DIAGNOSIS OF ALCOHOL INTOXICATION IN VICTIMS OF EMERGENCIES

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Relevance. In the case of death from injury, the question of whether the victim was intoxicated and to what extent, as the presence of alcohol intoxication could have affected the thanatogenesis of death is important. A reliable method of determining the concentration of ethanol in the body is its study in the blood, urine, and cerebrospinal fluid. But in extreme conditions, in large-scale disasters, during military conflicts, there may be difficulties in the selection, storage, transportation, and research of biological fluids. Therefore, the search for reliable non-invasive rapid methods is relevant.

Objective is the development of a set of criteria for improving the accuracy of detecting the presence of ethanol and determining its amount in deaths due to trauma in emergencies by non-invasive rapid methods.

Materials and methods. Review of scientific publications in international electronic scientometric databases PubMed, Embase, and Scopus by keywords. Search depth - 10 years (2008-2018). Comparison of literature data with the results of own research on the possibility of diagnosing alcohol intoxication to detect the presence and determination of ethanol in biological fluids (saliva, blood, urine) of persons who died and died in emergencies by indicative and evidentiary methods.

Results. The possibility of using the non-invasive express method (indicator test strips) as a guide to detecting the presence and quantification of ethanol in the saliva of deaths and deaths from injuries in emergencies, conflicts, in the absence of the necessary conditions for blood storage and urine (lack of power supply, the impossibility of freezing objects, storage, destruction of objects during transportation, etc.) was described. It is proved that the average result of the quantitative content of ethanol in blood and urine, found in the evidence-based method of research (gas-liquid chromatography), coincides and confirms the result obtained by us in conducting a non-invasive rapid method using indicator test strips. In the course of the conducted researches, the conformity concerning objectivity and correctness of detection of the presence and quantitative content of ethyl alcohol with the use of indicator test strips which is confirmed by researches of blood, urine by evidential methods (gas-liquid chromatography) is proved.

Conclusion. A non-invasive rapid method (indicator test strips) can be used as a guide to detect the presence of ethyl alcohol and determine its quantitative content in the saliva of the dead and deceased, with subsequent confirmation by evidence-based methods of research (gas-liquid chromatography) of blood, urine.

Keywords: diagnosis, alcohol intoxication, ethyl alcohol, test strips, gas-liquid chromatography, dynamics, trauma, mortality.

Relevance. Recently, special attention has been paid to the study of traumatic changes that occur in the human body due to the constant increase in the number of man-made disasters, military conflicts, emergencies, industrial and domestic injuries, traffic accidents. The number of deaths and injuries continues to increase every day, so the nature, mechanism, duration of injuries, the presence and impact of alcohol intoxication, development of measures to reduce injuries, provide timely medical care, improve diagnosis, treatment, and prevention of injuries is relevant [1]. It should be noted that in cases of death from injuries, for law enforcement agencies and insurance companies it is often important to ask whether the victim was intoxicated and to what extent, as the presence of alcohol intoxication could affect the thanatogenesis of death., etc. [3-7]. In the literature, much attention has always been paid to the effects of alcohol on the body, especially in injuries. It is proved that a reliable method for determining the concentration of ethyl alcohol in

the body is its study in blood, urine, and cerebrospinal fluid. But quite often in emergency conditions, at large-scale catastrophes, during military conflicts there are difficulties at selection, storage, transportation, and research of biological liquids. These difficulties arise due to limited technical equipment of laboratories, lack of power supply, the impossibility of freezing objects, destruction during transportation [2]. In the injured, indicative methods can be used to detect the presence of alcohol intoxication and its degree: breathalyzers to determine the alcohol content in the exhaled air; indicator test strips for measuring the content of ethyl alcohol in human saliva and urine, etc., with which you can perform a rapid analysis.

The objective of this work was to develop a set of criteria to improve the accuracy of detecting the presence of ethyl alcohol and determine its quantitative content in the dead and deceased due to trauma in emergencies by non-invasive rapid methods.

MATERIAL AND METHODS

The material of the study was biological fluids (saliva, blood, urine) of 32 of males and females, aged 20 to 60 years, who died from injuries and were dissected in the thanatopsy department of the Bureau of Forensic Medicine of Luhansk region. To determine the amount of ethyl alcohol were used: indicator test strips (in the study of saliva), the method of gas-liquid chromatography (in the study of blood and urine), followed by statistical analysis of the results. The anamnestic data, data on the mechanism of an injury, and circumstances of its reception were considered, in the present medical documentation, results of laboratory researches were studied, and also results of section research of a corpse were considered.

The method using indicator strips has a high sensitivity to the primary alcohols in the biological fluid, namely: ethanol, propanol, methanol. The method with the detection of ethanol content in the saliva is based on a highly specific enzymatic reaction of oxidation of primary alcohols to aldehyde and hydrogen peroxide. Due to the action of hydrogen peroxide in the presence of the enzyme peroxidase, the chromogen is oxidized, resulting in the formation of a colored compound. The degree of color is proportional to the alcohol content in saliva.

To determine the alcohol in the saliva of the deceased, a test strip was inserted into the oral cavity of the deceased so that the sensory part of the strip was completely immersed in saliva; after 10 s (using a stopwatch), the strip was removed from the oral cavity and cleaned of excess saliva on the sensory part. Then the strip was placed on a clean dry and flat surface so that the touch part was on top. After two minutes, evaluated the degree of the color of the sensor element and determine the concentration of ethanol on the color scale, which is on the package with insufficient light.

For the semi-quantitative determination of ethanol in saliva, the color of the indicator part was compared with the corresponding color field of the color scale. There are five color areas that correspond to the following ethanol concentration: yellow - 0.0%; light green - 0.02% (or 0.2 ‰); lime - 0.05% (0.5 ‰); green - 0.1% (1 ‰); dark green - 0.2% (2 ‰).

If the color changed only the outer boundaries of the sensor part, and the color of the Central part did not change, the test was repeated.

To confirm the reliability of the result, studies were performed to detect and quantify ethanol in blood and urine according to the generally accepted method on a gas chromatograph «Chromatek-Crystal 5000.2». To do this, after conversion of ethanol and other aliphatic alcohols into lighter compounds - alkyl nitrites - by reacting alcohols with sodium nitrite and trichloroacetic (THO) acid, which are separated, depending on the polarity and boiling point, on a chromatographic column filled with solid support with the applied liquid phase at a certain constant temperature, and eluted with an inert carrier gas at a certain flow rate into the detector, the signal of which is amplified and recorded in the form of

a chromatogram with peaks. Each peak corresponds to the absolute retention time of a particular component, which is pre-determined when setting the calibration characteristics. The calculation of the amount of ethanol is performed by the method of internal standard, which uses isopropanol or n-propanol. In this case, the areas or heights of the ethyl nitrite peaks and the internal standard are measured automatically, and using the coefficients previously calculated during the calibration by the method of least squares, the concentration of ethyl alcohol in the biological fluid (blood, urine) is calculated. The heights or areas of the peaks are measured in units of the response of the detector, in this case - millivolts for the height of the peak, and the ratio of height to width at half height - for the area of the peak.

The work was carried out in accordance with the requirements of the «Instruction on forensic examination» (order of the Ministry of Health of Ukraine № 6 from 17.01.1995), in accordance with the requirements and norms, standard regulations on ethics of the Ministry of Health of Ukraine № 690 from 23.09.2009, «The procedure for removing biological objects from the dead, the bodies of which are subject to forensic examination and pathological examination, for scientific purposes (2018)».

RESULTS AND DISCUSSION

Compliance with the objectivity and correctness of detection of the presence and quantitative content of ethyl alcohol using the semi-quantitative method (indicator test strips) is confirmed by blood and urine tests by evidence-based methods (gas-liquid chromatography).

Let's show it by example. M.'s husband, 36, died. When examining saliva with an indicator test strip, the color of the strip changed to a greenish color, which corresponded to an ethanol concentration of 0.1%, or 1 ‰, (Fig. 1, A), which indicates a slight degree of alcohol intoxication. When using the evidence-based method (gas-liquid chromatography), the average result of the quantitative content of ethanol in the blood was 0.95% (average value with a deviation of not more than 5%) (Fig. 1, B). At the research of urine gr. M. by gas-liquid chromatography revealed an average result of ethanol content in urine of 1.48% (average value with a deviation of not more than 5%) (Fig. 1, B).

Thus, the detected average result of the quantitative content of ethanol in the blood was 0.95% in a patient M, was detected in the evidence-based method of research (gas-liquid chromatography) the content of ethyl alcohol confirms the result obtained by us when conducting a non-invasive rapid method using indicator test strips, which revealed the presence of alcohol and quantitative content corresponding to mild alcohol intoxication.

The average result of the quantitative content of ethanol, which in urine is 1.48 ‰ was detected by the evidence-based method of research (gas-liquid chromatography), and the content of ethyl alcohol was detected by the method of gas-liquid chromatography

Fig. 1. The content of ethanol in different biological fluids in casualty M., determined in different ways:

- A. In saliva, according to the indicator test strip – 0,1 %.
- Б. In the blood, according to gas-liquid chromatography – 0,95 %.
- В. In urine, according to gas-liquid chromatography – 1,48 %.

in the blood - 0.95 % in a patient M; as well as when conducting a non-invasive rapid method using indicator test strips, was detected the presence of alcohol and quantitative content, which corresponded to a mild degree of alcohol intoxication, in which the concentration of alcohol is from 0.5 % to 1.49 %.

The obtained research results show that our data coincide with the literature on the possibility of detecting and quantifying the method of ethyl alcohol in saliva by an indicative method using indicator test strips and evidence-based methods for living persons as a rapid diagnosis to determine the presence and degree of alcoholism as well as in persons with traumatic injuries, but it should be noted that we have for the first time demonstrated the possibility of using non-invasive methods in the study of the saliva of the dead [1, 2].

CONCLUSION

Demonstrated the possibility of using non-invasive rapid methods (indicator test strips to detect the presence of

ethyl alcohol and determine its quantitative content in the saliva of casualty and deaths from injuries in emergencies, conflicts in the absence of necessary conditions for blood and urine storage) freezing of objects, storage, destruction of objects during transportation, etc.). Correspondence with the objectivity and correctness of detection of the presence and quantitative content of ethyl alcohol using indicator test strips confirmed by blood and urine tests (gas-liquid chromatography). It is shown that the average result of the quantitative content of ethanol in the blood, found in the evidence-based method of research (gas-liquid chromatography) coincides and confirms the result obtained by a non-invasive rapid method using indicator test strips, which revealed the presence of alcohol and content, which corresponded to a mild degree of alcohol intoxication in the dead and deceased in the presence of traumatic injuries.

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ДІАГНОСТИКА АЛКОГОЛЬНОГО СП'ЯНІННЯ У ЗАГИБЛИХ ПРИ НАДЗВИЧАЙНИХ СИТУАЦІЯХ

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Актуальність. У випадках смерті від травм важливе значення має питання, чи знаходився загиблий в стані алкогольного сп'яніння і якого ступеню, як наявність алкогольного сп'яніння могла вплинути на танатогенез смерті. Достовірним методом визначення концентрації етанолу в організмі є його дослідження в крові, сечі та лікворі. Але в надзвичайних умовах, при масштабних катастрофах, під час військових конфліктів можуть виникати труднощі при відборі, збереженні, транспортуванні і дослідженні біологічних рідин. Тому актуальним є пошук надійних неінвазивних експрес-методів.

Мета. Розробка комплексу критеріїв підвищення точності виявлення наявності етанолу та визначення його кількості у померлих внаслідок травми в умовах надзвичайних станів неінвазивними експрес-методами.

Матеріали та методи. Огляд наукових публікацій в міжнародних електронних наукометричних базах даних PubMed, Embase і Scopus за ключовими словами. Глибина пошуку – 10 років (2008-2018 рр). Співставлення літературних даних з результатами власних досліджень, про можливість діагностики алкогольного сп'яніння по виявленню наявності і визначенню кількості етанолу в біологічних рідинах (слина, кров, сеча) осіб, померлих та загиблих в умовах надзвичайних ситуацій, орієнтовними і доказовими методами.

Результати. Продемонстрована і наведена можливість використання неінвазивного експрес-методу (індикаторних тест-смужок), як орієнтовного, для виявлення факту наявності та визначення кількісного вмісту етанолу в слині померлих та загиблих від травм в умовах надзвичайних станів, конфліктів, при відсутності необхідних умов для зберігання крові і сечі (відсутність електропостачання, неможливість заморозки об'єктів, зберігання, руйнування об'єктів під час транспортування, тощо). Доведено, що середній результат кількісного вмісту етанолу в крові і сечі, виявлений при проведенні доказового методу дослідження (газо-рідинної хроматографії), співпадає і підтверджує результат, отриманий нами при проведенні неінвазивного експрес-методу з використання індикаторних тест-смужок. В ході проведених досліджень доведена відповідність щодо об'єктивності і правильності виявлення наявності і кількісного вмісту етилового спирту з використанням індикаторних тест-смужок, яка підтверджена дослідженнями крові, сечі доказовими методами (газо-рідинної хроматографії).

Висновок. Неінвазивний експрес-метод (індикаторні тест-смужки) може бути використаний, як орієнтовний, для виявлення факту наявності етилового спирту та визначення його кількісного вмісту в слині померлих і загиблих, з подальшим підтвердженням доказовими методами дослідження (газо-рідинної хроматографії) крові, сечі.

Ключові слова: діагностика, алкогольна інтоксикація, етиловий спирт, тест-смужки, газо-рідинна хроматографія, динаміка, травма, смертність.

ДИАГНОСТИКА АЛКОГОЛЬНОГО ОПЬЯНЕНИЯ У ПОГИБШИХ ПРИ ЧРЕЗВЫЧАЙНЫХ СИТУАЦИЯХ

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Актуальность. В случаях смерти от травм важное значение имеет вопрос, находился ли погибший в состоянии алкогольного опьянения и какой степени, как наличие алкогольного опьянения могло повлиять на танатогенез смерти. Достоверным методом определения концентрации этанола в организме является его исследования в крови, моче и ликворе. Но в чрезвычайных условиях, при масштабных катастрофах, во время военных конфликтов могут возникать трудности при отборе, хранении, транспортировке и исследовании биологических жидкостей. Поэтому актуальным является поиск надежных неинвазивных экспресс-методов.

Цель. Разработка комплекса критериев повышения точности выявления наличия этанола и определения его количества у умерших вследствие травмы в условиях чрезвычайных ситуаций неинвазивными экспресс-методами.

Материалы и методы. Обзор научных публикаций в международных электронных наукометрических базах данных PubMed, Embase и Scopus по ключевым словам. Глубина поиска - 10 лет (2008-2018 гг). Сопоставление литературных данных с результатами собственных исследований, о возможности диагностики алкогольного опьянения по выявлению наличия и определению количества этанола в биологических жидкостях (слюна, кровь, моча) лиц, умерших и погибших в условиях чрезвычайных ситуаций, ориентировочными и доказательными методами.

Результаты. Продемонстрирована и приведена возможность использования неинвазивного экспресс-метода (индикаторных тест-полосок), как ориентировочного, для выявления факта наличия и определения количественного содержания этанола в слюне умерших и погибших от травм в условиях чрезвычайных положений, конфликтов, при отсутствии необходимых условий для хранения крови и мочи (отсутствие электроснабжения, невозможность заморозки объектов, хранения, разрушения объектов во время транспортировки и т.д.). Доказано, что средний результат количественного содержания этанола в крови и моче, обнаруженный при проведении доказательного метода исследования (газо-жидкостной хроматографии), совпадает и подтверждает результат, полученный нами при проведении неинвазивного экспресс-метода при использовании индикаторных тест-полосок. В ходе проведенных исследований доказано соответствие объективности и правильности выявления наличия и количественного содержания этилового спирта с использованием индикаторных тест-полосок, подтвержденное исследованиями крови, мочи доказательными методами (газо-жидкостной хроматографии).

Вывод. Неинвазивный экспресс-метод (индикаторные тест-полоски) может быть использован, как ориентировочный, для выявления факта наличия этилового спирта и определения его количественного содержания в слюне умерших и погибших, с последующим подтверждением доказательными методами исследования (газо-жидкостной хроматографии) крови, мочи.

Ключевые слова: диагностика, алкогольная интоксикация, этиловый спирт, тест-полоски, газо-жидкостная хроматография, динамика, травма, смертность.