

From the National Zoological Park, Smithsonian Institution, The Zoological Societies of London and San Diego, the Los Angeles Zoo, and the Tama Zoological Park, Tokyo.

LEIOMYOMAS IN THE GENITAL TRACT OF LARGE ZOO MAMMALS

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Introduction:

Smooth muscle tumors of the genital tract are relatively rare in domestic animals. Although the common practice of ovariohysterectomy performed at an early age might account for a low incidence in pet animals, records for larger species reveal a similarly low incidence of genital leiomyomas, with only a few reports of this tumor occurring in cows, ewes, sows, and several species of nonhuman primates (King, 1972). These findings contrast sharply with the statistics for uterine leiomyomas of women, in whom this is one of the most common tumors found during the child-bearing age (Robbins and Cotran, 1979).

In our series, leiomyomas were found in the uterus of two Asian elephants (*Elephas maximus indicus*), and in the vaginal tracts of 4 Indian rhinoceros (*Rhinoceros unicornis*).

Case Histories:

The Asian elephant is a popular animal for exhibition at many of the world's zoological parks. We have been able to examine material from two aged females, one from the National Zoo and one from the Los Angeles Zoo. These animals were approximately 30 and 60 years old, respectively. Both had tumors within the wall of the uterus up to 8 cm in diameter. They were well circumscribed and the cut surfaces were yellowish-white and had a fibrous appearance. Histologically, the tumors consisted of elongated smooth muscle-like spindle cells that formed whorls and interwoven patterns.

The leiomyomas in these elephants were incidental necropsy findings, with no apparent clinical signs prior to the animals' deaths.

The Indian rhinoceros is an endangered species whose habitat along the river systems of the Indian subcontinent is rapidly being destroyed. The horn of this diminishing species is valued for its alleged aphrodisiac-like qualities, while the urine and bile are also thought to have medicinal qualities. There are approximately 1,000 of these animals left in the wild--approximately 250 in the Royal Chitwan National Park in Nepal, and 6-8 hundred in Kaziranga National Park in Assam, India. These animals inhabit the jungle grasses that line the river banks and have a life span of from 30 to 40 years (Sedenticker, 1980). Currently, there are also 63 Indian rhinoceros on exhibit in zoos around the world. Thirty four of these are males and 28 are females. There have been 40 births recorded in captivity since 1956 (International Stud Book, 1980).

Following are descriptions of the 4 cases of multiple leiomyomas that occurred in the vaginal tracts of 4 Indian rhinoceros. These were detected in somewhat aged animals, most of which were not showing estrous cycling at the time the tumors were diagnosed.

Case No. 1.

This female Indian rhinoceros has been at the Tama Zoological Park in Tokyo for more than 20 years. She had a stillborn calf in 1966, and a male calf in 1973. She has not had a normal estrous cycle since 1979. In February of 1979, she was noted to have vaginal bleeding, followed by a purulent discharge. Several days later, a multilobular mass began to protrude from the vulva (Figs. 1, 2, 3). Numerous pedunculated masses were found further anterior in the wall of the vaginal tract by palpation and endoscopic examination. In May of 1980, the protruding mass was removed and proven to be a large leiomyoma. There has been no recurrence of vaginal bleeding or discharge since that time, however, numerous masses still persist in the vagina.

Case No. 2.

a 24-year-old female Indian rhinoceros died with acute hemorrhagic enterocolitis while at the San Diego Zoo. Although on breeding loan from the Philadelphia Zoo, she had never produced offspring. At necropsy there were numerous firm, circumscribed masses up to 5 cm in diameter noted in the vagina and cervix. Several nodules were also in the supporting ligaments of the bladder and uterus. These masses were proven to be leiomyomas histologically.

Case No. 3.

is an over-thirty-year-old female Indian rhinoceros currently at Amsterdam. In 1971, in London, a pedunculated mass was noted in the dorsal wall of the vagina. Other masses were palpated in the cervix and lower uterus and biopsies showed them as typical leiomyomas. This animal had had two calves some 10 or 12 years before the tumors were noted. She has had no evidence of estrus since 1970. At the last examination some 4 years ago, the tumors were still present but were felt to be clinically benign.

Case No. 4.

was a 17-year-old female Indian rhinoceros from the National Zoo that had a male calf in 1974, after which no further estrous activity was observed. In 1980, she developed a rectal prolapse and while the prolapse was being reduced "polyps" were observed in the dorsal vagina near the cervical os. These were biopsied and shown to be leiomyomas. Several months later, the animal died of a torsion of the duodenum associated with gastric impaction. These changes were considered not to be related to the earlier prolapse or vaginal tumors. At autopsy, the distance from the vulvar lips to the ovary was 140 cm. A large (25-30cm) fluid-filled cyst was adjacent to the right ovary (Fig. 4). The cyst had a thick rugous lining (Fig. 5) and was filled with clear yellow fluid. Its histologic appearance was compatible with a salpingo-coele. Both ovaries contained cysts, but normal follicles or corpora lutea were not evident. In addition, there were numerous cysts throughout the endometrium. The vagina and area round the cervical os contained numerous firm, white, often pedunculated masses, the largest of which was 8 cm in diameter (Fig. 6).

Histologically, the vaginal masses from all 4 of the rhinoceros in this study were similar in that they consisted of circumscribed nonencapsulated, interlacing, well-differentiated spindle cells that resembled smooth muscle (Fig. 7). There was no evidence of nuclear pleomorphism or mitotic activity in any of the 4 cases examined. The tumors had a dense connective tissue stroma which varied in amount from area to area.

Discussion:

None of the 4 Indian rhinoceros had reproduced after the diagnosis of leiomyoma was made, nor was there evidence of estrous cycles occurring in 3 of the 4 animals. In women, the role of estrogens in the development of uterine leiomyomas remains somewhat controversial. These tumors seem to grow rapidly during pregnancy, but usually regress and become fibrotic after menopause. It is probable that the induction of these tumors and subsequent growth are endocrine dependent. Attempts to induce these tumors in laboratory animals using exogenous estrogens have been inconclusive (R o b b i n s and C o t r a n, 1979).

After the rhinoceros from the National Zoo (Case No. 4) became anestrus, her estrogen levels were determined to be elevated for more than twice as long as 2 rhinoceros showing normal estrous cycles in a study in which urinary estrogen excretory patterns were determined by radioimmunoassay (K e s s e m, 1981). Although these data are preliminary, it does suggest a relationship between anestrus, hyperestrogenism, and the occurrence of vaginal leiomyomas and other reproductive tract abnormalities in these rhinoceros. These findings are especially interesting in light of the proposed role of estrogens in the development of uterine leiomyomas in women.

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Summary:

Leiomyomas in the genital tract of large zoo mammals

Leiomyomas, benign tumors of smooth muscle origin, occurred in the reproductive tracts of 6 large mammals from several different zoos. Two were uterine leiomyomas in Asian elephants and 4 were vaginal leiomyomas in 4 Indian rhinoceros. The vaginal tumors in the rhinoceros were associated with abnormal estrous cycles, with no births occurring in any of the animals after the tumors were discovered. One of the rhinoceros, determined to have hyperestrogenism clinically, also had ovarian cysts and a large salpingocele when later necropsied. Based on preliminary findings, it is possible that these tumors may be estrogen-dependent, as is proposed for the relatively common uterine leiomyomas (fibroids) of women.

Zusammenfassung:

Leiomyome im Genitaltrakt von Großsäugern im Zoo

Leiomyome, d. h. gutartige Tumoren der glatten Muskulatur, wurden bei sechs Großsäugern verschiedener Zoos festgestellt. In zwei Fällen handelte es sich um Leiomyome der Gebärmutter bei Asiatischen Elefanten, während bei vier Indischen Nashörnern, die nicht mehr gebären, Leiomyome der Vagina beobachtet wurden. Eines der Nashörner zeigte Erscheinungen eines Hyperöstrus und wies später bei der Sektion Ovarialzysten und eine Salpingocele auf. Auf Grund vorläufiger Befunde wird angenommen, daß bei der Entstehung derartiger Tumoren, ebenso wie bei der Frau, der Östrogenspiegel eine Rolle spielt.

Résumé :

Des léiomyomes dans l'appareil reproducteur de grands mammifères de jardins zoologiques

Des léiomyomes, c'est-à-dire des tumeurs bénignes à la musculature lisse ont été dépistés chez six grands mammifères de différents jardins zoologiques. Dans deux cas, il s'agissait de léiomyomes utérins chez des éléphants d'Asie alors que chez le rhinocéros de l'Inde, nous avons trouvé chez quatre femelles qui ne mettaient plus de petits au monde des léiomyomes vaginaux. Un des rhinocéros manifestait des phénomènes d'un hyperoestrogénisme et présentait plus tard, lors de la dissection, des kystes de l'ovaire et un salpingocoele. Les constatations préliminaires portent à croire qu'il se peut que ces tumeurs dépendent de l'oestrogène, ainsi qu'on l'a proposé au sujet des léiomyomes utérins chez la femme.

Резюме:

Лейомиомы в половых органах больших млекопитающих.

Лейомиомы, доброкачественные опухоли гладкомышечного происхождения, были обнаружены у шести крупных млекопитающих из различных зоопарков. В двух случаях лейомиомы матки были обнаружены у азиатских слонов и четыре случая лейомиомы влагалища у четырех индийских носорогов. Опухоли влагалища у носорогов сопровождались нерегулярными эстральными циклами, причем у всех животных наблюдалось бесплодие. При вскрытии трупа одного из носорогов, у которого клинически была установлена гиперострогения, была также обнаружена киста яичника и большая грыжа маточной трубы. Основываясь на предварительных исследованиях, становится вероятным, что эти опухоли являются эстрогено-зависимыми, как и в случае сравнительно распространенных лейомиом матки / фиброиды / у женщин.

References:

- KASSAM, A. A. H. and LASLKY, B. J. (1981): Estrogen excretory patterns in the Indian rhinoceros (*Rhinoceros unicornis*), determined by simplified urinary analysis. *Am. J. Vet. Res.* **42**, 251-255.
- KING, N. W., JR. (1973): Comparative pathology of the uterus. In, *The Uterus*. Eds., Norris, H. J., Hertig, A. T., and Abell, M. R. Page 54B. The Williams and Wilkins Company, Baltimore.
- International Stud Book for the Great Indian Rhinoceros (*Rhinoceros unicornis*) (1980): Second Edition, published by Zoological Garden, Basel (Director, Dieter Ruedi).
- ROBBINS, S. L. and COTRAN, R. S. (1979): *Pathologic Basis of Disease*. Pages 1271-1274, second edition. W. B. Saunders Co., Philadelphia.
- SEIDENSTICKER, J. (1980): National Zoological Park, personal communication.

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Fig. 1: Leiomyoma extrudes from the vulva of an Indian rhinoceros from the Tama Zoo (Case 1)



Fig. 2: A closer view of tumor from Fig. 1, with animal in recumbency

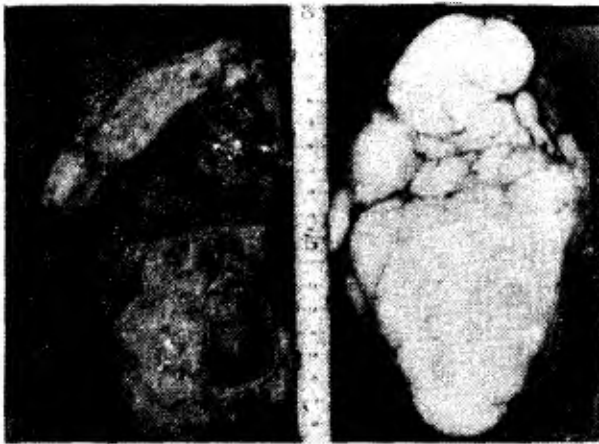


Fig. 3: Appearance of excised leiomyoma showing lobular formation and a dense fibrous pattern on the cut surface(right)



Fig. 4: Entire reproductive tract of rhinoceros from the National Zoo(Case 4). Note large salpingocoele in upper right corner(floor tiles are 15 cm, side)



Fig. 5: Appearance of the open reproductive tract from Fig. 4. Fluid has been drained from the salpingocoele. Note the large mass at the cervical os(arrow) and the long cervical canal present in the indian



Fig. 6: Closer view of large lobulated leiomyoma from Fig. 5.

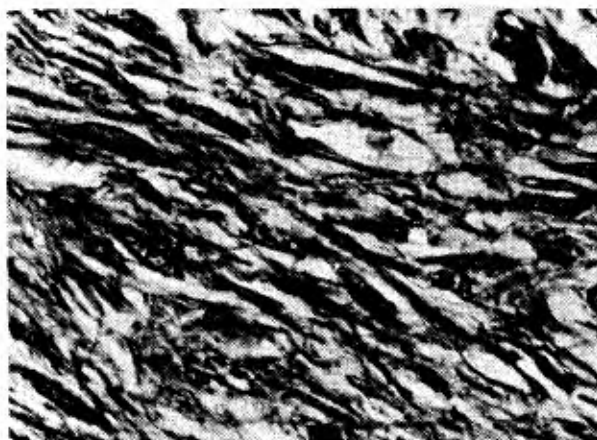
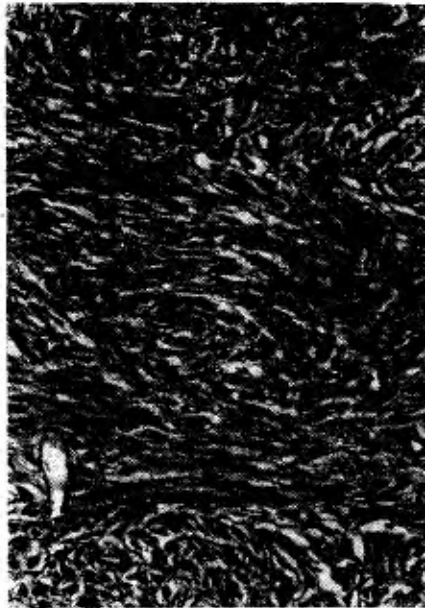
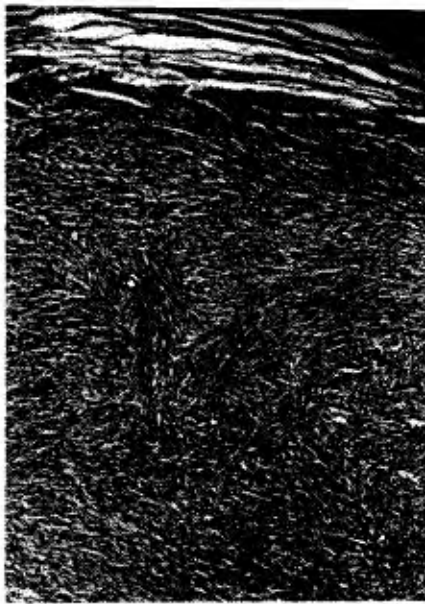


Fig. 74 Histologic appearance of vaginal tumor shows circumscribed masses of smooth muscle-like spindle cells that interlace.