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BIOLOGICAL SIGNIFICANCE OF SYNTHETIC DRUGS AND INFUSION SOLUTIONS IN THE DEVELOPMENT OF NOVEL HEPATOPROTECTIVE COMBINATIONS

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ABSTRACT

The increasing incidence of liver pathologies has intensified the need for the development of new-generation hepatoprotective agents in modern pharmacology. This article analyzes the biological significance of hepatoprotective combinations developed on the basis of synthetic drug substances and infusion solutions. The effects of a combination consisting of monoammonium glycyrrhizinate, glycine, and L-cysteine hydrochloride on hepatocyte stability, antioxidant system activity, and endogenous detoxification mechanisms are examined. The biological synergy of the components is scientifically substantiated as a factor that enhances the effectiveness of complex therapy for liver and biliary system diseases.

Introduction: The liver is one of the main metabolic centers of the human body, and its function is closely associated with detoxification, biosynthesis, and energy metabolism processes. Impairment of hepatic function leads to systemic pathological changes and contributes to the progression of chronic diseases. In recent years, uncontrolled use of medications, exposure to environmental factors, and metabolic syndromes have contributed to an increase in liver damage. This situation has made the development of combination drugs capable of targeting multiple pathogenetic mechanisms simultaneously a pressing task in pharmacotherapy.

Therapeutic Role of Synthetic Drugs and Infusion Solutions: Synthetic drugs are characterized by a high degree of purity, stable chemical composition, and predictable pharmacological effects. These properties ensure their safe and effective use in clinical practice. Infusion solutions play an essential role in maintaining internal homeostasis, particularly in preserving water–electrolyte balance and promoting the elimination of toxic metabolites. When used in combination with synthetic drugs, infusion solutions contribute to the enhancement of hepatoprotective effects.

Pharmacological Characteristics of Monoammonium Glycyrrhizinate: Monoammonium glycyrrhizinate is the ammonium salt of glycyrrhizic acid, synthesized primarily from glycyrrhizic acid extracted from the roots of *Glycyrrhiza glabra* (licorice). In pharmacology, it is widely used as a potent hepatoprotective, anti-inflammatory, and membrane-stabilizing agent. It appears as a white or off-white crystalline powder, readily soluble in water. Chemically, it is a triterpene glycoside derivative and remains stable under physiological conditions.

Monoammonium glycyrrhizinate exerts its effects through the following mechanisms:

- suppression of inflammatory mediator synthesis (IL-1, TNF-α);
- stabilization of hepatocyte membranes;
- reduction of lipid peroxidation;
- immunomodulatory activity.

By attenuating inflammatory reactions in hepatocytes, this compound preserves the morphological integrity of liver tissue and slows the progression of fibrotic processes.

Biological Significance of Glycine: Glycine is a non-essential amino acid widely distributed in the human body and plays a crucial role in both central nervous system function and hepatic metabolism. Its chemical formula is $NH_2–CH_2–COOH$, with a molecular weight of 75.07 g/mol, and it appears as a white crystalline substance. Glycine participates in protein synthesis, supports conjugation reactions during detoxification, and contributes to the maintenance of intracellular energy balance. In addition, it reduces oxidative stress and supports antioxidant defense mechanisms, thereby protecting hepatocytes from damage.

Antioxidant Role of L-Cysteine Hydrochloride: L-Cysteine hydrochloride is a sulfur-containing amino acid derivative and a key precursor for glutathione synthesis. Its chemical formula is $C_3H_7NO_2S·HCl$. It appears as a white or slightly colored crystalline powder and is readily soluble in water. By promoting glutathione synthesis, L-cysteine hydrochloride neutralizes reactive oxygen species and enhances the activity of detoxification enzymes. As a result, lipid peroxidation is reduced and hepatocyte resistance to toxic injury is increased.

Biological Basis of the Combined Effect: The combined use of monoammonium glycyrrhizinate, glycine, and L-cysteine hydrochloride provides the following biological effects:

- protection and stabilization of hepatocyte membranes;
- comprehensive activation of antioxidant defense systems;
- enhancement of endogenous detoxification processes;
- improvement of liver and biliary system functions.

This combination represents a scientifically substantiated approach for the development of next-generation hepatoprotective agents.

At present, ensuring the quality of combined hepatoprotective medicinal products used in the treatment and prevention of liver diseases represents one of the most relevant scientific and practical challenges in the field of pharmaceutical science. In particular, the efficacy and safety of combinations composed of biologically active substances such as

glycine, L-cysteine hydrochloride, and monoammonium glycyrrhizinate require comprehensive quality control using modern analytical methods.

1. Identification of the Combination Components

The authenticity of each active substance included in the combination is confirmed using physicochemical analytical methods. The identification process employs the following modern analytical techniques:

- **Fourier Transform Infrared Spectroscopy (FT-IR)** — used to identify functional groups and compare individual spectra of the substances with reference standards;
- **UV–Visible Spectrophotometry (UV–Vis)** — applied to evaluate characteristic absorption maxima of the active substances;
- **High-Performance Liquid Chromatography (HPLC)** — serves as the primary method for effective separation and reliable identification of the components.

These methods provide accurate and reliable confirmation of the presence of each active ingredient in the combination.

2. Quantitative Analysis Methods

Determination of the quantitative composition of active substances directly influences the pharmacological efficacy of the medicinal product. Therefore, analytical methods with high accuracy and reproducibility are applied:

- **HPLC method** — enables simultaneous quantitative determination of glycine, L-cysteine hydrochloride, and monoammonium glycyrrhizinate;
- **Capillary electrophoresis** — used as an additional and confirmatory method for quantitative analysis of amino acids;
- **UV–Vis spectrophotometry** — quantitative evaluation is performed using calibration curves constructed based on standard solutions.

3. Control of Purity and Related Impurities

Ensuring the safety of medicinal products requires the identification of impurities and degradation products. For this purpose:

- **Chromatographic analysis** is used to detect unidentified impurities and degradation products;
- **Heavy metal content** is assessed using atomic absorption spectrometry (AAS) or inductively coupled plasma mass spectrometry (ICP-MS);
- **Residual solvents** are determined by gas chromatography (GC).

4. Evaluation of Physicochemical Parameters

The physicochemical properties of the combination are assessed in accordance with current pharmacopoeial requirements:

- **pH value** — determined by potentiometric method;
- **Solubility** — evaluated in specified media according to pharmacopoeial procedures;
- **Moisture content** — determined using the Karl Fischer titration method.

5. Stability Studies

To evaluate the chemical and physical stability of the combination during storage:

- Accelerated and long-term stability studies are conducted in climatic chambers in accordance with ICH guidelines;

- Changes in active substance content, appearance, and physicochemical parameters are comprehensively analyzed at predetermined time intervals.

Conclusion. Hepatoprotective combinations developed using synthetic drugs and infusion solutions possess significant biological relevance in the treatment of liver diseases. The combination of monoammonium glycyrrhizinate, glycine, and L-cysteine hydrochloride demonstrates high therapeutic potential by protecting hepatocytes, supporting antioxidant defense mechanisms, and enhancing detoxification processes.

The application of modern analytical techniques such as HPLC, FT-IR, UV–Vis spectrophotometry, and GC for quality control of this combination ensures full compliance with the requirements for quality, safety, and therapeutic efficacy of the medicinal product.

References:

1. Ivashkin V.T., Drapkina O.M. Pathogenetic principles of hepatoprotective therapy. *Terapevticheskii Arkhiv*, 2020.
2. European Association for the Study of the Liver (EASL). Clinical Practice Guidelines on liver and biliary diseases. *Journal of Hepatology*, 2018.
3. Gao Y., Wang Z. Glycyrrhizic acid derivatives in liver disease treatment. *Pharmacological Research*, 2021.
4. Lu S.C., Mato J.M. Glutathione metabolism and liver protection. *Hepatology*, 2019.
5. Katzung B.G. *Basic and Clinical Pharmacology.* McGraw-Hill, 2020.
6. Тоштемирова Ч.Т., Мадатова Н.Ф. Маркетинговый анализ противодиарейных лекарственных средств // Universum: медицина и фармакология.- 2024.- 4(109). – С.46-53(ISSN: 2311-6129; Ulrich's Periodicals Directory).
7. Тоштемирова Ч.Т., Дусчанова Г.М., Нормахаматов Н.С. Структурные особенности надземных и подземных органов лекарственного растения Gentiana Olivieri Griseb.. произрастающего в условиях Джизака// Фармацевтический журнал.- №4.-2024.-С.5-15
8. Тоштемирова Ч.Т.., Нормахаматов Н.С. Ўзбекистонда ўсадиган доривор GentianOlivieri Griseb.нинг элементлар таркибини ўрганиш // Eurasian journal of medical and natural sciences.-2024.-Vol.4.-Issue 10,-P.87-90(ISSN 2181-278X; ResearchBib=7,924).