



**MORPHOLOGICAL CHANGES IN THE MICROCIRCULATORY
BED OF THE COLON UNDER CHRONIC CARBON MONOXIDE
EXPOSURE**

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***Abstract:** This study investigates morphological alterations in the microcirculatory bed of the colon under conditions of chronic carbon monoxide (CO) exposure. Special attention was paid to structural changes in arterioles, capillaries, venules, and hemomicrocirculatory exchange vessels. Histological analysis revealed vascular dilation, endothelial swelling, perivascular edema, stasis, erythrocyte aggregation, and thickening of the vascular wall. In prolonged exposure, destructive changes in endothelial cells, narrowing of capillary lumens, and signs of microthrombosis were observed. These alterations indicate severe impairment of tissue perfusion and development of chronic hypoxia. The obtained data demonstrate that chronic CO intoxication leads to progressive microcirculatory disorders that play a key role in trophic and functional damage of the colonic wall.*

***Keywords:** carbon monoxide, colon, microcirculation, capillaries, endothelium, hypoxia, vascular morphology, hemomicrocirculatory bed.*

Main part

Introduction

Carbon monoxide is one of the most common toxic environmental pollutants and a potent inducer of hemic hypoxia due to its high affinity for hemoglobin. Chronic exposure leads to persistent oxygen deficiency, metabolic disturbances, and structural damage in various organs and tissues.

The colon is highly dependent on adequate microcirculation because of its intense epithelial turnover, absorptive processes, and barrier function. The



hemomicrocirculatory bed plays a crucial role in maintaining tissue homeostasis, ensuring oxygen delivery, nutrient transport, and removal of metabolic products.

Structural remodeling of microvessels under chronic CO intoxication is a key pathogenetic mechanism of colonic dysfunction. However, detailed morphological data on these changes remain limited, which determines the relevance of the present study.

Materials and methods

The study was performed on experimental laboratory animals divided into control and chronic CO exposure groups.

Colon tissue samples were fixed in neutral buffered formalin, embedded in paraffin, and stained with hematoxylin and eosin. In addition, special staining methods were used to assess vascular wall integrity and connective tissue components.

The following parameters were evaluated:

- diameter of arterioles and venules;
- capillary lumen size;
- thickness of the vascular wall;
- endothelial cell morphology;
- presence of stasis and erythrocyte aggregation;
- perivascular edema;
- microthrombus formation.

Morphometric analysis was performed using light microscopy with statistical evaluation ($p < 0.05$).

Results and discussion

Control group

In the control group, the microcirculatory bed of the colon had a typical structural organization. Arterioles possessed well-defined walls, capillaries had narrow and uniform lumens, and venules showed moderate blood filling. The endothelium was intact, and perivascular spaces were not expanded.



Chronic carbon monoxide exposure

Chronic CO exposure caused pronounced morphological alterations in all components of the microcirculatory bed.

Arterioles:

- uneven dilation of the lumen;
- thickening of the vascular wall due to plasma impregnation;
- endothelial swelling and partial desquamation.

These changes indicate impaired vascular tone regulation and increased permeability.

Capillaries:

- narrowing or irregular dilation of the lumen;
- deformation of the capillary contour;
- erythrocyte aggregation and stasis;
- destruction of endothelial cells.

Such alterations significantly reduce transcapillary exchange and oxygen diffusion.

Venules:

- marked blood congestion;
- dilation of the lumen;
- perivascular edema;
- leukocyte marginalization.

These features reflect the development of chronic venous hyperemia and inflammatory reactions.

In prolonged exposure, microthrombi and focal obliteration of capillary lumens were observed, indicating severe microcirculatory insufficiency.

Pathogenetic interpretation

The detected vascular changes are associated with:

- hemic hypoxia;
- activation of lipid peroxidation;



- endothelial dysfunction;
- increased vascular permeability;
- impaired rheological properties of blood.

As a result, tissue perfusion decreases, leading to dystrophic and atrophic processes in the mucosa and muscular layers of the colon.

Conclusion

Chronic carbon monoxide exposure causes significant structural remodeling of the microcirculatory bed of the colon. The main morphological manifestations include vascular dilation, endothelial damage, stasis, perivascular edema, and microthrombosis.

These changes lead to impaired tissue trophism, chronic hypoxia, and functional insufficiency of the colonic wall. The microcirculatory disturbances represent one of the leading pathogenetic mechanisms of colonic injury in chronic CO intoxication.

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