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Short communication

MORPHOLOGICAL STUDY OF MAST CELLS IN FELINE PARANAL SINUS

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Summary

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A histological study upon the localization, density (mm^2), shape and dimensions of mast cells in the wall of paranal sinuses (PS) of healthy European shorthair cats from both genders at the age of 3–4 years was performed. In 240 fields, 2762 mast cells were counted. In the propria of PS mucosa and the outlet duct, mast cells were relatively regularly distributed. In the lining epithelium, the intraepithelial localization was observed as a single finding. Similar localization was observed among the epithelial cells of part of glandular tubules, with frequent occurrence of cell clusters of 3–5 cells in the interstitium. In the musculature, mast cells were detected in both the perimysium and the endomysium. Single mastocytes were situated around the acini of sebaceous glands, around their outlet ducts as well as intraepithelially. Fewest cells (4.0±0.3 /mm^2) were observed in the external anal sphincter and the most numerous – in the connective tissue (18.1±0.9 /mm^2). Their average number was 11.6±0.7 /mm^2 in the apocrine layer and 9.8±0.6 /mm^2 for sebaceous glands clusters. The shape of mast cells in the muscle layer was elongated and in the other part of the PS wall – mainly oval. The comparative analysis of the present data with a similar study of ours in dogs showed statistically significantly lower number of mast cells in the PS in cats.

Key words: cat, mast cells, paranal sinus

Mast cells (Mcs) are traditionally involved in the regulation of inflammation and fibrosis, the immune response as well as the development of tumours. They secrete a number of proinflammatory substances as cytokines, chemokines, growth factors etc. (Emerson & Cross, 1965; Myles *et al.*, 1995, Noli *et al.*, 2003).

In previous studies of ours (Stefanov & Vodenicharov, 2006, Stefanov *et al.*, 2007), we reported the localization, density, shape and dimensions of Mcs in canine paranal sinus (PS). Although there are single reports about the density of mast cells in the cutaneous zone of the anal canal in carnivores (Myles *et al.*, 1995, Noli *et al.*, 2003), there are no data about the presence, shape and dimensions of Mcs in cats. Also, data about these parameters in domestic carnivores are not available. The histological structure of PS in carnivores is similar (Budsberg & Spurgeon, 1983, Budsberg *et al.*, 1985). In cats however, clusters of sebaceous glands, prominating to the PS cavity are situated in the propria. A higher incidence

of inflammations of this organ is reported in dogs (Monteiro-Riviere, 1998).

The scarce data about the presence of mast cells in wall of PS in cats and dogs and their role in the pathogenesis of PS diseases, motivated the present investigation.

The material for the investigations was obtained from the wall of the PS of 4 male and 3 female healthy cats at the age of 3–4 years. The animals were euthanized with 5% thiopental solution. Pieces of 1 cm^2 from all parts of the PS wall were fixed in Carnoy's fixative for 4 hours at room temperature. Then they were dehydrated in ascending ethanol series, cleared in xylene and embedded in paraffin. From them, longitudinal and transverse cross sections of 5–6 μm, stained with 0.1% aqueous solution of toluidine blue (pH 3) were prepared.

The density (number/mm^2) and the dimensions of mast cells (in μm) were determined with a micrometre eyepiece, and their shape was determined by light microscopy.

The statistical analysis of data was done by the Mann-Whitney test.

Light microscopy showed that mast cells in the propria of the PS outlet duct were evenly distributed. Single cells were observed in vicinity of the epithelial basal membrane as well as intraepithelially (Fig. 1). Often, clusters of 3–5 mast cells were observed among the glandular tubules (Fig. 2). In mucosal propria, mast cells were situated near the capillaries and around the small blood vessels, in whose adventitia such cells were also present.

In the muscle layer, mastocytes were observed in both the perimysium and the endomysium.

Single mast cells were located around the acini of sebaceous glands, in the region of their outlet ducts, and also intraepithelially.

Table 1 shows that the highest density of mast cells (per mm^2) was that in the propria – 18.1±0.9, followed by that in the apocrine glands – 11.6±0.7 and sebaceous glands – 9.8±0.6, and the lowest in the external anal sphincter (4.0±0.3 per

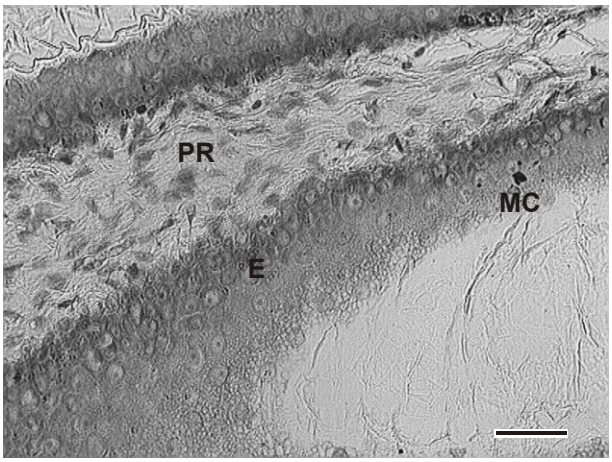

Fig. 1. Intraepithelial localization of mast cells (MC) in *Lamina epithelialis mucosae* (E); PR – propria. Bar = 45 μm.

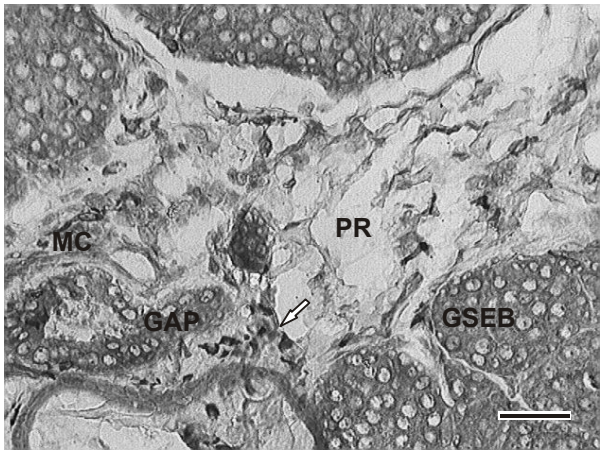

Fig. 2. Mast cells (MC) situated around tubules of apocrine glands (arrow) and intraepithelially; GAP – apocrine glands; GSEB – sebaceous glands; PR – propria. Bar = 45 μm.

Table 1. Area of studied regions of the paranal sinus wall, number and dimensions of mast cells within

Parameter	PR	ES	GAP	GSEB	Total
Area, mm² (%)	80 (33)	48 (21)	56 (23)	56 (23)	240 (100)
Number (%)	1472 (53)	159 (5)	633 (23)	498 (19)	2762 (100)
Number, mm² (min–max)	18.1±0.9 (15.0–22.0)	4.0±0.3** (3.0–5.0)	11.6±0.7** (9.0–15.0)	9.8±0.6** (8.0–12.0)	10.0±0.6 (8.8–13.5)
Length, μm (min–max)	18.9±0.7 (17.0–20.4)	24.7±0.6 (23.8–27.2)	18.9±1.0 (13.6–20.4)	17.4±0.9 (13.6–20.4)	20.0±0.8 (17.0–22.1)
Thickness, μm (min–max)	11.6±0.2 (10.7–12.1)	8.9±0.06 (8.7–9.1)	13.2±0.2 (12.4–13.9)	13.2±0.2 (12.8–13.8)	11.7±0.2 (8.4–12.2)

PR –propria; ES – external anal sphyncter; GAP – apocrine glands; GSEB – sebaceous glands. The data for the number (mm^2), length and thickness are mean ± SEM; ** statistically significant difference of Mcs numbers in the different layers of PS vs PR ($P<0.01$).

mm^2). The longest mast cells were detected in the external anal sphincter, followed by those in the propria, sebaceous and apocrine glands. The highest thickness was observed in mast cells in sebaceous glands, apocrine glands and the propria, followed by those of the external anal sphincter.

Our studies on mast cells shape revealed that they were the most elongated in the muscle layer and oval in the propria, sebaceous and apocrine glands.

The present investigation describes for the first time in detail the localization, density, shape and dimensions of Mcs in the paranal sinus wall in the cat.

A similar localization of mast cells near the blood vessels in the PS propria is reported by Emerson & Cross (1965) and recently, in a study of ours in canine PS

and anal canal (Stefanov & Vodenicharov, 2006; Stefanov *et al.*, 2007).

The predominant occurrence of Mcs in the PS propria confirmed the studies of other authors (Xu *et al.*, 1993; Hill & Martin, 1998), having reported highest number of mastocytes in the propria of studied organs.

As to the mast cells shape, the present results are the same as reported in dogs (Stefanov *et al.*, 2007).

It is remarkable that in general, the mast cells in the PS wall in cats were with bigger dimensions (length 20.0±0.8 μm, thickness 11.7±0.2 μm) than data in dogs (length 14.3±0.4 μm, thickness 9.6±0.4 μm), reported in Stefanov *et al.*, (2007). Further, the difference was statistically significant ($P<0.05$).

The average Mcs number in feline PS wall (10.0±0.6 /mm^2) was statistically significantly lower from the respective number in the dog (47.2±9.0 /mm^2, $P<0.01$).

In conclusion, the considerably lower number of mast cells in the PS wall in cats, compared to dogs, allowed us to support a recent hypothesis of ours (Stefanov & Vodenicharov, 2006), about the role of these cells in the pathogenesis of this organ. The fewer mast cells in the PS of cats are probably one of the causes for the rather lower incidence of PS inflammations in this animal species (Monteiro-Riviere, 1998).

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