Avian Radiology

James Gill BVSc MVM MACVSc

Canley Heights Veterinary Clinic, Shop 6, Harden Street and Avoca Road, Canley Heights, NSW 2166

The obscure we eventually see. The completely obvious, it seems, takes longer - Anon.

Radiology plays an important role in avian diagnostics. Avian practitioners vary in their use of this valuable diagnostic tool. Some practitioners use it as a screening technique as part of a routine diagnostic work up in nearly all diagnostic cases. Others use it for assessment of specific conditions eg fractures or as a last resort after haematology, biochemistry and microbiology have failed to help with obtaining a specific diagnosis. These differences or biases are a result of the historical development of avian medicine in the particular practice and the associated differences in acquired expertise. Either approach is not necessarily right or wrong but as we mature as avian clinicians and our knowledge of individual syndromes increases, a more complete and flexible approach to each case will develop.

Unless there are specific indications (for example, an abdominal swelling or a non specific lameness) we do not radiograph birds as a first option in gathering diagnostic information. We find that other methods such as biochemistry, haematology and gram stains are quicker, cheaper and safer (in terms of radiation exposure to our staff), considering the facilities we have in our practice.

However in other practices it may be quicker and cheaper to obtain valuable diagnostic information with good quality radiographs as a first option.

The presence of air sacs within the body cavity gives a natural contrast media enabling good visualisation of many internal organs and bone structure of the pneumatic bones.

The small size and rapid respiration of the patient creates some technical difficulties. Remember when reviewing the literature that the majority of our patients in Australia are under 100 g body weight, whereas a lot of the literature refers to birds over 300 g body weight. It is easier to get useful information from radiographs in galahs than budgerigars or cockatiels

X Ray Machines capable of delivering low Kvp, high Ma and short exposure times offer distinct advantages. The amount of detail is at least partly limited by the focal spot size of the X ray machine.

We are currently using human extremity plates containing rare earth screens which give wonderful fine detail which out ways the disadvantages of requiring slightly increased exposure. The film is medium speed which we use for dog and cat radiology. I find that it is simpler to use just one combination of screens and film than have multiple combinations with

a large number of different veterinarians taking radiographs. Human mammography film is used by many practitioners to improve detail in the avian radiography.

The requirement for high quality radiographs also means that we change our developer and fixer solutions far more regularly than we might otherwise in dog and cat practice. The availability of relatively cheap automatic film processors can overcome many of the darkroom problems that plague veterinary practice (for example, the Fuji fpm 100A). The new generation automatic film processors do not need high volume turnover to ensure proper functioning of chemicals. The savings in labour may well offset the capital cost.

Digital Radiography is obviously the way of the future. The ability to enhance and magnify the resultant radiographs on the computer screen may offer many advantages with the small patient. The limitation on quality will still be limited by the focal spot size of the X ray machine.

Restraint of the avian patient can be accomplished in a number of ways.

1. Anaesthesia, Isoflurane anaesthesia is a quick safe and effective method of restraint. The birds head and limbs can then be positioned with masking tape. Isoflurane anaesthesia is safer and less stressful to even severely ill birds than manual restraint when taking radiographs.

2. Restraint boards a variety of designs for perspex restraint boards have been developed. They work on the principle of placing the head in a set of stocks and tying the legs to attachments on the other end of the perspex board.

3. The bird in the box, for severely compromised bird it can be useful to radiograph the bird in a cardboard box to screen for heavy metal particles, foreign bodies or for an egg, often to just convince a disbelieving client. It is unwise to try and interpret any more than this from this view.

The essential feature of both methods is to get the radiographer away from direct exposure to X rays and to position the bird accurately so as to not have to take unnecessary repeat exposures. Anaesthesia is my preferred method of restraint.

Treat birds with palpable abdominal swelling with great care as they have a compromised respiration.
There is absolutely no point killing the patient to get diagnostic information.

Positioning of the avian patient follows the same principles as for our other patients - that is, two views should be taken of all areas of interest.

Whole body radiographs, lateral and ventrodorsal.

> **Lateral**, the bird is held in lateral recumbency and this should be standardised either right or left. Right lateral recumbency will probably become the standard accepted technique.[1] The wings are extended dorsally and the legs are extended caudoventrally. If the area of interest is the cloaca or caudal abdomen the legs can be extended cranioventrally. In a true lateral radiograph the two acetabulum will be superimposed on each other, in practice this is difficult to achieve. Foam wedges of various sizes and angles are useful in positioning the patient.
>
> **Ventrodorsal**, the bird is held in dorsal recumbency with the legs extended caudally and the wings extended laterally. On the resultant radiographs the keel and the spine should be superimposed giving a distinct straight line. Symmetry is important particularly when evaluating shoulder and hip injuries, liver size and lung disease. However it is difficult to achieve and great care should be taken in perfecting your technique.

Stressed wing position is recommended for evaluation of the shoulder [8]. In this ventrodorsal position the wings are extended laterally and then stressed cranially so that carpi are taped alongside the head. When evaluating the shoulder region and checking for symmetry between the left and right it is useful to evaluate changes in the clavicular air sac as an indication of damage in this region.

Head radiographs are taken with standard ventrodorsal and lateral views. In addition oblique views are often useful in defining the extent of injuries and damage to bones and soft tissues.

Limb radiographs, lateral, ventrodorsal and stressed radiographs are positioned as described for whole body radiographs. Oblique radiographs may be useful in evaluation injuries to the scapula and coracoid. Anterioposterior radiographs of the extended wing with the body of the bird held upright over the edge of the table is the most suitable position in our experience.

Magnification Radiography can be useful to evaluate specific areas such as the head and some joints. The bird is separated from the film by foam blocks, the disadvantage of this is that you get a blurring and distortion of the image which is inversely proportional to the distance between the bird and the X-ray plate. The need to get a larger image of small areas in small patients can outweigh this disadvantage, but equally we have to be even more careful not to over interpret the resulting radiographs.

Normal radiological anatomy varies greatly between groups of birds and between species. It is important to try and become familiar with the normal anatomy of the species that you commonly see. There is a need for a great deal of research work to be done in this area in evaluating normal parameters. If a practice is developing expertise in a particular species of bird it is wise to collect a set of normal reference radiographs.

Psittacine birds, because of their commercial and emotional value as pets are the most commonly radiographed bird in our practice and probably most avian practices and I will limit

the discussion of normal anatomy to this group. However it should be remembered that there may be considerable variation between species within this group and the following description should be used as guidelines. The interpretation of the results obtained from the radiographs should be considered in light of the clinic all examination haematological, biochemical and microbiological findings.

The psittacine whole body ventrodorsal radiograph, the liver and heart create an hour glass shape being surrounded by air sacs. The liver does not normally extend beyond a line drawn between the scapula and the centre of the femoral head .[2] The gizzard lies in the lower left quadrant of the abdomen. The crop tends to lie to the right side of the cervical spine and is normally empty in the middle of the day. The lungs have a regular reticular pattern and good visualisation of these in a normal bird is evidence of good technical quality of the radiographs. The air sacs should be evenly black.

The lateral view of the psittacine patient provides the best visualisation of the kidneys and in our experience they should not normally extend below a line drawn parallel to the spine and through the ventral border of the acetabulum. Gonads are rarely visualised except in the breeding season. The spleen can be visualised on many lateral radiographs and splenomegaly can be recognised.

On lateral radiographs the liver and heart shadows fuse in a normal psittacine and space or radiolucent line in this area indicates a decrease in liver size.. In our experience the dorsal borders of the heart, liver and gizzard form a straight line parallel to the ventral border of the spine.

The intestines rarely contain gas.

The gizzard normally contains radio dense gravel. Excessive accumulations of gravel or grit is pathological. At times we find it difficult to quantify the “excessive”. The degree of radio density is also important in determining the presence of heavy metal particles. Galvanised wire steel or lead give an absolute radiodensity. No grits blue metal or gravel can match this radiographically.

The reticular pattern of the lungs is also will recognised on lateral radiographs. An obvious air sac space normally exists between the heart, lungs, kidneys, gizzard and liver. If the air sac can be visualised as a radiodense line it indicates thickening of the air sac.

Skeletal Anatomy, birds do not have nutrient foramens in the bones and as a result that hair line fracture is invariably a hair line fracture.

All wing bones and the femur do not have epiphyseal centres of ossification. The tibiotarsus and tarsometatarsus have epiphyseal centres of ossification similar to mammals. [3]

The humerus femur and tibiotarsus are pneumatic bones to varying degrees in different species and should have dark medullary cavities on radiographs.

RADIOLOGICAL PATHOLOGY

Look for changes in size shape and density as well as for changes in position.
Look for what is not on the radiographs
Develop a systematic approach to evaluating the radiograph

Skeletal pathology follows the same patterns as for dogs and cats. Neoplasia tend to be destructive rather than proliferative in nature and the earliest signs are often soft tissue densities in the medullary cavity.

Pathologic fractures are common, but apart from this obvious sign it is difficult to be accurate about demineralisation of bone. This partly a function of the thin cortices and partly the reduced numbers of epiphyseal centres of ossification. The use of aluminum step wedges as a comparative technique would be needed to give an a accurate estimation of the degree of demineralisation.

The evaluation of abdominal and thoracic pathology also involves the same general principles as in dogs and cats.

The presence of abnormal masses, foreign bodies, of unusual fluid or gas densities of the loss of air sac space are all good indicators of disease.

Contrast Studies

Barium meals can provide useful information but you have to weigh up the risks of anaesthetising a bird after barium to take the radiographs and the subsequent risks of inhalation pneumonia. The alternative is to use a restraint board where you don't get the same quality of radiograph.

Intraosseous or intravenous administration of intravenous contrast material eg Conray can also help to delineate abdominal organs if given in the hind legs. If given via a wing it can highlight the heart and lungs. The radiographs are taken immediately the injection is finished and then again approximately one minute later

Myelography has been performed on some large species .[8]

CT scans and MRI also have wonderful potentials. With these expensive advanced imaging techniques and contrast studies I think it is prudent to ask - is the extra diagnostic information going to lead to a different treatment regime or a treatment regime that is going to save a patients life or improve its quality of life?

Ultrasonography is limited in the avian patient especially those under 300 g body weight because the bodycavity is largely surrounded by bones and the internal organs surrounded by air in the air sacs. It has been demonstrated to be useful in some cardiac evaluations by positioning the probes at the end of the keel and directing it through the liver towards the heart.

It can also be used to evaluate cases of egg peritonitis and inspissated yolk in the oviduct and uterus.

The role of radiography in our clinical protocol for treatment of a sick bird is:

- weigh bird daily before fluid therapy antibiotics and ± CaEDTA
- faecal flotation
- CBC and biochemistry profile if costs justified ie valuable or emotionally important patients
- Clearview test on choana and/or cloacal swab
- if faecal flotation is negative, repeat
- if vomiting crop wash wet prep and gram stain
- if diarrhoea, do a Gram stain
- if Gram negative, consider culture and sensitivity
- if abdominal swelling present radiograph immediately; **abdomenocentesis and tap off fluid first if possible**. Don't kill the bird to get a radiograph!!!
- if continuing to lose weight over 48 hours, radiograph and CBC and biochemistry profile if client willing and reassess therapy

References and Further Reading

1. Rubel GA, Isenbugel E. and Wolvekamp (1990). Atlas of Diagnostic Radiology of Exotic Pets. WB Saunders Company. p 77

2. McMillan MC (1986). Radiographic Diagnosis of Avian Abdominal Disorders. *Comp Cont Educ* **8**:616-632

3. Fowler M (1980). Recent Advances in the study of Raptor Diseases. Proceedings of the International Symposium on Diseases of Birds of Prey, 1st-3rd July 1980, London 1980. Eds Cooper JE and Greenwood AG. p 75.

4. Nickel R, Schummer A and Seiferle E (1977). Translated by Siller WG and Wight PAL. Anatomy of the Domestic Birds. Verlag Paul Parey Berlin, Hamburg

5. Orosz SE, Ensley PK and Haynes CJ (1992). Avian Surgical Anatomy. WB Sanders Philadelphia

6. Smith AM and Smith BJ (1992). Atlas of Avian Radiographic Anatomy W.B. Saunders Co., Philadelphia.

7. Krautwald M-E, Tellhelm B, Hummerl GH, Kostka VM and Kalete E (1992). Atlas of Radiographic Anatomy and Diagnosis of Cage Birds. Paul Parey, Scientific Publishers, Berlin and Hamburg.

8 Samour J and Naldo JL [Eds] (2007). Anatomical and Clinical Radiology of Birds of Prey, Including Interactive Advanced Anatomical Imaging. Saunders Limited. p 5.