

MICROANATOMICAL STUDIES ON THE ISTHMUS OF OVIDUCT IN EMU BIRD (*Dromaius novaehollandiae*)

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Abstract: The wall of the isthmus was relatively thick and comprised of tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa. The mucosa contained large and short primary mucosal folds. The large primary folds were flat, broad and branched separated by deep crypts and carried secondary and tertiary folds. The isthmus was lined by pseudo stratified columnar ciliated epithelium. Lamina propria was packed densely with branched tubular glands. Submucosa was highly vascular with large amount of collagen fibres, extended into the central core of the mucosal folds and contained groups of branched tubuloalveolar glands. Tunica muscularis contained thick inner circular and outer longitudinal layers of smooth muscle fibres with stratum vasculare in between. The inner circular layer of smooth muscle fibres were extended into the core of the mucosal folds.

Keywords: Microanatomy, isthmus, oviduct, emu.

Introduction

The Emu is the second largest living bird and is reared commercially in many parts of the world for meat, oil, skin and feathers, which are of high economic value. The isthmus of emu is slightly constricted and located ventral to the middle and caudal lobes of the left kidney and ventral to the cranial extent of the left ischium and left pubic bone and responsible for the formation of shell membranes (Robert *et al.*, 2011). The literature is available only on the gross anatomical features of the oviduct in the emu bird. Hence the present work has been undertaken.

Materials and Methods

The present work was conducted at the Department of Veterinary Anatomy, College of Veterinary Science, Rajendranagar, Hyderabad. The tissue samples of magnum were obtained from ten adult apparently healthy Emu birds from slaughter house in Vijayawada and poultry farm in the Hyderabad. The tissue pieces were fixed in 10% neutral buffered formalin and Bouin's solution and processed as per the methods described by Singh and

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Sulochana, 1997). Paraffin sections of 3-5 μm thickness were cut and subjected to the routine and special histological staining methods.

Results and Discussion

The wall of the isthmus was relatively thick and comprised of tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa from within outwards (Fig.1). The mucosa of isthmus was folded and contained many large and few short primary mucosal folds oriented in longitudinal direction (Fig. 1). The large primary folds were flat, broad and branched separated by deeper crypts and carried secondary and tertiary folds. The primary folds were considered to be the largest folds among all the folds of oviductal mucosa. Similar observations were reported by Balash *et al.* (2013) and Mirhish *et al.*(2013) in turkey and Ghule *et al.* (2010) in japanese quail. However, the primary folds were reported to be occasionally branched and finger like in hens by Mehta and Guha (2012).

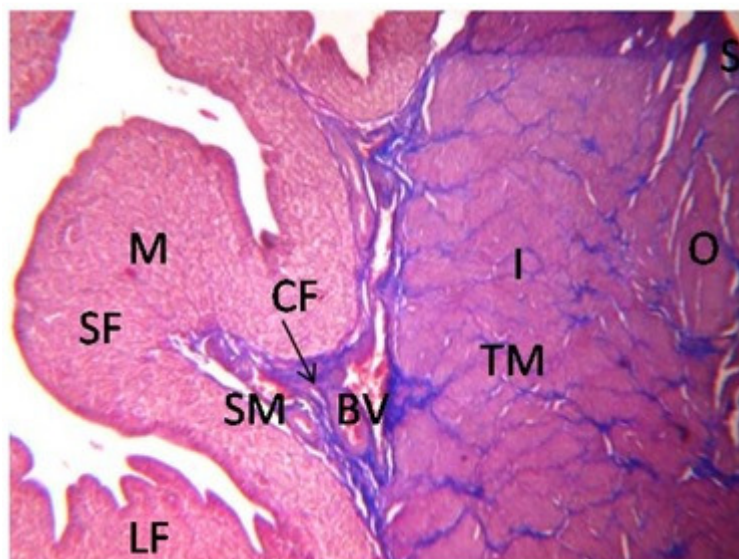


Fig.1. Photomicrograph of wall of the isthmus showing tunica mucosa (M) , submucosa (SM), tunica muscularis (TM) and tunica serosa (S). LF- Large primary mucosal fold SF- Short primary mucosal fold, CF- Collagen fibres, BV- Blood vessels, I- Inner circular, O- Outer longitudinal layer. Crossman's modification of mallorys triple stain X 4

The total number of primary mucosal folds per cross section of isthmus was ranged from 34 to 35. The length of the primary and secondary folds was recorded to be $2459.20 \pm 87.79 \mu\text{m}$ and $962 \pm 145.70 \mu\text{m}$ respectively, while the width of primary folds was found to be $1166.22 \pm 41.60 \mu\text{m}$. However the length of folds was reported to be about $3000 \pm 1.1, 900 \pm 2$ micrometer in turkey (Balash *et al.*, 2013)

The mucosa of isthmus was lined with pseudo stratified columnar ciliated epithelium (Figs. 2, 3) as reported by Bacha and Bacha (1990) in fowl, Ghule *et al.* (2010) in japanese quail, Lucy and Harshan (2011) in Japanese quail and Mehta and Guha (2012) in hen. The epithelium contained ciliated and non ciliated columnar cells and goblet cells. The height of the lining epithelium was $27.75 \pm 1.56 \mu\text{m}$. The surface epithelium showed equal number of ciliated and goblet cells as reported by Parto *et al.* (2011) and Mirhish *et al.* (2013) in turkey. The ciliated columnar cells showed apical spherical nuclei, while non ciliated cells possess basal spherical nuclei. The lining epithelium on primary folds was corrugated and carried deep crypts (Fig. 3), bases of which were extended down into the lamina propria as ducts and terminated into branched tubular glands (Figs. 3,4). The smooth muscle fibres were scattered regularly in the connective tissue underneath basement membrane of the surface epithelium. The core of the mucosal folds was filled with densely packed secretary acini and submucosal connective tissue along with smooth muscle fibres in the central part (Fig. 3).

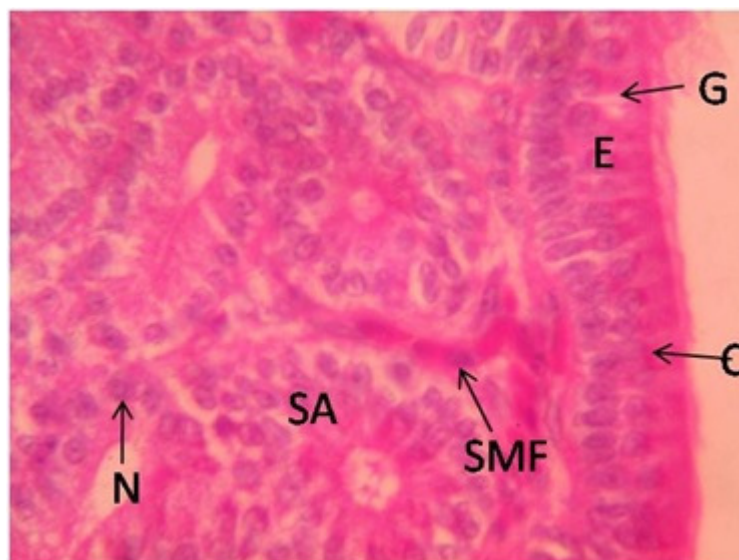


Fig.2. Photomicrograph of isthmus showing pseudo stratified columnar ciliated epithelial lining (E) and secretory acini (SA). C- Columnar cells, G- goblet cells, N- Nucleus, SMF- smooth muscle fibres.
Haematoxylin & Eosin
X 40

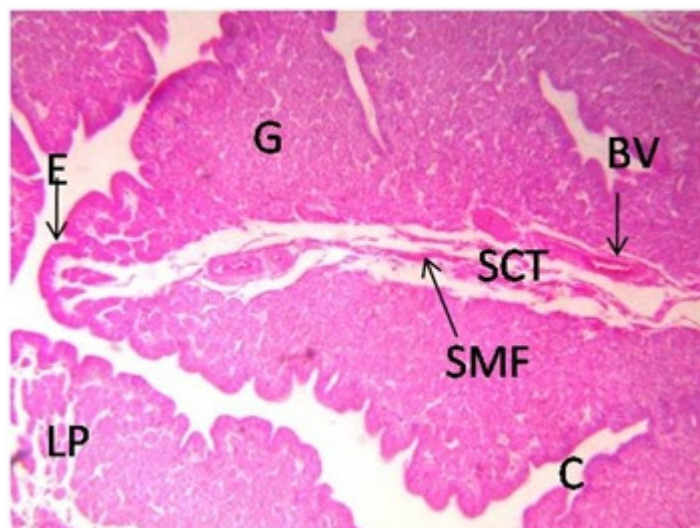


Fig.3. Photomicrograph of large primary fold of isthmus showing corrugated epithelial lining (E) and densely packed tubular glands (G) in lamina propria (LP). SCT- Submucosal connective tissue in the core of the fold, SMF - Smooth muscle fibres, C-crypt between the folds, BV- Blood vessels. Haematoxylin & Eosin X 4

The lamina propria was filled with densely packed branched tubular glands in sub epithelial layer (Figs.3,4) as reported by Mehta and Guha (2012) and Balash *et al.* (2013) in hen and contained strands of loose connective tissue around the secretory acini. The thickness of the glandular acini was $34.80 \pm 1.42 \mu\text{m}$. The secretory acini were lined with columnar and pyramidal cells, the cytoplasm of which was filled with acidophilic cytoplasm (Fig. 2). The thickness of the glandular epithelium was $11.46 \pm 0.53 \mu\text{m}$. The ducts of the tubular glands were lined with pseudo stratified columnar ciliated epithelium as reported by Balash *et al.* (2013) in turkey and were opened commonly on to the surface at the bases of corrugations or into the deep crypts on the surface of the primary folds. The lymphocytes were scattered irregularly in the connective tissue core of mucosal folds. The separation between the lamina propria and sub mucosa well marked by the presence of distinct muscularis mucosa, which contained a thin layer of smooth muscle fibres.

The submucosa of isthmus was made up of highly vascular connective tissue with large number of collagen fibres (Fig.1) few elastic fibres as reported in Japanese quail by Ghule *et al.* (2010). Groups of branched tubuloalveolar glands with secretory acini with a large duct in the center surrounded by a layer of fibrous tissue were noticed in the submucosa of isthmus (Fig. 4). Presence of branched tubular glands in various birds was reported by King and Mc Lelland (1975,) in domestic fowl, Mirhish *et al.*(2013) in hen, Ghule *et al.* (2010) in

Japanese quail and Parto *et al.* (2011) in turkey. The duct was lined with pseudo stratified columnar ciliated epithelium with goblet cells (Fig.4) and opened into the base of the deep crypts on the side of primary folds. The epithelial cells lining the glands showed spherical nuclei with prominent nucleoli in the basal portion of acidophilic cytoplasm. The submucosal connective tissue had extended into the central core of the mucosal folds and it was highly vascular (Figs.1,3).



Fig.4. Photomicrograph of mucosal primary fold of isthmus showing groups of branched tubulo-alveolar glands (BTG) in the submucosa (SM). D- duct. E- epithelium, TG- Tubular glands, LP- Lamina propria. Haematoxylin & Eosin X 10

The tunica muscularis was the most predominant layer in the wall of isthmus (Figs. 1). It was composed of two layers, thick inner circular and outer longitudinal layers of smooth muscle fibres (Fig.1). Similar findings were observed in turkey (Parto *et al.*, 2011; Balash *et al.*, 2013) and Japanese quail (Lucy and Harshan, 2011). The muscle bundles were surrounded by highly vascular loose connective tissue. The muscle fibres from the inner circular layer of tunica muscularis were extended upward into the center of the primary and secondary mucosal folds (Fig.5). The stratum vasculare is predominant between the muscle layers of tunica muscularis and contained loose connective tissue with several blood vessels (Fig.6) as reported by Lucy and Harshan (2011) in Japanese quail. The tunica serosa was well developed made up of layers of subserosal connective tissue and flattened epithelium.

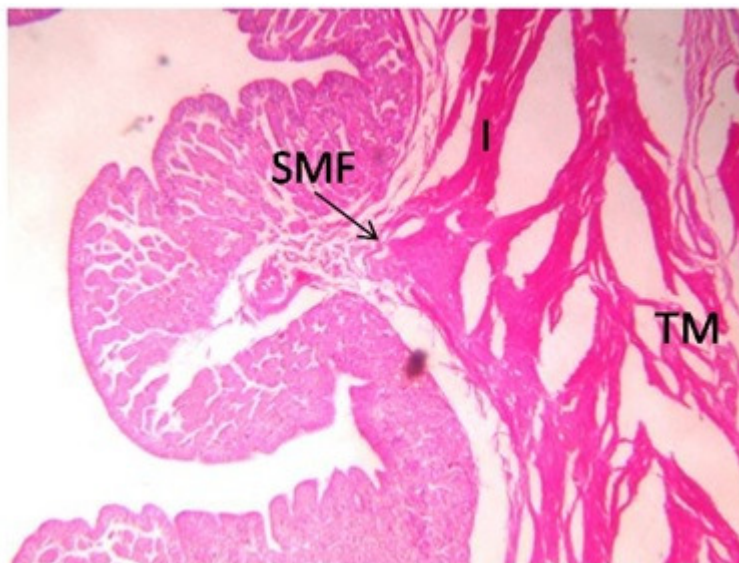


Fig.5. Photomicrograph of primary mucosal fold of the isthmus showing the extension of smooth muscle fibres (SMF) into its core from inner circular layer (I) of tunica muscularis (TM).

Haematoxylin & Eosin X 4



Fig.6. Photomicrograph of tunica muscularis (TM) of isthmus showing highly vascular connective tissue i.e., stratum vasculare (SV) between inner circular (I) and outer longitudinal (O) layers of smooth muscle fibres.

Trichrome X 40

Masson's

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