Onderstepoort J. vet. Res., 53, 111–117 (1986)

THE TOPOGRAPHY OF THE THORACO-ABDOMINAL VISCERA IN THE OSTRICH *(STRUTHIO CAMELUS)*

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ABSTRACT

BEZUIDENHOUT, A. J., 1986. The topography of the thoraco-abdominal viscera in the ostrich *(Struthio camelus)*. *Onderstepoort Journal of Veterinary Research*, 53, 111–117 (1986).

The topography of the thoraco-abdominal viscera in the ostrich was studied in 20 birds varying in age from 2 weeks to 12 months. The lungs occupied the dorsal third of the thorax, and the heart lay in the cranioventral thorax perpendicular to the long axis of the body. There was no pleural cavity. The liver was situated in the caudoventral part of the thorax, and the proventriculus occupied the left cranial part of the abdomen between the 7th vertebral rib and the acetabulum. The gizzard lay in the cranioventral part of the abdomen, resting on the sternum and abdominal floor. The duodenum formed a loop from right to left, with the pancreas lying between the 2 limbs of the loop. The coiled jejunum and ileum occupied the ventral part of the abdomen between the gizzard and pelvis. The two caeca lay on either side of the terminal ileum with their apices in the pelvis. The rectum was the longest part of the intestine and could be divided into a thick proximal segment situated in the right dorsal part of the abdomen, and a thin distal part that occupied the left caudodorsal part of the abdomen. The trilobed kidneys lay along the ventral surface of the synsacrum, with the adrenal glands at their cranioventral poles. The testes lay ventrally to the cranial divisions of the kidneys, whereas the left ovary was situated ventrally to the cranial division of the left kidney. The spleen lay wedged in between the right kidney, caudal vena cava and proventriculus. The thyroid glands were situated at the cranial borders of the subclavian arteries, and the thymus lay at the base of the neck.

INTRODUCTION

The ostrich industry has once again reached a stage of great economic importance to the farming community in South Africa. Veterinarians are often called on to give advice on disease and parasite control, and to perform post-mortem examinations on dead birds. There is no literature available on the anatomy and topography of the thoraco-abdominal viscera of the ostrich by means of which the veterinarian can orient himself. Most of the work on the anatomy of the ostrich was done during past centuries, and publications are not only difficult to obtain but also to read and interpret. Sir E. Home (1812, cited by Mitchell, 1901) gives some measurements of the intestines of ratites, while Brown (1682) and Mcalister (1864) gives a description of the general anatomy of the ostrich, including some of the viscera. The stomach and intestines are discussed by Gadow (1890) while Mitchell (1901) mentions the secondary loop of the duodenum and remarks on the length of the rectum. Schulze (1908) gives a description of the lungs and airsacs, and Cho, Brown & Anderson (1984) compare some of the viscera of 4 species of ratites, including the ostrich. A broad outline of the topography of the thoracic and abdominal viscera is given by Duerden (1912), mainly as an aid to farmers wishing to do a post-mortem examination. In the present study, 20 ostriches were examined to establish the topography of the thoraco-abdominal viscera.

MATERIALS AND METHODS

A total of 20 ostriches, of both sexes, between the ages of 2 weeks and 12 months were used in the study. The birds were anaesthetized by intravenous injection of either 6 % pentobarbitone sodium or alphaxalone and alphadolone acetate[1]. The left carotid artery was canulated at the base of the neck and the birds allowed to exsanguinate. After exsanguination they were fixed by perfusion at 100–120 mm Hg with 10 % formalin or half strength Karnovsky's (1965) solution. One to 3 hours later the wings and intercostal muscles were removed by careful dissection to expose the thoracic viscera. The hind limbs were removed and the abdominal walls were reflected ventrally to expose the abdominal viscera. It was necessary to remove some of the peritoneal folds and the layer of fat on the gizzard in order to expose the viscera. The viscera were then photographed *in situ* to record their positions. The intestinal tract was subsequently removed to determine the position of the kidneys, genital organs, adrenal glands and spleen.

The terminology used is that of Nomina anatomica avium. BAUMEL, J., KING, A. S., LUCAS, A. M., BREAZILE, J. E. and EVANS H. E. (eds.) (1979).

RESULTS

General remarks

The bony thorax of the ostrich was bounded dorsally by the thoracic vertebrae, laterally by the vertebral and sternal ribs, and ventrally, as well as cranially, by the sternum. The sternum was an oval, dish-like structure oriented perpendicularly to the long axis of the body, with its concave surface facing caudally. It was attached to the 3rd to 7th vertebral ribs by means of 5 sternal ribs (Fig. 1 & 2). The first 2 and the last vertebral ribs did not come into contact with the sternum. The bony thorax enclosed the trachea and lungs, the heart, liver, spleen, oesophagus and parts of the proventriculus and gizzard.

The pubic symphysis formed the caudal border of the abdomen, since there was no clear division between the abdominal and pelvic cavities. The abdomen was bounded dorsally by the synsacrum and dorsolaterally by the bony pelvis. The rest of the abdominal wall was made up of the abdominal muscles, fascia and peritoneum. The pelvis and abdomen contained the intestinal tract, urinary tract, gonads, adrenal glands and cloaca.

Lungs (Fig. 1, 2, 3 & 6)

The lungs occupied the dorsal third of the thorax. They were bounded dorsally by the thoracic vertebrae and the heads of the vertebral ribs, laterally by the bodies of the 3rd to the 7th vertebral ribs, and ventrally by the horizontal septum. The ventral border of the lungs lay at the uncinate processes of the vertebral ribs, so that the lungs did not reach the distal ends of the vertebral ribs. The vertebral and costal surfaces fused with the thoracic wall to obliterate the pleural cavity. A series of openings along the ventromedial border of the lung opened into the airsacs. The cranial and caudal thoracic airsacs separated the lungs ventrally from the oesophagus.

Received 14 January 1986—Editor

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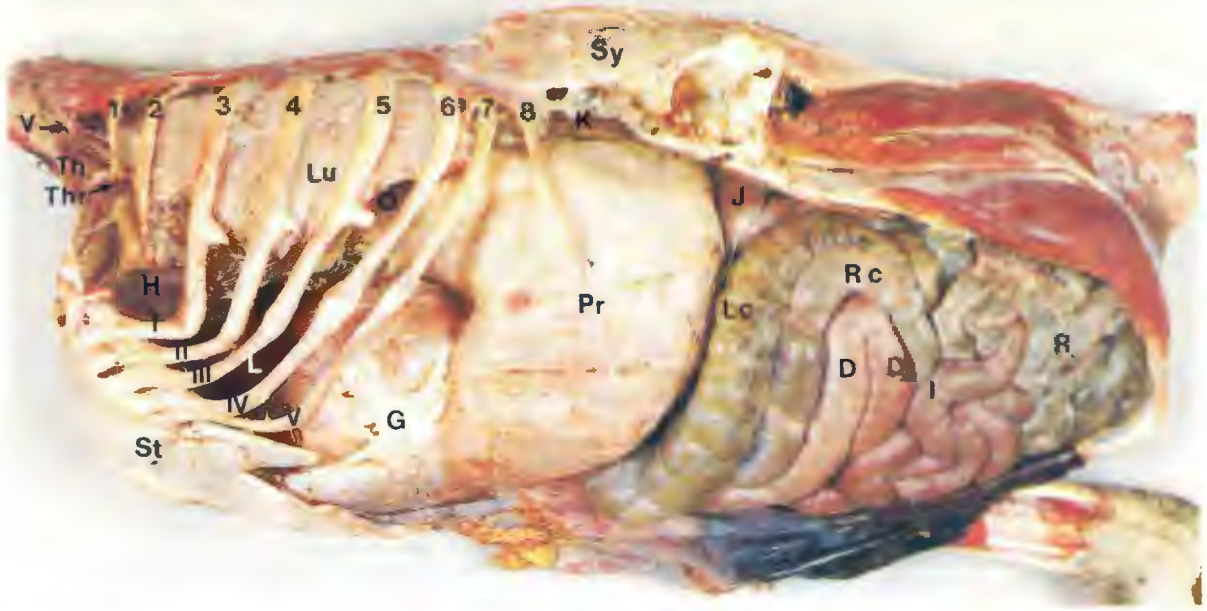

FIG. 1 Left lateral view

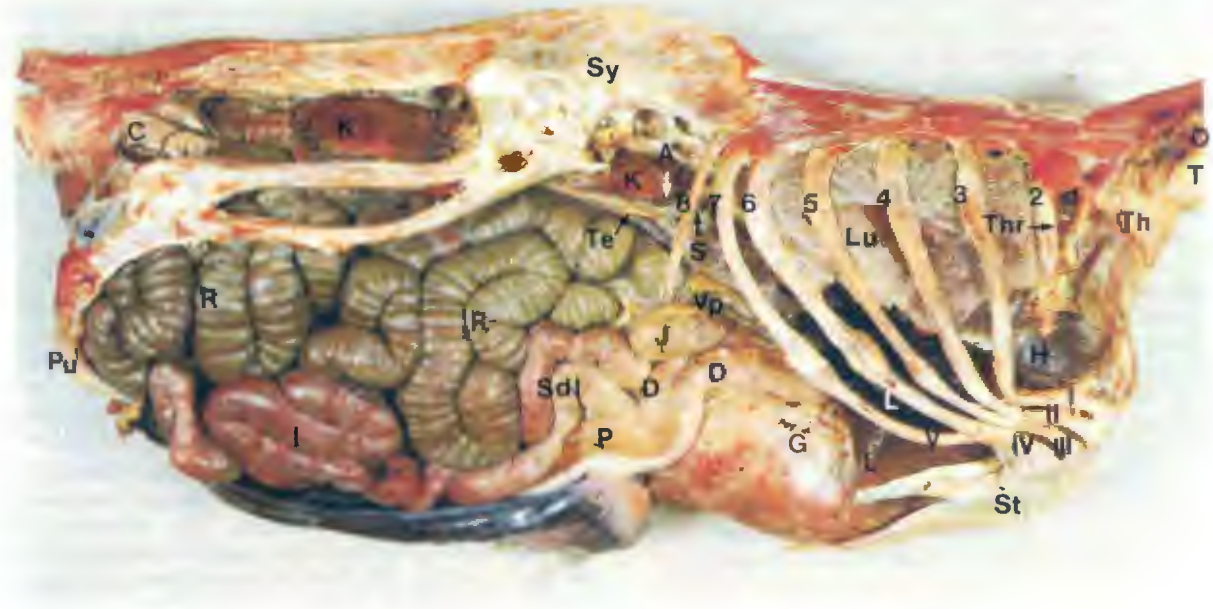

FIG. 2 Right lateral view

Heart (Fig. 1, 2 & 3)

The heart occupied the cranioventral part of the thorax with its long axis perpendicular to the long axis of the body. The heart was related to the sternum and first 3 sternal ribs cranially, craniolaterally, and ventrally, and to the left and right lobes of the liver, caudally and caudolaterally. The caudal border of the heart lay on a vertical line through the 3rd intercostal space with the apex of the heart at the 5th sternocostal junction, while the dorsal or basal border lay at the level of the distal end of the 2nd vertebral rib. The median compartment of the clavicular airsac separated the heart dorsally from the oesophagus and trachea, whereas the intrathoracic diverticulum of the clavicular airsac separated the heart from the sternum.

Liver (Fig. 1, 2, 3, 5 & 6)

The liver lay within the hepatic peritoneal cavities and occupied the caudoventral part of the thorax. It was bounded cranially by the heart, caudally by the gizzard, ventrally by the sternum and dorsally by the oesophagus and proventriculus. The left lobe was divided into a small caudodorsal lobe, a large caudoventral lobe, and a small left intermediate lobe, while the larger right lobe of the liver was undivided. There was no gall bladder. The bile duct left the porta hepatis just to the left of the

FIG. 3 Right view, intestines removed

FIG. 4 Intestines

hepatic artery and hepatic portal vein. The caudal vena cava ran through the dorsal part of the right lobe of the liver.

Oesophagus and stomach

The cervical oesophagus passed caudally along the right side of the neck, dorsal to the trachea and large right external jugular vein (Fig. 2 & 3). There was no crop. From the thoracic inlet the oesophagus passed caudally between the heart and lungs (Fig. 1). The cervical airsac separated the oesophagus from the lungs dorsocranially, while the clavicular airsac separated the oesophagus from the heart ventrally. The oesophagus passed through the cranial and caudal thoracic airsacs caudal to the heart. At the level of the 6th vertebral rib the oesophagus dilated and continued as the proventriculus, without clear demarcation.

The large, sac-like proventriculus (Fig. 1, 3 & 5) occupied the cranial part of the abdomen on the left. The dorsal margin of the proventriculus extended from the 6th intercostal space to the acetabulum, while the caudal margin lay on a vertical line through the acetabulum. The left or parietal surface extended dorsally along the left abdominal wall from the left lung and kidney to an area just caudal to the sternum ventrally. The visceral or right surface faced medially and was related to the gizzard, small intestine, caeca and colon. Distally, the proventriculus turned cranially along the abdominal floor to open into the gizzard (Fig. 1, 3 & 5). There was no isthmus gastris.

The well-developed, biconvex gizzard (Fig. 1, 2, 3 & 5) lay in the cranioventral part of the abdomen between the liver cranially and the proventriculus caudally. The

FIG. 5 Ventral view, intestines removed

FIG. 6 Ventral view, stomach and intestines removed

cranial half of the gizzard rested on the sternum, while the caudal half lay on the abdominal floor. The left and right tendinous centres faced ventrolaterally and dorsolaterally respectively. The duodenum left the proventriculus on the right just above the right tendinous centre (Fig. 2 & 3).

Duodenum and pancreas

In the fresh state, the duodenum was pink and measured about 80 cm in length. The duodenum left the gizzard at the level of the last sternal rib on the right (Fig. 2 & 3) to form a narrow, extended loop, the ansa duodenalis (Fig. 1, 2 & 4). The descending or proximal limb of the loop ran caudoventrally along the right abdominal wall, across the midline just cranially to the umbilical scar and then caudodorsally along the left abdominal wall. About midway up the left abdominal wall the proximal loop turned caudally back on itself to form the ascending or distal limb of the duodenal loop. The ascending limb ran along the caudal border of the descending limb. Both limbs were held together by a narrow fold of mesentery. A small secondary loop was generally present in the ascending limb of the duodenal loop (Fig. 2 & 4). At the level of the 7th vertebral rib on the right, the distal limb of the duodenum turned caudally to continue as the jejunum. There was no distinct morphologic transition from duodenum to jejunum. The pancreas (Fig. 2 & 4) lay in the mesentery between the 2 limbs of the duodenal loop, extending from the gizzard to the end of the loop. A small portion of the pancreas was sometimes observed to extend into the secondary loop of the ascending limb of the duodenum. The hepato-enteric duct from the liver opened into the descending limb of the duodenum about 7 cm from the gizzard (Fig. 3 & 4), while the pancreatic duct opened into the ascending limb of the duodenum close to the duodeno-jejunal junction (Fig. 4).

Jejunum (Fig. 1, 2 & 4)

In the fresh state, the jejunum was pink and measured approximately 160 cm in length. From its origin at the level of the distal end of the last vertebral rib on the right the jejunum ran caudoventrally. The first portion was straight, but soon became coiled. The coiled section occupied the cranioventral part of the abdomen dorsal and caudal to the duodenum (Fig. 2). In some specimens, the jejunum also occupied the dorsal part of the abdomen

between the right kidney and gizzard, displacing the rectum caudally (Fig. 1). The jejunum ended at the small vitelline diverticulum (Meckel's diverticulum) (Fig. 4).

Ileum (Fig. 1, 2 & 4)

The ileum was the longest part of the small intestine and, like the jejunum, was very coiled. It extended from Meckel's diverticulum to the ileo-rectal junction, measuring up to 400 cm in length. The ileum was pink in colour but gradually became a darker red-green towards the ileo-rectal junction. From its origin, the ileum extended caudally into the pelvis, occupying the caudoventral part of the abdomen on the right and left. In the pelvis, the ileum turned cranially and became less coiled with the apices of the caeca on either side. From the pelvis the ileum ran cranially and to the left, passing dorsally to the duodenal loop, to reach the dorsocaudal border of the proventriculus on the left (Fig. 1). In this position, the left caecum lay dorsal to the ileum and the right caecum ventral to the ileum. The ileum then turned ventrally along the caudal border of the proventriculus, across the midline along the caudal border of the gizzard, to end with a small supraduodenal loop medially (deep) to the duodeno-jejunal flexure and jejunal veins on the right.

Caeca (Fig. 1 & 4)

The 2 caeca began at the ileo-rectal junction on the right, caudal to the liver, between the gizzard and the cranial pole of the right kidney. They extended caudally on either side of the ileum to the pelvis. In the mature bird, they measured about 95 cm in length. At their origin, the left caecum lay caudodorsally to the ileum and the right caecum cranioventrally to the ileum. A common fold of mesentery enclosed the caeca and ileum, while a separate peritoneal fold attached the duodenal mesentery to the left caecum. The bases of the 2 caeca were thin-walled, with a large lumen, sacculated and dark green. Their bodies tapered towards their apices, which were thick-walled and free of sacculations. The right caecum was generally slightly longer than the left caecum.

Rectum (Fig. 1, 2 & 4)

The rectum was the longest part of the intestinal tract, measuring approximately 16 metres in length (Fig. 4). In the fresh state it was a dark green from the ingesta present in it. The rectum could be divided into a proximal or thick part and a distal or thin part. The proximal part was thin-walled, with a wide lumen and sacculations containing soft faecal matter. The distal part was thick-walled, with a small lumen, free of sacculations containing firm faecal matter in the form of pellets (Fig. 4). There was a gradual transition from the thick part to the thin part of the rectum. From its origin at the ileo-rectal junction, the rectum passed caudally. The first few centimetres were narrow and straight where it passed laterally to the left caecum, and then it widened and became very coiled. The coils of the proximal or thick part of the rectum occupied the dorsal part of the abdomen on the right, from the liver and gizzard cranially, to the pelvis caudally (Fig. 2). The coils of the distal or thin part of the rectum occupied the caudodorsal part of the abdomen and pelvis on the left (Fig. 1). The terminal part of the rectum straightened and widened where it opened into the coprodeum of the cloaca. A distant rectocoprodeal fold separated the interior of the rectum from the coprodeum.

The cloaca (Fig. 3, 5 & 6) occupied the dorsocaudal part of the pelvis and consisted of a coprodeum, receiving the rectum, an urodeum, receiving the ureters and genital openings, and a terminal proctodeum containing the phallus.

In the newly hatched ostrich chick, the ratio of small intestine to rectum was found to be 1:1; at 3 months of age the ratio was 1:1,5 and at 6 months it reached the ratio of the adult bird, namely, about 1:2.

Kidneys (Fig. 1, 2, 3, 5 & 6)

The 2 elongated kidneys lay symmetrically in the bony depression along the ventral aspect of the synsacrum, and were covered by peritoneum (Fig. 6). They were approximately 30 cm long and 7 cm wide and extended from the level of the last vertebral rib to the middle of the pelvis. The kidneys were red-brown with a granular appearance and could be divided into cranial, middle and caudal divisions. The oval cranial divisions lay between the last vertebral ribs and the pelvis (Fig. 1, 2, 3 & 6). The right cranial division was situated dorsolaterally to the caudal vena cava, while the left cranial division lay dorsally to the proventriculus. The narrow middle divisions lay along the midline of the synsacrum between the 2 acetabula (Fig. 6). The caudal divisions were the largest and they extended from the acetabula to the middle of the pelvis. Medially they reached the midline (Fig. 5 & 6).

The ureters left the caudomedial surfaces of the kidneys to open into the urodeum (Fig. 5 & 6).

Testes and ovaries

The 2 testes of the male bird were situated on either side of the caudal vena cava, ventral to the cranial divisions of the kidneys. The left testicle was positioned slightly caudal to the right one (Fig. 6). They were about 16 cm long and 5 cm wide during the breeding season. The epididymis lay on the dorsomedial surface of the testis, while the ductus deferens left the caudal part of the epididymis as a fairly straight tube, parallel to the ureter, near the midline. The ductus deferens opened into the dorsal part of the urodeum.

The left ovary of the female bird was suspended from the dorsal body-wall, ventral to the cranial division of the kidneys. The size, shape, and position of the ovaries varied greatly, depending on the breeding cycle. The left oviduct ran caudally along the ventral surface of the kidneys to open into the urodeum. There was no right ovary or oviduct.

Spleen (Fig. 2, 3 & 6)

The sausage-shaped spleen was dark-red and was positioned cranially to the right kidney between the 6th to 8th vertebral ribs. It was enclosed in a dense layer of connective tissue and peritoneum. The spleen was wedged in between the caudal vena cava on the right, the right kidney caudally, and the visceral surface of the proventriculus to the left. On transverse section the spleen had a triangular appearance. In the mature bird it measured 8,75 × 2,5 cm.

Adrenal gland

The left adrenal gland was a crescent-shaped body, approximately 6 cm long and 1 cm wide, situated opposite the last vertebral rib on the left (Fig. 6). It lay between the cranioventral pole of the left kidney and the cranial pole of the left testicle in the male or ovary of the female. The right adrenal gland was a triangular body, approximately 3 cm long, situated opposite the last vertebral rib on the right (Fig. 2, 3 & 6). It lay dorsolateral to the caudal vena cava, wedged in between the cranioventral pole of the right kidney and the spleen.

Thyroid gland (Fig. 1 & 2)

The 2 thyroid glands were dark-brown, rounded bodies, situated on the cranial borders of the subclavian arteries, dorsally to the common carotid arteries. They were partly surrounded by the clavicular airsac. The

parathyroid was generally embedded in the medial aspect of the thyroid gland.

Thymus (Fig. 1, 2 & 3)

The left thymus was situated at the base of the neck, cranial to the first vertebral rib and ventral to the vagus nerve (Fig. 1). The right thymus lay at the base of the neck on the right, lateral to the oesophagus, trachea and right jugular vein, in front of the first vertebral rib (Fig. 2 & 3). They were yellow, lobulated, and about 5 cm long and 3 cm wide in young birds. The thymus was seen to regress with age.

Discussion

Lungs

According to Mcalister (1864), the lungs are positioned in the dorsal and caudal regions of the thorax, whereas Schulze (1908) states that they occupy the dorsal region of the left and right halves of the thorax. Brown (1682) and Duerden (1912) describes the lungs as being comparatively small and situated dorsally to the heart and liver. In the present study, the lungs were found to fill the dorsal third of the thorax between the 1st to 7th vertebral ribs, extending from the vertebrae dorsally to the level of the uncinate processes of the vertebral ribs ventrally. Contrary to the situation in the domestic fowl, there was no pleural cavity.

Heart

Duerden (1912), Lorentz (1920) and Mcalister (1864) state that the heart of the ostrich lies in the middle of the thorax, with lobes of the liver on both sides. In the present study, the heart was found to occupy the cranioventral part of the thorax, with the lobes of the liver against the heart caudally and laterally. The heart extended from the sternum cranially to the level of a vertical line through the 3rd intercostal space caudally, and the apex of the heart lay at the level of the 5th sternocostal junction. Contrary to its situation in most birds, the long axis of the heart in the ostrich was found to be perpendicular to the long axis of the body.

Liver

The topography of the liver of the ostrich agreed with the findings of Mcalister (1864) and Duerden (1912). It lay in the caudoventral part of the thorax, on the sternum, between the heart and gizzard. The right lobe was somewhat larger than the subdivided left lobe. There was no gall bladder.

Stomach

According to Mcalister (1864), the oesophagus of the ostrich dilates to form an indistinct proventriculus, with the cardia dorsal to the pylorus. Duerden (1912) describes the proventriculus as a greatly enlarged part of the oesophagus, without clear demarcation from it. Gadow (1890) finds that the stomach of the ostrich is in the usual position of avians. He describes the proventriculus as an enormously dilated structure which has caused the gizzard to rotate 150° around its transverse axis. Cho *et al.* (1984) note that in the ratites they examined the proventriculus of the ostrich is the largest and the gizzard the smallest. In the present study, the structure of the proventriculus and gizzard was in accordance with the findings of Gadow (1890). The sac-like proventriculus was found to occupy the cranial area of the left part of the abdomen. It extended from the 6th intercostal space to the acetabulum along the dorsal abdominal wall, with its caudal border on a vertical line through the acetabulum. Distally, the proventriculus turned cranially and to the right along the abdominal floor, to open into the gizzard. There was no isthmus gastris. The gizzard lay in the cranioventral part of the abdomen with its cranial half on the sternum and the caudal half on the abdominal floor.

Intestine

Some authors describing the intestinal tract of birds, notably Mitchell (1901) and Gadow (1890), attach some phylogenetic importance to its structure and length. A wide range in total length of the intestine of the ostrich has been reported. Mcalister (1864) finds it to be between 1 260 cm and 1 320 cm in length, while Hunter & Perrault, (cited by Mcalister, 1864) find it varies between 870 cm and 2 100 cm in length. Duerden (1912) states that the intestine of the ostrich is enormously long, while Mitchell (1901) finds the rectum to be as long as or longer than the small intestine. In the present study, the mean total length of the intestine in the adult bird was 2 390 cm. The small intestine was found to be 750 cm long, the large intestine 1 640 cm, and the caeca 95 cm. In the newly hatched chick, the ratio of small intestine to rectum was 1:1; at 3 months of age the ratio was 1:1,5 and at 6 months it reached the adult ratio of about 1:2. The structure and position of the duodenum was in accordance with the descriptions of Mcalister (1864), Mitchell (1901), Duerden (1912), and Cho *et al.* (1984). Duerden (1912) fails to differentiate with any exactitude between the jejunum and ileum, whereas in the present study a small vitelline diverticulum, which separated the jejunum and ileum, was found consistently. According to Duerden, the intestine fills the entire middle and caudal parts of the abdomen. In this study, the small intestine was found to fill the ventral part of the abdominal cavity between the gizzard and the pelvis. The large intestine could be subdivided into a proximal thick part, characterized by the presence of soft faecal matter and sacculations, filling the right dorsal part of the abdomen and pelvis, and a distal thin part, characterized by its small lumen and the presence of faecal pellets, filling the caudodorsal abdomen and pelvis on the left. The caeca extended into the pelvis, just ventrally to the cloaca.

Pancreas

The position and shape of the pancreas agreed with the findings of Mcalister (1864), Duerden (1912) and Cho *et al.* (1984). It lay between the 2 limbs of the duodenal loop, with the opening of the pancreatic duct into the duodenum positioned approximately 80 cm distal to the beginning of the duodenum.

Kidneys

The appearance, shape and position of the 2 kidneys was in agreement with the findings of Mcalister (1864) and Duerden (1912). They were large, elongated, trilobed bodies, situated ventrally to the synsacrum and extending from the level of the last vertebral rib to the middle of the pelvis.

Testes and ovaries

According to Mcalister (1964), the testes are situated cranially and laterally to the kidneys; Duerden (1912) describes them as being situated ventrally and medially to the cranial lobes of the kidneys; whereas Cho *et al.* (1984) describe them as being positioned ventrally to the kidneys. Both Mcalister (1864) and Duerden (1912) state that the testes are about 8 cm long. In the present study, the left testis was found to lie ventromedially to the cranial lobe of the left kidney, whereas the right testis lay ventrolaterally to the cranial lobe of the right kidney. The size of the testes varied according to the age and the reproductive stage of the birds. In birds, 3 months old, they were 2 cm long, while in the mature and sexually active bird they attained a length of 16 cm.

Only a left ovary and oviduct were present. The size, structure, and position of the ovary was in accordance

with the findings of Mcalister (1864) and Duerden (1912). It was suspended from the dorsal body-wall, ventral to the left kidney. The sizes of the ovary and oviduct varied greatly, depending on the stage of the breeding cycle.

Spleen

Mcalister (1864) describes the spleen as being elliptical, 7,5 cm long, and situated cranially to the left kidney, whereas Duerden (1912) finds it to be cylindrical and situated on the dorsal, outer side of the proventriculus. Cho *et al.* (1984) state that the spleen is kidney-bean-shaped. Contrary to the findings of the previous authors, the spleen was found to be sausage-shaped and situated cranially to the right kidney, wedged in between the caudal vena cava to the right and the cardia of the proventriculus to the left.

Adrenal gland

Mcalister (1864) describes the adrenal glands as 2 flattish, oval, deep orange bodies situated at the upper part of the kidneys, whereas Duerden (1912) finds them to be 2 yellow bodies at the upper inner extremity of the kidneys. In the present study, the crescent-shaped left adrenal gland was located opposite the last vertebral rib between the cranioventral pole of the left kidney and the cranial pole of the left testicle. The triangularly shaped right adrenal gland was located opposite the last vertebral rib, dorsomedial to the caudal vena cava, wedged in between the cranioventral pole of the right kidney and the spleen. Both adrenal glands were dark-yellow in colour.

Thyroid gland

Mcalister (1864) describes the thyroid glands as 2 dark-brown, rounded bodies attached to the carotid arteries. Contrary to his findings, the 2 thyroid glands were found on the cranial borders of the subclavian arteries, dorsally to the common carotid arteries.

Thymus

The shape, position, and structure of the thymus was found to be in accordance with the findings of Duerden (1912). The thymus consisted of 2 lobed structures on the ventrolateral aspects of the base of the neck, cranially to the first vertebral ribs.

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LEGENDS TO FIGURES

A	Adrenal
Ad	Ansa duodenalis
C	Cloaca
D	Duodenum
G	Gizzard
H	Heart
Hd	Hepatoenteric duct
I	Ileum
J	Jejunum
K	Kidney
L	Liver
Lc	Left caecum
Lu	Lung
O	Oesophagus
P	Pancreas
Pd	Pancreatic duct
Pr	Proventriculus
Pu	Pubis
R	Rectum
Rc	Right caecum
S	Spleen
Sdl	Secondary duodenal loop
St	Sternum
Sy	Synsacrum
T	Trachea
Te	Testis
Th	Thymus
Thr	Thyroid
U	Ureters
V	Vagus nerve
Vcc	Vena cava caudalis
Vd	Vitelline diverticilum
Vp	Vena porta hepatis
1–v	Sternal ribs
1–8	Vertebral ribs