Protein metabolism and liver function (new ideas)

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In gratitude to A. Verghese for the book of the century "Cutting for Stone"

Abstract. The main goal is to investigate the role of the liver in protein metabolism. Venous blood counts are the only way to study liver function. For practical purposes this is sufficient, but for understanding liver function it is wrong. It is known that the blood of the portal vein and the hepatic artery flows to the liver, and the blood of the hepatic vein and the hepatic lymph, which is completely unknown in its composition, flows from the liver. The biochemical composition of the lymphatic system, which is not known at all, has never been taken into account in the study of this function.

For this, in an experiment on 23 dogs, the function of the liver in the inflowing and outflowing blood and lymph was investigated. The difference in the summed amount in the inflowing and outflowing blood and lymph should be determining the function of the liver.

It draws attention to the fact that there is more protein and protein fractions in the inflowing blood, which shows the regulating (sometimes leveling) role of the liver.

The quantitative composition of the liver lymph differs markedly from the general lymph.

Keywords: Blood from the portal vein and hepatic artery flowing to the liver, blood flowing from the liver through the hepatic vein and hepatic lymph. The general and hepatic lymphatic system.

Proteins – are high molecular weight natural substances, consisting of a chain of amino acids that are linked by a peptide bond. The most important role of these compounds is the regulation of chemical reactions in the body (enzymatic role).

Albumin is synthesized in the liver and reflects the functional state of the liver. The half-life (half-life) of albumin is about 20 days.

The liver plays a major role in the production of proteins. All albumin, 75-90% of α-globulins and 50% of β-globulins are synthesized by hepatocytes.

Y-globulins are synthesized by macrophages, they include stellate reticuloendotheliocytes (Kupffer cells). Basically, y-globulins are synthesized outside the liver.

Note that important proteins are synthesized in the liver — prothrombin, fibrinogen, proconvertin, and proaccelyrin.

Determination of the composition of the liver is of diagnostic and prognostic significance. The pathological process in hepatocytes sharply reduces the synthetic capabilities, which leads to a decrease in plasma albumin, which reduces the plasma oncotic pressure and leads to the development of edema and ascites.

It is known that a decrease in the level of total protein in blood plasma to 45 g/l indicates severe endogenous intoxication and an unfavorable outcome of the disease; a decrease in the concentration of total protein due to the albumin fraction reflects the use of albumin as the most important factor in plasma detoxification, binding and removal of toxins;

- an increase in alpha-2-globulins twice reflects the activity of the process with impaired deamination; an increase in gamma globulins indicates an increase in the production of coarse proteins;

- a decrease in the albumin-globulin coefficient (the ratio of the number of albumin to the amount of globulins) causes, in case of severe intoxication, the transition of albumin into the tissue as a result of impaired permeability of the vascular walls, a decrease in the intensity of albumin synthesis in the liver tissue, acceleration of their decay and transformation into other proteins, partly into globulins, as well as increased synthesis of alpha - 2 and gamma - globulins. Normally, the albumin-globulin coefficient ranges from 1.5 to 2.3. This is the first part of the article with well-known facts, without which it is impossible to understand what follows, they are all from books (2 and 4).

In everyday clinical practice, we use biochemical data obtained from venous blood parameters to determine liver protein metabolism, but this only indirectly shows liver function and is practically incorrect. This practice exists in all laboratories in the world, there is no other way. However, it is known that blood flows to the liver through two vessels - the portal vein and the hepatic artery, and blood flows through the hepatic vein and hepatic lymph. This in itself dictates a different approach in determining protein metabolism and the value in this liver.

Based on this, an attempt was made in an experiment on dogs to find out the role of the liver in protein metabolism from different positions, for this we took for the study of protein and

protein fractions the blood flowing to the liver from the portal vein and hepatic artery and, finally, the indicators of blood flowing from the liver in the hepatic vein and completely unknown in terms of its qualitative and quantitative composition of hepatic lymph (3).

We will consider each component of the inflowing and outflowing blood and lymph separately. There is a very important point here, we do not know what indicators should be taken as the norm. Naturally, the indicators of protein and protein fractions in venous blood cannot be the norm!

The norm should be considered indicators in the blood and lymph flowing from the liver. The difference between the flowing and flowing blood is an indicator of liver function.

In an experiment on 23 dogs, the function of the liver in the inflowing and outflowing blood and lymph was investigated. The biochemical composition of the lymphatic system has never been taken into account in the study of this function, and its composition is not known at all.

This is only a part of a large study of liver function, presented in a large number of articles (about 20).

The study of blood and lymph for protein and protein fractions was carried out in the laboratory of the Department of General Surgery. The composition is given in g/l (gram per liter).

Lymph. To obtain lymph, at present, the only possible method is drainage of the thoracic lymphatic duct (TLD) on the neck, which is possible with certain indications, but by the nature of the lymph it is mixed - hepatic lymph flowing from the liver simultaneously and flowing down the lumbar and intestinal trunks (1). Due to these circumstances, it is impossible to say which part of the lymph is determining the exchange of protein and protein fractions of the liver.

To differentiate lymph, an attempt was made in an experiment on dogs to obtain pure hepatic lymph. For this purpose, the TLD cistern was ligated in a certain way, and as a result, clear hepatic lymph was obtained. The method of obtaining hepatic lymph is described and an application for an invention is filed.

Organ and mixed lymph are different in their biochemical composition. We present the comparative results of the characteristics of the composition of protein and protein fractions from the general bed - the general lymph and from the lymph of the liver.

The quantities are shown in the table and graph. We present the composition of the protein and protein fractions in the lymph flowing from the liver in the general lymph and separately in the hepatic lymph.

Table.1. Protein	alb.	a1	a2	b1	b2	a
43	38	5.2	7.7	16.4	21.5	

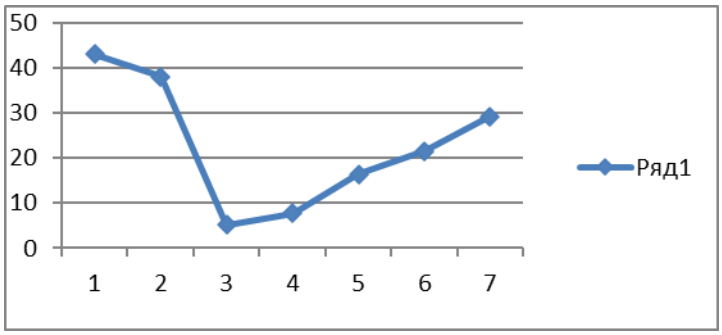
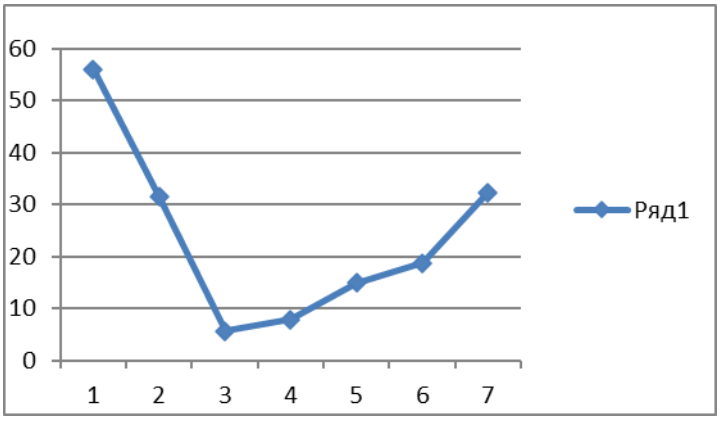


Table.2. Protein	alb.	a1	a2	b1	b2	a
56	32	5.7	7.9	15	19	



We see that the amount of protein in the hepatic lymph is 1.3 times higher, the fractions are higher for albumin a1 and albumin a2; the gamma globulin is 1.1 times higher.

All this, as indicated above, is presented in tables and graphs.

Liver function. The gradient of the difference between the inflowing and outflowing blood and lymph from the liver should be normal. The table below shows the summary data for each parameter in numbers.

Table 3. Protein metabolism of the liver is normal

	Numb	Protein	alb.	a1	a2
Vein	22	47	23.3	4.1	6.7
Infl.					
Port.vein	23	77	37.1	4.2	9.2
Artery	22	65	23.4	2.7	8
		142	60.5	6.9	17.2
total		71	30.2	3.4	8.6
Edema.					
Liv.vein	13	69	23.2	4.7	7.2
Lym.total	19	43	38	5.2	7.7
		112	61.2	9.9	14.9
total		56	30.6	4.9	7.4
Liv.vein	13	69	23.2	4.7	7.2
Lym.liv.	9	56	31.6	5.7	7.9
		125	54.8	10.4	15.1
total		62	17.4	5.2	7.5

At first glance, in the outgoing blood, in total, all indicators should be higher, but this turns out to be not the case, the main parameters of protein and albumin are lower. Here the regulating role of the liver is manifested. "Excess" protein flowing to the liver is not deposited in the body, unused proteins are broken down to nitrogenous compounds, carbon dioxide and water.

For greater clarity, let us consider separately the average content of protein components and fractions.

It is known that the range of blood protein levels in a healthy adult ranges from 65 to 85 g/l. Total blood protein is the sum of all types of proteins circulating in plasma.

The main fractions are albumins and globulins. Albumin is formed in the liver, its fraction is homogeneous in its structure and makes up about 60% of the total amount of proteins.

Consider first these two indicators - protein and albumin.

Table 4. The amount of protein and albumin in the blood and lymph of the liver is normal

			Protein	alb.
	Vein	Numb22	47	23,3
	Infl.			
	Port.v	23		
ein			77	37.1
	Artery	22	65	23,4
			142	60,5
	total		71	30,2
	Edem			
a.				
	Liv.ve	13		
in			69	23,2
	Lym.t	19		
otal			43	38
			112	61,2
	total		56	30,6
	Liv.ve	13		
in			69	23,2
	Lym.l	9		
iv.			56	31,6
			125	54,8
	total		62	17,4

Conclusions: The inflowing blood contains the largest amount of protein and albumin in total.

At the same time, there is less protein (1.1 times) and albumin (1.7 times) in the outflowing lymph. In the hepatic lymph, in comparison with the total amount of protein, there is more, and less albumin.

I repeat the explanation of this fact, the "extra" protein is not deposited in the liver, and the excess amount of proteins is broken down to nitrogenous compounds, carbon dioxide and water.

Albumin and globulins of the blood and lymph of the liver are normal.

Table. Albumin and globulins of blood and lymph of the liver are normal

	06.05.			a		a		b		d		
21			1		2		1		2			y
		Nu										
	mb			4.		6.		1		1		2
	Vein	22	1		7		1.9		9.5		4.2	
	Infl.											
	Port.v	23		4.		9.		1		2		2
ein			2		2		7		1.3		5.8	
		22		2.				1		1		1
	Artery		7			8	0		2.5		9.8	
				6.		1		2		3		4
			9		7.2		7		3.8		5.6	
				3.		8.		1		1		2
	total		4		6		3.5		6.9		2.8	
	Edem											
a												
	Liv.ve	13		4.		7.		1		1		2
in			7		2		2.3		4.2		1.9	
	Lym.t	19		5.		7.		1		2		2
otal			2		7		6.4		1. 5		9.2	
				9.		1		2		2		5
			9		4.9		8.7		5.7		1.1	
				4.		7.		1		1		2
	total		9		4		4.3		2.8		5.5	
	Liv.ve	13		4.		7.		1		1		2
in			7		2		2.3		4.2		1.9	
	Lym.l	9		5.		7.		1		1		3
iv.			7		9		4.9		8.7		2.3	
				1		1		3		4		6
			0.4		5.1		1.3		0.2		1.5	
				5.		7.		1		2		3
	total		2		5		5.6		0.1		0.7	

The albumin indicators in the outflowing blood and lymph are predominantly higher. There are also more globulins, but they are formed in the liver and the reticuloendothelial system (lymphocytes and plasma cells). and we do not take them into account.

Globulins are represented by a heterogeneous composition, because they are formed in the liver and the reticuloendothelial system (lymphocytes and plasma cells).

Table 5. Albumin-globulin coefficient

			Albumin globulin ratio
Vein	23.3	24.2	0.96
Port. vein/artery.	30.2	22.8	1.3
Liv.vein/liv. total.	30.6	25.5	1.2
Liv.vein/lymph liv.	17.4	27.1	0.6

The ratio of albumin to globulins is the albumin-globulin coefficient.

I assume that the albumin-globulin coefficient (tab. 5) in the peripheral blood does not characterize liver function. Follows the norm to take the indicator in the hepatic vein and hepatic lymph. As well as among other indicators, the coefficient of albumin and globulins is slightly higher in the blood flowing to the liver.

Conclusions:

1.For the study of various functions of the liver, the comparative nature of the inflowing and outflowing blood is acceptable. Flowing through two vessels - the portal vein and artery and outflowing blood - the hepatic vein and lymph. In this case, the organ hepatic lymph should be taken into account. The difference between inflowing and outflowing blood and lymph characterizes liver function.

2.The norm should be considered the indicators available in the flowing blood and lymph. Digital indicators should be made up of the sum of indicators from two vessels - hepatic vein and hepatic lymph.

3.The difference between the flowing and flowing blood from the liver is an indicator of liver function.

4.When comparing these ingredients, the level of indicators in the inflowing blood is higher than in the hepatic blood and hepatic lymph flowing out on average (total protein, albumin and globulins).

5. The albumin-globulin gradient in the inflowing and outflowing blood and lymph slightly predominates in the inflowing blood.

6. Attention should be paid to y-globulin, which is very high in venous blood. Y-globulins are synthesized outside the liver.

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