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CARDIOTOXICITY OF *VIPERIDAE* VENOM: A SYSTEMATIC REVIEW OF CLINICAL CASES OF ACUTE MYOCARDIAL INFARCTION AND TOXIC MYOCARDITIS

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Introduction. In Russia, venomous snakes are mainly represented by species from the viper family. Several thousand people suffer from viper bites each year in Russia; a small proportion of these cases are fatal, primarily due to cardiovascular causes. There is no study of this issue in the Russian medical literature, and the national clinical guidelines in cardiology do not mention the toxic effects of viper venom on the heart.
Objective. To systematize data on the toxic effect of venom from snakes of the *Viperidae* family on the human myocardium.
Methods. A systematic review of cases was conducted in accordance with the PRISMA 2020 criteria. The search was carried out in the electronic databases PubMed, Google Scholar, and eLibrary. The review included 30 publications (29 case reports and 1 case series) that met the inclusion and exclusion criteria. From each publication, the following data were extracted: country of the case, demographic data, vital signs, clinical presentation, laboratory and instrumental parameters, condition of the coronary arteries, outcomes, and therapy administered.
Results. Twenty-two cases of myocardial infarction (MI) (71%) were analyzed, 17 of which (77.3%) were ST-segment elevation MIs, and 9 cases of toxic myocarditis (TM) (29%). Seventy-one percent of the affected individuals had no prior medical history. Systolic blood pressure (SBP) in the MI group was statistically significantly lower than in the TM group ($p = 0.0344$). The median time from the bite to the onset of anginal pain in the MI group was 5.0 [0.3; 240] h. Signs of hypocoagulation were observed in 75% of cases, and leukocytosis (always neutrophilic) was present in 82.6% of cases. Significant T-wave changes were found in 26.6% of patients, predominantly as T-wave inversion in the chest leads, occurring in both the MI and TM groups. In MI cases, ST-segment elevation was recorded in 77.3%; among these, criterion ST-segment elevation was in the anterior leads in 52.9% and in the inferior leads in 47.1%. Ventricular tachycardia was detected in 2 patients, both with MI. In one TM case, severe atrioventricular block occurred, requiring implantation of a permanent pacemaker (PPM). Echocardiographic changes were documented in 55% of cases, with global hypokinesis observed in 18.2% of TM cases. The median left ventricular ejection fraction was 56.0 [40.0; 62.0]% for MI and 37.5 [30.0; 45.0]% for TM ($p = 0.0858$). In 8 cases (62.5% MI and 37.5% TM), the coronary arteries were intact according to coronary angiography; in 5 cases (100% MI), a large mural thrombus was visualized; and in 1 MI case (a 74-year-old patient), significant atherosclerotic coronary artery disease was found. Thrombolysis with reteplase and tenecteplase was performed in 11.8% of cases of ST-segment elevation MI. Dual antiplatelet therapy was administered to 40.9% of patients with MI. Blood component transfusion was required in 22.6% of cases to correct coagulation disorders. Hemodialysis was mentioned in two publications, both in MI cases. Clinical death occurred in 25.8% of the affected individuals immediately after the snake bite or upon admission. Overall mortality was 22.7% for MI and 22.2% for patients who developed TM.
Conclusions. Cardiovascular complications after viper bites are rare but can have a wide range of outcomes, including cardiac arrest, malignant ventricular arrhythmias, the need for pacemaker implantation, blood component transfusion, hemodialysis, and death. The management of this group of patients, including the use of antivenom, remains a topic for future research.

Keywords: viper; *Viperidae*; snake venom; toxic effect; cardiovascular diseases; myocardial infarction; myocarditis; snake bites

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КАРДИОТОКСИЧНОСТЬ ЯДА ГАДЮКОВЫХ: СИСТЕМАТИЧЕСКИЙ ОБЗОР КЛИНИЧЕСКИХ СЛУЧАЕВ ОСТРОГО ИНФАРКТА МИОКАРДА И ТОКСИЧЕСКОГО МИОКАРДИТА

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Введение. В России ядовитые змеи преимущественно представлены видами из семейства гадюковых. Ежегодно от укусов гадюк страдают несколько тысяч человек в России, малая часть этих случаев заканчивается летальным исходом, в основном по сердечно-сосудистым причинам. В российской медицинской литературе отсутствует изучение данного вопроса, в национальных клинических рекомендациях по профилю кардиологии не упоминается токсическое действие яда гадюк на сердце.
Цель. Систематизировать данные по токсическому действию яда змей семейства гадюковых на миокард человека.
Методы. Систематический обзор случаев был проведен в соответствии с критериями PRISMA 2020. Поиск осуществлялся в электронных базах данных PubMed, Google Scholar и eLibrary. В обзор вошло 30 публикаций (29 отчетов о случаях и 1 серия наблюдений), соответствующих критериям включения и исключения. Из каждой публикации были извлечены: страна случая, демографические

данные, жизненно важные показатели, клиническая картина, лабораторные и инструментальные параметры, состояние коронарных артерий, исходы и проведенная терапия.

Результаты. Проанализировано 22 случая инфаркта миокарда (ИМ) (71%), 17 (77,3%) из них — с подъемом сегмента ST, и 9 случаев токсического миокардита (ТМ) (29%). У 71% пострадавших отсутствовал предшествующий анамнез. Систолическое артериальное давление (САД) при ИМ было статистически значимо ниже, чем при ТМ (p = 0,0344). Медиана времени от укуса до развития ангинозных болей при ИМ составила 5,0 [0,3; 240] ч. В 75% случаев отмечены признаки гипокоагуляции, в 82,6% имелся лейкоцитоз, всегда нейтрофильный. Значимое изменение зубца T обнаружено у 26,6% пациентов, преимущественно в виде инверсии зубца T в грудных отведениях, как в группе с ИМ, так и в группе с ТМ. При ИМ элевация сегмента ST фиксировалась в 77,3%, из них в 52,9% случаев критериальный подъем сегмента ST был в передних отведениях, а в 47,1% — в нижних отведениях. У 2 пациентов обнаружена желудочковая тахикардия, в обоих случаях при ИМ. В 1 случае при ТМ наблюдалась выраженная атриовентрикулярная блокада, потребовавшая установки постоянного электрокардиостимулятора (ЭКС). В 55% случаев были зафиксированы изменения по эхокардиографии, глобальный гипокинез выявлен в 18,2% ТМ. Медиана фракции выброса левого желудочка для ИМ составила 56,0 [40,0; 62,0]%, для ТМ — 37,5 [30,0; 45,0]% (p = 0,0858). В 8 случаях (62,5% ИМ и 37,5% ТМ) коронарные артерии по данным коронарной ангиографии были интактны, в 5 случаях (100% ИМ) визуализировался крупный пристеночный тромб, и в 1 случае при ИМ у пациента 74 лет выявлено значимое атеросклеротическое поражение коронарного русла. В 11,8% случаев на фоне ИМ с подъемом сегмента ST выполнен тромболизис ретеплазой и тенектеплазой. 40,9% пациентов с ИМ получали двойную антиагрегантную терапию. В 22,6% случаев возникала необходимость переливания компонентов крови с целью коррекции нарушений свертываемости крови. Проведение гемодиализа упоминается в 2 публикациях, оба случая — при ИМ. 25,8% пострадавших перенесли клиническую смерть сразу после укуса змеи или на этапе поступления. Итоговая летальность составила: 22,7% для ИМ и 22,2% для пациентов, перенесших ТМ.

Выводы. Сердечно-сосудистые осложнения после укуса гадюк происходят редко, но могут иметь широкий спектр исходов, включая остановку сердца, злокачественные желудочковые аритмии, потребность в установке электрокардиостимулятора, переливание компонентов крови, гемодиализ, смерть. Особенности ведения данной группы больных, включая применение антидота, — вопросы для будущих исследований.

Ключевые слова: гадюка; семейство гадюковых; змеиный яд; токсическое воздействие; сердечно-сосудистые заболевания; инфаркт миокарда; миокардит; укусы змей

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INTRODUCTION

Bites of venomous animals are a pressing threat to human health and safety worldwide. Thousands of cases are recorded annually in which a person is exposed to venom upon encountering dangerous fauna. Globally, the most significant clinical danger to the population comes from groups such as arachnids, insects, and, to a lesser extent, jellyfish, amphibians, and snakes. Of particular concern is the steady upward trend in the number of such incidents. For example, in the United States, in 2018–2023, animal-related deaths, including those caused by venomous animals, increased by 38% [1]. The World Health Organization (WHO) has developed a strategic roadmap aimed at reducing mortality and disability from snake bites by 50% by 2030. Envenomation is officially included among the most prioritized neglected tropical diseases [2].

On the territory of the Russian Federation, the natural and climatic conditions are generally not favorable for the widespread distribution of highly toxic venomous animal species. Nevertheless, one cannot ignore the high level of environmental diversity in the country, which includes climatic zones ranging from temperate to subtropical, as well as the current dynamics of climate change, which involves warming and shifts in climatic zone boundaries. Moreover, the very low population density in Russia, together with vast steppe and forest areas, creates relatively few anthropogenic obstacles for the habitation of these species. These conditions may become favorable for the expansion of the range and increase in the number of certain venomous animal species, which in the future could affect the risk of their encounters with humans and the associated toxic effects. The most represented and widespread family of venomous snakes in Russia is the *Viperidae* (Table 1) [3].

Several species of this family are found in Russia, but the greatest clinical significance is associated with bites of the common adder (*Vipera berus*): the species is distributed almost everywhere, which explains why cases of envenomation are most frequently reported (Fig. 1).

Table 1. **Main species of *Viperidae* occurring within the territory of the Russian Federation**

Snake species	Brief description
Common adder *(Vipera berus)*	The most widespread species, inhabiting almost the entire territory of Russia (forests, swamps). Coloration varies from gray to black with a zigzag pattern on the back
Steppe viper *(Vipera ursinii/ renardi)*	Found in steppes and meadows, in Crimea, the Ciscaucasian region and Southern Siberia. Smaller than the common adder, its venom is less toxic
Pit viper (common pit viper, Ussuri pit viper, rock pit viper) (*Gloydius)*	Distributed in the Volga region, the Caucasus and the Far East. More aggressive than common adders, has a flattened head and spotted coloration
Blunt-nosed viper (Levantine viper) *(Macrovipera lebetina)*	One of the most dangerous and large (up to 2 m) snakes, inhabits the North Caucasus and Dagestan. Possesses extremely toxic venom
Caucasian viper (Kaznakow's viper) *(Vipera kaznakovi)*	Brightly colored (orange-yellow or red) snake, inhabits the Black Sea coast
Nikolsky's viper *(Vipera nikolskii)*	Inhabits mainly forest-steppe and steppe regions of the European part of Russia, as well as the black-earth areas, and extends to the foothills of the Urals; has a deep black color
Dinnik's viper (Vipera dinniki) *(Vipera dinniki)*	In Russia, it is found exclusively in high- and mid-mountain regions of the North Caucasus. A clear dark zigzag stripe runs along the back, which sometimes merges into a solid black line

Table compiled by the authors based on data from the source [3]

The common adder (*Vipera berus*) is a venomous snake of the viper family, distributed throughout the Eurasian continent, including northern latitudes. Its body length is usually 750–1000 mm; females are larger than males. Color variations (morphs) range from light gray to brown, reddish-copper, and entirely black (melanistic). The key identifying features are a dark zigzag stripe along the back (sometimes continuous or spotted), an X-shaped pattern on the head, and dark lateral spots. The snake's venom is used for hunting; for humans, a bite is very painful but rarely fatal. The common adder is much less demanding regarding ambient temperature than most other snakes, mainly due to its ability to change thermoregulatory behavior [4]. It can survive in harsh conditions, up to the Arctic Circle, and remains active at relatively low temperatures (even

Figure prepared by the authors

Fig. 1. **Geographic range of the common adder (*Vipera berus*) in Russia: red colour — habitat range**

10–15 °C), which allows it to colonize northern latitudes and mountainous regions [5].

The stimulus for our work was a rare case of acute myocardial infarction after a snake bite, described in 2025 [6]. In this article, we present a systematic review of cases of acute myocardial infarction (MI) and toxic myocarditis (TM) resulting from bites of snakes of the *Viperidae* family in various regions of the world. Such information is absent from the Russian scientific literature and may be of clinical interest (when extrapolated to local representatives of the *Viperidae* family).

The study purpose is to systematize data on the toxic effect of *Viperidae* venom on the human myocardium.

METHODS

The systematic review was prepared according to the PRISMA 2020 algorithm[1]. The search was conducted in the databases PubMed and eLibrary, as well as via the Google Scholar search tool, to select publications describing infarctions and myocarditis following bites of snakes from the *Viperidae* family. The study included full-text original articles published up to December 2025, available in English, Spanish, and Russian. Works reported only as abstracts, duplicates, and review articles were excluded. Articles in which the link between viper venom and myocardial damage could not be confirmed were also not included in this systematic review. In the end, we compiled a list of publications based on their relevance to the subject of this review. The keywords included the following terms: snake bites or snake venoms or snakes or *Viperidae*; and cardiac or heart or myocardial infarction or myocarditis or cardiology or ischemia.

Two researchers independently screened the titles and abstracts of the identified articles. A third researcher was consulted in cases of disagreement during the selection process. All authors independently analyzed the studies to ensure accuracy and consistency and to eliminate the risk of bias. Disagreements were resolved by reaching consensus.

From each selected publication, the following information was extracted: country of the case, patient age and sex, prior medical history, vital signs upon admission, consequences of the bite and clinical presentation, laboratory data (including markers of myocardial necrosis), electrocardiogram description, echocardiogram and magnetic resonance imaging findings, condition of the coronary arteries, patient outcomes, and therapy administered. The study results were processed using the Jamovi Version 2.6.44 (Australia) statistical software[2].

The total number of publications based on the initial search strategy was 1076. Studies presented only as abstracts were excluded; such articles numbered 388. After reading the remaining full-text publications, 535 articles were removed: 381 were duplicates, and 154 were reviews. Cases where the snake species or family was not reported, as well as cases where the snakes belonged to the Elapidae family (which do not occur in Russia), were not included in the systematic review. Single cases of hemorrhagic pericarditis, cardiac tamponade, non-infective endocarditis, and cardiac rhythm and conduction disturbances following a snake bite without other signs of myocardial injury were also excluded from the review. Also excluded were cases of Takotsubo cardiomyopathy following bites, because there are discrepancies in interpreting the extent of damage directly from the direct action of viper venom on the myocardium versus the effect of catecholamines released into the bloodstream due to the emotional and physical stress of the snake bite itself. Furthermore, cases of Kounis syndrome (allergic coronary syndrome) were not included, since we believe these episodes are not pathophysiologically related to the topic we address, and there are difficulties in identifying the actual trigger of the allergic reaction. In total, 30 publications (29 case reports and 1 case series) that met the inclusion and exclusion criteria were included in the systematic review (Fig. 2).

We refrained from statistical analysis for several reasons: extreme heterogeneity of the data (single cases with unique clinical characteristics, treatment regimens, and outcomes); low quality of the original information (case reports are considered low-evidence due to their subjectivity and high risk of bias, especially publication bias — the tendency to publish only positive or unusual outcomes); assessment of uncertainty is not feasible (with a small number of studies it is difficult to determine heterogeneity among them). Methods that account for such uncertainty have low power.

RESULTS AND DISCUSSION

Case descriptions

General characteristics. We analyzed 22 cases of myocardial infarction (MI) (71%), 17 of which (77.3%) were ST-segment elevation MI, and 9 cases of toxic myocarditis (TM) (29%). Some data from the cases included in the review, specifically the diagnosis, complications of the bite, coronary artery assessment, and myocardial revascularization methods, are presented in Table 2[3]. Countries with a tropical climate predominated (19 cases, 61.3%). India and Sri Lanka accounted for 51.6% of the included MI and TM cases. In 22 cases (71%), the

[1] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. https://doi.org/10.1136/bmj.n71

[2] The Jamovi Project (2022). Jamovi (Version 2.6.44) [Computer Software]. https://www.jamovi.org

[3] Table 2. Data on cases of acute myocardial infarction and toxic myocarditis resulting from *Viperidae* snake bites. https://doi.org/10.47183/mes.2026-518-annex

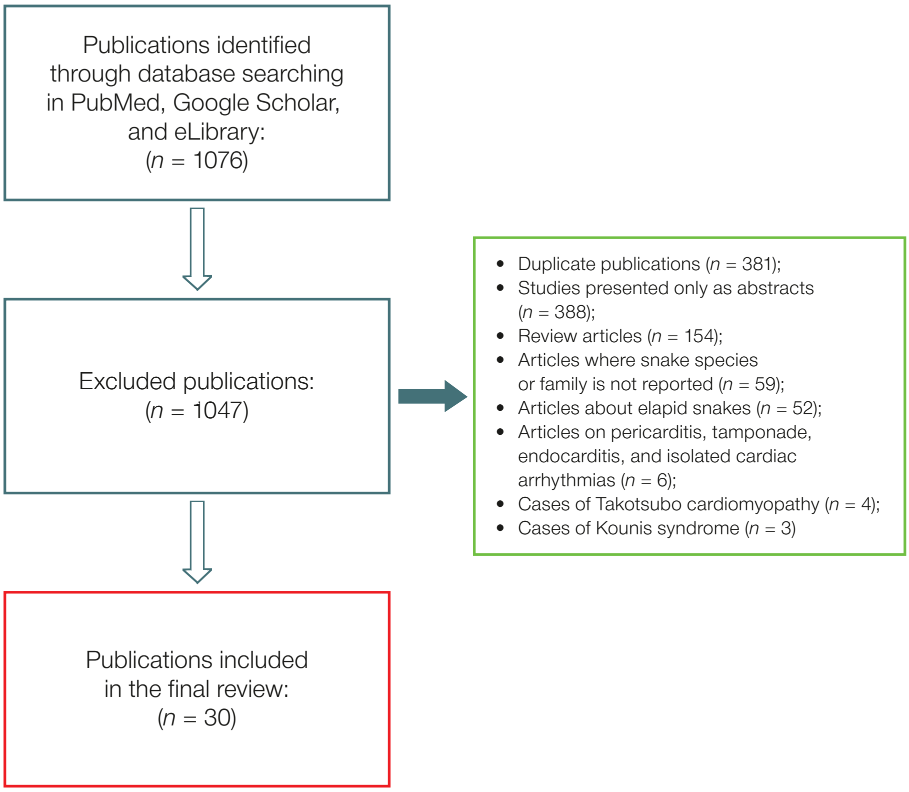

Figure prepared by the authors

Fig. 2. Flowchart of the systematic review: “Cardiotoxicity of *Viperidae* venom: a systematic review of clinical cases of acute myocardial infarction and toxic myocarditis”

victims had no prior medical history or comorbidities; in 4 cases (12.9%), prior history was not mentioned. Dyslipidemia was recorded in 1 case (3.2%), pre-existing arterial hypertension in 2 cases (6.4%), and type 2 diabetes mellitus in 2 cases (6.4%). Patients with a prior medical history did not differ in outcomes or severity of complications from patients without a prior medical history.

Clinical data. SBP in MI was statistically significantly lower than in TM (p = 0.0344). The median time from the bite to the onset of anginal pain in the MI group was 5.0 [0.3; 240] h. In 5 cases (55.6%) out of 9 with TM, anginal pain was absent; in 4 cases (44.4%) of TM, anginal pain was not mentioned (Table 3).

Laboratory parameters. Coagulogram parameters were reported in 24 out of 31 cases, of which signs of hypocoagulation (increased whole-blood clotting time and increased activated partial thromboplastin time) were present in 18 cases (75%). Complete blood count results on admission were available in only 23 out of 31 cases; leukocytosis (neutrophilic in all cases) was present in 19 cases (82.6%). Myocardial damage confirmed by a positive high-sensitivity troponin test was reported in 14 cases (45.2%) of those with available data. No differences were observed between MI and TM.

Electrocardiographic (ECG) examinations. An ECG was not described in one clinical observation. An ECG described as unchanged was recorded in 2 cases (22.2%), both in the TM group. Significant T-wave changes were found in 8 patients (26.6%) out of 30, predominantly as T-wave inversion in the chest leads, occurring in both the MI and TM groups. In MI, ST-segment elevation was recorded in 17 cases (77.3%); among these, criterion ST-segment elevation was in the anterior leads in 9 cases (52.9%) and in the inferior leads in 8 cases (47.1%). Ventricular tachycardia was detected in 2 patients (9.1%), both with MI; one case of atrial fibrillation (11.1%) was noted in TM and one case of ventricular fibrillation (4.5%) in MI. Conduction disturbances — complete right bundle branch block (in MI) and complete left bundle branch block (in TM) — were registered in 2 cases (6.7%) out of 30. In one TM case, severe atrioventricular block occurred, requiring implantation of a permanent pacemaker (PPM).

Echocardiographic examinations. An echocardiogram (Echo) description was absent in 11 cases (35.5%) out of 31. Normal Echo parameters were found in 9 patients (45%) of the 20 with available data; among these, 6 patients (66.7%) had MI and 3 patients (33.3%) had TM; in one case from this group, no ECG changes were recorded either. In the remaining 11 cases (55%),

Table 3. Main clinical characteristics in the groups with myocardial infarction and toxic myocarditis

Parameters, M_e [Q_1; Q_3]	Myocardial infarctions	Toxic myocarditis	*p*-value
Age, years	42.5 [17; 74]	43.0 [14; 93]	0.663
Time to onset of anginal pain, hours	5.0 [0.3; 240]	–	–
HR, bpm	97.0 [56; 180]	69.5 [48; 146]	0.277
SBP, mmHg	100.0 [50; 155]	120.0 [120; 172]	0.0344
DBP, mmHg	60.0 [00.0; 90]	70.0 [60; 79]	0.537

Table compiled by the authors based on data from the sources [6–35]

Note. M_e [Q_1; Q_3] — median [25th; 75th percentile]; HR — heart rate; bpm — beats per minute; SBP — systolic blood pressure; DBP — diastolic blood pressure; "–" — no information available.

some changes were documented: local wall motion abnormalities were visualized in 9 cases (81.8%), and global hypokinesis was found in 2 cases (18.2%) of TM. Left ventricular ejection fraction (LVEF) was measured in 10 individuals; a reduction below 50% was detected in 4 cases (40%) of these 10. The median LVEF was 56.0 [40.0; 62.0]% for MI and 37.5 [30.0; 45.0]% for TM (p = 0.0858).

Instrumental examinations and revascularization. Cardiac magnetic resonance imaging (MRI) was reported in only 2 TM cases: both patients showed hyperintense signal on T2 mapping and late transmural enhancement. Coronary angiography was performed in 14 cases: in 12 cases (54.5%) of MI and in 2 cases (22.2%) of TM. In 8 cases (62.5% MI and 37.5% TM), the coronary arteries were intact; in 5 cases (100% MI), a large mural thrombus was visualized; and in 1 MI case (a 74-year-old patient), significant atherosclerotic coronary artery disease was found. Thromboaspiration and coronary stenting were performed in 4 cases (18.2%) of MI. Thrombolysis with reteplase and tenecteplase, respectively, was performed in 2 cases (11.8%) of ST-segment elevation MI. All patients who underwent revascularization survived.

Therapy and outcomes. 9 patients (40.9%) with MI received dual antiplatelet therapy. Antibiotic therapy was administered after the snake bite in 12 cases (38.7%) out of 31; beta-lactams were used in most cases. Blood component transfusion was required in 7 cases (22.6%) out of 31 to correct coagulation disorders and treat hemorrhagic and disseminated intravascular coagulation (DIC) syndrome. Hemodialysis was mentioned in two publications, both in MI cases (9.1%). 8 patients (25.8%) out of 31 experienced clinical death immediately after the snake bite or upon admission to the emergency department: 6 of these (27.3%) were MI patients (5 died, 1 survived) and 2 (22.2%) were TM patients (1 died, 1 survived). One patient with TM died during a prolonged hospital stay due to complications. Overall mortality was 22.7% for MI (5 out of 22 cases) and 22.2% for patients who developed TM (2 out of 9 cases). Polyvalent antivenom was used in the treatment of the majority of the deceased (57.1%).

Socio-economic aspects

According to the data of the Federal Center for Hygienic Education of the Population of Rospotrebnadzor, several thousand cases of venomous snake (viper) bites are recorded annually in the European part of Russia. Fatalities account for 0.3% of all bitten cases, with highly toxic bites of the blunt-nosed viper being the predominant cause of death[4]. The statistics on bites in Russia are obviously incomplete, taking into account cases where medical attention is not sought in rural areas, as well as the lack of data from the Asian part of the country. Extermination of snakes as a preventive measure is unacceptable: they regulate the number of rodents, which are vectors of dangerous zoonoses (hemorrhagic fever with renal syndrome, Q fever, tularemia, leishmaniasis, etc.). Moreover, snake venom is used in the treatment of epilepsy, Alzheimer's and Parkinson's diseases, arthritis, and certain forms of lupus [36].

Snake venoms can be used in the development of pharmaceuticals. Among the drugs that contain biologically active substances isolated from snake venom or their synthetic analogues are captopril, enalapril, eptifibatide, and tirofiban — cardiological drugs that have been actively used in clinical practice for decades. To date, less than 0.01% of the components of snake venoms have been identified and characterized, highlighting the significant potential for further research in this field [37].

[4] https://cgon.rospotrebnadzor.ru/naseleniyu/zdorovyy-obraz-zhizni/opasna-li-gadyuka/?ysclid=mq6d1qpz8324589318

At present, only one center for the targeted harvesting of snake venoms operates in Russia — the Novosibirsk Serpentarium (Siberian Herpetological Center)[5]. The production of the antidote (purified concentrated liquid equine antivenom against common adder venom) is also carried out by the only pharmaceutical company in the country — Scientific and Production Association "Microgen". It is known that the Tula ZooExotarium has one of the largest collections (about 500 species) of reptiles, and local herpetologists are successfully breeding snakes, including rare species, which is especially valuable because the venom of poorly studied snakes may contain fundamentally new components with unique properties[6].

Venom composition and its physiological effects

The composition of venom varies among different species depending on age, sex, prey availability, diet, geographic location, and other factors. Envenomation by *Viperidae* generally causes myotoxicity and hemotoxicity [38]. Viper venom has a complex, multicomponent composition, but the major components are PLA_2 25–65%; C-type lectin up to 26%; SP up to 29%; SVMP up to 16% [39, 40]. The largest number of specific effects affecting cardiac and vascular physiology have been described for PLA_2 [41], including stereotyped vasorelaxation [42]. It should be noted that structurally similar proteins lacking enzymatic activity may also possess cardiotoxic effects [43]. Depending on the specific toxin, the effect on the myocardium can vary widely, from a sustained increase in contraction strength to marked suppression, even contracture [44]. Circulatory insufficiency of myocardial fibers is often a result of the toxic effect of *Viperidae* venom. A recent Chinese study in 50 patients who suffered envenomation from a pit viper showed that global longitudinal strain of the left ventricular endocardium (GLSendo) is a highly sensitive and specific predictor for identifying high-risk patients with myocardial damage caused by a venomous snake bite, especially in combination with high-sensitivity troponin [45].

Cardiotoxicity

In this review, attention is drawn to a predominance of ST-segment elevation MI after a bite, with an approximately equal ratio between anterior and inferior lesion localization. Patients with a prior medical history did not differ in outcomes or severity of complications from patients without a prior medical history. SBP in MI was statistically significantly lower than in TM; this fact can be explained by more severe hemodynamic disturbances in MI and the more frequent occurrence of life-threatening arrhythmias. The median time from the bite to the onset of anginal pain in MI was 5 h, indicating a delayed rather than immediate development of the acute event. Neutrophilic leukocytosis after snake bites develops as a protective response of the body to the active components of the venom that cause tissue necrosis, inflammation, hemolysis, and general toxic effects. Coronary angiography in the context of developing MI or TM is performed in less than half of viper bite cases, which, in our opinion, is related to economic and logistical difficulties. In all MI cases, a fresh mural thrombus was visualized, confirming the hematotoxic nature of viper venom and its involvement in the pathogenesis of type 2 MI [6].

Overall mortality after viper bites is roughly similar in cases of developing MI and TM. In the majority of fatal cases, polyvalent antivenom was administered; therefore, questions arise regarding its efficacy. Different diagnostic systems are used for measuring the levels and types of troponin and creatine kinase-MB, making direct comparisons based on their absolute numerical values impossible. Extrapolating the information obtained to cases of common adder bites is difficult due to incomplete data. Further studies are needed, taking into account the existing differences in body weight of the bitten individuals, the volume (dose) of venom received, the seasonal variation in venom toxicity, and differences among snakes within the family.

CONCLUSION

Cardiovascular complications following viper bites are rare but can encompass a wide range of outcomes. In a small proportion of the cases we analyzed, cardiovascular manifestations led to serious consequences such as cardiac arrest, malignant ventricular arrhythmias, the need for pacemaker implantation, blood component transfusion, hemodialysis, and death, which may be related to the dose of viper venom received and the composition of its components. Regional health services in Russia should be aware of the potential severity of cardiovascular complications from viper bites and pay special attention to their rapid diagnosis and treatment. The management algorithm, specific treatment features for this group of patients, the justification for having an antidote, and its availability on the territory of Russia — all these are questions for future research.

[5] http://www.sibserpent.ru
[5] https://www.tulazoo.ru/nauka.html

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