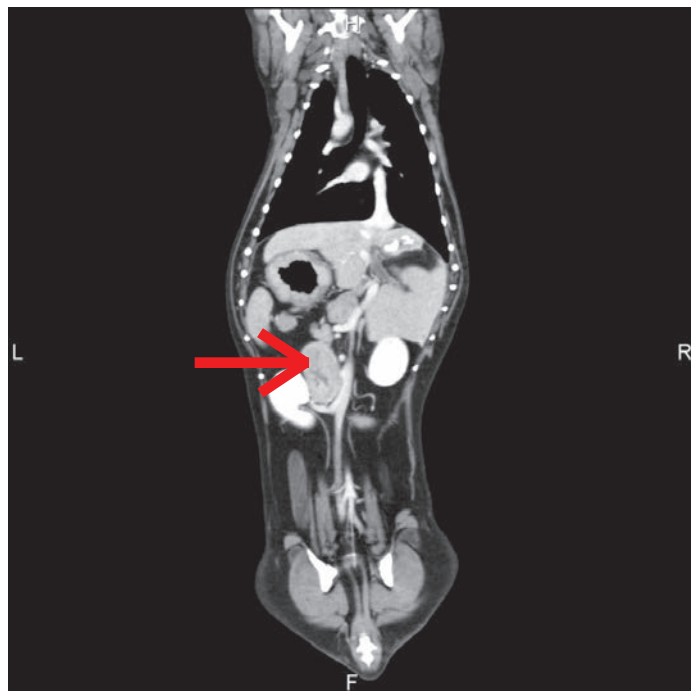


Image 1

it abuts against the left kidney, vena cava, and left renal vein, it does not visibly invade into any of these structures. Size and association with adjacent structures is sometimes difficult to evaluate with abdominal ultrasound (especially if the patient is a larger dog) due to shadowing from the adjacent GI tract and/or lungs, so CT is preferable for pre-surgical evaluation.

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## Case 2: Possible colon mass

Ultrasound cannot penetrate bone, so structures that are encased in bone (such as the central nervous system or intra-pelvic structures) should be evaluated with a three-dimensional imaging modality such as CT or MRI. In a recent case, we performed an ultrasound on a patient with a history of tenesmus and blood in the stool. The clinician felt a mass on the colorectal floor on rectal exam. Unfortunately, abdominal ultrasound did not reveal an obvious cause, histopathology via blind endoscopic mucosal biopsies was inconclusive, and the patient did not improve with supportive care, so CT of the abdomen and pelvis was performed. CT revealed a generally thickened distal colorectal wall with an adjacent and irregular mass-like lesion in the vaginal vestibule (images 2 & 3) and mucoid debris in the vagina. Delineation between the colon and vagina was indistinct. While surgery could be undertaken, the consensus was that complete resection would be difficult, extensive reconstruction may be necessary, and if the colon was involved and required resection, a hemipelvectomy would be necessary. These findings certainly changed

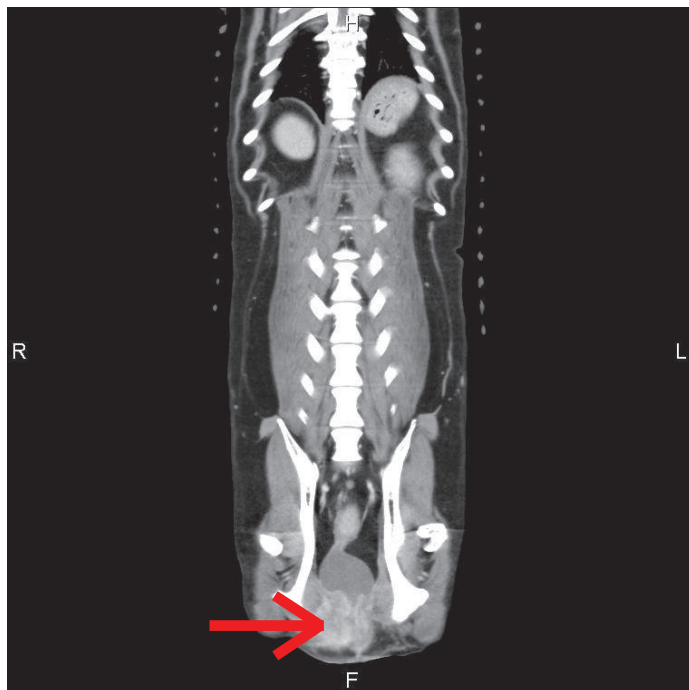


Image 2

the clinical and surgical plan and likely the prognosis for this patient.

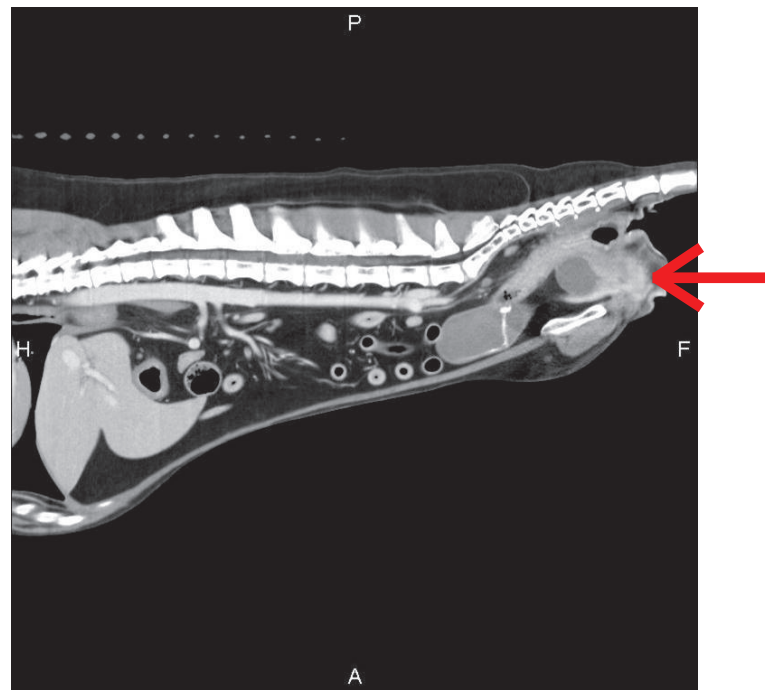


Image 3

## Case 3: Thoracic mass

The last case presented for coughing that did not respond to medical management; radiographs revealed a large mediastinal mass. The mass size could be estimated on radiographs and, while ultrasound could be useful to describe the appearance of the mass and obtain samples for cytology, neither modality is sufficient to evaluate thoracic masses for association with adjacent organs/structures or possible vascular or bony involvement. Radiographs cannot differentiate between structures of similar opacity (such as fluid and soft tissue) and ultrasound cannot penetrate gas in the lungs, so portions of masses and their association/invasion is often obscured. Again a three-dimensional imaging modality is preferred for most potentially surgical thoracic disease. This mass was quite extensive (image 4) and certainly abutted against many structures such as the heart and mediastinal vessels, but did not visibly invade

into any of them. After a frank discussion with the owner about the possible surgical difficulties (incomplete resection, subtle vascular invasion, etc), the owners proceeded with surgery and the mass was well-encapsulated and more easily removed than initially thought. The CT results allowed the surgeons to have a more educated conversation with owners than would have been possible without this imaging.

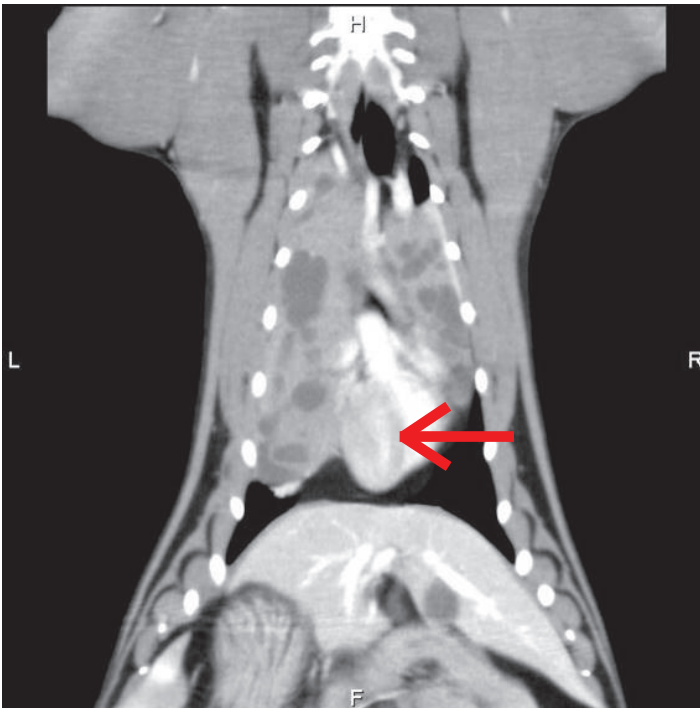


Image 4



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### Arizona Veterinary Dental Specialists, PLLC

#### Dentistry

- ◆ Periodontics
- ◆ Dental digital radiography
- ◆ Root canals
- ◆ Nasal disease treatment
- ◆ Oral disease treatment
- ◆ Oral surgery
- ◆ Orthodontics
- ◆ Restoration
- ◆ Professional teeth cleaning
- ◆ Maxillofacial surgery
- ◆ Oral fractures
- ◆ Fractured teeth treatment
- ◆ Malocclusion treatment
- ◆ Crown therapy
- ◆ In house lectures
- ◆ Telephone radiographic consultation
- ◆ Bite evaluation

### Arizona Veterinary Oncology, PLLC

#### Radiation Oncology

- ◆ Conventional Radiation Therapy
- ◆ Stereotactic Radiosurgery
- ◆ I-131 radioactive iodine treatment

#### Medical Oncology

- ◆ Chemotherapy
- ◆ Immunotherapy
- ◆ Cryotherapy
- ◆ Oncologic surgery
- ◆ Clinical trials

### Desert Veterinary Medical Specialists

#### Internal Medicine

- ◆ Endoscopy
  - Bronchoscopy
  - Bronchoalveolar lavage
  - Colonoscopy
  - Cystoscopy
  - Foreign body retrieval
  - Gastroduodenoscopy
  - PEG tube placement
  - Rhinoscopy
- ◆ Endocrine disorders
- ◆ Emergency consultations
- ◆ Blood and plasma transfusions
- ◆ Gastrointestinal diseases
- ◆ Genitourinary disorders
- ◆ Hepatic diseases
- ◆ Infectious diseases
- ◆ Intensive care treatment
- ◆ Immune-mediated diseases
- ◆ Nutrition consultations
- ◆ Oxygen therapy
- ◆ Pancreatic diseases
- ◆ Pulmonary diseases
- ◆ Renal disease
- ◆ Respiratory diseases
- ◆ Second opinion examinations
- ◆ Ultrasonography
- ◆ Tracheal and urethral stenting

#### Cardiology

- ◆ Echocardiography
- ◆ Electrocardiogram (ECG)
- ◆ Chest radiographs
- ◆ Blood pressure
- ◆ Pericardiocentesis
- ◆ Cardiology breed certification
- ◆ Holter monitoring
- ◆ Event monitoring
- ◆ Non-surgical PDA repair
- ◆ Balloon valvuloplasty
- ◆ Pacemaker implantation
- ◆ Invasive blood pressure measurements
- ◆ Angiography

- ◆ Implantable ECG Loop Recording

#### Radiology

- ◆ Outpatient and inpatient ultrasound
- ◆ Radiology Rounds
- ◆ Digital radiography
- ◆ Outpatient and inpatient CT scans
  - 64 slice
- ◆ Fluoroscopic urinary, GI, and tracheal studies
- ◆ Nuclear imaging
  - GFR scans
  - Bone scans
  - Thyroid scans
  - Splenic scintigraphy
- ◆ Radiographic interpretation
- ◆ CT and MRI interpretation

### Dermatology for Animals, PC

#### Dermatology

- ◆ Allergy testing (skin testing) and immunotherapy
- ◆ CO<sub>2</sub> laser for ablation of skin tumors
- ◆ Testing for food allergies and hypoallergenic diets
- ◆ Ear disease diagnosis and treatment
- ◆ Bacterial and fungal skin disease diagnosis and treatment
- ◆ Cytological smears and microbiologic examinations
- ◆ Ectoparasite identification and treatment
- ◆ Immune-mediated and hormonal skin disease diagnosis and treatment
- ◆ Treatments of nail and nail bed disorders
- ◆ Skin biopsy sampling and histopathology interpretation
- ◆ Liquid nitrogen cryotherapy

...continued on page 5

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- ◆ Abdominal surgery
- ◆ Airway surgery
- ◆ Angular limb deformity surgery
- ◆ Arthroscopy
- ◆ CT Scans
- ◆ External skeletal fixation
- ◆ Fracture repair
- ◆ Laparoscopy and Thoracoscopy
- ◆ Neurologic surgery
- ◆ Oncologic surgery
- ◆ Oral surgery, such as maxillofacial surgery and oral fractures
- ◆ Orthopedic surgery
- ◆ Otologic surgery
- ◆ Perineal surgery
- ◆ Reconstructive surgery
- ◆ Ring fixators
- ◆ Soft Tissue surgery
- ◆ Thoracic surgery
- ◆ Tibial Plateau Leveling Osteotomy (TPLO)
- ◆ Triple Pelvic Osteotomy (TPO)
- ◆ Total Hip Replacement (THR) both cemented and cementless procedures available
- ◆ Tracheal Stenting
- ◆ Tibial Tuberosity Advancement (TTA)

## Anesthesia and Pain Management

- ◆ Anesthetic management of high risk and critical care patients
- ◆ Extensive anesthesia monitoring
  - Blood pressure, both direct and indirect
  - Pulse oximetry
  - Electrocardiogram
  - Capnography
  - Body temperature
  - Ventilator therapy
- ◆ Pain patches
- ◆ Chronic pain management consultations

## Arizona Veterinary Emergency & Critical Care Center Emergency and Critical Care

- ◆ In house diagnostic tests
  - STAT laboratory blood tests
    - \* Complete Blood Count (CBC)
    - \* Serum biochemical analysis
    - \* Blood gas analysis
    - \* Urinalysis
    - \* Blood lactate measurement
    - \* Coagulation testing
    - \* Ethylene glycol (Antifreeze) testing
    - \* Parvovirus testing
  - Digital x-rays
    - \* Radiologist interpretation
  - Scanning ultrasound
  - Gastrointestinal endoscopy
- ◆ Specialized Therapies
  - Intravascular volume expansion/shock therapy
  - Blood component therapy
  - Rattlesnake antivenom therapy
  - Oxygen
  - Short and long term ventilator therapy
  - Anesthetic ventilator
  - Pain medication delivery via constant rate infusion
  - Nutritional support
  - Feeding tube placement
  - Peritoneal dialysis
  - Continuous suction for chest and other drains
  - Central and peripheral IV catheter placement
  - CPR with advanced life support
  - Electrical defibrillation & emergency cardioversion
  - Anesthesia for high-risk critical patients
- ◆ Soft tissue emergency surgical procedures performed by our emergency veterinarians (included, but not limited to):
  - Wound repair
  - Emergency tracheostomy
  - Chest tube placement
  - Abdominal surgeries
  - Gastric Dilatation Volvulus (GDV) or bloat surgery
  - GI foreign body removal
  - C-section
  - Splenectomy
  - Bladder stone removal
- ◆ Intensive monitoring
  - Electrocardiogram (EKG)
  - Blood pressure (direct arterial and indirect)
  - Urinary catheter placement and measurement of urine output
  - Pulse oximetry (Oxygen saturation)
  - Capnography (End Tidal CO<sub>2</sub>)
  - Central venous pressure
  - Arterial and venous blood gas measurement

## Eye Care for Animals, dba Ophthalmology

- ◆ Biomicroscopy
- ◆ Indirect ophthalmoscopy
- ◆ Electroretinography
- ◆ Ultrasonography
- ◆ Applanation tonometry
- ◆ Fluorescein angiography
- ◆ Glaucoma treatment
- ◆ Cataract surgery
- ◆ Corneal reconstructive surgery
- ◆ Treatment of eyelid abnormalities







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*October 2017*

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We will strive to discover and share knowledge that will continuously improve the veterinary profession.

### **EXCELLENCE**

At Arizona Veterinary Specialists, our standard is excellence in all that we do and the way in which we do it.

### **COMPASSION**

The spirit of all our relationships will be driven by compassion.

### **PATIENT CARE**

We are committed to providing compassionate, ethical, and quality care to our patients. We treat them as if they are members of our own families.

### **INTEGRITY**

We will conduct ourselves in a manner that will instill confidence and trust in all of our interactions.