MORPHOFUNCTIONAL ALTERATIONS OF THE ESOPHAGUS INDUCED BY CARBON MONOXIDE EXPOSURE AND POTENTIAL APPROACHES FOR THEIR CORRECTION

Bakhronov B.B.
Bukhara State Medical Institute named after Abu Ali ibn Sino

Objective: To investigate structural and immunohistochemical alterations in the esophagus caused by prolonged carbon monoxide (CO) exposure and to assess the therapeutic potential of phytocompounds derived from Silybum marianum (milk thistle) and Carthamus tinctorius (safflower)

Materials and Methods: A total of 200 outbred white rats (200–250 g) were included in the experiment and randomly assigned to four groups: control; chronic CO exposure; CO + *Silybum marianum*; CO + *Carthamus tinctorius*.

Chronic CO intoxication was simulated by exposing animals to concentrations of 200–300 mg/m³ (0.02–0.03%) for 1–2 hours daily, 5–6 times per week, over a period of 1–3 months to induce sustained hypoxic conditions.

After completion of the exposure period, the animals were sacrificed, and esophageal tissue samples were collected. Specimens were fixed in 10% neutral formalin, dehydrated, and embedded in paraffin. Sections (5–7 μm) were stained with hematoxylin–eosin and according to Van Gieson.

Immunohistochemical staining was performed using the streptavidin–biotin–peroxidase technique with Ki-67 as a marker of cell proliferation and Bcl-2 as an indicator of anti-apoptotic activity. Quantitative assessment of immunopositive cells was carried out per 1 mm² using morphometric analysis.

Results: Prolonged CO exposure resulted in marked structural deterioration of the esophageal mucosa. Epithelial thickness significantly decreased (from 45 ± 2.3 to 26 ± 1.2 nm), while edema (from 10 ± 0.6 to 20 ± 1.1 nm), inflammatory cell infiltration (from 35 ± 3 to 140 ± 9 cells/mm²), and overall inflammatory activity (from 0.5 ± 0.1 to 4.0 ± 0.2 points) were notably increased.

Administration of phytocompounds mitigated these adverse changes. In the *Carthamus tinctorius* group, epithelial thickness reached 42 ± 2.0 nm, inflammation decreased to 1.5–2.0 points, and infiltration to 60–70 cells/mm². In the *Silybum marianum* group, epithelial thickness was 43 ± 2.1 nm, inflammation 1.3 ± 0.1 points, and infiltration 55 ± 4 cells/mm².

Conclusion: Long-term exposure to carbon monoxide leads to significant morphofunctional impairment of the esophagus. Treatment with phytocompounds

based on *Silybum marianum* and *Carthamus tinctorius* effectively attenuates inflammatory and degenerative alterations. These findings highlight the potential role of plant-based therapies in protecting esophageal tissue under chronic hypoxic conditions.