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## **Clinical and morphological characteristics of the venous system of the liver in patients with chronic obstructive pulmonary disease at different stages of chronic pulmonary heart formation**

*N.V. Loskutova, I.A. Buldakova, I.G. Menshikova, A.A. Grigorenko*

AmurStateMedicalAcademy, Blagoveshchensk, Russia

### **Abstracts:**

A study of blood flow in the hepatic veins in 158 patients with chronic obstructive pulmonary disease (COPD) and autopsy material from 53 patients who died of COPD in different stages of

formation of chronic pulmonary heart disease (CPH). Found that the functional and morphological changes in the venous system of the liver develops in the early stages of COPD are characterized by reduced blood flow in the hepatic veins, compensatory plethora tsentrolobulyarnyh departments slices with the expansion of central venous (CV) and sinusoidal. The severity of the changes increases during disease progression, CPH and circulatory failure. Decompensation occurs CPH sclerosis CV and portal tracts, sinusoidal capillarization, a significant decrease in the rate of blood flow in the hepatic veins, formed a "stagnant liver."

**Keywords:** chronic obstructive pulmonary disease, chronic pulmonary heart, liver hemodynamic, venous system of the liver

The results of studies conducted in recent years, allowed us to formulate a modern concept of COPD as a disease that is characterized by significant extrapulmonary effects that may contribute an additional burden of the disease in individual patients [3]. The severity and prognosis of the disease is often determined by extrapulmonary manifestations [1, 4, 5]. It is known that abnormally in nature inflammatory process in COPD is initially localized in the airways and lung parenchyma, but at certain stages of the disease manifested its systemic effects. Consequently, according to reports of COPD can be treated as a disease of the whole organism in which there is involvement in the pathological process of almost all organs and systems. To determine the stage of disease when there are signs of systemic lesions, the important is to compare the clinical and functional and morphological data. Undoubted interest in COPD is the study of the liver that plays an active role in the regulation of deposit of blood and venous return to the heart, thus facilitating the work of the right ventricle (RV) in heart failure. Is a violation of the functional capacity of the liver, which is accompanied by changes in the metabolic processes in the body as a whole, contributes to the progression of systemic inflammation and chronic pulmonary heart disease. In the available literature, we met a few studies on the study of the liver in this condition [2].

The aim of our study was to investigate the characteristics of venous blood flow and morphological state of the venous system of the liver in patients with chronic obstructive pulmonary disease at different stages of the formation of chronic pulmonary heart disease.

### **Materials and Methods**

The study involved 158 patients with COPD exacerbation, which were divided into the following groups: Group 1 - 45 patients without PH alone, group 2 - 70 patients with compensated CPH, the third group - 43 patients with decompensate CPH. Verification of the diagnosis and determination of the severity carried out according to the criteria presented in the international concept GOLD «Chronic Obstructive Pulmonary Disease. Global Initiative 2009». The study excluded patients with liver disease, congenital and acquired heart disease, bronchial asthma and pulmonary tuberculosis. The average age of the patients was  $53,6 \pm 3,8$  years, duration of disease -  $13,8 \pm 4,6$  years, smoking index -  $14,5 \pm 1,6$  pack / years. The control group consisted of 20 healthy subjects, comparable with the patients by age and sex. Comprehensive survey of hemodynamic were performed on ultrasound machine XD-XE 11 «PHILIPS» (USA) and «Aloka-3500" (Japan) in the M-, B-, and color Doppler flow mapping. We studied the peak systolic velocity (Vs), diastolic (Vd) and presystolic flow (Va) in the hepatic veins on the breath, exhale, and medium. Calculated algebraic speed ratio of systolic and diastolic flow in the hepatic veins (Vs / Vd). Measured the diameter of the hepatic veins, the ratio of cross-sectional area of hepatic veins and portal vein (PSPV / PSVV). All patients underwent clinical and laboratory examination, the study of respiratory function, blood gas composition arterializovannoy, intracardiac and pulmonary hemodynamics.

Autopsy material studied in 53 patients who died of COPD in different stages of CPH. The first group included 10 patients with COPD with no signs of CPH, the second group - 22 patients with COPD with CPH in the stage of compensation, in the third group - 21 patients with decompensated COPD CPH. The study excluded dead with signs of the presence of cirrhosis of the liver. The control group included 10 deaths corresponding sex and age, who died a violent death,

and no signs of pulmonary and cardio - vascular diseases. Research material vessels of the venous system of the liver: central Vienna (CV), the terminal branches of the intrahepatic portal vein (IV), a sine wave. Material fixed in 10% neutral formalin and embedded by the usual method in paraffin. Histological sections 5-7 microns thick were stained with hematoxylin and eosin surveillance. On microscopic examination under a light microscope NIKON H550S, using an ocular micrometer and an ocular grid for tsitogistologicheskikh studies measured the cross-sectional area of CV and IV, the width of the output waveform in tsentrolobulyarnyh areas, a wall thickness of CV, CV plethora degree, the degree of plethora intraorgan branches of explosives.

The processing of the data according to the recommendations made by using the software package Statistica 6.0. Non-parametric statistical methods were used: U - Mann-Whitney test (Mann-Whitney U-Test), T - Wilcoxon test (Wilcoxon Matched Pairs Test). Considered reliable indicators of differences at  $p < 0.05$ . Study was approved by the Ethical Committee of SEI HPE Amur State Medical Russian (protocol number 4 on 01.06.2009).

### **Results and mesothods**

An ultrasound in Group I revealed slowing of blood flow in the hepatic veins. A characteristic feature was a statistically significant decrease in the speed of systolic and diastolic flow exhalation to  $0,310 \pm 0,026$  m / s and up to  $0,203 \pm 0,012$  m / s, respectively, an increase of expiratory Vs/Vd, due to the decrease of Vd. In our opinion, this may be due to an increase in intrathoracic pressure and obstruction of venous blood flow to the heart on the exhale. The diameter of the hepatic veins, PSPV/PSVV did not differ significantly from the performance of healthy individuals.

The patients in Group II recorded decrease Vs and Vd in the hepatic veins, as inspiratory ( $p < 0,001$ ), and exhalation ( $p < 0,001$ ). Average rate of systolic and diastolic flow was  $0,308 \pm 0,013$  m/s and  $0,183 \pm 0,009$  m/s, respectively ( $p < 0,001$ ). Found mostly drop Vd, as evidenced by a statistically significant increase in the Vs/Vd. There was a trend to an increase in Va, which may be due to a violation of the right atrial stretch. Registered extension of the hepatic veins ( $p < 0,05$ ), increase PSPV / PSVV.

In decompensated CCP showed a significant decrease in Vs to  $0,253 \pm 0,027$  m / s ( $p < 0,001$ ) and Vd to  $0,139 \pm 0,015$  m / s ( $p < 0,001$ ), an increase in Vs/Vd to  $1,82 \pm 0,06$  ( $p < 0,001$ ). In 21,5% of patients had a change in the direction of blood flow in the hepatic veins. Of these, 9.3% of patients recorded positive systolic flow at 16.3% - a positive diastolic. There was a statistically significant increase in the hepatic veins Va, which can be due to reduced contractility of the right atrium. There was a significant expansion of the hepatic veins ( $p < 0,001$ ) and increase PSPV/PSVV. The changes revealed testified about the development of venous congestion in the liver.

As a result of the morphological study of autopsy material COPD patients who died without evidence of CPH has been established (Fig. 2, 3) an increase in the diameter and cross-sectional area of CV and IV ( $p < 0,001$ ), the width of the sinusoidal ( $p < 0,001$ ), and a plethora of CV BB ( $p < 0,001$ ).

In the second group revealed a significant increase in wall thickness of the CV due to its plasmatic impregnation and hyalinosis. Further noted compared to the control increased diameter and cross-sectional area and the CV BB and BB plethora CV, a significant increase in width of the sinusoids. Due to the expressed plethora happened merging multiple sinusoids together with the formation of a sort of "lakes". In decompensated heart pulmonary sclerosis detected CV and portal tracts, there was a decrease compared with the second group of plethora of CV and IV ( $p < 0,001$ ). Width sinusoids was lower than in the second ( $p < 0,001$ ) and the first group ( $p < 0,05$ ), but significantly higher than the control group performance ( $p < 0,001$ ). The set of full-fledged CV and the adjoining sinusoidal shaped painting "nutmeg liver". The wall of the sinusoid appeared connective tissue sheath, there was a so-called sinusoidal capillarization.

### **Conclusions**

1. Impaired venous drainage from the liver develops in the early stages of COPD are characterized by reduced blood flow in the hepatic veins. By slowing down the speed of blood flow in the hepatic

veins develop compensatory plethora tsentrolobulyarnyh departments slices with the expansion of CV and sinusoidal.

2. Against the background of the progression of respiratory failure, the development of CPH and circulatory failure is further reduced venous outflow from the liver, which is accompanied by a significant expansion of CV, increased merger and sinusoids to form "lakes", the growing plethora, formed a "butternut liver."

3. Decompensated CPH in the liver in developing irreversible morphological changes, characterized by multiple sclerosis CV and sinusoidal capillarization, there is a further slowdown in the rate of blood flow in the hepatic veins.

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