HISTOLOGY OF THE HUMAN SPLEEN DURING THE PRENATAL PERIOD

THESIS

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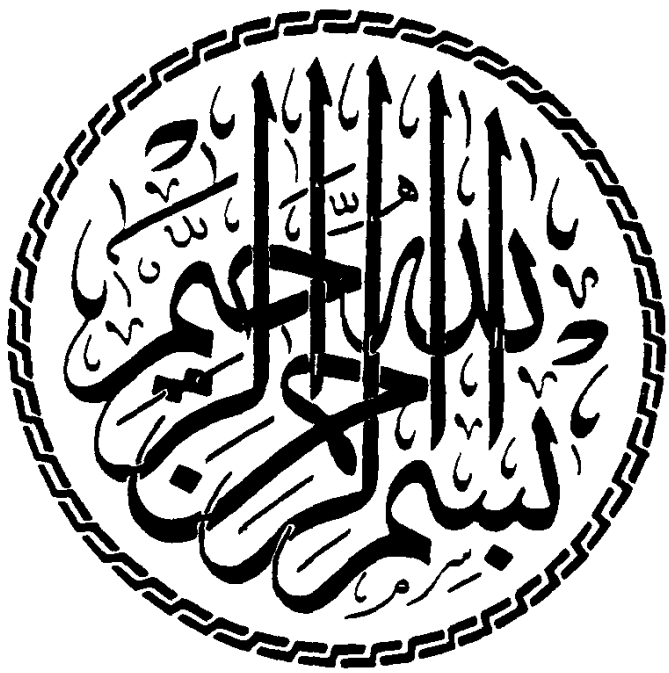

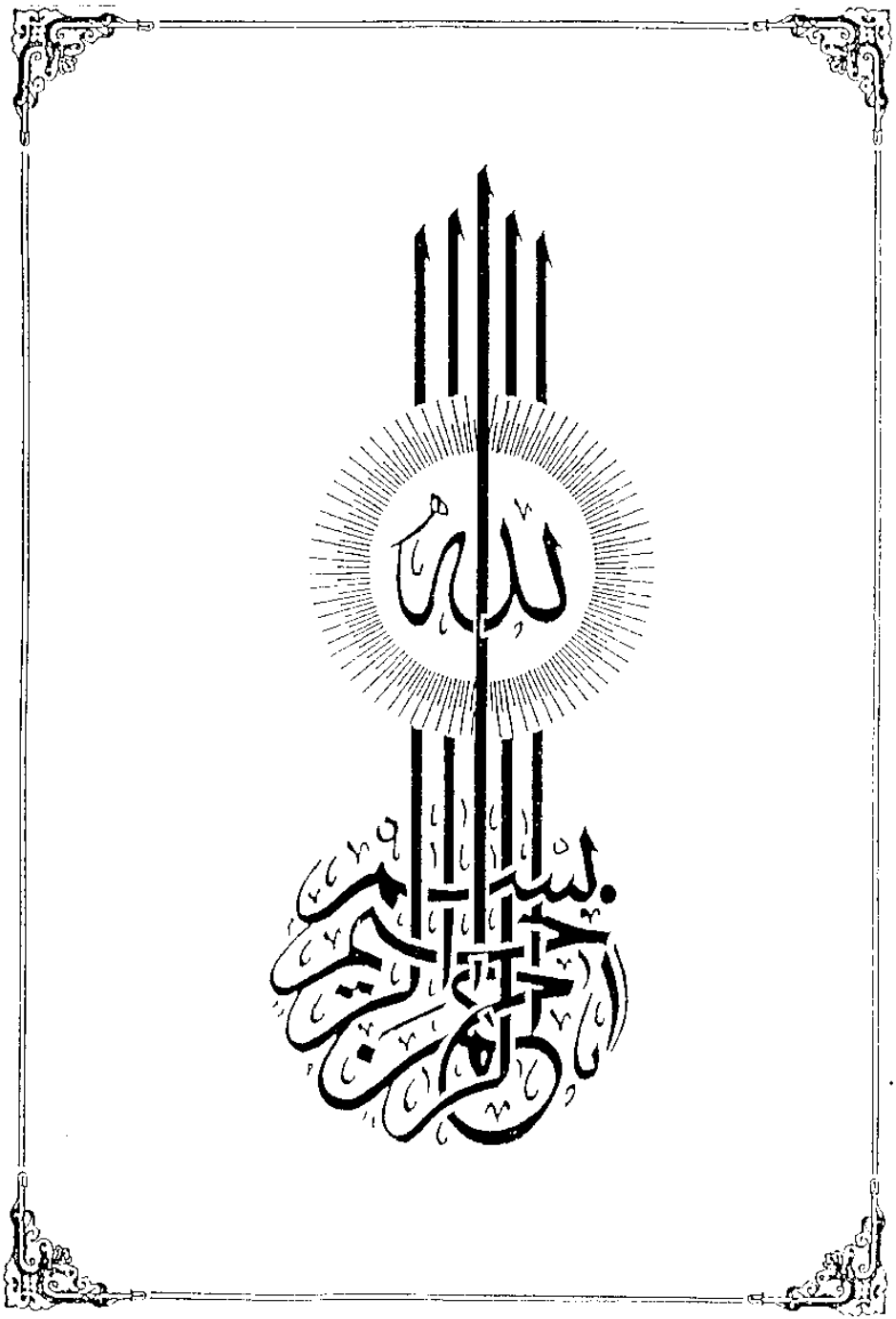

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The spleen is a lympho-reticular organ having unique morphological and functional features. It serves as a selective filter interposed in the bloodvascular system for the removal of abnormal or old blood cells, particulates and antigenic materials from the circulation. The spleen also sequesters, stores and releases blood cells and platelets, its lymphoid tissue participates in immune response, and it can serve as a haemopoietic organ *[Cormack, 1987]*.

Inspite of the fact that the spleen participates significantly in host defense mechanisms, it is not essential for life. Nevertheless, its removal puts the host at risk during overwhelming infections, and the post-spleenectomy infection rate is especially high in children but is also significant in adults *[McCuskey, 1985]*.

During the past years, considerable new knowledge had been obtained about the splenic structure and function. These advances are the direct result of the advent of transmission and scanning electron microscope, high resolution in vivo microscopy improved immunocytochemical, histochemical and pharmacological techniques and a rapid

expansion in knowledge about immunocellular biology. Also, ultrasound has become an important tool of evaluation of foetal spleen.

Reviewing the available literature, it was found that special attention has been paid to the histology of the human adult spleen , while that in the prenatal period has not received much attention.

Our aim of this work is to show the histological picture of human spleen during various stages of prenatal development.

REVIEW OF LITERATURE

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I. Embryology

The spleen appears first in embryos during the fifth week of gestation as a localized mass of undifferentiated mesenchymal cells (condensation of mesodermal cells) within the mesogastrium. These cells multiply by mitosis, and as the mass enlarges it soon bulges out to the left side of the stomach and a little dorsal to it.

The mesothelium covering the cell mass continues to proliferate and add to the splenic blastema until 7th week when the mesothelial cells become cuboidal and separated from the splenic tissue by a membrane that later becomes the splenic capsule.

The elements of the primary mesenchymal perimordium differentiate in two directions. Some remain connected with one another by means of processes and become arranged into anastomosing trabeculae. The trabecular columns produce reticular fibers, thus forming the reticular framework of both the red and white pulp. Other mesenchymal cells become isolated as free cells within the meshes of that framework. The isolated free cells are at first basophilic. Then they multiply rapidly and differentiate into erythroblasts, myeloblasts, megakaryocytes and lymphoblasts. However, very

little myeloid and lymphoid haemopoiesis occur during foetal life. By 13-20 gestational weeks, haemopoiesis reaches a peak. Lymphocytes are produced throughout life. Small masses of splenic tissue may become detached from the main mass and develop into accessory spleen. *[Hamiltton and Mossman, 1972 and Marjorie, 1983]*.

II. Histology Of Human Adult Spleen:

The human adult spleen is invested by visceral peritoneum. This limiting capsule is composed of dense ordinary connective tissue covered with flattened squamous mesothelium. The capsule contains abundant collagen fibers in addition to elastic fibers and few smooth muscle cells.

From the hilum and capsule, trabeculae of dense ordinary connective tissue extend into the substance of the spleen, bringing in blood vessels, and nerves and providing substantial support. The space between the trabeculae and the capsule is occupied by the splenic pulp. The soft splenic pulp receives internal support from a meshwork of reticular fibers.

White pulp is formed of lymphatic sheath containing dense accumulation of small lymphocytes surrounding the small arterial branches extending from the trabeculae (periarteriolar lymphatic sheath), and numerous lymphatic nodules scattered along the course of the extending arterial branches. Also the white pulp is known to include antigen - presenting dendritic cells. The PALS are densely populated with T-lymphocytes. These cells assume their perivascular distribution after they have entered the immediate vicinity of the sheath by way of small arterial vessels that supply

the interface between the white and red pulp (i.e. the marginal zone). In contrast,the lymphatic nodules are densely populated with B-lymphocytes. On prolonged exposure to blood-borne antigens, germinal centers appeared. Proliferating and differentiating progeny of the activated B-lymphocytes in primary and secondary lymphatic nodules become progressively displaced toward the red pulp, where their maturation into antibody-secreting plasma cells is completed. Plasma cells are therefore generally prominent in the marginal zone and red pulp of the spleen.

The red pulp is formed of 2 main components :

1. Numerous sinusoids which are thin-walled venous blood spaces with a wide lumen lined by long thin endothelial cells that have relatively wide, slit-shaped gaps between their lateral borders. These lining cells are supported by anastomosing circumferential rings of basement membrane.

2. Supporting meshwork of reticular fibers with their associated population of reticular cells and vast number of blood cells lying free in the interstices of the meshwork, numerous macrophages, erythrocytes, leukocytes, platelet, and plasma cells. *[Cormack, 1987]*.

III. HISTOLOGY OF HUMAN FOETAL SPLEEN

Gilmour (1941) stated that the human spleen of 11 - 13 gestational week (g.w.) foetuses was formed of vessels surrounded by spindle cells,lying in a pulp of widely meshed delicate connective tissue with an occasional recognizable sinusoid;.A few megakaryocytes were usually seen in sinuses. In the pulp there was a lake of blood in which there were a very few haemocytoblasts,eosinophils myelocytes,leucocytes and few normoblasts. He mentioned that the erythroblasts were probably not formed is situ from precursors but were carried in from the blood stream.

Between 8 and 20 g.w. there was in addition a few scattered foci of erythropoiesis, some in sinuses but most in the pulp. They consisted of early and late erythroblasts with occasionally one or two haemocytoblasts. At 18g.w. very few haemocytoblasts were present in the cellular connective tissue around the arteries. At 20 g.w.haemocytoblasts were more numerous and lymphocytes had been formed from them constituting small malpighian bodies. In the remaining foetuses there was a little variation, the total amount of haemopoiesis was always slight and near the end of pregnancy was very minimal. Megakaryocytes decreased but one or more have always been found. Full term spleens showed a few scattered haemocytoblasts, normoblasts, eosinophils and few