Introduction
The unique anatomy of birds grants radiography special diagnostic value in this species. Radiolucent air sacs throughout the body can be evaluated and provide a high contrast medium to soft tissues, thereby improving radiographic visualisation of coelomic organs. Additionally, avian anatomy makes digital coelomic palpation and airway auscultation challenging, increasing reliance on imaging for diagnoses.

Equipment
Due to the typically small size of the patient, high resolution radiographs illustrating fine detail are required. To produce high quality images, a high output generator is ideal; 300 milliamperes (mA) in combination with 40 – 90 peak kilovoltage (kVp) range. Fine detail films similar to those used in human mammography and high definition intensifying screens help to achieve better detail. Grids are not necessary due to small patient size and the presence of air sacs, which reduce scattered radiation. Digital radiography is of great value in avian practice because of advances in the development of species-specific algorithms as well as the speed of development, which reduces general anaesthetic time for these sensitive patients.

Radiographic Technique
To create a wide grey-scale range, a low kV technique (40 – 55kV) combined with a high mA (5 – 7mA) and a short exposure time is recommended. Short exposure times are critical in reducing motion artefact caused by the rapid respiratory rate of birds. Collimation is important to minimise scatter. Dental x-ray systems can be useful for imaging the extremities of small birds, but due to the low mA capacity of the generator and inability to utilise a short exposure time, they have limited value for imaging the coelomic cavity.

Positioning and practicalities
Orthogonal views in avian species should include ventro-dorsal and right lateral projections. Whole body versus collimated coelom views are dependent on clinician preference. Radiographs exhibiting poor positioning are of limited diagnostic value. Patient fasting is recommended prior to radiography; 2 hours for small birds and 3 – 5 hours for larger birds. General anaesthesia using isoflurane is widely used to achieve correct positioning and minimise stress of handling to patients. Avian restraint boards or paper adhesive tape (which is less damaging to feathers) can be used to position the patient. See Fig 1 and 2, for guide to positioning.

Exploratory ‘bird in a box’ radiographs (horizontal beam utilised, bird sitting in a box with cassette positioned vertically and perpendicular to the x-ray beam) reduces handling and negates the need for general anaesthesia. Conditions such as metal ingesta or calcified egg binding can be used to position the patient. See Fig 1 and 2, for guide to positioning.

Contrast administration (barium sulphate solution) via gavage tube can aid visualisation and further assessment of the gastrointestinal tract.

Quizlet
There is a positioning error in the overleaf radiograph—can you spot it?

References
Assess the **trachea and syrinx**, especially in patients with inspiratory dyspnoea. Aspergillus granulomas and foreign bodies can sometimes be visualised radiographically.

Assess the **lungs**. Normal lungs are described as having a ‘honey comb’ appearance. Assess for changes in radiopacity or the presence of masses. Masses are commonly fungal granulomas but can also be neoplastic or bacterial in origin. A proportion of the lung field is superimposed by the cardiac silhouette in the VD view so obtaining an orthogonal view is important.

Assess the **hepatic silhouette** for widening or asymmetry (hepatopathy, compressive pathology in caudal coelom including effusion, space occupying lesions and enlarged proventriculus). Generally, on the VD view, the liver should not extend laterally beyond an imaginary line connecting the coracoid and acetabulum (see dotted line ‘a’), but this is species dependent.

**Urogenital system.** The kidneys are assessed most easily on a lateral projection. The gonads are rarely visualised on either view but in reproductively active birds can increase quite dramatically in size. Radiologically detectable pathology can include neoplasia, renal calcinosis, egg binding and ovarian cysts.

**Musculoskeletal system** for trauma and abnormal radiopacity.

**Air sacs** are radiolucent in the normal patient. Changes in radiopacity, and the presence of radiopaque lines are indicative of pathology.

Assess the **cardiac silhouette** for size and shape. In medium-sized psittacines the width of the cardiac silhouette on a VD view (dotted line ‘x’) should be between 51-61% of thoracic width when measured at the widest point (dotted line ‘x+y+z’). An increased width may be due to conditions such as pericardial effusion or cardiomegaly. A decreased width and an angular and retracted shape may indicate a microcardia associated with hypovolemia and dehydration.

Assess the **cardio-hepatic silhouette**. In most psittacine species, the silhouette is an hour glass shape on the VD view with the hepatic waist being marginally wider than the heart.

**Gastrointestinal tract and spleen** are better visualised on the lateral projection due to superimposition on the VD view. The presence of grit can facilitate locating the ventriculus. Intestines are not as obviously visualised as in mammals because they are usually devoid of gas.
**Right Lateral Projection of an African Grey Parrot**

*Due to anatomical variations between avian species referral to an avian anatomy textbook is recommended.*

**Assess the musculoskeletal system** for trauma, arthritis and abnormal radiopacity.

**Assess the trachea and syrinx**, especially in patients with inspiratory dyspnoea - aspergillus granulomas and foreign bodies can sometimes be visualised radiographically.

**Assess the lungs.** Normal lungs are described as having a 'honeycomb' appearance. Assess for changes in radiopacity or the presence of masses. Masses are commonly fungal granulomas but can also be neoplastic or bacterial in origin.

**Air sacs** are radiolucent in the normal patient*. Changes in radio-opacity, the presence of radiopaque lines or loss of coelomic detail is indicative of pathology.

**Assess the urogenital system.** Assess the kidneys for size, shape and radiopacity. Radiologically detectable pathology in this system can include neoplasia, renal calcinosis, egg binding and ovarian cysts. In reproductively active birds, the gonads can increase quite dramatically in size7.

The **proventriculus, ventriculus, intestines** and **spleen** are better visualised on the lateral projection. The presence of grit can facilitate locating the ventriculus. The normal spleen can sometimes be visualised as a spherical organ on the lateral view; an enlarged spleen can indicate infection7. The normal proventriculus is sometimes visible on the lateral view, and can distend pathologically in conditions such as proventricular dilatation disease or lead toxicity*. Intestines are not as visible as in mammals because they are devoid of gas in the normal bird.

**Assess the crop** for abnormal distension, gas or foreign bodies.

**Assess the area of the liver.** Generally, in adult birds, the caudal margin of the hepatic silhouette should not extend past the caudal tip of the keel*. A decrease in the size of the air sacs may indicate an organomegaly.

**Assess the cardiac silhouette and major vessels** for size and shape. An increase in size may be due to conditions such as pericardial effusion or cardiomegaly. A decreased size and an angular and retracted shape may indicate a microcardia associated with hypovolemia and dehydration6. Atherosclerosis can sometimes be visualised by an increased radiopacity or calcification of the great vessels on lateral view6.

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