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RESEARCH ARTICLE

Anatomy of the Cervical Canal in the Angora Goat *(Capra hircus)*

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Summary

This study was performed to reveal the anatomy of the cervical canal in Angora goats. For this purpose, sixty genital tracts of adult Angora goats in estrus, weighing from 40 to 50 kg, obtained from Konya slaughterhouses, were used. The materials were examined by dissection and latex cast techniques. In dissections, the vaginal protrusions were star, duckbill, crescent, spiral, cluster and bump-shaped. In the materials with latex cast and dissection, because the circular folds were of high volumes in the caudal half of the cervical canal, the blind sacs were deeper than those of the cranial half. Based on the latex cast, we have noticed with interest that the cervical canal had a convexity in dorsal direction because its cranial and caudal thirds were curved ventrally. It was concluded that the anatomical structure of the cervical canal mentioned in this study might be considered in intrauterine catheter applications in Angora goats.

Keywords: *Cervical canal, Circular fold, Goat, Anatomy*

Ankara Keçisinde *(Capra hircus)* Canalis Cervicis Uteri'nin Anatomisi

Özet

Bu çalışma; Ankara keçilerinde canalis cervicis uteri'nin anatomisini belirlemek için gerçekleştirildi. Bu amaçla Konya mezbahalarından temin edilen, ağırlıkları 40-50 kg aralığında ve östrus döneminde olan ergin 60 adet Ankara keçisinin genital organları kullanıldı. Toplanan materyaller latex kast yöntemi ve diseksiyonla incelendi. Portio vaginalis'in yıldız, ördekgagası, hilal, helezonik, üzüm salkımı ve yumru olmak üzere 6 tip görünüm arz ettiği tespit edildi. Latex kastı ve diseksiyon yapılan materyallerde plicae circulares'in, canalis cervicis uteri'nin caudal yarımında büyük hacimli olması nedeniyle oluşan kör keselerin cranial'dekilere göre daha derin şekillendiği görüldü. Latex kastlarında ise canalis cervicis uteri'nin cranial ve caudal 1/3'lerinin ventral'e doğru kıvrılmasından dolayı kanalın dorsal yönde bir dışbükeylik gösterdiği tespit edildi. Ankara keçilerinde intrauterin kateter uygulamalarında canalis cervicis uteri'nin bahsedilen anatomik yapısının göz önüne alınması gerektiği kanısına varıldı.

Anahtar sözcükler: *Canalis cervicis uteri, Plica circularis, Keçi, Anatomi*

INTRODUCTION

The cervical canal is a potential area for problems related to uterine infections, pregnancy and parturition because it links normally septic vagina to the normally sterile uterus and because it is an area through which sperm and neonates must pass. Moreover, cervical artificial insemination and collection of cytological information on the condition of the uterus depends on passage through the cervical canal [1-5].

The development of a practical, commercial artificial insemination program using frozen-thawed semen requires a technique for depositing into the uterus through the cervical canal. However, the cervical barrier and the complex anatomy of the ewe cervical canal restrict the passage of insemination instruments which have been developed for the cow [5-7]. To date, although a large number of studies have been performed on the cervical canal of the ewe [4,8-12], a little is known on the caprine cervical canal. Moreover, although the Angora goat, native to Turkey, has been known for excellent quality mohair worldwide [13], there are no reports on its cervical canal. We have thus aimed to reveal some morphological aspects of the cervical canal in the Angora goat, using longitudinal section and latex cast of the cervical canal.

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MATERIAL and METHODS

Sixty cervices of slaughtered Angora goats in estrus, obtained from Konya slaughterhouses, were used. The goats were native breeds in Turkey, 3 to 4 years of age, weighing from 40 to 50 kg. To make the anatomical structure of the cervical canal more visible and to fill fully the canal and its blind sacs with latex, the cervices were collected in September, October and November which are mating seasons for small ruminants in Konya surroundings. Estrus scanning was first performed by the male goats that were also brought for being slaughtered. After the goats that permit for mating were marked and traced along the stages of the slaughter, their genital tracts were collected during the removing offal. Then, the materials were transferred to the anatomy laboratory of the Veterinary Faculty of Selcuk University, of which, 30 were prepared for longitudinal sections and the remaining were filled with about 50 ml blue (Setacolor™, cobalt blue, num. 20, PEBEO, Cedex, France) - colored latex (Rubber latex™, MERCAN, Istanbul, Turkey) for each material. Longitudinal sections were performed in a dorsoventral direction and keep at room temeperature of +4°C. After the base of the uterine cavity was ligatured, the outer surface of the cervix was pressed lightly with hand in different direction in order to fill completely the blind spaces in the canal and around the external cervical orifice during injection of latex solution from the vaginal cavity to the cervical canal. As soon as the filling was completely finished, the vaginal cavity was also ligatured. After a latex solidification of 5 days, the specimens were placed in 30% KOH solution over 24 h at room temperature for corrosion, and finally the corrosion cast was rinsed with warm running water to take its soft remains away at some different intervals. The image analyses of the longitudinal sections and the casts of the cervical canal were recorded and photographed. Nomina Anatomica Veterinaria [14] was used for terminology.

RESULTS

We showed that the vaginal projections of Angora goats were star *(Fig. 1/A)*, duckbill *(Fig. 1/B)*, crescent *(Fig. 1/C)*, spiral *(Fig. 1/D)*, cluster *(Fig. 1/E)* and bump-shaped *(Fig. 1/F)*. In the specimens examined, the star, duckbill, crescent, spiral, cluster and bump-shaped vaginal protrusions were 22, 6, 2, 6, 4, and 20 in number, respectively. The mean number of cervical folds in Angora goats was 4.3. These folds of the canal were nearly funnel-shaped, with the smallest opening pointing caudally *(Fig. 2/e)*. The results indicate that the projection diversities of the cervical canal into the vaginal cavity were not related to the numbers of cervical folds. The inseminator, therefore, can not use these variables to predict differences in the length, number and volume of the circular folds for insemination of goats.

In the materials with latex cast and longitudinal sections, since the larger cervical folds existed in the caudal half of the cervical canal when compared with the cranial half, the blind sacs were deeper than those of the cranial half (Fig. 2/f). Some cervical folds in the caudal half of the cervical canal were eccentrically aligned to the rest of the canal. Based on the longitudinal section and latex casts, it was observed that the eccentric cervical canals, which are the greatest obstacle for cervical

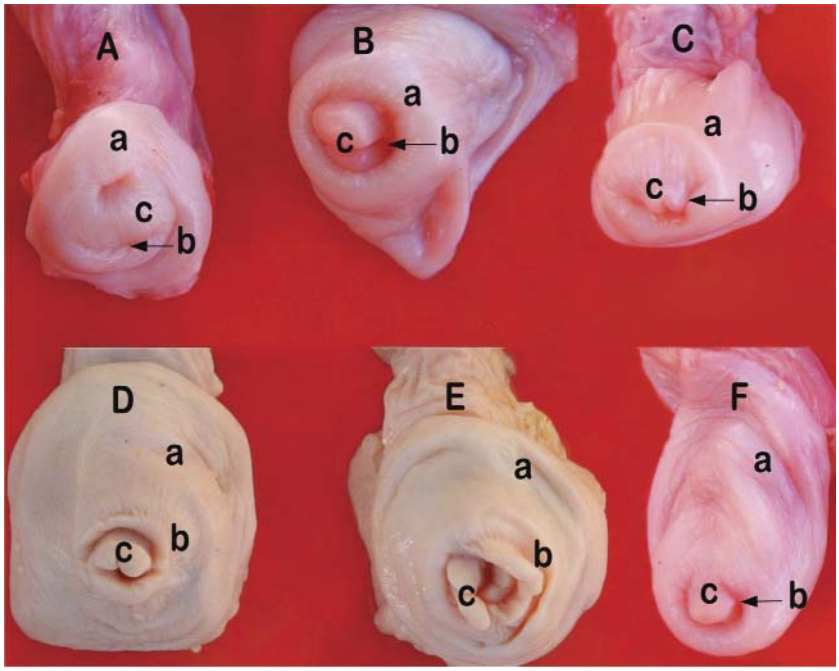

Fig 1. Appearances of the vaginal protrusions in the Angora goat

A. Star, **B.** Duckbill, **C.** Crescent, **D.** Spiral, **E.** Cluster, **F.** Bump, **a.** Vaginal cavity, **b.** Vaginal fornix, **c.** Vaginal protrusion, **d.** External cervical orifice, **e.** Funnel-shaped cervical folds with the smallest opening pointing caudally, **f.** Blind sac, **g.** Accentric cervical canal, **g'.** Eccentric portion of the cervical canal, **h.** Internal cervical orifice, **i.** uterine cavity

Şekil 1. Ankara keçisinde portio vaginalis'lerin görünümleri

A. Yıldız, **B.** Ördek gagası, **C.** Hilal, **D.** Helezonik, **E.** Üzüm salkımı **F.** Yumru, **a.** Cavum vaginale, **b.** Fornix vaginae, **c.** Portio vaginalis, **d.** Ostium uteri externum, **e.** Caudal'deki en küçük açılış kısımlarıyla birlikte huni görünümlü plicae circulares, **f.** Kör kese, **g.** Accentric seyirli canalis cervicis uteri, **g'.** Canalis cervicis uteri'nin eccentric bölümü, **h.** Ostium uteri internum, **i.** Cavum uteri

penetration, were at the level of the second *(Fig. 3/g')* or the third *(Fig. 2/g')* folds from the external cervical orifice in 18 and 20 Angora goats, respectively. However, it was very interesting that 22 Angora goats had thoroughly eccentric cervical canals *(Figs. 2, 3/g)*.

The cervical canal of the Angora goat had a convexity in dorsal direction *(Fig. 3)* because its cranial and caudal thirds were somewhat curved ventrally.

DISCUSSION

Although the diversities in the appearances (star, duckbill, crescent, spiral and cluster) of the vaginal protrusions supported the observations on the ewe [3,6,15], there is also the bump-shaped one in the Angora goat. In this study, we observed the high number of star and bump-shaped vaginal protrusions, which can suggest

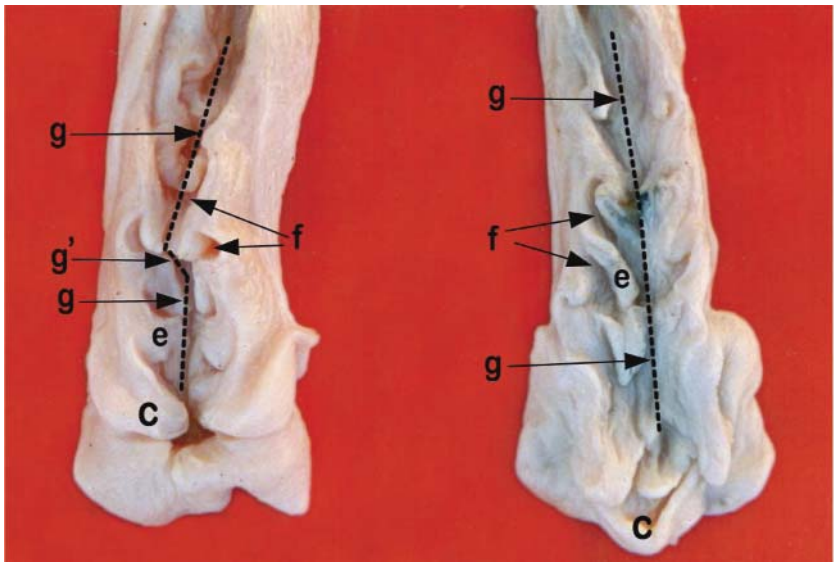

Fig 2. Longitudinal section of the cervical canal. Letters as for Fig 1

Şekil 2. Canalis cervicis uteri'nin longitudinal kesiti. Harfler şekil 1'deki gibidir

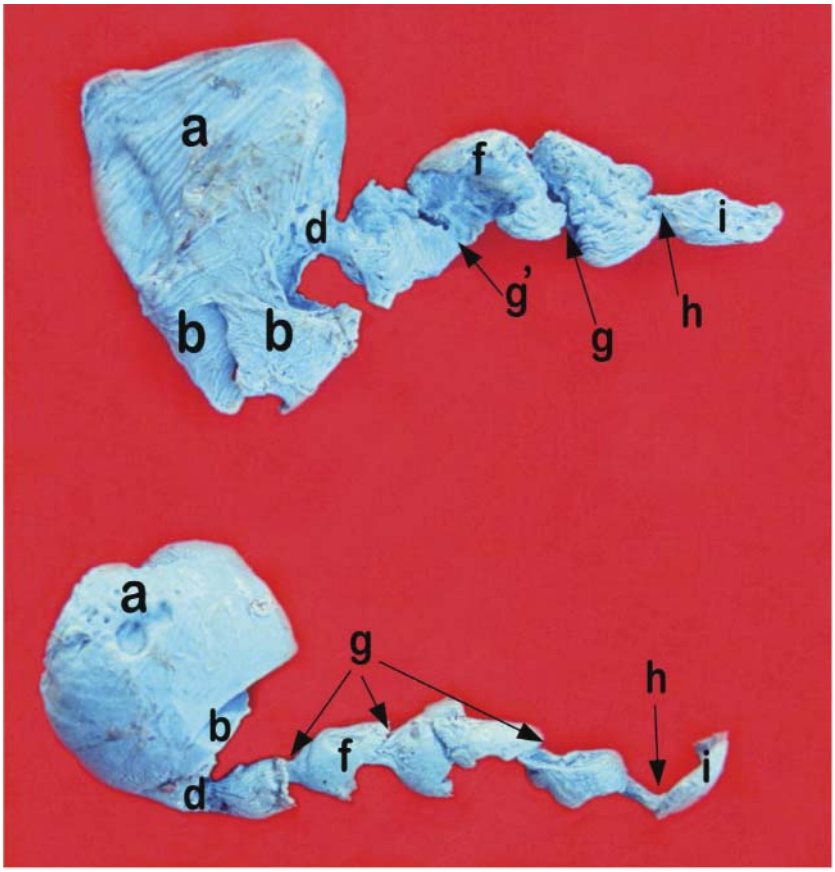

Fig 3. Latex casts of the cervical canal. Letters as for Fig. 1

Şekil 3. Canalis cervicis uteri'nin latex kastları. Harfler şekil 1'deki gibidir

that catheter may be inserted more comfortably to the external cervical orifice in the Angora goat than that of the ewe.

Although the authors [3,6,15] stated that the numbers of the cervical folds varied from 5 to 6, this mean was 4.3 in the Angora goat. Hence, it may be suggested that artificial insemination can be more easily performed than that of the ewe.

We showed that the cervical folds caudal to cervical canal have higher volume and deeper blind sacs than those of the cranial half, which is consistent with the results of the authors [4,8,10,12,15].

We observed that 38 Angora goats have the eccentric cervical canals in the caudal half of the canal as in the ewe [3,6,12]. Therefore, in design of effective instrumentation and technique for transcervical passage in this species these factors must be taken into account. The determination of complete eccentric cervical canals in 22 Angora goats proposes that the goat cervical canal permits to easier artificial insemination than that of the ewe. The cervical canal of the Angora goat had a dorsal directed-convexity as described earlier in the ewe [10,15].

Some researchers [3,4,6] recorded morphometric parameters regarding the length and diameter of the cervical canal and the height of each cervical fold and the distances between the cervical folds. However, in this study, no biometric measurements are taken from the cervical canal cast due to the fact that it may expand and/or narrow depending on differences in injection pressure, and from longitudinal section because its length and width can change at different sexual phases and even at different hours of same phase.

In conclusion, the results from this study suggest that in the Angora goat the intrauterine catheter application for different objectives may be more practical than that of the ewe. However, the location and number of the cervical folds (especially the most eccentric ones) should be considered to develop a suitable catheter in manipulating the easy and no traumatic passage through the cervical canal. Moreover, the authors propose that this study will shed light on future studies on the cervical canal of the Angora goat, and that it may contribute considerably to the present anatomical knowledge in this species.

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