AUCTORES
Globalize your Research

Journal of Scientific Research and Biomedical Informatics
Yıldız L.Z.*

Open Access

Research Article

# Diagnostics and Identification of the Degree of Intoxication of Patients Bitten by a Poisonous Snake (Macrovipera Lebetina Obtusa)

**Yıldız L.Z.**

Recep Tayyip Erdoğan University (RTEU), Medical Faculty, Department of Medical Physiology, Turkey.

**Corresponding Author:** Yıldız L.Z, Recep Tayyip Erdoğan University (RTEU), Medical Faculty, Department of Medical Physiology, Turkey.

**Received Date: December 27, 2021; Accepted Date: December 24, 2021; Published Date: January 05, 2022**

**Citation:** Yıldız L.Z (2022). Diagnostics and Identification of the Degree of Intoxication of Patients Bitten by a Poisonous Snake (Macrovipera Lebetina Obtusa). *J. Scientific Research and Biomedical Informatics*, 3(1); DOI:10.31579/jsrbi.2022/025



## Abstract

This paper presents the results of experimental studies to identify the degree of intoxication of patients bitten by a poisonous snake (Macrovipera lebetina obtusa), who are being treated in the clinic.
The aim of the research was to determine the content of snake venom in the blood of people with intoxication of varying degrees, which develops after the bite of poisonous snakes by the method of introduced fluorescence. The research material was the blood serum of patients bitten by a poisonous snake (Macrovipera lebetina obtusa). The determination of snake venom toxins in the blood of patients was carried out using a combination of extraction methods in the blood-0.9% sodium chloride solution, followed by determination on a Hitachi-850 spectrofluorimeter (Japan).

As a result of experimental studies, a mild degree of intoxication with snake (Macrovipera lebetina obtusa) venom was revealed with the content of toxins in the blood of patients in the range of 0.125-0.850 μg / ml (on average 0.492 μg / ml) and a severe degree of intoxication with the content of toxins in the blood of patients bitten by snake at a concentration of within 14.50-20.30 μg / ml (average 17.10 μg / ml).

**Keywords:** blood serum; Macrovipera lebetina obtuse; patients; venom snake

## Introduction

Snake venom is of great value for medicine and biology. It is used to prepare antivenom serums. Venom of viper is used as a hemostatic agent and during operations for the removal of tonsils, during nosebleeds, etc. [12].
The rational use of zootoxins in medical practice is impossible without experimental study and theoretical substantiation of the essence of the reactions developing in the body in response to the penetration of one or another venom. Snake venoms have a strong toxic effect only in lethal or sublethal doses. Small doses of venom do not cause any clinical manifestations of poisoning and have long been used in the treatment of many serious diseases [3, 4].
More recent examples of innovation within snakebite diagnostics in Brazil include an impedimetric immunosensor based on electrochemical impedance spectroscopy [5], while a different group similarly developed an ELISA and an immunochromatographic strip for diagnosis of snake species in Taiwan [6].
The poison that has entered the body is distributed very unevenly. Biological barriers (capillary walls, cell membranes, hematoencephalic and placental barriers) have a significant effect on the distribution of toxic compounds. Most zootoxins undergo biotransformation in the body, many aspects of which have not been sufficiently studied [7, 8].
Undoubtedly, the effective use of snake venoms in the clinic should be based on a deep knowledge of their composition and properties and, first of all, on experimental research.
Experimental studies and clinical observations indicate serious structural disorders in organs and tissues under the poisonous action of snake venoms. Their nature is associated with the species of the snake, the dose of venom and its activity, the place of the bite, etc., which must be taken into account when carrying out medical measures.
There are no methods of express-analysis of the concentration of snake venom in the blood of patients bitten by a poisonous snake, contributing to the optimization and rationalization of pharmacotherapy.
Animal poisons are used as diagnostic agents for blood diseases and for obtaining an experimental model, in order to test new drugs in violation of blood clotting, water-salt metabolism, etc. Thus, there is no doubt about the value of snake venom for the diagnosis and treatment of diseases.
In the literature, there are isolated works on the possibility of using fluorescent probes in pharmacology, in the study of the distribution of drugs in tissues and cells of a living organism. However, there are no data

on the study of the pharmacokinetics of the poison of the Transcaucasian viper using a fluorescent probe.

Currently, there are no unified methods for the differential determination of the nature of various zootoxins. Methods for detecting the degree of poisoning and non-specific methods of treatment need to be improved, since recommendations and instructions on methods of treatment for snake bites do not always give the desired therapeutic effect [9, 10, 11].

For the appropriate conduct of pharmacotherapy, it is important to study the penetration of animal poisons into organs and tissues. The importance of the problem is determined by the fact that the site of impact of snake venoms is not only blood, but also other tissues and cells.

The study of the distribution of viper venom during intoxication seems essential to them not only to determine the severity of intoxication, the prognosis of the disease, but also in the development of measures to combat the coming shifts, as well as to prevent possible complications.

Elucidation and development of methods for studying this problem is relevant not only from the point of view of determining and choosing the most rational measures to combat the intoxication with snake venoms, often with improper treatment that ends in death. This is of great importance in the light of identifying the possibility of using small doses of venom, as well as its individual fractions and enzymes that make up its composition as medicines for various diseases.

Snakebite envenoming is predominantly an occupational disease of the rural tropics, causing death or permanent disability to hundreds of thousands of victims annually. The diagnosis of snakebite envenoming is commonly based on a combination of patient history and a syndromic approach. As such, achieving timely diagnosis, and thus treatment, is a challenge faced by treating personnel around the globe. For years, much effort has gone into developing novel diagnostics to support diagnosis of snakebite victims, especially in rural areas of the tropics. Gaining access to affordable and rapid diagnostics could potentially facilitate more favorable patient outcomes due to early and appropriate treatment [12].

A small number of works have been devoted to the study of the distribution of animal venoms in the experiment. In the literature, there are isolated works on the application of the method of fluorescent probes in pharmacology, in particular, in the study of pharmacokinetics of drugs [13].

Due to the lack of information on the pharmacokinetics of zootoxins, we decided to investigate the kinetics and distribution of the viper venom in an experiment using a fluorescent probe. By measuring fluorescence, information about conformation, binding sites, interactions with a solvent, and other information can be obtained.

Insufficient development of methods for determining the concentration of snake venom in the blood of patients, the lack of an express analysis of the presence of zootoxins, often do not allow practitioners, by quickly eliminating the development of subsequent links in the pathogenesis of intoxication, promptly to contribute to the achievement of the required therapeutic effect.

As you know, the general reaction of the body to snakebites, first of all, depends on the amount, location of the bite and the activity of the injected venom.

The main task in providing assistance to victims of a snake bite, in essence, comes down to blocking or destroying the venom and stimulating the body to fight the secretion of the snake's venomous glands that has penetrated the blood and lymph.

In this regard, the correctness in the appointment of doses, applied medications and serum, determines the outcome of treatment, eliminates their side effects. Therefore, the primary and necessary is the determination of the concentration of the venom in the victim's body.

Thus, all of the above indicates that in the experimental and clinical study of snake venoms there are contradictory and very complex problems that require further study and resolution.

Based on the foregoing, the purpose of these studies was determination of the content of snake venom by the method of introduced fluorescence in the blood of people with intoxication of varying degrees, developing after the bite of poisonous snakes.

## Material and research Methods

The research material was the blood of patients bitten by a poisonous snake (Macrovipera lebetina obtusa). The determination of snake venom toxins in the blood of patients was carried out using a combination of extraction methods in the blood-0.9% sodium chloride solution, followed by determination on a Hitachi-850 spectrofluorimeter (Japan).

## Research results

The studies were carried out in the blood of patients undergoing treatment at the Republican Toxicological Center after snake bites. The age of the patients ranged from 12 to 42 years, of which 11 were men, 4 were women. The concentration of snake venom toxins was determined spectrofluorimetrically.

During their stay in the clinic, blood was taken from all patients from a finger in an amount of 0.1 ml (once for spectrofluorometric quantitative determination of the content of snake venom), 10 hours after the bite, presumably by a viper, into the lower leg.

Table 1 and 2 show the spectrofluorometric parameters of blood in patients bitten by a poi-sonous snake. As can be seen from tables 1 and 2, toxic effects are observed in patients with different concentrations of toxins.

The severity of intoxication practically depends on the on cen-tration of the venom. A moderate effect is observed when the content of toxins in the blood of patients is in the range of 0.125-0.850 μg / ml (on average 0.492 μg/ml), and serious toxic signs of snake venom - at a concentration of 14.50-20.30 μg / ml (average 17.10 μg/ml).

| Disease history | Age | Gender | $F_{480/540}$ | Venom concentration, μg/ml |
|---|---|---|---|---|
| 4311 | 14 | female | 0.350 | 3.500 |
| 3643 | 25 | female | 0.050 | 0.125 |
| 5802 | 34 | female | 0.460 | 4.600 |
| 5550 | 41 | female | 3.300 | 16.50 |
| 1880 | 16 | male | 0.025 | 0.500 |
| 3310 | 17 | male | 0.823 | 0.850 |
| 1883 | 16 | male | 6.411 | 6.700 |
| 2564 | 29 | male | 22.140 | 20.300 |
| 2373 | 42 | male | 16.230 | 14.500 |
| 3079 | 40 | male | 17.890 | 17.00 |
| 3085 | 22 | male | 17.910 | 17.20 |
| 2384 | 18 | male | 4.810 | 4.80 |
| 3042 | 13 | male | 5.080 | 5.07 |

| | | | | |
|---|---|---|---|---|
| 3086 | 15 | male | 0.501 | 0.550 |
| 3060 | 12 | male | 0.410 | 0.430 |

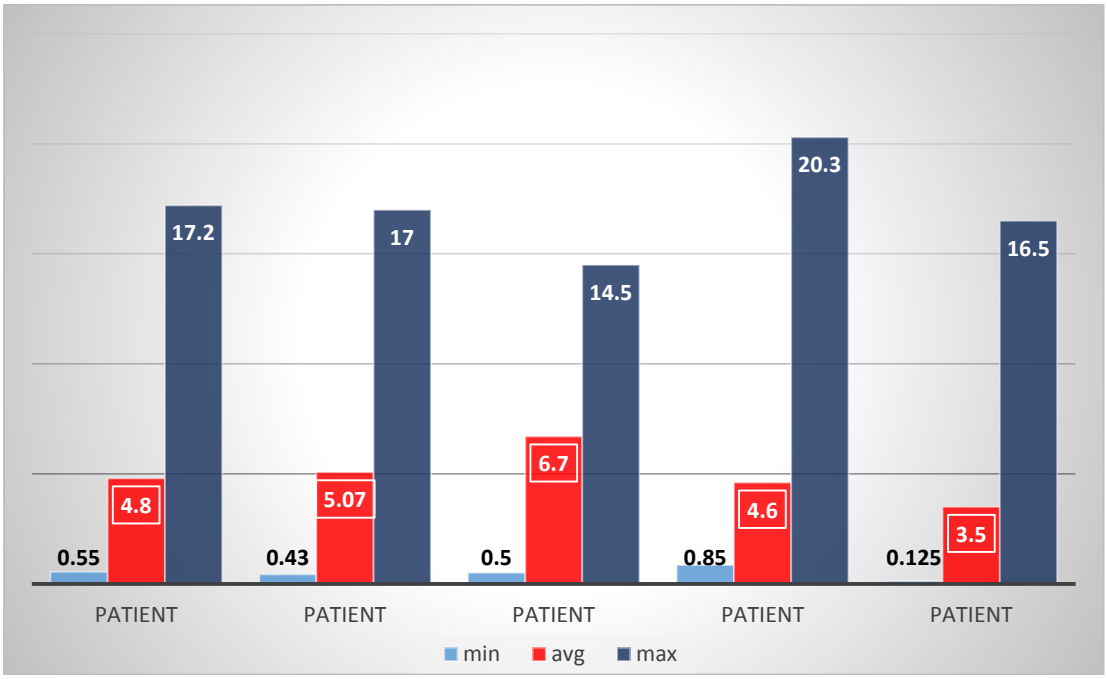
**Table 1:** Spectrofluorometric determination of snake venom in the blood of bitten patients by snake

| Patient group | Statistical indicators, M ± m |
|---|---|
| Mild intoxication | 0.492±0.12 |
| Average degree of intoxication | 4.933±0.25 |
| Severe intoxication | 17.100±1.91 |

**Table 2**: Concentrations of snake venom in the blood of patients bitten by snake (in μg / ml; n = 5)

Figure 1 shows a diagram of the grouping of patients bitten by snake, according to the levels of toxins in the blood. Based on the data on the concentration of snake venom in the blood of patients, it is possible to establish a high level of toxins and the maximum permissible safe concentration, that is, to establish the likelihood of extremely toxic phenomena.

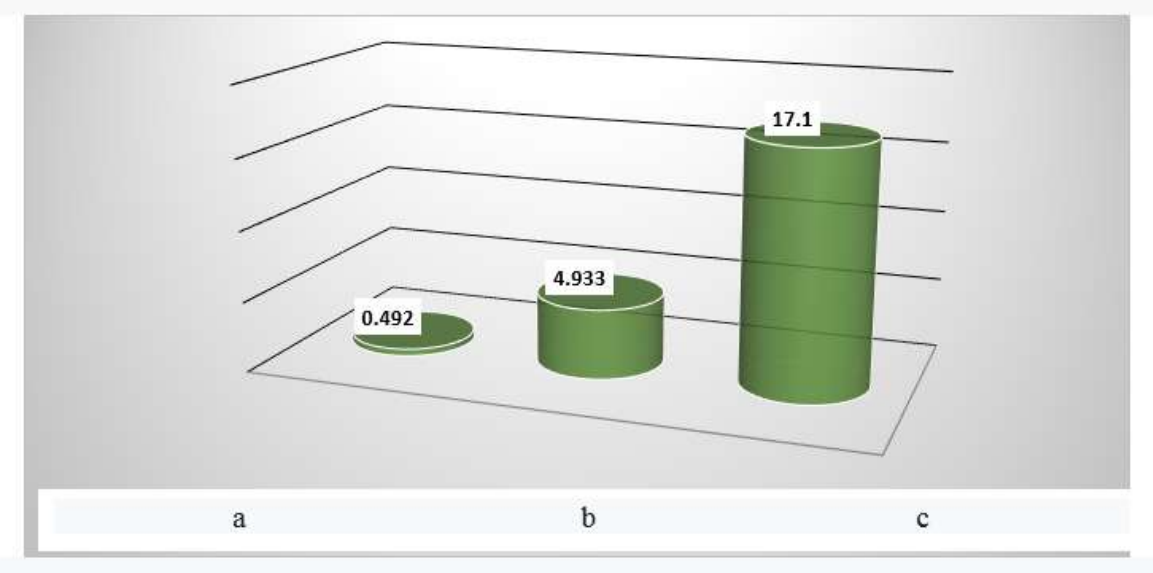
If the level of venom is higher than the maximum allowable, then the safety of treatment may be at risk. Although the values of the average minimum and maximum permissible concentrations can vary individually, nevertheless, in many cases, the differences turn out to be much smaller than the individual fluctuations.




Venom concentration in μg / ml

**Figure 1:** Diagram of grouping patients bitten by snake according to the levels of venom toxins in the blood, μg / ml, Where: C min., C avg., C max - respectively the minimum, average, maximum concentration

An illustration of the concentration of snake venom depending on the severity of poisoning is shown in Figure 2.




Venom concentration in µg / ml

**Figure 2:** Diagram of the dynamics of the content of viper venom in the blood of patients bitten by snake,
Where:
**a** - Mild degree;
**b** - Medium degree;
**c** – Severe degree.

As can be seen from the figure, toxic effects are observed in different patients with different values of the concentration of snake venom.

The method of introduced fluorescence applied by us, from our point of view, can become one of the most effective ways to control the content of zootoxins in the blood of patients with snake venom poisoning. It should be especially emphasized that the method of fluorescent probes is one of the methods of express analysis, which requires a minimum amount of time - about 20 minutes (from the moment of sampling) and a small amount of blood - 0.2-0.02 ml.
Thus, with the use of fluorescein, priority results were obtained, ways of their practical application in medical zootoxinology were developed, and the prerequisites for its diagnostic use were determined.

## Conclusions

1. As a result of experimental studies, a mild degree of intoxication with viper venom was revealed with the content of toxins in the blood of patients in the range of 0.125-0.850 µg / ml (on average, 0.492 µg / ml).
2. Experimentally, a severe degree of intoxication was revealed with the content of toxins in the blood of patients bitten by viper at a concentration in the range of 14.50-20.30 µg / ml (on average 17.10 µg / ml).

## Reference

1. Zaidel A.N. Atomic-fluorescent analysis, M., Nauka, 1980, 192 p.
2. Malikov M. About the chemical composition of snake venoms. Ecology and biology of animals of Uzbekistan, Tashkent, 1969, p. 3-5.
3. Barkagan Z.S., Sukhoveeva E.Ya., Shevchenko V.I. Results and prospects of the use of snake venoms in the recognition of disorders in the blood coagulation system. Abstracts of the III All-Union Herpetological Conference, 1973, pp. 30-31.
4. Farid T., Nasser H., Zaki K., Asmar M.E.Low molecular weigth factor X activator from Cerastes vipera (Sahara sand viper) venom. J. Toxicon, 1993, v. 31, No 8, pp. 1007-1017.
5. Liu CC, Yu JS, Wang PJ, Hsiao YC, Liu CH, Chen YC, et al. Development of sandwich ELISA and lateral flow strip assays for diagnosing clinically significant snakebite in Taiwan. *PloS Negl Trop Dis*, 2018,12:1, p.23.
6. Faria RAD, Lins V de F, Nappi GU, Matencio T, Heneine LGD. Development of an Impedimetric Immunosensor for Specific Detection of Snake Venom. *Bionanoscience* (2018) 8, pp. 988–996.
7. Mitelman L.M. Results of a laboratory test of a blood clotting drug made from the venom of lebetox viper. Herpetology of Central Asia, Tashkent, Fan, 1968, pp. 108-112.
8. Naulleau G., Bonnet X. Body condition threshold for breeding in a viviparous snake. Ecologia, 1996, v. 107, No 3, p. 301.
9. Orlov B.N., Gelashvili D.B., Ibragimov A.K. Poisonous Animals and Plants of the USSR, Higher School, Moscow, 1990, 271 p.
10. Osterman L.A. Chromatography of proteins and nucleic acids, M., Nauka, 1985, 536 p.
11. Mitelman L.M. Results of a laboratory test of a blood clotting drug made from the venom of lebetoks viperas. Herpetology of Central Asia, Tashkent, Fan, 1968, pp. 108-112.
12. Knudsen C., Jürgensen J.A., Føns S., Haack A. M., et all. Snake bite Envenoming Diagnosis and Diagnostics. Front. Immunol., April 2021.
13. Topchiyeva Sh.A. Optimization of pharmacotherapy for intoxication with snake venom by the method of fluorescent probes. Mat.conf., Dedicated. 60th anniversary of higher pharmaceutical education in Azerbaijan. Baku, 1999, pp. 209 – 211.

**DOI:** 10.31579/jsrbi.2022/025