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Study numerical and histological measurement of the thickness capsule of human spleen in different age groups

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Abstract
The spleen is a special organ that is crucial to the functioning of our circulatory and immunological systems. Also, the spleen removes abnormal red blood cells (RBCs) from circulation, helping to maintain the balance between red blood cells creation (erythropoiesis) and elimination. The aim of this study is to find out the difference in the thickness of the spleen capsule between the study groups. The collected specimens were divided into three groups like Group 1 (0 to 14 years), Group 2 (14 to 50 years), and Group 3 (over 50 years). Hematoxylin and eosin (HE) staining to diagnosis thickness of capsule. The results showed increased thickness of spleen capsule with advanced age; the thickness was; in G1, G2, and G3 (14.938± 1.07, 21.074±3.34, and 52.828±19.53) respectively. Conclusion, thickness of spleen capsule increased with aging.

Keywords: RBCs, histological measurement, erythropoiesis

Introduction
Being the body's largest secondary lymphoid organ, the spleen conducts a range of immunological roles in addition to hematopoiesis in addition red blood cell clearing (Lewis *et al*., 2019) [4]. The anatomic architecture of the spleen allows it to filter blood of infections and aberrant cells while also facilitating low-probability contacts between antigen-presenting cells (APCs) and cognate lymphocytes. A thick connective tissue capsule with little muscle surrounds the human spleen. The organ is divided into connecting compartments by a complex branching network of trabeculae that originates from the interior capsular surface (Ratcliffe, 2016) [5]. The red pulp, a network of cellular cords, is located between the venous sinuses. After distributing branches to the white pulp and marginal zone, the major artery separates into straight, thin arteries known as penicilli. These penicilli could either disappear completely or grow into smaller artery capillaries (Grossi and Lydyard, 1998) [3]. White nodules with a homogeneous distribution make up the lymphoid tissue of the spleen, often known as the white pulp. The splenic arterial/arteriolar circulation and the white pulp of the spleen are closely related. The periarteriolar lymphoid sheaths, which are cylindrical lymphocyte cuffs, surround the central arteries, which develop from trabecular arteries within the fibrous trabeculae (PALS). B and T cells are mixed together in the PALS, with a majority of CD4-positive T lymphocytes (Dabbs, 2021) [2]. The current study identifies the various numerical and histological findings in capsules of the human spleen in dissimilar age groups.

Material and method
2.1: Collection of specimens
The human spleen was studied in the Kirkuk General Hospital from autopsied bodies from the mortuary room.

2.2: Histological processing and staining of tissue
After being removed from the 10% formalin solution, the spleens were next rinsed in regular saline and dried using blotting paper. After biometry, slices were cut from the specimen using a sharp scalpel in planes that went through the hilum and into the capsule, depending on the size of the spleen. Pieces ranged in thickness and size from 3-5 to 4-5 mm. Slices were fixed, and tissue processing was completed. Haematoxylin and eosin were used to stain the tissue slices as usual. With both low-power and high-power light microscopes, the stained sections were analyzed to determine the architecture of the capsule in each age group.

2.3: Analysis
One-way ANOVA was used to statistically analyze the recorded data. Statistics considers a P value of 0.05 to be significant.

Results
3.1: Numerical and histological measurement of the thickness of spleen capsule
3.1.1: Numerical measurement of the capsule thickness
The mechanical characteristics of the healthy spleens can be explained in part by understanding the splenic capsular structure. As people age, their spleens lose some of their functional capacity and undergo histological alterations. In order to distinguish between the various age groups in the of Iraqi people, this cross-sectional descriptive research helped to learn how to assess the thickness of the splenic capsule. For convenience of differentiating the thickness of splenic capsule in relation to age. The results showed increased thickness of spleen capsule with advanced age; the thickness was; in G1, G2, and G3 (14.938± 1.07, 21.074±3.34, and 52.828±19.53) respectively. Table 1 and figure 1 results revealed that there is a variation in the thickness of the capsule between the research groups.

Table 1: Variations in the capsule thickness of different age groups

	S.	Thickness of capsule for five area (um)					Mean ± S.D\Sam.	Mean ± S.D\G.
		1	2	3	4	5		
G1	1	16.013	16.544	12.623	13.571	13.646	15.86±2.67	**14.938± 1.07** ****
	2	10.973	12.025	16.115	13.392	14.044	15.26±3.98	
	3	12.548	13.641	14.884	18.719	19.221	15.80±3.01	
	4	21.983	15.594	13.431	13.456	11.86	13.30±1.97	
	5	15.983	19.594	14.431	12.456	16.86	14.47±1.7	
G2	1	13.917	13.006	21.367	21.518	16.319	17.22±4.03	**21.074±3.34** **
	2	27.02	20.743	11.045	18.069	18.05	18.98±5.75	
	3	30.801	29.908	25.94	17.469	21.441	25.11±5.65	
	4	21.728	19.956	21.235	22.220	15.207	20.12±2.9	
	5	20.738	20.994	25.252	26.993	25.724	23.94±2.87	
G3	1	94.905	79.289	104.196	85.69	69.638	86.74±13.42	**52.828±19.53** ****
	2	35.413	38.402	45.587	47.635	51.643	43.73±6.68	
	3	42.513	32.642	51.835	30.811	45.516	40.66±8.84	
	4	61.001	44.321	46.624	47.379	61.965	52.25±8.5	
	5	47.693	44.54	38.32	48.03	25.26	40.76±9.5	

((P value: **** P < 0.0001; ** P < 0.003))

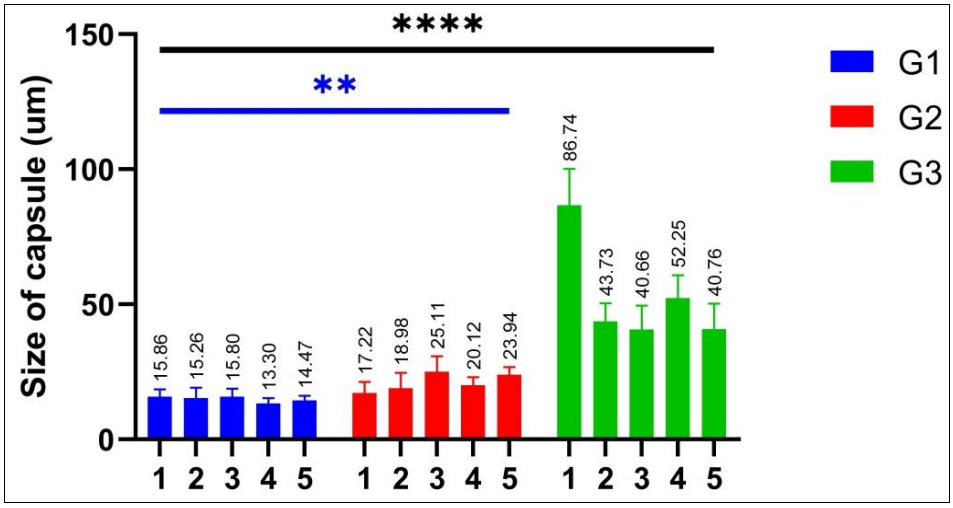

Fig 1: Shows the difference between p-value of the capsule thickness in groups. Small number above column represents the mean of each sample. **** *P <0.0001,* ** *P <0.003.*

3.1.2: Histological measurement of the capsule thickness

In this part of the study, 5 slides from each age group were chosen and studied under a high-power objective 50X to measure the thickness of the splenic capsule.

Group 1

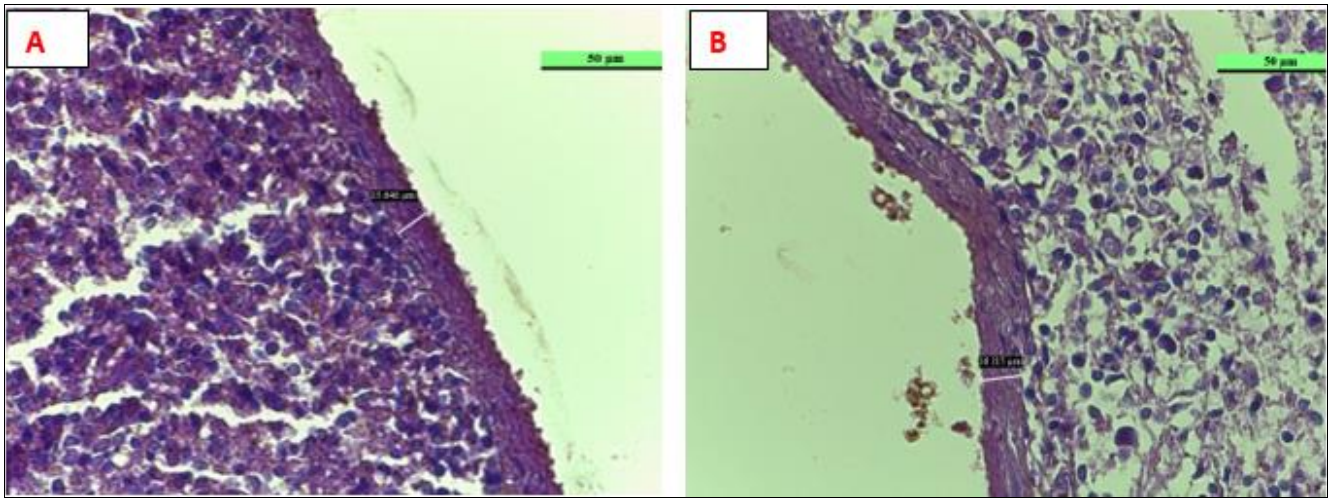

Fig 2: A: Capsule thickness of in group 1/sample 1 (H&E stain, 50X) and B: Capsule thickness of in group 1/sample 2 (H&E stain, 50X)

Group 2

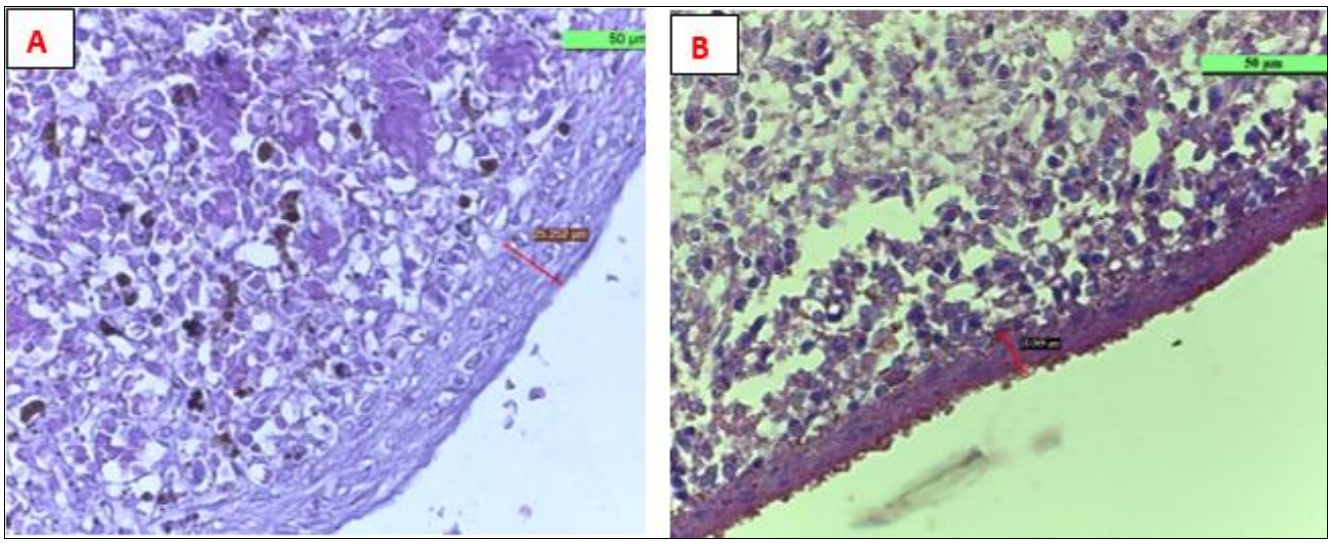

Fig 3: A: Capsule thickness of in group 2/sample 5 (H&E stain, 50X) and B: Capsule thickness of in group 2/sample 2 (H&E stain, 50X).

Group 3

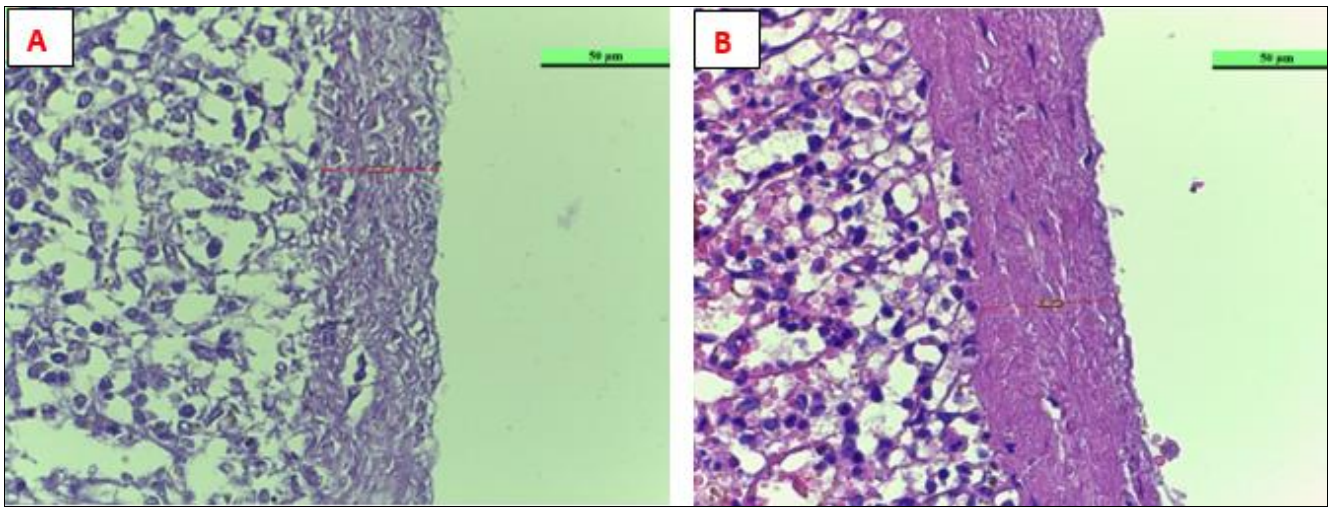

Fig 4: A: Capsule thickness of in group 3/sample 5 (H&E stain, 50X) and B: Capsule thickness of in group 3/sample 4 (H&E stain, 50X).

Discussion

The findings of the current investigation demonstrated that spleen capsule thickness rises with aging table 1, (14.938± 1.07, 21.074±3.34, 52.828±19.53), in groups 1, 2 and 3 respectively (Mean±S.D). And, these results agreed with (Shumi *et al*., 2016) [7] who reported that, aging causes an increase in the capsule thickness of spleen. Also, (Alim *et al*., 2012) [1] who described that significant difference in the thickness of splenic capsule with aging. Researcher stated this, too, human capsular thickness of spleen (Rahman *et al*., 2016), furthermore, (Alim *et al*., 2012) [1] described the thickness of the spleen capsule was found to upsurge with forward age in humans. Likewise, due to advanced decrease in the amounts of elastic fibers in the splenic capsule with aging and replace with collagen fiber (Rodrigues *et al*., 1999) [6], similarly, reduced synthesis of elastin with aging (Stadler, 1989) [8].

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