
7. Summary

“Diagnostic Imaging of the ostrich (*Struthio camelus*)”

The aim of this study was to develop a standard radiographic and ultrasonographic procedure for the coelomic cavity of the normal ostrich as well as a gastrointestinal contrast study and to describe its physiologic appearance with these three imaging modalities.

Radiography

A standard radiographic procedure was developed for the coelomic cavity of female non-breeding ostriches. Positioning, collimation, centering and a technique chart were defined to give reproducible and consistently good quality radiographs. Radiographs were obtained from one adult ostrich cadaver, two adult female ostriches as well as 2 growing ostriches at various stages. A 6-frame technique was established for lateral views taking the topographic tissue distribution into consideration and using easily palpable landmarks as centering points. Standing true right lateral radiographs are recommended for standard procedures. For DV exposures a 3-frame technique in the recumbent ostrich was found to be optimal. Birds should be fasted if possible. A technique chart for lateral exposures is provided (Table 1).

Radiographic anatomy

This part of the study provides a reference for the radiographic anatomy of the coelomic cavity of female ostriches as a representative of Struthioniformes. One ostrich cadaver, two adult and two growing ostriches were used. Right lateral radiographs produced by a 6-frame technique and two DV radiographs produced by an adapted 3-frame technique were selected and schematic illustrations of these were labelled to illustrate normal radiographic anatomy. Differences to other avian species and unique features of the ostrich were briefly discussed. This atlas of the normal radiographic anatomy of the coelomic cavity of the ostrich should facilitate the interpretation of pathology. This study supplies additional in vivo anatomic information which could not be obtained in cadavers. For the application of this study upon other Struthioniformes, one should be aware of a number of anatomic variations.

Gastrointestinal contrast study

This study described the radiographic protocol and appearance of the normal contrast filled gastrointestinal tract in the ostrich. Ten gastrointestinal contrast studies were performed in seven normal ostriches of varying ages. They were starved for 16 h and administered 25-50 % liquid barium sulfate in dosages ranging from 7-10 ml/kg and concentrations from 25-100 %. Craniodorsal (D1), midventral (V2) and caudoventral (V3) radiographs were made according to a previously described 6 frame-technique for left-to-right lateral standing views. Additional DV views were used to assist in interpretation. Survey radiographs followed by a series of post contrast radiographs were made. Barium filled structures that were consistently identified included the esophagus, proventriculus, ventriculus, duodenum and proximal and distal rectum. Due to the superimposition of the remainder of the small intestine individual segments were difficult to differentiate. The caecae were inconsistently seen and when identified, it was only for a short period of time. The optimal dosage was 10 ml/kg of a 50 % barium solution for chicks and of a 25 % solution for adults. The authors believe that this can be a useful diagnostic technique in ostriches particularly as nowadays many ostriches are kept as pet birds increasing their value. Additionally it assists in answering anatomic and physiologic questions.

Transcutaneous ultrasonography

Ultrasonographic examinations were performed on clinically healthy growing and adult non-breeding female ostriches. Multiple acoustic windows and the normal ultrasonographic appearance of the coelomic viscera were described. Good images of the heart and its major vessels, proventriculus, ventriculus, intestines, liver and kidneys could be obtained. Additionally, an anechoic structure, believed to function as an urinary bladder, could be imaged in the cloacal region. The pancreas, spleen, thyroid glands, inactive ovary and adrenals could not be seen in this study. General limitations were the size of the ostriches, massive leg and dorsal muscles, large sternum, the extensive air sac system, compact convoluted intestines and varying amounts of gastrointestinal gas. Ostriches do not possess a gallbladder and thus it could not be used as a landmark or acoustic window. The extensive air sac system and feathers did not limit the use of ultrasonography as much as anticipated. Imaging of air sacs should however be considered to detect pathologic processes such as air sacculitis which may result in consolidation. An ultrasonographic topographic map was provided.

The results of this study showed, that particularly radiography and ultrasonography of the ostrich are simple, informative, non-invasive and stress-minimizing diagnostic imaging modalities whose diagnostic potential appears to be promising. Gastrointestinal contrast radiography represents an additional diagnostic procedure. However the veterinarian must be aware that the procedure is time consuming (even though reduced to a minimum if the given guidelines are followed), costly and contrast administration may be stressful. Furthermore, the here applied imaging procedures described may be helpful to answer other interesting scientific questions. This study confirmed for the first time the urine storage function of the ventral pouch of the coprodaeum. Additionally, anatomical deviations from *in vivo* to *in situ* could be described.