Australasian Association of Veterinary Diagnostic Imaging

NEWSLETTER March 2008

INSIDE THIS EDITION…

AAVDI Executive Committee 2007/2008

President – Belinda Hopper
president@aavdi.org

Vice President – Mark Owen
M.C.Owen@massey.ac.nz

Secretary – Zoé Lenard
secretary@aavdi.org

Treasurer – Robert Nicoll
treasurer@aavdi.org

General Committee Members
Nola Lester
Veronica Damien

Conference Planning Subcommittee
Nola Lester Graeme Allan
Mark Owen Marjorie Milne

2008 Conference Subcommittee
Dayle Tyrrell, Marjorie Milne
Veronica Damien

Newsletter editor: Marjorie Milne

AAVDI welcomes the input of its members. People interested in taking an active role in AAVDI can contact the secretary.

Presidents Report Belinda Hopper

For those of you (like me) who graduated a little while back, the field of veterinary diagnostic imaging in Australia today is almost unrecognisable from that of our heady student days. While the thought of having to manage without ultrasound now is enough to send most of us screaming to the bottle, those of us lucky enough to have access to CT and MRI are also rapidly coming to rely on these exciting modalities when diagnosing and managing our patients. These modalities have brought with them new challenges, not least of which is choosing one! If you are struggling to understand your patient's nasal CT, or trying to decide how to image your spinal patient, AAVDI is a great resource for you. Last year Rob Nicoll turned on an excellent conference featuring Dr Don Thrall, as you will read in this issue. I was privileged to attend, was inspired and educated by the high quality presentations, and pretty excited to hear and meet Dr Thrall! AAVDI's 2008 conference will target musculoskeletal imaging, a subject that proves difficult for undergraduates, practitioners and specialists alike, yet is something that we face every day. I urge you all to make room in your CE calendar for this one. Finally, the digital radiology revolution is upon us so if you are resisting the urge to upgrade, or are just plain confused about the technology, then you have come to the right place. You will find a fabulous review in this newsletter and presentations in all our seminars to keep you informed. We have a newly formed committee for future conference planning so get all your great ideas and pet hates in to the committee chair, Dr Nola Lester. Thank you, Graeme, for your leadership and hard work as AAVDI President, and to the rest of the AAVDI office bearers and committee members. Providing world class continuing education takes many hours of work and we are incredibly lucky to have such a dedicated group of radiologists and practitioners willing to devote their time on top of a full work schedule. Thanks guys, and happy imaging.

IVRA

Members of AAVDI are also automatically members of the International Veterinary Radiologists Association (IVRA).

IVRA is a proactive organization that encourages research involving veterinary radiology and the distribution of veterinary radiology knowledge throughout the world. It aims to represent the radiology discipline in other veterinary organisations, and encourages training in veterinary radiology.

IVRA hold a tri-annual conference, and members are entitled to a reduced conference registration fee.

Check out the IVRA website on www.acvr.org/ivra for more information.

Australasian Association of Veterinary Diagnostic Imaging

NEWSLETTER March 2008

New Veterinary Radiologists in Australia

2007 saw the admission of Dr Zoe Lenard (Murdoch University) and Dr Dayle Tyrrell (University of Melbourne) as Fellows of the ACVSc Radiology Chapter after their successful completion of Fellowship examinations in July.

2008 sees some exciting additions to the growing numbers of Veterinary Radiologists in Australia. The University of Sydney welcomes Dr Robert Wrigley as Professor of Veterinary Diagnostic Imaging. Dr Wrigley originally hails from NSW. Dr Wrigley completed his DVR in 1981 and was a Founding Member of ECVDI. He has been working at Colorado State University for 28 years as Professor of Veterinary Diagnostic Imaging, and is widely published. He has strong interest in the fields of Ultrasonography and Computed Radiography, CT and MRI. Dr Wrigley will be joined by Dr Richard Lam and Dr Juan Podadera Best, who commence as residents in Diagnostic Imaging at the University of Sydney.

Following a fond farewell of Dr Roger Lavelle after 30 years of service, The University of Melbourne Diagnostic Imaging section welcomes Dr Sandra Martig. Dr Martig completed a residency in Radiology at the University of Bern, Switzerland, and recently gained entry into the ECVR. Her areas of interest are imaging of the musculoskeletal system, radiographic contrast procedures and interventional diagnostic imaging. She returns to the UMVCH radiology team after completing a locum position in 2007.

AAVDI conference 2007 Imaging In Oncology

The 2007 AAVDI conference was held in Sydney on 22nd and 23rd July. Many members braved the cold conditions to witness a delightful day of information on Imaging in Oncology. Members were treated to the acclaimed international speaker Dr Donald Thrall, author of Textbook of Veterinary Diagnostic Radiology. Dr Thrall provided half day tuition on the "Cutting Edge Radiation Oncology", which was well received. Dr Thrall also presented an interesting update on the progression of Imaging in Oncology since the 1970s, and a series of Case Studies in Oncology. Dr Veronika Langova provided an overview on the complex subject of Paraneoplastic Syndromes, and Dr Peter Bennett spoke on Staging of the Cancer Patient. Radiologists Drs Allan and Nicoll, and Dr Max Zuber spoke on the use of radiology, ultrasound and nuclear medicine in neoplastic disease.
Dr Zoe Lenard presented on the state of Digital Radiography in Australia, discussing the differences between CR, DR, and conventional film-screen radiography. All speakers are warmly thanked for their efforts, in particular Dr Robert Nicoll who acted as conference convener.

AAVDI conference 2008 Musculoskeletal Imaging

The 2008 AAVDI conference will be held in Melbourne over the weekend 6th and 7th September. This one and a half day conference will provide updates on the use of Diagnostic Imaging for musculoskeletal disorders, including Radiographic Techniques, Digital Radiography, approaches from a surgical perspective, and advanced imaging techniques.
A range of Australasian speakers are engaged to entertain and educate on this relevant and important topic. Practical film reading sessions are also planned.
Please see the enclosed flier for more information, check out the AAVDI website, or email conference convenors Dr Dayle Tyrrell (dayle@unimelb.edu.au) Dr Marjorie Milne (mmil@unimelb.edu.au) or Dr Veronica Damien (mvdamian@hotmail.com).

Upcoming International Conferences

EAVDI Svolvær, Norway
August 6 – 10, 2008

ACVR San Antonio, Texas
October 21 – 25, 2008

IVRA Búzios, Rio de Janeiro, Brazil
July 26 – 31, 2009.

Australasian Association of Veterinary Diagnostic Imaging

NEWSLETTER March 2008

Website Watch

The AAVDI website www.aavdi.org has been updated to display a case of the month. These cases provide a chance to polish your diagnostic skills, and include a radiographic assessment by a Veterinary Radiologist. It also contains information on the upcoming 2008 conference.

Animal Insides is a website dedicated to digital radiography. It provides tonnes of useful information for those considering a DR purchase, as well as useful general radiology tutorials, and some written resources. This website is worth checking out! www.animalinsides.com

Digital Radiography

Introduction

Digital radiography refers to the mechanism of image capture where the radiographic image is converted to a digital image. Digital radiographic systems are becoming more common in veterinary practices around Australia. With time, the advantages of Digital radiography over conventional Film-Screen Radiography (FSR) will see the replacement of FSR with newer technology. As such it is important for veterinarians to be aware of emerging digital radiography technology. This review will provide an introduction to the terminology and technology of digital radiography.

Advantages and disadvantages

The production of digital images has the following advantages over traditional FSR:

- No need to maintain a darkroom (chemicals, films, cassettes, processing machine)
- Digital storage of images eliminates requirement for film storage.
- Wide latitude means good quality DR images are produced over a wider exposure range, reducing the need for 're-takes' due to poor exposure
- Digital processing techniques leads to better contrast resolution, and the ability to display soft tissues and bone, or 'thick' and 'thin' anatomy, simultaneously.
- Digital processing can allow selective enhancement of different structures
- Digital images allow easy transmission of images to colleagues for a second opinion, or in the use of teleradiology.

Disadvantages of digital radiography include

- Cost of installation (varies markedly depending on individual clinic requirements), although this is offset by savings in developing cost, film storage, and improved efficiency
- Ongoing IT support is recommended.
- New technology requires a 'steep learning curve'
- Reduced spatial resolution compared to FSR, however it has been shown that this is not clinically significant, and that the improved contrast resolution leads to overall improvement in image quality. (Buckley 1991, Swee 1997, Bindeus 2002)

DICOM – what does it mean?

DICOM is stands for Digital Imaging and Communication in Medicine. It is a communication protocol with a standard file storage format, (like .jpg or .bmp) designated as .dcm. It allows the integration and communication of medical images from different vendors. To enable flexibility in image review, storage and communication, it is important to ensure that a digital radiography system produces and stores images in a DICOM format. More information on DICOM can be found through the resources listed at the end of this article. (Wright 2008)

Types of Digital Radiography

The basic forms of digital radiography can be divided into Computed Radiography (CR), or Direct Digital Radiography (DDR).

CR uses a photosensitive imaging plate which replaces the film and intensifying screen combination used with FSR. The imaging plate is housed in a rigid, waterproof cassette for protection. Radiographic exposures are made in a very similar manner to traditional film-screen cassettes, and CR is easy to adapt to, and is able to utilise existing x-ray machines and tables. The imaging plate captures a latent image when exposed to x-rays. The cassette is placed in a plate reader, the latent image is read by a laser light, and then processed into a digital image. After reading, the imaging plate is exposed to bright white light which erases the cassette, allowing the

Australasian Association of Veterinary Diagnostic Imaging

NEWSLETTER March 2008

cassettes to be re-used. The speed of the plate reader varies, but generally processing takes approximately 30 to 180 seconds. Taking radiographs with a CR system takes a similar time to radiographing with the traditional FSR system and automatic processor. CR systems are usually less expensive than DDR systems.

With DDR, the imaging plate is directly read and converted to the digital image, eliminating the plate reading step. Thus with DDR a digital image is produced almost immediately, and work-flow may be more rapid and efficient using DDR. (Figure 1) Direct digital radiographic systems may use flat panel detectors, or charge-coupled devices (CCD) detectors.

Flat-panel detectors may involve direct or indirect conversion of x-ray energy into an electrical charge.

1) Direct image conversion involves the use of a photosensitive material that produces an electric charge when impacted by x-rays. Using circuitry, this electric charge is converted into an electrical current which is digitised, and processed into a digital image.
2) Indirect image conversion converts the x-rays into light, which then exposes photosensitive material creating the electric charge, which is digitised and then processed to form the digital image.

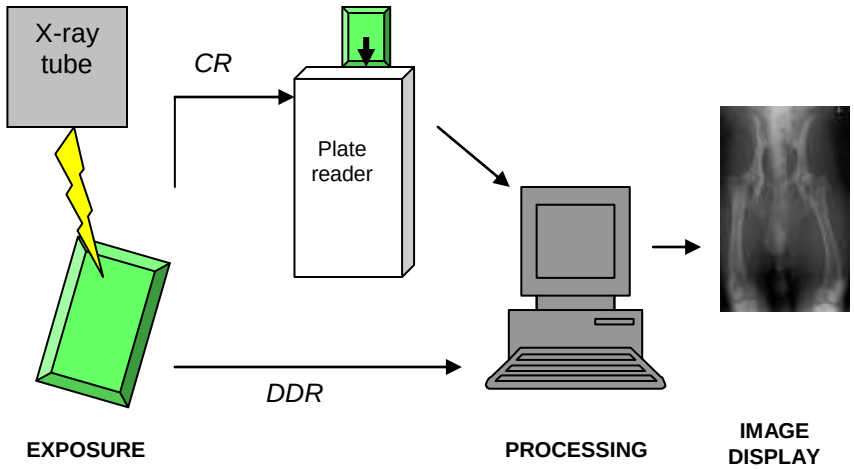

Figure 1. Work-flow of Computed Radiography (CR) vs Direct Digital Radiography (DDR)

CCD detectors use a lens and fibre-optic system to minify the radiographic image and expose a CCD chip, similar to those used in digital photography. After exposure of the CCD chip, the electrical charges are read out as a digital signal, which is processed into the digital image. Due to the optical minification requirements of CCD systems, the x-ray beam must always be at right angles to the CCD plate, thus CCD systems are not appropriate for equine radiography. Minification also reduces the detection efficiency of CCDs, resulting in reduced radiation dose efficiency. CCDs however are cost effective, allowing them to compete with flat panel detectors in the veterinary market.

Image Quality

Image quality is obviously influenced by the same old factors as FSR such as patient preparation, positioning, collimation of the x-ray beam, and to a lesser extent radiographic technique selection. Marked underexposure will lead to a mottled, grainy image. Careful attention must still be paid to these factors when using digital radiographic equipment.

A large determination of final image quality depends on the image processing step. The digital signal provides a measure of x-ray energy absorption over a small area called a *pixel*. The digital processing step applies an algorithm to these pixel values, to allocate a gray scale and produce the final digital image. Inappropriate or primitive

algorithms or inappropriate algorithm selection will produce poor quality digital images. It is important to ensure that veterinary specific algorithms of high quality are provided when purchasing a digital radiography system.

Image Display

After the digital image is produced, it is usually viewed on a computer monitor. Images may be printed; however this removes the benefit of avoiding film storage, and is not recommended. Many software programs are available that allow for the image contrast and brightness to be manipulated, allow for magnification of the image, and provide digital measuring tools. Image viewing software is often provided by the digital radiography vendor, however there are several free programs and some excellent programs for purchase, available from the internet.

It is important to understand that not all computer monitors are equal and in order to make best use of the digital image without loss of resolution and contrast, high quality monitors with high resolution, high luminescence, & a high contrast ratio are used. There is controversy in the literature as to which monitors are the best to use. Ideally medical grade, black and white LCD monitors are recommended, however the high cost of these monitors usually means a compromise is made with the selection of high quality LCD monitors such as those with a resolution of at least 2 to 5 MP, contrast ratio of 1000:1, and luminescence of 1500 cd/m^2. Please refer to other resources for a more comprehensive discussion on image monitors.

Image Storage

The digital images may be stored locally on the digital radiography workstation, however practices with a moderate to large work-flow, or those with multiple digital imaging modalities should consider installation of a Picture Archiving and Communication and Storage system (PACS). Such a system will allow integration of DICOM images from multiple modalities, will provide for the storage and back-up of the digital images, will enable communication of the images throughout a hospital, and to other colleagues for second opinion or teleradiology.

Careful consideration must be given to safe methods of image back-up. Options include on-site vs off-site storage, storage using hard-drives, CD or DVDs, magnetic tapes, or contracting a third party to archive images via a network. Consider consulting an IT professional for advice regarding the best image back-up method for your situation.

Digital Radiography Artifacts

As with any imaging modality, new artifacts are produced and it is important to be aware of these to avoid inappropriate interpretation or missed diagnoses. A complete review of artifacts is beyond the scope of this article, and the reader is referred to other resources for more information.

DR artifacts include:

- Excessive image “noise” or graininess.
- Over-shoot or ‘Uberschwinger’
- Double exposures
- Grid lines producing a Moire
- Pattern
- Ghost Images
- Calibration Mask Errors
- Inappropriate algorithms

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