ABSTRACT

Key words: radiology, avian radiographic appearance

INTRODUCTION:

When dealing with birds, some difficulties can be encountered when trying to reach a diagnosis, this also because of the lack of commercially available diagnostic tools, like specialized laboratories, in-house kits, and reference ranges. Radiology, with its simple and direct images is relatively easy to interpret and is an useful diagnostic tool for the avian veterinarian.

Nowadays in any small animals' practice there is a radiological apparatus that can be used for avian patients, as well.

One of the most important concerns, when working with very small animals, is the quality of the image. In fact, birds breathe very quickly, therefore timing should be fast. Further avian patients generally have little peri-visceral fat, and this limits the differentiation between the different tissues.

RADIOLOGICAL APPARATUS AND EXPOSURE FACTOR: One of the major problems in avian radiology is the loss of sharpness due to the patient movement. Taking a picture using very short exposure time (0.015 - 0.05 second) can help to avoid this problem. Thus the kilovolt should be kept as low as possible (45 - 55 kV) in order to have an high contrast picture and a wide shade of grays that results in a good quality picture.

Depending on the film and the screen, the exposure would vary within 10 and 20 mAs. So that it is advisable to use powerful radiological apparatuses, that may reach those values with the shortest possible time. Machines that reach 200 - 300 mA are good for our purposes.

THE FILM: although there is no uniformity in the general opinion about using mono- or bi- emulsion films, when the size of the patient is small enough, the author prefers to use a mono-emulsion film for mammography. Because the rapidity of the shot is more important than other exposure values.

CHASSIS ADN SCREEN: any chassis can be used, but the rare earth screen is preferable. Generally the use of the grid is not necessary with the avian patient that could be sit directly on the chassis.

POSITIONING OF THE PATIENT (with or without anesthesia): Although the avian skeleton is easy to visualize, the differentiation within the soft tissues is difficult, especially in very small animals.

For these reasons a perfectly symmetric positioning and a good knowledge of the avian anatomy are needed in order to avoid misinterpretation of the radiograph.

Although it is debated if anaesthetize the birds when taking a radiograph, everybody agrees that anesthesia is to be avoided in the following cases:

- Very tame animals that may be easily handled.
- Very weak animals in critical conditions, where the risk of the anesthesia is very high.
- Very young animals in which it is possible to take picture of the standing bird.
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Sedation/anesthesia is advisable in very excited birds, or dangerous birds when their conditions are not critical and they can stand the risk of an anesthesia. In any case the author suggests to use Isoflorane. Loro Parque

Whether the patient is anesthetized or not, should be positioned with the help of a special tramp, or with the help of other material, such as tape, or other adhesive strips.

When positioning a bird for a ventro-dorsal x-ray, the head will be held slightly extended, the wings open at 90° with the body longer axis and the legs will be extended caudally, parallel to the body. The sternum will ideally project exactly over the spinal cord, while scapulae, hips and femurs will be aligned.

On the other hand, for a latero-lateral projection the wings will be extended dorsally and fixed together. Between the wings and in order to keep them slightly distant, a small lining may be put. This will avoid the rotation of the whole body. For the same reason, the legs will be fixed separately. The leg closer to the working plan will be held more cranially then the upper one. In this way hips, ribs, coracoids and kidneys will be overlapped.

CONTRAST MEDIA: are used mainly for the x-rays of the digestive system. Also, they may useful to understand to which system are belonging radio-opaque masses, in the coelomic cavity, that cannot differentiated by other means.

The mostly used contrast media is Barium sulfate. The commercial solution should be diluted to obtain a 25 45 % concentration. 20 ml/Kg BW of this dilution is then administered by gavage to the patient. Alternatively to Barium sulfate, Iohexol can be used, even if it has an almost double intestinal transit time.

Making x-rays contrast media in birds, some rules should be followed:
- Fast the patient for about two hours before the administration of the contrast media. Do not prolong fasting too much, as this might alter transit time.
- Always shoot two empty radiographs (VD and LL), before using the contrast media.
- Do not use Barium sulphate if an intestinal rupture is suspected.

Contrast urography is seldom performed in avian patients. Since birds lack a urinary bladder, a kidney pelvis and a urethra, the contrast study will be focusing only on the ureters. To diagnose kidney diseases, other techniques are used, such as biopsy. Anyway, iodine compounds can be used for contrast urography, at a doses of 700 800 mg of iodine/Kg BW.

CONTRAST MEDIA AND ANESTHESIA: until recently, due to what was known about mammals' respiratory physiology, the general rule was to avoid general anesthesia in birds, before contrast media radiograph were taken. This to avoid to alter the gastrointestinal transit time. Very recently, a joint study run by Dr. Angela Lennox in the US and the veterinary staff of the Loro Parque, showed that isoflurane anesthesia does not alter significantly this time.

AVIAN RADIOGRAPHIC APPEARANCE

SKELETON:
Skull: the avian skull includes several sinuses, and they may be very complex. In some taxonomic groups (i.e. Psitaciformes), the upper bill is joined to the frontal bone by a moveable joint. Further, birds have a chain of scleral bones, in the eye. Those have a striking looking in the x-rays.

Spinal column: it is constituted by various tracts, that differ from the classical divisions of the mammalian spine. Avian spinal column is divided in the following tracts: cervical, thoracic, synsacrum (a partially or totally solidly fused series of vertebrae in the pelvic region in birds, that includes the lumbar, sacral and caudal vertebrae), free caudal and ptygostyle (last caudal vertebrae, fused together).

The number of cervical vertebrae can vary in the different species, between 10 and 25. As a general rule parrots have 12 cervical vertebrae.

Forelimbs and pectoral girdle: the pectoral (or shoulder) girdle is formed by the clavicle (the two clavicles are fused distally, forming the furcula), coracoid and scapula.

The sternum, with few exceptions, such as the ratites, has a keel the serves to anchor the powerful pectoral muscles.

The wing skeleton is formed by the humerus, radio, ulna (larger of the radius), by the carpal bones (radial and ulnar), carpus-metacarpus and hand. The latter includes the bones of the alula, the two metacarpals and the phalanges.

Hind limbs and pelvic girdle: apart the synsacrum, the avian pelvic girdle includes the ileum and the ischium, which are fused, and the pubis, that is independent.
The skeleton of the leg includes the femur, patella, tibiotarsus, fibula and fingers.

RESPIRATORY SYSTEM: this is one of the most different systems between birds and mammals.

Trachea: is easily spotted at x-rays, especially because it made of closed cartilaginous rings. In some bird species the trachea has an unusual shape:

- Mynah birds: the trachea forms an angle with ventral apex, when it enters into the thorax.
- Cranes: especially in some species, the trachea curls up in a ball.
- In the males of several anseriformes (ducks, swans and geese), the trachea has a well evident bulla.

Lungs: due to the structure of the distal portion of the parabronchi, in the latero-lateral projections, avian lungs show a distinct “honeycomb” image. Any respiratory disease may alter the radio-density of this image, making it darker, or even clearer, up to disappear.

Air sacs: most avian families have 9 air sacs, but differences exist. Air sacs are radiologically well evident, and appear like dark areas (air filled), within the body cavities. Generally speaking it is considered normal that are of the same dark gray tone as the air outside the body (keeping in mind that still there some soft tissues in between). In the case of air sacculitis the radiological appearance of the air sacs may change in the shape, gray tone, or also for the presence of focal lesions.

CIRCULATORY SYSTEM

Heart: in most species the heart is located between the second and sixth rib. The width of the heart base is approximately the 50% of the maximum width of the coelomic cavity. In a ventro-dorsal projection, together with the liver, the heart forms a sandglass figure, whose shape may change with several diseases. The few heart problems that may be radiologically evident are: cardiomegaly, reduced size of the heart (very rare) and arteriosclerosis with mineralization of the great heart vessels.

DIGESTIVE SYSTEM: birds have a relatively short digestive system, when compared to mammals. It is radiologically divided in cervical esophagus, crop (in the avian families that have it), thoracic esophagus, proventriculus, ventriculus (gizzard), intestine and cloaca. In the ventro-dorsal projection, cervical esophagus and crop will lay on the right side. In some species (most pigeons and doves), the crop is also extending on the left side.

In the ventro-dorsal projection the proventriculus is slightly on the left side, while in the latero-lateral one it lays dorsally to the liver.

The ventriculus is easily identified, as it often contains some grit, or other radio opaque material. In the latero-lateral projection it is located caudo-ventrally to the ventriculus, while in a ventro-dorsal one, it will be found slightly on the left side of the coelomic cavity.

The various portions of the avian intestine are not easily differentiated at x-ray, unless they contain air or fluids, and both those findings are not normal. Exceptions to this rule are the young chicks, not yet weaned, Mynahs and Toucans. In those birds the presence of fluids in the intestine may be normal, while the presence of gasses is never so.

SPLEEN: this organ cannot always be spotted in the radiographs. A normal spleen can only be identified in the latero-lateral projection, especially when there pathologies that increase its size and eventually its radio-density, too.

In psittacine birds the spleen is a rounded organ, showing up at the junction of the proventriculus and ventriculus.

LIVER: as pointed out before, in many avian species and especially in parrots, in the latero-lateral projection the liver appears joint to the heart, forming a sandglass figure. Most alterations of such a silhouette depend on:

- A heart problem;
- A liver problem;
- A proventricular problem.

In the ventro-dorsal projection the liver borders should not pass an ideal line that goes from the shoulder joint to the acetabulum. In the latero-lateral projection, the liver should not pass the sternum.

KIDNEYS: are divided in three lobes (cranial, median and caudal). From the kidneys are originating the ureters, that will open directly into the cloacal urodeum. In fact birds do not possess an urinary bladder. Kidneys are not easy to identify in the ventro-dorsal projection, but they are easily spotted in the latero-lateral one, where their silhouette is evident in the dorsal part of the coelomic cavity, like if they were “hanging” from the synsacrum. Kidneys are extra-peritoneal organs in birds, too.

GONADS: are well seen in the latero-lateral projection, where they appear as slightly radio-dense organs, located cranio-ventrally to the cranial lode of the kidney.

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