УДК 611.9:616.3-089] (06)

T. M. DOSAEV, A. N. BEKISHEVA, S. T. OMAROVA,
A. A.BALAPANOVA, D. S. BAIGAMISOVA
Kazakh National Medical University after S. Asfendiyarov (Almaty)
Department of Normal Anatomy

SPECIES PECULIARITIES OF DOG SPLEEN MORPHOLOGY

Thus, main species peculiarities of dogs spleen as opposed to human spleen and other laboratory animals are following: 1) the capsule and the trabeculae is much broader 2) have a prevailing quantity of myocytes as opposed to fibroblasts quantity, both in the capsule and the trabelulae.
Keywords: *Spleen, capsule, trabeculae*

Introduction

There are a number of species differences in the gross and histologic appearance of the spleen. In dogs the spleen is somewhat dumbbell shaped, while in most animals, it is more uniform along the longitudinal axis. The spleen in dogs is able to expand to store large numbers of erythrocytes, but it is also capable of rapid contraction (1). That is why the spleen gross appearance is quite variable, ranging from large in size and dark red to blue-black in color to smaller and lighter red. The capsule and trabeculae of dogs contains more smooth muscle (2).

The aim of this paper is to study regularities and species peculiarities of dogs spleen architecture and to develop diagnostics and treatment methods, very important for clinical morphology and veterinary surgery (3,4). This problem is also important for theoretical and clinical medicine, since a dog is vastly used as a laboratory animal in research studies, which can be applied in medical practice. Individual anatomical variability of a dog spleen as to its weight, size and shape is rather wide, what makes its shape classification difficult enough.

Mareich M. V. [5] offers to differentiate three types of dogs spleen shape: 1) unciform, 2) lingulate and 3) transitional (atypical).

Material and Methods

Sections of six adult mongrel dogs of both sexes were fixed in neutral formalin and embedded in paraffin. The sections were stained with azure-2 and eosin. Cross-section of the capsule and trabeculae was measured by the ocular micrometer, lens used with magnification ratio 20 and the ocular has a pitch of 10. The bulk density of fibroblasts and myoblasts in the capsule and trabeculae was studied a standard grid of LOMO microscope MBI-15.

Results

Main structural and functional elements of the spleen are – support and contractile apparatus, represented by the capsule and trabecular system, and intertrabecular spaces, consisting mainly of reticulum

The capsule and trabeculae contain dense connective fibers and smooth muscle. In some cases the capsule has local irregular thickening due to elastic fibers garnetting. In the subcapsular area individual hemorrhage foci are noticed. The hemorrhage foci erythrocytes are round and disk-shaped, some of the being lysed (leached). The trabeculae also contain dense fibrous connective and smooth muscle tissue. There are thickened areas in the trabeculae due to uneven proliferation of connective and muscle tissue.

In dogs spleen like in other animals having spleens of deposit type (horses, ruminants, pigs, predators), the capsule and trabeculae are rich with muscled tissue ejecting the deposited blood into the bloodstream (Picture 1,2). In the capsule and trabeculae among connective tissue elastic fibers dominate, allowing the spleen to change its sizes and withstand the its volume increase. The well developed smooth muscle of the capsule in dogs spleen contain collagen and elastic fibers intermixed with fibroblasts. On the cross-section of the dog spleen, dissected at the moment of constriction, the capsule and trabeculae are markedly thicker than those in vivo.

Morphometric analyses of the capsule and trabeculae of the dog spleen showed that the cross-section of the capsule is considerably longer than that of the trabeculae. See Table 1.

Table 1

Description	Cross-section (mkm)
The capsule	171±4.12
The trabeculae	118±2.13

Volume density (Vv) of myocytes dominates over fibroblasts Vv in both, the capsule and the trabeculae. See Table 2 below.

Table 2

Description	Vv	Vv
Type of cells	Fibroblasts	Myocytes
The capsule	38.2±6.3	61.8±7.2
The trabeculae	37.7±6.1	63.3±6.7

With microscopy, it is apparent that the splenic white pulp is presented by lymphoid follicles of various sizes, consisting of lymphoid tissue cells. Most of lymphoid follicles are typically found at the adventitial coat of the artery with numerous capillaries deviating from it. Central arteries locate eccentrically within lymphoid follicles.

Most of lymphoid follicles are comprised of functionally and morphologically distinct compartments: periarteriolar B-zone , clear center with mantel zone and marginal zone. The periarteriolar zone is densely populated with small lymphocytes, macrophages and dendritic cells in between them. The lymphocytes of this zone have compact hyperchromatic nuclei with narrow cytoplasm. The clear centers of lymphoid follicles consist of larger cells with clear and large nuclei and relatively narrow cytoplasms, some of them being in the phase of mitosis. The clear centers of lymphoid follicles are surrounded by a thin lymphocytic rim of - the mantle zone, which in some areas was barely visible.

Follicles are surrounded by the marginal zone, containing T- and B-lymphocytes and macrophages. It is suggested that one of the functions of the marginal zone is cooperative interaction of different cells in the immune response. In the result of such interaction the marginal zone B- lymphocytes , stimulated by a proper antigen, proliferate and differentiate into antibody-producing cells in total plasma cells and are accumulated in cords of the red pulp. Reticular fibers form the supporting network for the spleen follicles; at the thymus-independent area they are continuous radially and at the T-zone – along the long axis of the central artery.

According to Schmidt E.E.et al. (6), within the periarteriolar lymphoid sheath (PALS) in dogs there are very few capillaries different from rodents where the PALS have abundant capillaries. Also in dogs, as opposed to rats, capillaries are surrounded by a cluster of macrophages, so called ellipsoids or periarterial macrophage sheaths (PAMS) (7).

The major region of the spleen is filled with the red pulp, located between lymphoid follicles and the trabeculae, which is spaced among reticular meshwork and free cell elements, such as blood cells, plasma cells and macrophages.

The red pulp is abundantly rich with arterioles, capillaries and thin venous sinuses, which contain lymphocytes, macrophages and erythrocytes. Sinuses are mainly extended and filled with blood.

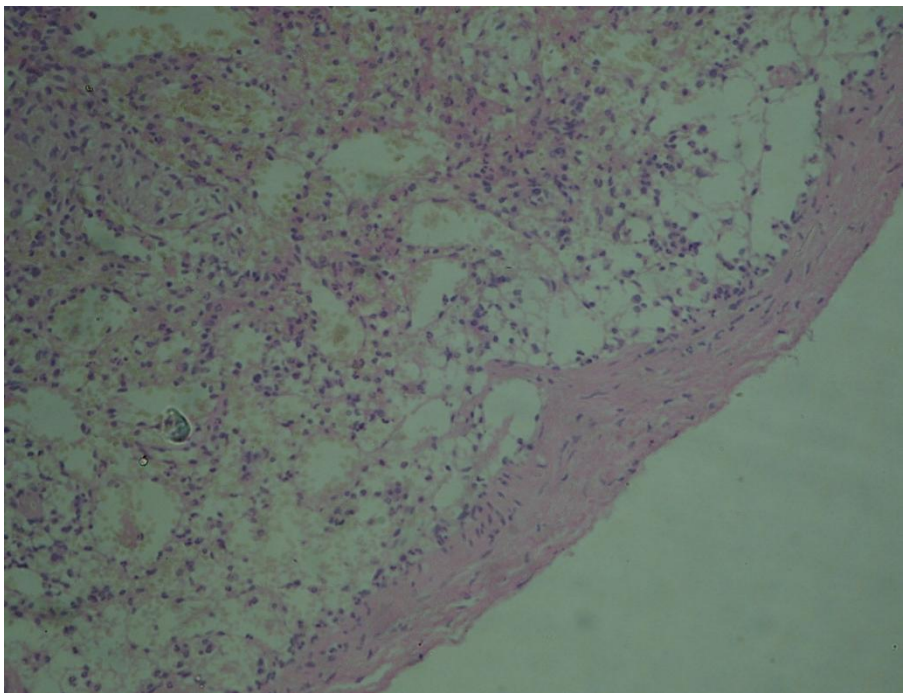
Species variation in the structure and morphology of the venous sinuses allows to classify spleens into two groups, sinusal spleens and nonsinusal spleens. In dogs the sinusal spleen is found. (8). The red pulp is abundantly rich with sinuses in the area adjacent to the marginal zone of lymphoid follicles, where numerous anastomoses are formed. The number of venous sinuses in dogs spleen is greater than that of other laboratory ruminants. In cavity of particularly broad sinuses there are lymphocytes, macrophages, leukocytes and erythrocytes. Such sinuses are called “working” sinuses, temporarily isolated from the bloodstream.

Conclusions: Thus, main species peculiarities of dogs spleen as opposed to human spleen and other laboratory animals are following:

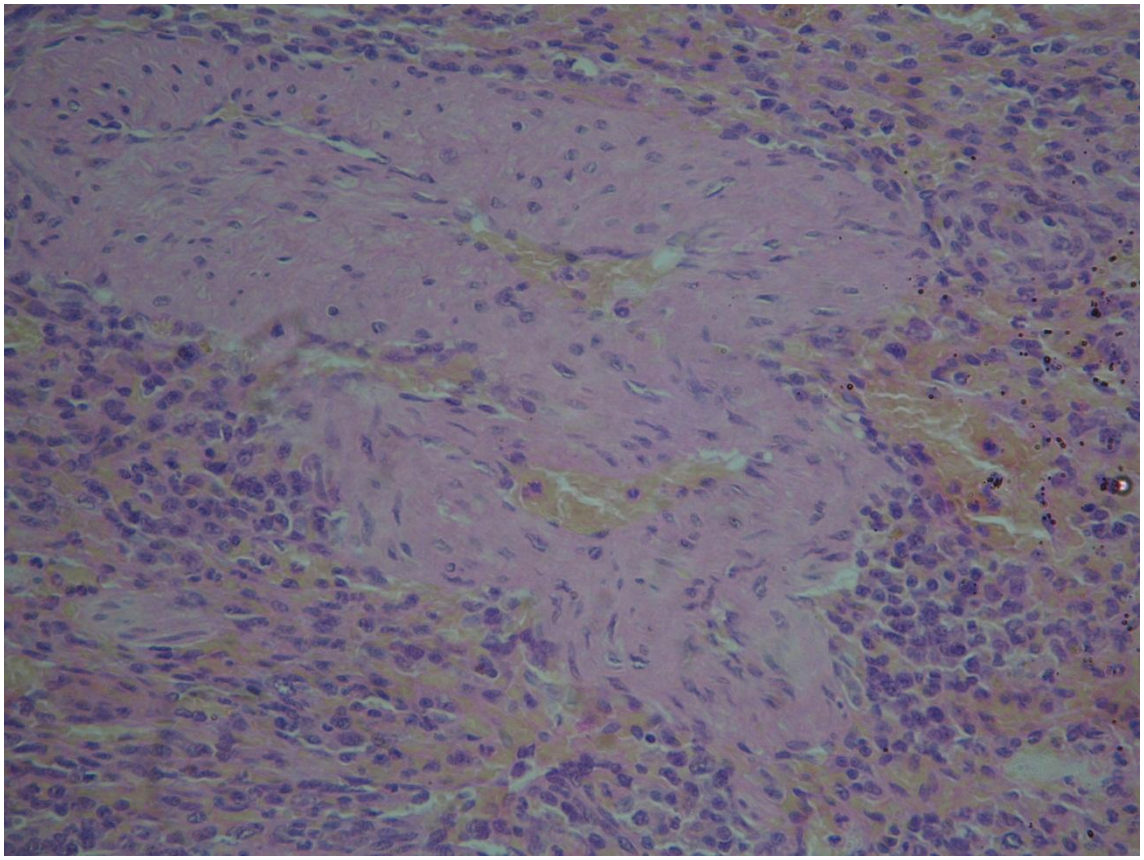
1) the capsule and the trabeculae is much broader; 2) have a prevailing quantity of myocytes as opposed to fibroblasts quantity, both in the capsule and the trabelulae; 3) have a well expressed venous sinuses making numerous anastomoses; 4) dogs spleen have very few capillaries within PALS; 5) dogs spleen have abundant well expressed capillaries within PAMS.

REFERENCES

1 Valli V.E., McGrath J.P., Chu I. Hematopoietic system//Handbook of Toxicologic Patology.-2002.-2.- P. 647-649
2 Cesta M.F. Normal structure, function and histology of the spleen//Toxicologic Pathology.-2006.-5.-P.-455-465
3 Vishnevskaya T. Y. , Ilgeev S. T. Dogs spleen and its arteries//Journal of Orenburg State Agriculture University. - 2004.- V.4.-4-1.-P.-150-151
4 Kuzmicheva E. V. Structural and functional peculiarities in Canidae//Morphology .-2008.-№2.-P.-72-75
5 Mareich M. V. Experiments on rational reasons for dogs splenography // Abstract of thesis .-2005.- Krasnodar
6 6.Schmidt E.E., MacDonald I.C., Groom A.C. Comparative aspects of splenic microcirculatority pathways in mammals: the region bordering the white pulp//Scanning Microsc.-1993.-7.-613-628
7 7.Blue J., Weiss L. Electron microscopy of the red pulp of the dog spleen including vascular arrangements, periarterial macrophage sheaths (ellipsoids), and the contractile, innervated reticular meshwork//Am. J. Anat.-1981.-161.-189-218
8 8.Schmidt E.E., MacDonald I.C., Groom A.C. Microcirculation in mouse spleen (nonsinusal) studied by means of corrosion casts//J. Morphology.-1985.-186.-P.-17-29



Picture 1 - Cross-section of the capsule of the dog spleen. Azure-2 and eosin . x 400.



Picture 2 - Cross-section of the dog spleen. Numerous broad trabeculae within the connective tissue. Azure-2 and eosin . x 400.

ВИДОВЫЕ ОСОБЕННОСТИ МОРФОЛОГИИ СЕЛЕЗЕНКИ СОБАК

Резюме: Методами морфометрии и стереологии установлено, что основными отличительными особенностями селезенки собак от селезенки человека и других лабораторных животных является: 1) значительные по ширине капсула и трабекулы 2) существенное преобладание количества миоцитов над фибробластами в капсуле и трабекулах.
Ключевые слова: Селезенка, капсула, трабекулы

Түйін: Морфометрия мен стереология тәсілдерімен анықталған, иттер көкбауырының басты ерекше өзгешіліктерді мынандай:
1) капсуламен трабекулалардың едәуір кең болуы 2) миоциттердің көлемдік тыныздығының капсула мен трабекулардағы фибробластардың көлемдік тығыздығынан елеулі басым болуы.
Түйіді сөздер: Көкбауыр, көкбауырдың қапшығы, трабекулар