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Gross Structure of the Cervical Region of the Uterus of White-Tailed Deer[1]

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Abstract. The uterine cervix of the white-tailed deer, *Odocoileus virginianus,* consists of the narrowed-down multiple-valved part between the vagina and the hollow thinner-walled uterus proper. The length of the cervix of a mature doe in December may vary from 40 mm to 84 mm. It is composed of four to six, but generally of five, heavily muscled valves with the openings through the valves alternating dorsally and ventrally. This arrangement of valves results in an undulating or twisted passageway through the cervix. Age and reproductive history influences variation in size. The inside surface of the cervix is covered with small longitudinal folds of tissue.

Much literature has been published on different phases of reproduction in the white-tailed deer (*Odocoileus virginianus*). Although many aspects of the subject have been reported, there is a lack of information on the anatomy of the reproductive tract of deer. This paper will contribute data on the gross anatomy of the cervix region of the reproductive tract of the white-tailed deer.

Examination of the structural characteristics of the cervix was initiated in the hopes that some characteristic might be found that would provide a quick and reliable indication of age and whether or not the doe had ever been pregnant. A total of 113 cervixes were examined in the project.

METHODS

The reproductive tracts used in this study were collected from does killed on the highways or taken during the December hunting seasons in Iowa and at the Nebraska portion of the De Soto National Wildlife Refuge in 1962 and 1963. Reproductive tracts and lower jaws were salvaged from does killed on highways and sent frozen to Iowa State University. Other tracts were collected at deer checking stations and from cooperating hunters in Iowa.

The specimens, when they arrived at the Wildlife Research Unit, were preserved in 10% formalin as described by Haugen (1963). Both the vagina and the uterus were inflated with formalin, and the tracts were stored for later study. The uteri

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were examined, and information was recorded on ovarian structures, embryo development and dates of breeding as reported by Haugen and Trauger (1963). The age of each doe was determined from tooth-wear characteristics.

External Appearance Of The Cervix

The cervix is that narrowed-down and thick-walled portion of the reproductive tract between the hollow, thin-walled uterus and the vagina and is composed of a series of thick-walled, closely-spaced valves. Normally the diameter of the anterior end of the cervix may vary from 4 mm to 12 mm in a mature doe, but, during parturation, it expands to permit the passage of the fetus.

At the anterior end of the reproductive tract, the horns of the uterus are separated, but they unite to form a common chamber near the region of the cervix. The walls of the common chamber converge to join the narrower cervix. From this point, the diameter of the cervix increases slightly to the posterior, forming a tapered tube consisting of a series of valves (Figure 1.)

By palpating the outside of the cervix, the relative position of the valves can be detected. At each valve, there is a slight constriction in the wall of the cervix tube. This can also be seen in some specimens.

At the vaginal end of the cervix, there is an abrupt increase in the diameter of the reproductive tract. The tissue at this point is rather firm and thick because it is at this point that the wall of the cervix expands to form the last valve and connects with the wall of the vagina.

The size of the cervix is complete by the end of the first year and a half as indicated by length (Table 1). Length was measured from the most anterior portion of the longitudinal folds of tissue on the inner surface to the most posterior portion of the last valve which on occasions may protrude into the vagina. The mean length of the cervix of the fawns was 35.5 mm. At 1½ years, the mean length was 48.3 mm, and all other age groups vary around this figure.

Table 1. Length of the uterine cervix of white-tailed deer.

Age	Number examined	Extreme in mm	Mean in mm
Fawn	28	25.5-49.0	35.5
1½	16	32.0-59.0	48.3
2½	4	42.0-70.0	53.5
3½	8	38.0-59.5	48.6
4½	8	39.0-60.0	51.3
5½	1		47.0
6½	2	40.0-61.5	50.7
7½	5	46.0-84.0	57.0

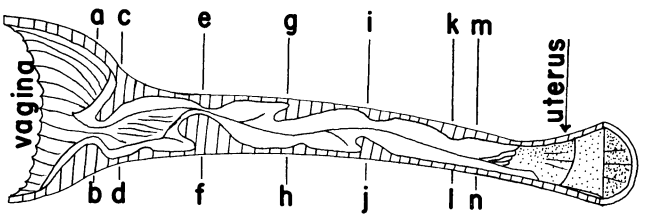

Fig. 1. Sagital section of the uterine cervix of a white-tailed deer (diagrammatic).

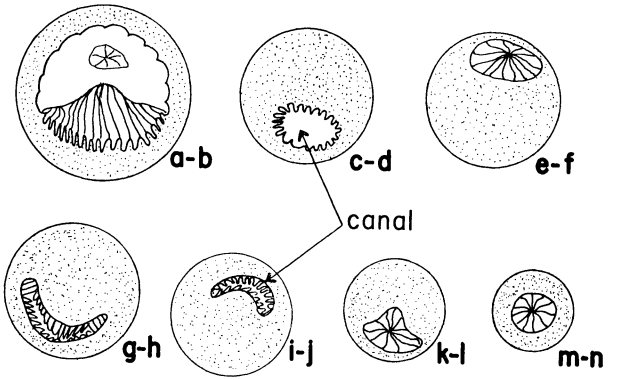

Fig. 2. Cross sections of the cervix as indicated in Fig. 1.

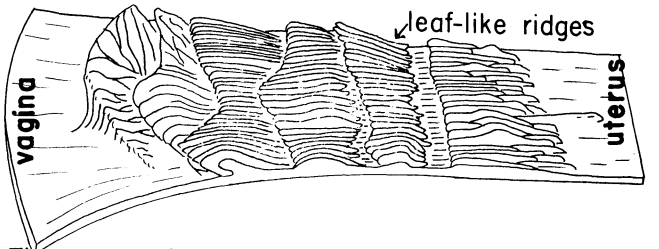

Fig. 3. Cervix opened dorsally and spread to show internal appearance.

The diameter of the cervix increases with age for about the first 5½ years (Table 2). Diameter was measured in three positions along the cervix: at the anterior valve (No. 1), between valves 3 and 4, and at the posterior valve (No. 6). For convenience, the valves have been numbered from one (the most anterior) to six (the most posterior).

Table 2. Diameter (external) of the uterine cervix of white-tailed deer.

Age	Number examined	Mean diameter (mm) at		
		Vaginal end	Mid-point	Uterine end
Fawn	28	16.1	8.9	7.8
1½	11	19.6	11.3	10.0
2½	4	26.5	12.3	9.0
3½	6	23.0	13.0	11.3
4½	5	19.4	11.0	10.2
5½	1	21.0	14.0	14.0
6½	2	20.0	11.0	9.0
7½	4	20.7	14.0	10.3

Internal Anatomy Of Cervix

The Valves. Most cervixes are composed of five valves (62% of 87 tracts), all of which are oriented so that the lip of the valve extends posteriorly (Figure 1). Four valves were found in 17 per cent of the tracts, and 21 per cent had six valves. Generally those tracts which had four valves lacked what might be normally considered the first and last valve. When the first valve was present, it was represented by a slight ridge on the internal surface of the cervix and seldom was prominent except for its expanded leaf-like longitudinal folds.

Between each of the valves there is an intervalvular space which varies with the length of the cervix. One noticeable characteristic was that the more posterior valves were slightly farther apart. This intervalvular space was generally filled with the lip of the next most anterior valve. The expanded portion or lip of each valve points toward the opening of the next most posterior valve.

The openings in the more anterior valves seem to be more in the center of the valve. Progressing posteriorly, the openings tend to become more dorsal and ventrial in their alternation through the cervix. This results in a crooked passageway through the cervix as can be seen in the cross-section views of Figure 2.

The lip extending toward the opening of the adjacent posterior valve is most prominent in the fifth and sixth valves. The sixth valve formed the junction with the vagina on the posterior end of the cervix. The fifth valve developed a lip which protruded through or to the opening of the sixth valve. The other valves had a similar development but to a lesser extent.

The three anterior valves (Nos. 1-3) did not develop a distinct point. Each lip had a blunt appearance. Valve No. 1, absent in most of the specimens, seldom developed a lip. It may serve to illustrate the structure of the valves.

The central mass of the valve is composed of the same muscular tissue as the wall of the cervix. The valve appears as a thickening of the wall of the cervix which results in a constricted

ring around the canal in the cervix (Figures 1 and 3). Half of this ring appears as an expansion in the form of a lip on the valve. On the inner surface of this mass are the folds of tissue extending longitudinally through the canal (Figure 3).

Valves No. 2 and 3 were very similar. Each completely ringed the canal of the cervix, but the lip of the third valve was developed to a greater extent. The lips of these valves were much shorter than those on the more posteriorly located valves.

The fourth and fifth valves had lips which were pointed or blunt but were more grossly developed than the lips on the more anterior valves. The central masses of these valves were well expanded and generally filled the intervalvular space.

The space between valves five and six in some specimens was small; in others, it seemed enlarged as if dilated. A dilated condition could have been partially caused by liquid pressure when the vagina was inflated with formalin to preserve the reproductive tract. An examination of fresh specimens revealed that this same characteristic exists in the unpreserved cervix. Preservation, however, apparently accentuated the opening.

The appearance of the sixth valve was variable. It does not completely encircle the canal of the cervix as do valves No. 2 through 5. It either develops as a partial circling of the canal, or, when it makes a complete encirclement of the canal, it does not form a closed ring. Instead, the ends of the valve which normally meet are offset.

Along with the characteristics of the valves, there is the positioning of the valves in the cervix to consider. The expanded portion of the valves alternate ventrally and dorsally along the cervix (Figure 1). The expanded portion of the valves may be greatest in length anywhere in the dorsal or ventral half of the valves. This makes it possible for the valve to be in a position to correspond with the opening of the valve posterior to it.

A particularly numbered valve is not always in the same position in the cervix. There is variation in the pattern of the arrangement. Valve No. 6 may serve as an indicator of the two types of alternating patterns. This valve occurs in a dorsal position in 18 of 74 cervixes examined. A majority of the cervixes have this valve in a ventral position.

The Canal of the Cervix. The alternating of the valves forms an undulating canal through the cervix. This is compounded into a series of twisted undulations by the shifting of the expanded portion of the valve from one side to another as it fills the opening of the valve posterior to it. Cross-sections of the cervix at the valves illustrate the path of the canal (Figure 2). Anteriorly, the canal is fairly straight, but it takes on the most twisted undulating shape to the posterior end.

When the cervixes were opened, many were found with mucus in their cavity (43%), especially from the fourth to sixth valves. In cervixes with large amounts of mucus, it was found throughout its full length. Fawn cervixes which had not experienced estrus, were without mucus.

The Interior Longitudinal Folds. Numerous parallel, thin, leaf-like ridges or folds are found on the interior surface of the cervix. They are small folds or thin ridges of tissue running longitudinally through the cervix. These ridges vary in height (up to 2.9 mm) in various parts of the cervix.

The folds are highest on the tip of the valve lip and shortest in the intervalvular spaces. The ridges are not continuous throughout the full length of the cervix.

Most individual folds run from about the mid-point between two valves, over the valve area and on to the next intervalvular space. Succeeding leaf-like ridges start from the side or base of preceding shortening ridges. Each ridge increases in height gradually until it extends onto the valve. At this point, the new "leaf" is at its greatest height, and it composes most of the body of the valve. As the new ridge extends down the opposite side of the valve and on to the intervalvular space, it also will branch and give rise to another ridge. This pattern is repeated throughout the network of thin folds.

The fact that the ridges are at their greatest height on the lip of a valve and that these become thickened on the tip adds to the body of the valve. This thickening of the edge of the ridges occurs only on their central-most margin on the tips of the valves. These ridges have a triangular appearance in cross-section.

On the anterior end of the cervix, where the ridges begin, one ridge usually extends farther than the others. With the exception of three cases in 61, the projection was located in a mid-ventral position in the cervical canal.

The lip of the sixth valve was short, pointed or blunt and curved down on the tip. The folds of tissue occur on the anterior side of the valve. The surface of the valve may show a variety of forms, reflecting the appearance of the interior surface of the vagina. Its surface may vary from smooth to ridged. The surface appearance may be grouped into four types: (1) smooth surfaced with some "cracks," (2) undulating surface, (3) serrated appearance in cross-section and (4) with numerous ridges.

After a careful examination of the cervix was completed, the data obtained were compared with the age and reproductive histories of the deer. From this comparison, it was concluded

that the gross anatomy of the cervix alone does not yield a reliable index to age or reproductive history.

ACKNOWLEDGMENTS

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Literature Cited

Haugen, A. O. 1963. J. Wildl. Mgmt. 27(1):142-143.
——— and D. L. Trauger. 1962. Proc. Iowa Acad. Sci. 69:231-238.

The Orangethroat Darter (*Etheostoma spectabile*) in Eastern Iowa

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Abstract. The orangethroat darter, thought possibly to be extinct in Iowa, has been collected from a limited area north of Marion in Linn County, and from Des Moines County, near Burlington. An unpublished record from Davenport has not been confirmed. Another record from Taylor's Slough at Ft. Madison, in Lee County, is considered doubtful.

Conservationists, ecologists, and biologists generally have concern about changes in the fauna and flora. Loss of a species formerly present is a matter of regret, especially when the apparent cause is some aspect of human activity. It is a truism to say that pollution, growth of cities, and intensification of farming practices all take their toll of native animals, particularly the aquatic forms with limited tolerances in habitat preference. The status of any rare or threatened species is of scientific concern because of the evidence it provides of changing conditions, which affect management and conservation efforts. And it is of moral concern to those who give thought to man's responsibility to the other animals and to his future generations. Certainly the trend toward setting aside sanctuaries and preserves on national, state, and county levels is based on these concerns.

Among the poorly known species for which there is need and

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