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BIOCHEMICAL BLOOD PARAMETERS OF MINKS WITH INDUCED TOXIC HEPATITIS

Research article

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Abstract

This publication provides information about the study of the main biochemical markers, which can be used to suspect the development of toxic hepatitis (in its acute form) in fur animals (minks). Toxic hepatitis is a common liver disease in fur-bearing animals (minks in particular) with an acute or chronic course that develops as a result of the ingestion of chemical or other harmful substances (xenobiotics, ecotoxicants, ecopolutants, poor-quality or spoiled feed, certain drugs, etc.). Toxic hepatitis, especially in fur-bearing animals, is still common, but at the same time, a pathology that has not been sufficiently studied in a diagnostic sense. Based on our study, we can conclude that although the main metabolic markers have certain trends described above, they nevertheless require additional diagnostic approaches.

Keywords: mink, biochemical parameters, liver pathology, toxic hepatitis, hepatopathy induction.

БИОХИМИЧЕСКИЕ ПОКАЗАТЕЛИ КРОВИ НОРОК С ИНДУЦИРОВАННЫМ ТОКСИЧЕСКИМ ГЕПАТИТОМ

Научная статья

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Аннотация

Данная публикация содержит информацию об исследовании основных биохимических показателей, по которым можно заподозрить развитие токсического гепатита (в острой форме) у пушных зверей (норок). Токсический гепатит – распространенное заболевание печени пушных зверей (в частности, норок) с острым или хроническим течением, развивающееся в результате попадания в организм химических или других вредных веществ (ксенобиотиков, экотоксикантов, экопolutантов, некачественных или испорченных кормов, некоторых лекарственных препаратов и т.д.). Токсический гепатит, особенно у пушных зверей, остается распространенной, но в то же время недостаточно изученной в диагностическом отношении патологией. На основании нашего исследования можно сделать вывод, что хотя основные метаболические маркеры имеют определенные тенденции, описанные выше, тем не менее они требуют дополнительных диагностических подходов.

Ключевые слова: норка, биохимические показатели, патология печени, токсический гепатит, индуцирование гепатопатии.

Introduction

Morphological and functional features of the liver in different animal species, in particular, in fur-bearing animals, are due to the influence of numerous factors of evolutionary development, type of feeding, conditions of detention, etc. Under conditions of domestication, fur animals often suffer from metabolic disorders as a result of feeding errors and physical inactivity during cage keeping [1], [2], [3].

Toxic hepatitis is a common liver disease in fur-bearing animals (minks in particular) with an acute or chronic course that develops as a result of the ingestion of chemical or other harmful substances (xenobiotics, ecotoxicants, ecopolutants, poor-quality or spoiled feed, certain drugs, etc.) [4], [5], [6].

Acute toxic hepatitis usually develops as a result of a single exposure to a high dose of hepatotropic poison or a relatively small dose of a highly toxic substance with a specific affinity for liver cells [7], [8], [9].

The main goal of this work is to identify and analyze the main biochemical markers indicating the presence of toxic hepatitis (in its acute manifestation) in animals with specific clinical manifestations of such pathology.

Research methods and principles

The experiments were carried out in 2022 at the Mermeriny fur farm (Mermeriny village, Kalinin district, Tver region). Palomino minks (*Mustela vison* Schreber, 1777) were chosen as model animals.

Due to the fact that toxic hepatitis is considered to be a widespread, but sporadically manifested pathology, clinically healthy animals (10 females and 10 males, 1-year-old) were selected to create a parity group for further inducing pathology in

them. Randomization was carried out by a group (block) method with stratification by age and gender. Toxic hepatitis was induced according to the method described in the Guidelines for the experimental (preclinical) study of new pharmacological substances, edited by Khabriev R.U. using ethylene chloride (1,2-dichloroethane), the toxicant dosage was calculated individually for each animal with interspecies dose conversion factors [10] / The manipulations carried out as part of the study were approved by the Committee on Bioethics of the FSBEI HE SPbSUVM, they correspond to the "European Convention for the Protection of Vertebrate Animals used for Experimental and Other Scientific Purposes", adopted in Strasbourg in 1987; and also in accordance with Directive 2010/63/EU. Blood sampling from animals was carried out taking into account the rules of asepsis and antisepsis by cutting the tip of the tail into vacuum test tubes for biochemical analysis, improvacuter with a coagulation activator.

The content of the main biochemical parameters, such as total protein, albumin, total bilirubin, alkaline phosphatase, glucose, cholesterol, total bile acids, aspartate aminotransferase and alanine aminotransferase (with further calculation of the de Ritis coefficient) was determined on a biochemical analyzer URIT 8021A VET (URIT Medical Electronic Group Co., Ltd, China). The de Ritis coefficient was calculated as the ratio of the activity of serum aspartate aminotransferase and alanine aminotransferase, the amount of total bilirubin was determined by the colorimetric diazomethod according to Jendrashik-Cleghorn-Groff with sodium nitrate (JSC LenReaktiv, Russia), albumins – by the colorimetric method using bromcresol green (JSC LenReaktiv, Russia), total protein – by the biuret method based on a color reaction with copper sulfate (JSC LenReaktiv, Russia) in an alkaline medium. Cholesterol content was assessed by the standard Ilka method (manufacturer of the Ilka reagent, JSC LenReaktiv, Russia), glucose content, by the glucose oxidant method (manufacturer of glucose oxidase, LLC BioPreparat, Russia).

Statistical processing of the results was carried out in the Statistica 6.0 software. Mean values of indicators (M), standard errors of means (\pm SEM) were calculated.

Main results

Biochemical parameters of the blood of the studied groups are presented in Table 1. The lack of reliability calculation was due to the exploratory nature of the study and the absence of control groups.

Table 1 - Biochemical parameters of the mink blood with induced toxic hepatitis

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Parameter	Males (n=10), toxic hepatitis	Females (n=10), toxic hepatitis	Reference values
Total protein, g/l	95,5 \pm 6,2	68,90 \pm 4,3	53-72
Albumins, g/l	42,41 \pm 2,13	42,26 \pm 1,26	33-41
De Ritis Coefficient (AST/ALT)	0,31	0,81	1,1-1,3
Alkaline phosphatase, IU/l	219,88 \pm 28,34	285,99 \pm 21,67	30-120
Glucose, mmol/l	5,1 \pm 0,63	4,36 \pm 0,27	3,4-7,3
Cholesterol, mmol/l	4,46 \pm 0,22	4,11 \pm 0,31	3,7-7,02
Bilirubin total, μ mol/l	12,2 \pm 0,18	10,6 \pm 0,72	1,71-8,55

Note: AST - aspartate aminotransferase, ALT - alanine aminotransferase

Analyzing the obtained data, it can be concluded that in males and females with induced toxic hepatitis, in addition to the general indicators of the functional abilities' violation of the liver (increased activity of alkaline phosphatase), there was a violation of protein metabolism (increased amount of total protein), which is characteristic of toxic hepatitis due to with the fact that in inflammatory processes, one of the first to violate the protein-synthesizing function of the liver.

The amount of total protein in males exceeded the upper limit of the reference intervals by 41,25%, in females, despite the fact that on average the indicators corresponded to the upper limit of the reference values (passed along the upper limit of the conditional norm), in some animals there was an increase by 1,8-2%, which makes it possible to consider this parameter in females as doubtful from a diagnostic point of view.

The albumin fraction of proteins in both males and females was slightly increased, by an average of 3,65%, which is also an insufficiently characteristic diagnostic criterion.

More indicative in this pathology is a sharp decrease in the values of the de Ritis coefficient, especially in males, which indicates that the synthesis of specific transaminases is one of the first to change in toxic hepatitis.

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So, the amount of total protein in males exceeded the upper limit of the reference intervals by 41,25%, in females, despite the fact that, on average, the indicators corresponded to the upper limit of the reference values (passed along the upper limit of

the conditional norm), in some animals there was an increase by 1,8-2%, which makes it possible to consider this parameter in females as doubtful from a diagnostic point of view.

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More indicative in this pathology is a sharp decrease in the values of the de Ritis coefficient, especially in males, which indicates that the synthesis of specific transaminases is one of the first to change in toxic hepatitis.

An almost two-fold increase in alkaline phosphatase is not an extraordinary biochemical observation, since this enzyme is elevated in any pathology associated with pathologies of the hepatobiliary system. A similar thesis can be applied to total bilirubin.

At the same time, it should be noted that fat and carbohydrate metabolism in the initial stages of toxic hepatitis do not undergo changes, as evidenced by the correspondence of glucose and cholesterol levels to the reference values.

Thus, it is the change in these indicators relative to the reference intervals that should be considered as metabolic markers of liver pathologies in fur-bearing animals (minks in particular). Further studies require confirmation using morphological research methods with an analysis of modern statistical methods.

Conclusion

Toxic hepatitis, especially in fur-bearing animals, is still common, but at the same time, a pathology that has not been sufficiently studied in a diagnostic sense. Based on our study, we can conclude that although the main metabolic markers have certain trends described above, they nevertheless require additional diagnostic approaches.

In further scientific works, we plan to study the features of morphological changes in this pathology in more detail.

Финансирование

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Конфликт интересов

Не указан.

Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

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Conflict of Interest

None declared.

Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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