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GROSS AND HISTOLOGICAL STUDY ON THE UTERUS OF CAMELS (*Camelus dromedarius*)

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ABSTRACT

In this study, 12 uteri of normal non-pregnant female camels from the industrial slaughter house of Mashhad were examined. Tissue samples were taken from different parts of each uterus (Horn, Body and Cervix). Histological sections were stained with Haematoxilin and Eosin, Periodic Acid Schiff, Alcian blue, Van Gieson and Verhof. The camel has a bipartite uterus, which is shaped more like the letter T than the classical Y shaped bipartite uterus seen in other ruminants. The left horn was longer (78.8±18.3mm) than the right horn (62.3±40.7mm) and the diameter of the left uterine horn (43.6±11.2mm) was more than the diameter of the right uterine horn (40.4±9.1mm). The length of uterine body was 65±9.4mm. The length of cervix was 50.1±10.2mm with 4-5 annular mucosal folds. Intercornual ligament was absent.

The endometrial lining consisted of a single layer of columnar epithelium supported by a lamina propria with simple tubular glands. The covering epithelium of endometrium was reacted positive to Periodic Acid Schiff. Myometrium has both a thick inner circular and a thin longitudinal smooth muscle, a vascular layer occurs in the longitudinal layer. Average diameter of endometrium and myometrium in horn and body of uterus was measured by an optical lens. Epithelial layer of the mucosa of cervix was simple columnar and its lining cells were glandular, their secretion activity was positive to Periodic Acid Schiff and Alcian blue.

Key words: Anatomy, camel, histology, uterus

Anatomy of uterus is well studied in humans and animals (Junqueira and Carneiro, 1986; Bank, 1993). The reproductive system of camels is frequently studied in research related to embryo transfer (Skidmore *et al*, 1998). Genital organs of the female dromedary have been studied previously (El Wishy, 1988). In view of this gross and histological anatomy of camel was studied.

Materials and Methods

Uterus of 12 normal non-pregnant female camels were obtained from the industrial slaughter house of Mashhad and examined. The measurements were made using a Collies calipre. The lengths of the left and right uterine horns were measured from the uterine bifurcation to the tip of horn. The length of the uterine body was measured from uterine bifurcation to the caudal end of the cervix. The diameter of uterine horns and body were measured at the mid point of each of these structures. The length of the cervix was measured from the caudal to the cranial end. Tissue samples were taken from different parts of uterus (uterine horn, uterine body and cervix) for histological study. Following 72 h fixation in neutral buffered formaldehyde solution (Lillie and Fullmer, 1976). The tissue was rinsed in 3 changes of 70% ethanol in 24h intervals and embedded in paraffin. A 5 µm thick sections were stained with Haematoxylin and Eosin (H&E), Periodic Acid-Schiff (PAS), Van Giesson (Vg), Verhof (V), Alcian blue (Ab) (Lee and Luna, 1988; Romeis, 1989).

Micrographs were taken with an Olympus Microscope, CH30 (Olympus, Tokyo, Japan).

Results

Camels had a bipartite uterus, which is shaped more like the letter T than the classical Y shaped bipartite uterus as seen in ruminants (Fig 1). The left horn was longer (78.8±18.3mm) than the right horn (62.3±10.7mm) and the diameter of the left uterine horn (43.6±11.2mm) was larger than right one (40.4±9.1mm). The length and diameter of the uterine body was 65±9.4mm and 65±15.5mm, respectively. The length and diameter of the cervix was 50.1±10.2mm and 60.4±10.8mm, respectively. Intercornual ligament was absent in the uterus of camel. In camel, the left uterine horn is distinctly larger than the right one.

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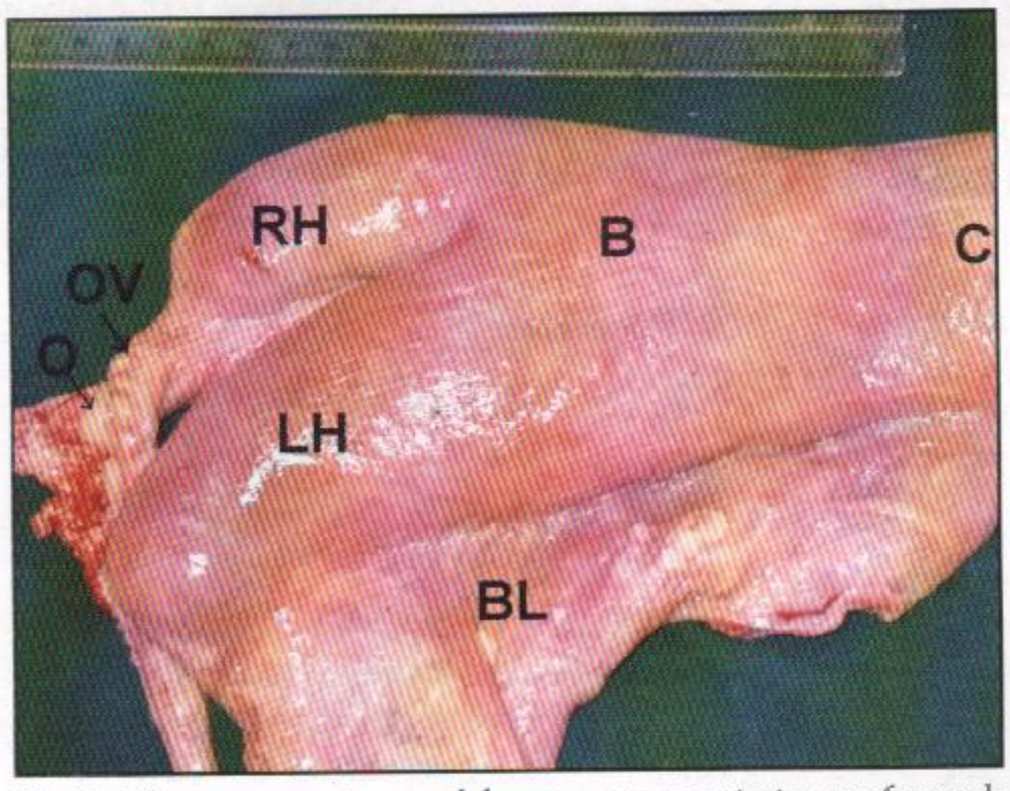

Fig 1. The gross anatomy of the non-pregnant uterus of camel: right horn (RH), left horn (LH); body (B), cervix (C), ovary (O), oviduct (OV) and broad ligament (BL).

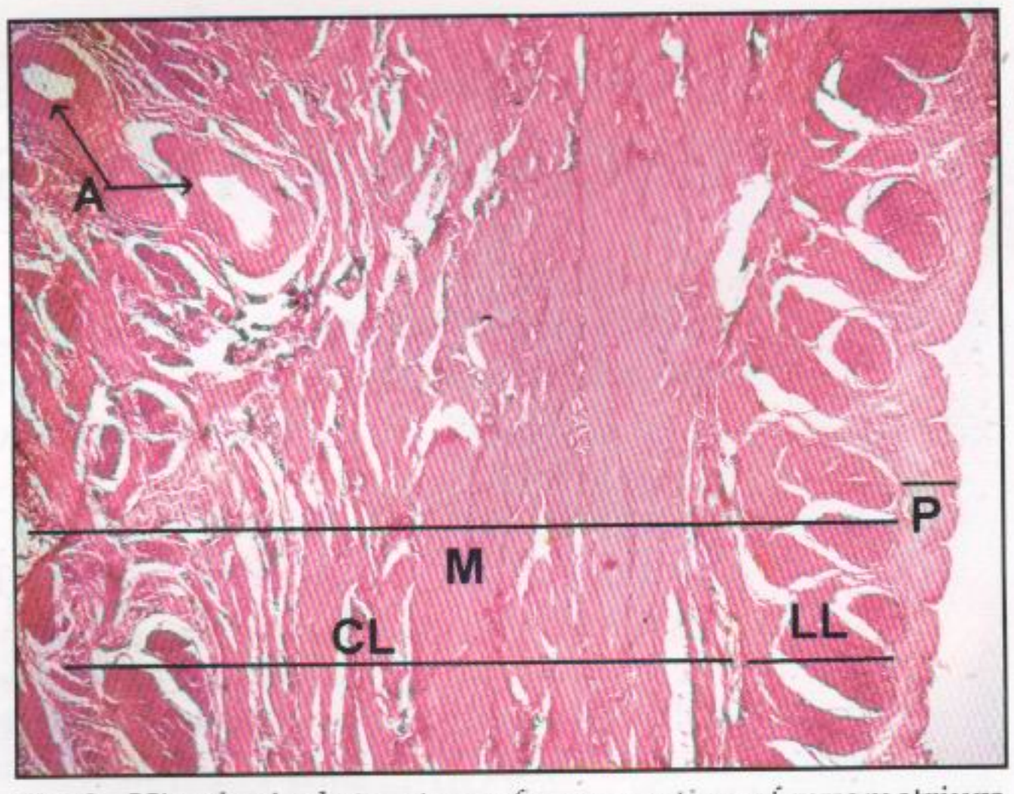

Fig 3. Histological structure of cross section of myometrium (M) and perimetrium (P) in the she camel's uterine horn showing circular muscular layer (CL), longitudinal muscular layer (LL) and artery (A), (H&E X 640).

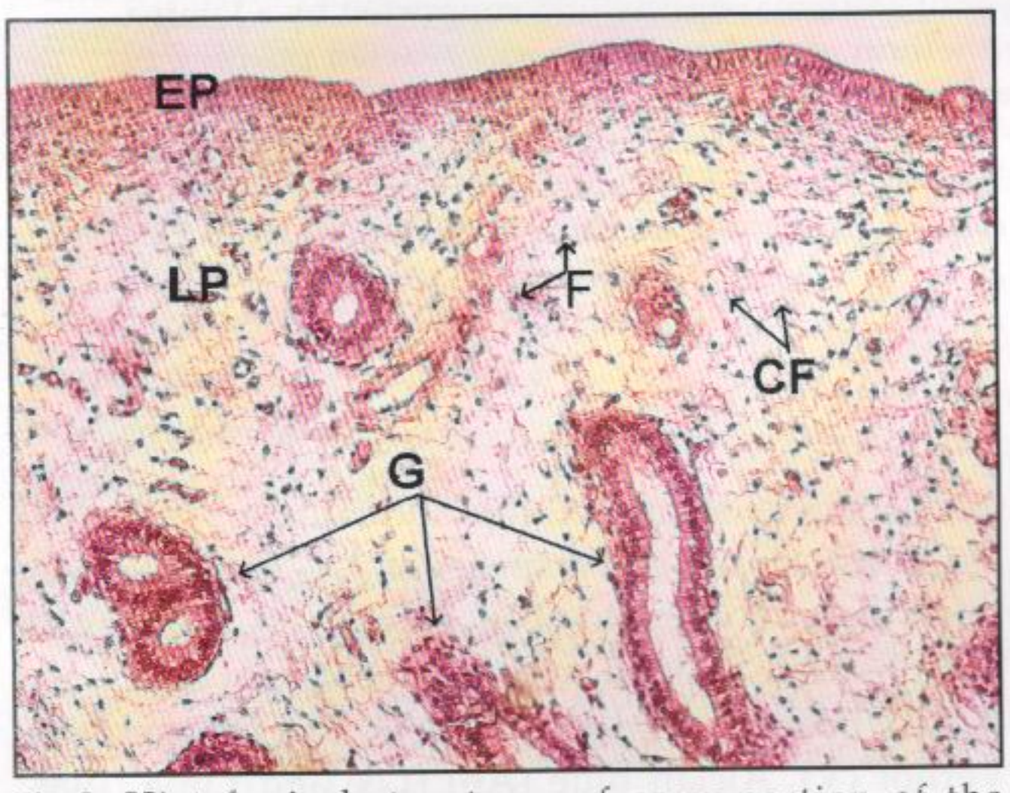

Fig 2. Histological structure of cross section of the endometrium in the uterine horn showing epithelium (EP), lamina propria (LP), fibroblast (F), collagen fibre (CF) and uterine gland (G), (H&E X 320).

Fig 4. Histological structure of cross section of myometrium (M) showing longitudinal muscle layer (LL), connective tissue (CT) and artery (A), vein (V), (H&E X 640).

The endometrium in camel consisted of epithelium and lamina propria containing simple tubular glands that sometimes branch in their deeper portions (near the myometrium). Its epithelial cells are simple columnar and are a mixture of ciliated and secretory cells. The epithelium of the uterine glands was similar to the superficial epithelium, but ciliated cells were rare in the glands. The connective tissue of the lamina propria was rich in fibroblasts and the connective tissue fibers are mostly of the reticular type (Fig 2). A PAS positive and AB negative reaction of the containing mucous was seen in the epithelium of the uterine horn and body.

The myometrium included the tunica muscularis. It had both a thick inner circular and a thin outer longitudinal coats of smooth muscle which continued into the mesometrium. A vascular layer was found between the outer longitudinal layers (Fig 3 and 4). Average diameter of the endometrium and myometrium in the horn and body of the uterus were measured by the optical lens (Table 1).

Table 1. Mean±SE diameter of the endometrium (E) and myometrium (M) on the uterus, right uterine horn (RUH), left uterine horn (LUH) and body (B).

Region	E(mm)	M(mm)
RUH	2.73±1	4.7±0.7
LUH	2.96±0.5	3.97±1.5
B	2.81±0.5	4.6±0.5

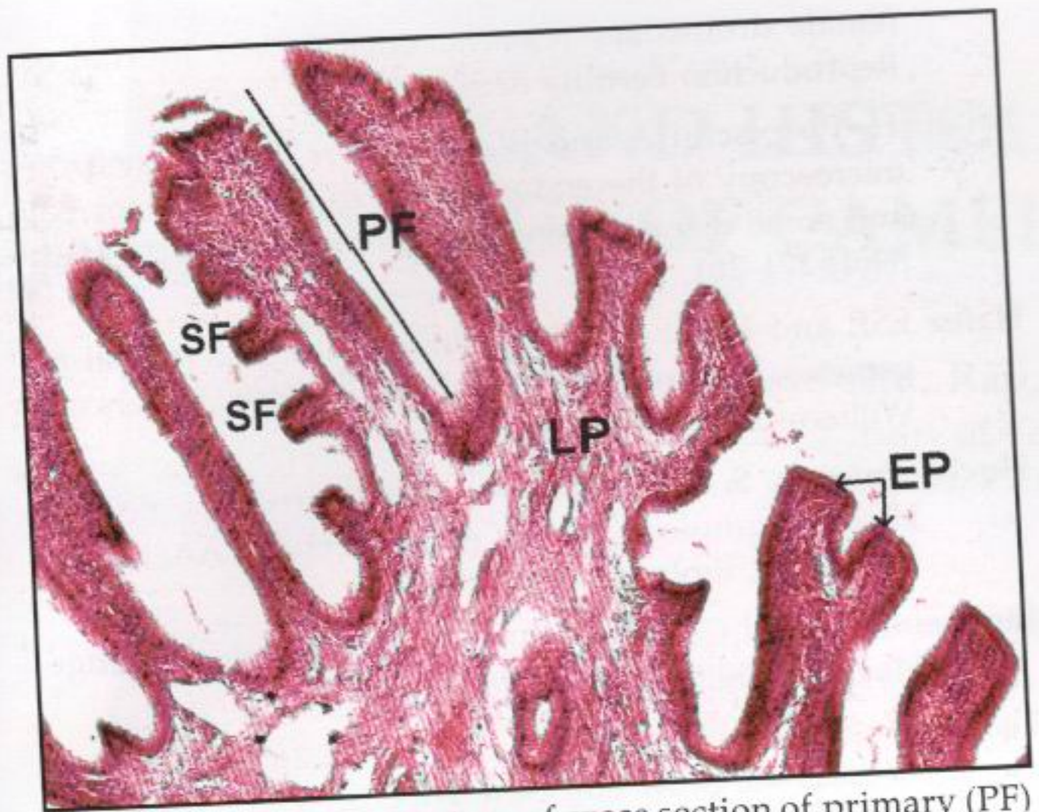

Fig 5. Histological structure of cross section of primary (PF) and secondary fold (SF) of the she camel's cervix showing epithelium (EP) and lamina propria (LP), (H&E X 160).

Fig 6. Histological structure of longitudinal section of mucosal layer between the cervix (C) and vagina (V) showing epithelium (EP), duct of gland (D), lamina propria (LP) and epithelial depression(ED) (X 320).

In camel, the lamina epithelialis of the uterine cervix was lined by simple columnar cells, their secretory activity was positive to PAS and AB (Fig 5, 6 and 7). The large number of longitudinal veins and venules were observed in lamina propria of the cervix in camel, appeared as venous plexus.

Discussion

The camel is a seasonally polyestrous and with induced type of ovulation. Decreasing length of daylight appears to be the stimulus for seasonality in camels (Sghiri and Driancourt, 1999; Skidmore *et al*, 1996). The oestrus cycle did not have a luteal phase. During cycle of 28 days the ovarian activity was strictly follicular. Follicles maturated in 6 days, maintained

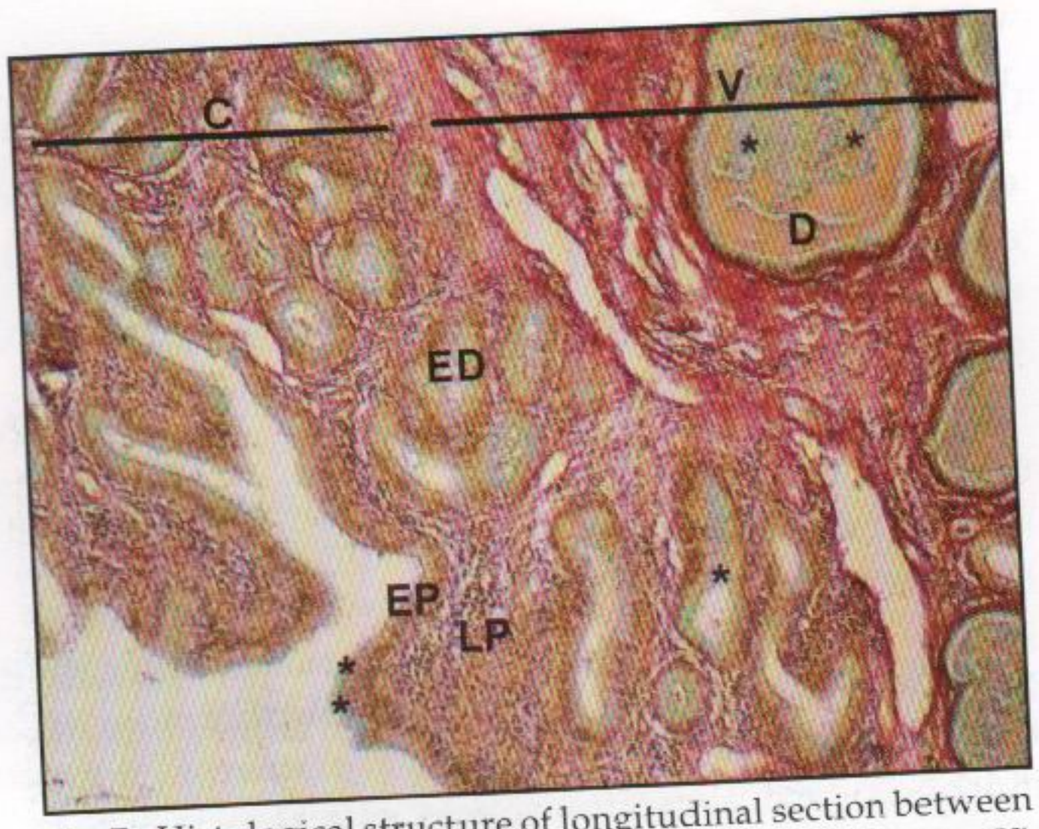

Fig 7. Histological structure of longitudinal section between the mucosal fold in the cervix (C) and vagina(V) showing epithelium (EP), duct of gland (D), lamina propria (LP), epithelial depression(ED), Alcian blue positive reaction (*), (AB staining X 320).

their size for 13 days and regressed in 8 days. Ovulation was non-spontaneous and required the stimulus of coitus (Musa and Abusineina, 1978).

In the camel, the left uterine horn is distinctly larger than the right one, even in the foetus (Arthur *et al*, 1986; Srikandakumar *et al*, 2001).

In this study the surface epithelium of endometrium was simple columnar which is similar to mare and bitch; it is pseudostratified columnar or simple columnar in the sow and ruminant (Dellmann and Eurell, 1998) and simple cuboidal epithelium in queen the endometrium (William *et al*, 1990). The free border of epithelial cell in uterine wall of camel showed microvilli, motile cilia and zeiotic blebs, Desmosomes and gap junction were seen as means of connections between the neighbouring cells (Fetaih *et al*, 1992). Uterine gland in camel was simple coiled, branched tubular but the branching and coiling of the glands are extensive than in the mare, whereas less branching is seen in carnivores. The secretory products of the lining and glandular epithelia include mucous, lipids, glycogen and protein (Bank, 1993). In the camel the lamina epithelial of cervix was lined by simple cells but in canine cervix lamina epithelial surface is lined by stratified squamous, it is a thin-walled structure in sow and it is well-developed in cow (Bank, 1993). In equine, the secretory cell was distinguished by a slender shape and darker cytoplasm contained PAS-positive secretory granules (Huchzermeyer *et al*, 2005).

Venous plexus was observed in lamina propria of cervix in camel, the function of the venous plexus,

which is otherwise described in the cervix of dogs, is unclear (Dellmann and Brown, 1987). Hypothetically, it may consider that such a strong vascularisation enables a rapid immunological reaction to bacteria, additionally, function as a cavernous body is conceivable, which support the occlusive mechanism of the cervical canal.

Cervical mucous follows a complex and secretion pattern in eutherian mammals and plays different roles in reproduction. On the one hand, the mucous facilitate the passage of sperm in the fertile part of the ovulatory cycle while on the other, it prevents the passage at other times. Furthermore, it functions as a filter for spermatozoa with morphological aberrations, acts as a reservoir for sperms and participates in nutrition and capacitation (Bond, 1982; Mullins and Saacke, 1989, Tsiligianni *et al*, 2003). In addition, its content of immunoglobulins, lysosome, lactoferrin and different enzyme activators and inhibitors indicates a bacteriolytic function of the mucous (Hafez and Hafez, 2000).

The present study increased our understanding of the reproductive biology of the camel. This will help scientists exploit recent advances in techniques such as super ovulation and embryo transfer more effectively. The secretory activity of uterine cervix of camel was positive to PAS and AB which indicated the presence of neutral and acidic glycoprotein (Yamabayashi, 1987).

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