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Croatian Medical Association

10th INTERNATIONAL MEETING ON FORENSIC MEDICINE ALPE-ADRIA-PANNONIA

Proceedings

Opatija, Croatia
23-26 May, 2001

ORGANIZATION OF TEAMS IN A MASS DISASTER IDENTIFICATION

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One of the tasks in a forensic medicine routine is identification in a mass disaster. In such identification teams, except forensic medicine experts have to be included investigation court team and crime investigation team from Ministry of Internal Affair, as a objective for a well and on time done identification. The identification team has to start from the first moment of the appearance on the place of the accident. In this paper we are explaining the profile and organization of forensic medicine: the number of persons, their profile, depending on their skill and experience in identification methods.

INTRODUCTION

Identification in a mass disaster is hard task, not only for the forensic medicine expert, but for all members in the team involved in the process of the identification procedure.

The aim of this paper is to provide a review of the manner of organization and accomplishing the identification procedure in cases of mass accidents except the methods of identification which are well known and described in every forensic medicine book.

The successful organizing and accomplishing the identification procedure of the mass accidents victims depends on the following conditions:

- inspection of the place of accident and providing the right evaluation and analyses
- organization of the searching service, collecting and transport of killed persons from the place of accident to the place where they should be identified
- providing complete information for the victims, such as the number, the sex and other features
- providing the space for accomplishing of the identification procedure and the space for work of the identification teams
- providing conditions and room where identification teams will work

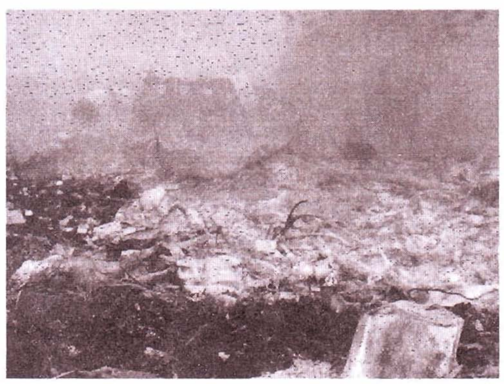
- organization of the identification teams, their number, qualification structure as well as the experience of the members in the teams
- coordination between identification teams, database and parties
- technical equipment of the identification teams

ORGANIZATION, STRUCTURE AND TASKS OF THE OPERATIONAL STAFF

Based on the last experiences from the already accomplished identification of victims in mass accidents, we know that for successful accomplishing of the identification procedure it is necessary to form an operational staff led by judge on duty for investigation which consist of other representatives such as the Professor of the Forensic Medicine Institute, representative from the Ministry of internal affairs, representative from the Criminalistic Technical Office, representative from the Ministry Transport and the representative from the Macedonian Army.

The tasks of this Operational staff that have to be solved are the following:

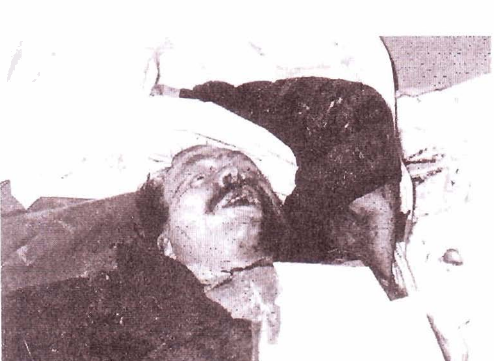
- inspection the place of accident, right evaluation and analyses of the accident



- security of the place of accident, provided by the representatives of the Ministry of internal affairs and the Macedonian Army
- establishing the approximate number of killed persons

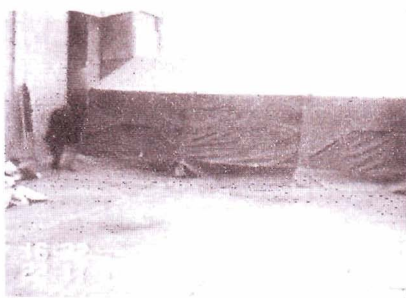
- getting the agenda of the exact number of killed persons
- establishing the manner of searching, withdrawing, collecting and transport of corpses and the parts of corpses to the place where they are to be identify

- marking with numbers the victims according to determinate procedure and define documents



- providing the necessary equipment for accomplishing of the identification procedure
- determination of profiles which would take part in the identification teams, the number and their equipment
- providing conditions and space for the work of the identification teams such as:

a) space for the corpses, so as the space for every corpse to be 4 square meters in order to make easier the manipulation with the corpses
b) space for laboratory and criminalistic analyses (dactiloscopy, space for biological traces and toxicology)
c) space for interview of the family members of killed persons who can provide the teams with useful facts, such as description of clothes, personal things, documents and personal characteristics (anomalies, injuries, diseases, special conditions and so on)



d) space for lodging the clothes and personal documents found by corpses and exposing them to the family members for recognition and making records for every recognized subject

- providing space for the daily break for the teams
- providing lodging for the teams
- defining the methods applied in the process of the identification procedure
- giving the identified persons to their families and providing their funeral

ORGANIZATION OF THE IDENTIFICATION TEAMS, IDENTIFICATION BASE

One of the targets of the operational staff is the organization of the teams which are to be involved in accomplishing of the identification procedure.

Every identification team should involve profiles as following :

- forensic medicine specialist as the leader of the team
- criminalistic technician
- photographer
- administrative clerk
- dactilograph
- dentist, biologist and toxicologist if is needed
- autopsy assistant

In order to provide fast and efficient work of the identification teams in the identification base, the process of identification should be accomplished by certain sequence, devided by following steps:

- general inspection of corpse or its parts and taking their photographs
- forming a file for every corpse which has been previously marked in number
- inspection of the clothes, personal things and documents with detailed description, put in separate bag marked with the same number as the file
- external inspection of corpses
- photographing and recording of every single corpse and parts of the corpses
- dactiloscoping, taking traces of fingers of every corpse and parts of corpses, i.e. torn palms
- if the identification is not possible considering above described ways, examination of forensic medical expert is necessary in order to establish the age, sex, height and the cause of death,

The work of every team involved in the process of identification procedure should be separated and independent from each other, and after the finished work, the results should be compared and the success of the identification procedure is measured on the basis of correspondence of the final facts.

In our last experiences as the result of the good collaboration between identification teams, successfully were accomplished the identification in the following cases:

1. The victims in plane crash in July 23 rd 1992 near Titov Veles in which were identificated 8 persons. The identification procedure was finished in three days

2. In plane crash on the airport "Petrovec", near Skopje, on the fifth of March, 1993 with total number of 91 passengers and 6 members of the equipment, 83 passengers lost their lives and the same were identificated. Identification procedure was finished in five days.

3. The plain crash near Ohrid, on the 20 th of November 1993, total number of 108 passengers and 8 members of equipment, 107 persons

are identificated, while one of them injured died in hospital. Identification procedure was finished in ten days.

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SOFTWARE DETERMINATION OF THE ENTRANCE ANGLE OF A GUNSHOT WOUND

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ABSTRACT

Objective: The objective of the paper is to determine the entrance angle of the gunshot wound by an external examination of the victim's body as well as to determine the length of the channel in the body that has been caused by the bullet.
Tools of analysis: Observations used for the preparation of this paper are gunshot wounds that have been analyzed during autopsies and court cases in the period 1998-2000 at the Institute of Forensic medicine and criminology in Skopje.
Methodology: We used forensico-medical findings regarding the characteristics of the gunshot wounds, as well as mathematical dependencies between coordinates of the entrance and exit wound to prepare the paper. The mathematical dependencies were extracted through a software program for two and three-dimensional determination of the entrance angle of the gunshot wound.
Results: Through the use of the software program we could determine the entrance angle of the gunshot wounds in relation to the horizontal and vertical plateau of the body in degrees, minutes and seconds. We also used the software program to determine the length of the channel wound.
Conclusion: In forensico-medical practice the use of this software program could determine the entrance angle of gunshot wounds, in relation to the horizontal and vertical plateaus of the body as well as the length of the channel very quickly and easily, which facilitates the job of the forensic expert.

Key words: entrance angle, gunshot wound, and software program

Objective

The objective of the paper is to determine the entrance angle of the gunshot wound by an external examination of the victim's body as well as to determine the length of the channel in the body that has been caused by the bullet.

Tools of analysis

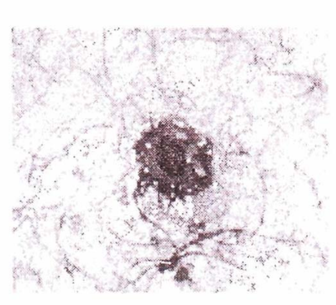
Observations used for the preparation of this paper are gunshot wounds that have been analyzed during autopsies and court cases in the period 1998-2000 at the Institute of Forensic medicine and criminology in Skopje.

Methodology

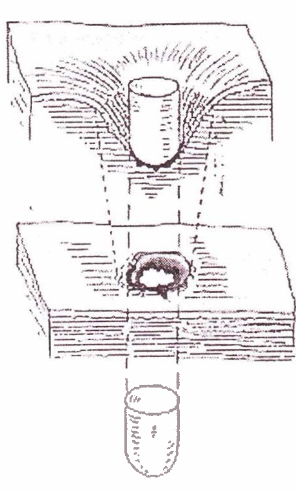
We used forensico-medical findings regarding the characteristics of the gunshot wounds, as well as mathematical dependencies between coordinates of the entrance and exit wound to prepare the paper. The mathematical dependencies were extracted through a software program for two and three-dimensional determination of the entrance angle of the gunshot wound.

From a forensico-medical perspective the gunshot wounds are analyzed in relation to the specific characteristics of the entrance, exit wound, and the channel though the victim's body. Depending on the angle through which the bullet entered the body i.e. whether it was through a sharp or straight angle, the following differences could be drawn:

- In gunshot wounds where the entrance of the bullet was perpendicular to the skin, in most cases, it produced a concentric abrasion ring, concentric hole, with a uniform punched-in margin. (Picture 1 and 2),

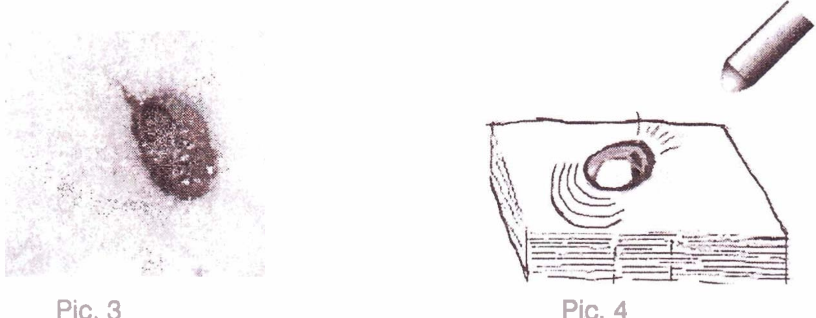


Pic. 1



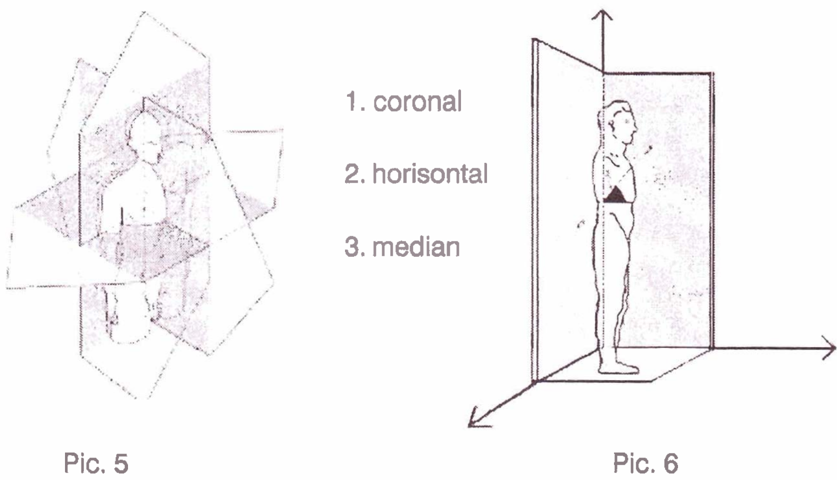
Pic. 2

- If the bullet penetrates the skin at an oblique angle, the zone of abrasion on the skin is eccentric, with the zone wider on the side from where the bullet entered, and the hole is oval or elliptical. Margins are punched-in on the side from where the bullet entered (Pictures 3 and 4).



Pic. 3 Pic. 4

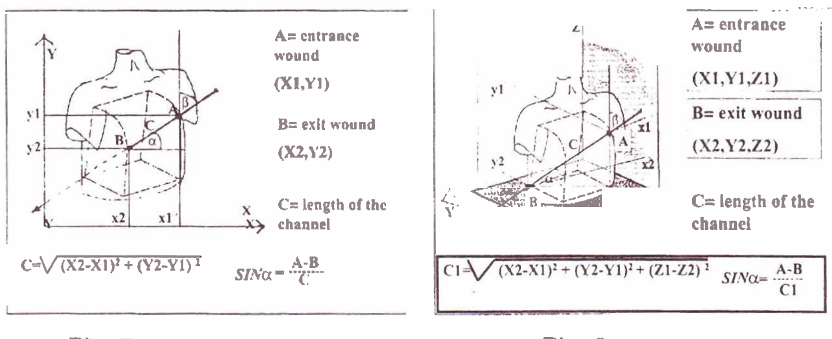
In order to determine the angle of the gunshot wound, we used mathematical dependencies between coordinates of entrance and exit wounds, which were measured in three levels (horizontal, median and coronal) pic. 5. The measurements results are plotted on the coordinate system (Picture 6).



Pic. 5 Pic. 6

Depending whether the bullet penetrates inside the flesh or makes subcutaneous wound, the entrance angle of the gunshot wound could be expressed in a two or three-dimensional coordinate system. In the two-

dimensional measurement of the gunshot wounds, when the bullet passes through the skin or the subcutaneous tissue, the measurements for the entrance and exit wound are analyzed in two plateaus, horizontal and coronal (Picture 7). In the three dimensional measurement of the gunshot wounds, when the bullet passes through the body's flesh the measurements of the entrance and exit wound are analyzed in three plateaus, horizontal, coronal and median (Picture 8). The objective of plotting the data on a coordinate system is to determine the length of the channel. For two-dimensional measurement of the channel the following formula was used $C=\sqrt{(x2-x1)^2+(y2-y1)^2}$, while for three dimensional measurement the formula is $C=\sqrt{(x2-x1)^2+(y2-y1)^2+(z2-z1)^2}$. Once we have measured the height of the enter and exit wounds, and we have determined the length of the channel, we calculated the entrance angle of the gunshot wound through the following formula sina=A-B/C.



Pic. 7

Pic. 8

Once we derived the mathematical calculations, we used the expertise of the specialists from the Technological & Metalurgical Faculty in order to develop a software program that uses Delphi for its graphical interface and MATHCAD for its mathematical ability. We entered the data for enter and exit wounds from the coordinate system in the software program which is capable of calculating the length of the channel as well as entrance angle of the gunshot wound in relation to the horizontal and vertical plateau of the body.

Results

Through the use of the software program we could determine the entrance angle of the gunshot wounds in relation to the horizontal and

vertical plateau of the body in degrees, minutes and seconds. We also used the software program to determine the length of the channel wound.

Conclusion:

In forensico-medical practice the use of this software program could determine the entrance angle of gunshot wounds, in relation to the horizontal and vertical plateaus of the body as well as the length of the channel very quickly and easily, which facilitates the job of the forensic expert.

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COMPARATIVE ANALYSIS OF STRANGULATIONAL ASPHIXIA INJURIES - - EXPERIENCES BASED ON CASES IN MACEDONIA IN THE PERIOD FROM 1999-2000

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ABSTRACT

Asphyxia injuries and strangulation asphyxia in particular, represent an important part of forensic traumatology. A lot has been said about them and in spite of all their complexity, they remain a typically forensic field of study. Therefore, they are inevitable both in the practice and the education of every forensic expert, in all the stages of their professional development. The aim of this paper is to summarize and analyze empirically obtained data during autopsies of strangulation asphyxia. It aims on one hand to compare data regarding separate types of strangulation asphyxia; and to discuss their correspondence with the established scientific views and expectations of this type of injuries on the other hand. Fifteen cases of death by strangulation asphyxia were analyzed, the forensic examination of which was conducted by the Skopje Institute of Forensic Medicine and Criminalistics in the period from 1999-2000. The principal method that was used, was the special autopsy technique of stratum-by-stratum preparation of the neck organs. Supplementary analyses from the common forensic practice have also been carried out. The results indicated significant differences among the various strangulation asphyxia injuries in terms of the autopsy findings, general and local, as well as the criminal-law character of the event when they occurred.

INTRODUCTION

Asphyxia injuries and strangulation asphyxia inparticular, represent an important part of forensic traumatology. A lot has been said about them and in spite of all their complexity, they remain a typically forensic field of study. Therefore, they are inevitable both in the practice and the education of every forensic expert, in all the stages of their professional development.

Asphyxia is a pathophysiological term that denotes a disorder or termination of the process of gas-exchange, which results in lack of oxygen - hypoxia or anoxia, and accumulation of one's own carbon dioxide in the body - hypercapnia. For the process of breathing to proceed normally, several things are considered essential: normal structure of the breathing air, proper functioning of the respiratory brain centre, passableness of the bronchial tubes, proper blood structure and normal tissue condition.

Obstructions and disorders can appear in any of the previously mentioned parts of the respiratory function causing asphyxia. If the reason for asphixiation is a disease, we deal with natural asphyxia. If the respiratory disorder is caused by a deadly or non-deadly violent influence of noxious agents (physical, chemical or mechanical), such a breathing disorder represents a violent asphyxia = asphyxia violenta.

In the mechanism of the deadly or non-deadly strangulation asphyxia injuries caused by squeezing of the neck, asphyxia is not the only occurring phenomenon. There are two more, equally important mechanisms: interruption of the brain blood circulation and shock due to the stimulation of the vegetative nervous system receptors. Precisely because of that, some authors distinguish between asphyxia injuries caused by respiratory disorders only, and those caused by a combined influence of the previously mentioned mechanisms.

This retrospective study displays only precise and empirically obtained data during autopsies of strangulation asphyxia. Thus, these data can be summarized, analyzed and compared: on one hand, regarding separate types of strangulation asphyxia; and on the other hand, discussing their correspondence with the established scientific views and expectations of this type of injuries in terms of autopsy findings, general and local, as well as sex, age, psycho-sociological status and the criminal-law character of the acts when they occurred.

MATERIALS AND METHODS

Fifteen cases of death by strangulation asphyxia were analyzed, the forensic examination of which was conducted by the Skopje Institute of Forensic Medicine and Criminalistics in the period from 1999-2000. The principal method that was used was the special autopsy technique of stratum-by-stratum preparation of the neck organs. Supplementary analyses from the common forensic practice have also been carried out.

RESULTS AND DISSCUTION

Comparative analysis of different kinds of stranugulational asphyxias by age, male, psychological status of a person and criminal-law character of the acts

Table No 1.

	Strangulatio manulais	Strangulatio funalis	Suspensio
A total of 15 cases	1	1	13
The criminal – law character	homicide of passion	infanticide	suicide
Age	38	neonatorum	1 – 20year. - 0 20 – 40year. - 5 40 – 60year. - 4 60 – 80year. - 4
Male	m.	m.	m. - 8 f - 5
Origin	victim – from city murderer–by velage	found in a vilage	7 – from vilage 4 – from city 2 – in the institutions (preason and hospital)
Psycho - sociological character of a person	victim intellectual, rich, homosexual, murdered in a try of sexual abuse of a young male murderer low education	infanticide	5 – Persons with psychyatric dyagnosis. 3 - socio-economic reasons: left from a wife and their 4 children; preasoner; coming back from abroad etc. 1 – strong pains in his spine the last year before, autopsy occurred fracture of a C-VII 1 – under alchocol 3 – persons who commited suicide quite, without sending a word, no lettters. They were all female in menopause.

- Male who had commited suicide by hanging were with different age: 23; 27; 28; 34; 47; 50; 52 and 62 years old. From a cases of female commited a suicide by hanging, just in one case an female was under 40 year old, and the other 4 ware above 45 years age, in postmenopausal period in fact.
- At a 4 cases of postmenopausal period female, a commitment of suicide is done quitely, without sending a word and without any obvious and for family known reasons.

- Higher incidence of hanging is correlated with male and people from rural.

Common finding – signs of asphyxiation, comparative analysis of investigated cases

Table No 2.

	strangulatio manualis	strangulatio funalis	suspensio
cyanosis (in a facial and neck area)	+ expressive	+	7 + 6 -
petechyal haemorrhages	+ facial and periorbital region	+ frontal region	5 + 8 -
ecchymoses subconjuctivales	+	- hyperemia	2 + 9 - paleness 2 - hyperemia
ecchymoses under serotic membranes	+ subpleurae + subepikardii	+ subpleurae + subepicardii	10 + , 3-, subplaurae 6+, 7- subepikardii 1+ subpericardii
acut tense of a lungs	+	+	11 + 2 -
liquid state of a dark red blood in a blood vessels	+	+	13 +

- The most usual finding of common signs of asphyxiation are: blood vessels filled with dark red blood in a liquid state and ecchymoses subpleurales.

  In a half of a cases was noted cyanosis; pethechyal haemorrhages and ecchymoses subepikardii.

- The most seldom finding are ecchymoses subconjunctivae.

Specific findings in a exterior appearance of a Suspension

Table No. 3

Semiopened mouth and a tongue bitten	8 + → 2 - bitten; 4 - out; 2 – just lookable from a mouth 5 /
Distribution of a livores mortis	Acording the time: down- 5 back and down - 4 back - 4
Agonal deterioration of a sphincters	5 + → sperm 3; feces 2; urine 0 8 /

Local pathologic finding in a asphyxiation injuries

Table No. 4.

	Strangulatio manualis	Strangulatio funalis	Suspensio
Pathologic finding on a skin	Bruises, hematomes and contusions. Signs of a fight.	Sulcus strangulationis	Sulcus suspensionis furrow - 10 band - 0 furrow + band -3
Internal neck soft tissue injuries	Hematomes and contusion on a subcutaneous tissue, muscles, glands and tyroid gland	Hematomes of the muscles esspecialy in the location of the ligature	Hematomes of a neck muscles-2 Hematoma in a thyroid gland- 1 No changes - 10
Hyoid bone	Multyphragmentary fractures	------------------	Fractures - 2 Hematoma in a surrounding soft tissues- 3 No changes - 10
Cartilagines of a throat	Fracturae of a thyroid cartilage, cricoid cartilage and tracheal cartilagines on meny places with hematomas	------------------	1-fracture of the cricoid cartilage 2 – haemorrhages in a surrounding soft tissues 10 – no changes
Pathologic finding on a big blood vessels in the neck region	Haemorrhages of a surrounding soft tissues	-------------------	Hematomes of the adventitija and ruptures of the intima - 8 No changes - 5

- The most expressive finding on a skin, subcutaneous tissue, muscles, soft neck tissues, glands, cartilagines and the hyoid bone, were registrated in Strangulatio manualis. Signs of a fight were noted.
- At the case of Strangulatio funalis an characteristic track of a strangulationem was found and a haemorrhages in the muscles under the track.

- In a total of 13 cases of suspension, in a 10 of them, the track of a suspension was formed as a furrow, in the same number of cases was single track and tipical, even though it is strong correlated with the characteristics of a ligature.

Internal pathologic finding in asphixiation injuries

Table No 5.

	Strangulatio manulais	Strangulatio funalis	Suspensio
Galea	Hematomes	Hematomes by birth	paleness - 6 hyperemia - 7
Brain	Haemorrhagia subarachnoidalis, oedema at contusiones	light swelling	no swelling - 6 light swelling - 6 oedema - 1
Beli drobovi	Oedema et aspiraciones sanguinis	----------	oedema - 7 no oedema - 6 filled blood vessels
Bubrezi	paleness	normal	12 – dark violet 1 - normal
Pancreas	----------	----------	5 - Haemorrhagia interlobularis 1 - Hyperemio interlobularis 7 – no changes
Stomach	----------	----------	6 - Haemorrhagiones submucosae 8 – No changes

INSTEAD OF CONCLUSION

The discussions concerning the tables that display our results can not be qualified as conclusions. A series of 15 cases is too small to draw general conclusions. This paper is a kind of a pilot-study of a wider research that will be the subject of an MS thesis.

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COMPARISON OF ALGORITHMS FOR TIME ESTIMATION SINCE DEATH

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1. INTRODUCTION

In the forensic medicine expertise the time of death is an issue of special interest in many cases after finding the body of the diseased. Preciseness of the answer is substantial for the reconstruction and clarification of the circumstances, especially in cases of an un-witnessed murder done by unknown killer, car-hit casualties with lethal result where the driver escaped from the scene of event and many other situations.

The estimate of the time since death, after the first 48 hours (the so called early postmortem period) is determined by routine applying conventional methods of corpse examination and detecting the development of postmortem changes. Due to the big variations in time of occurrence and duration of such corpse changes, influenced by many endogenous and exogenous factors, it allows only approximate determination of the time of death in a few hours interval after death.

The postmortem cooling of the body (algor mortis) is one of the significant parameters in estimating the time since death. After death the body temperature regulation is stopped, the corpse becomes poikilothermic resulting in drop of body temperature in order to adjust to the environmental temperature.

Newton law on cooling stipulates that the speed of cooling of the body is determined by the difference between the temperatures of the body and the environment. Accordingly, the graph of the temperature in relation to the time produces an exponential curve.

However, this law refers to small inorganic bodies and does not precisely describe the cooling of the human body, the latter being a huge mass with uneven shape, composed of tissues with different characteristics. Practical observations have shown that the cooling of human body can be best explained by the sigmoid curve when temperature is entered in relation to the time.

Equaling of the body temperature with the environment is done through conduction, evaporation and convection. The cooling is slower at the beginning. The shell cools first, followed by dropping of the inside temperature.

During the process of cooling, the human body initially maintains the temperature which may take a few hours – „temperature plateau" followed by a relative linear cooling, the rate of which diminishes as approaching the outside temperature. Each inert body with low thermal conductivity has such plateau in the first phase of cooling. This plateau produces the sigmoid cooling curve. The plateau, according to different authors, lasts from 1 to 5 hours, 3 hours in average.

The cooling of the body is complicated and it is difficult to estimate the time of death due to variety of circumstances that influence the cooling: body volume; body surface; body posture i.e. size of the lying surface; clothed or naked body; surrounding temperature and environment (e.g. cooling is quicker in water).

PURPOSE

In the past period more of the authors have used various algorithms for time estimation since death using the drop of body temperature as a basic parameter. The purpose of this paper is to compare some of the existing algorithms for time estimation since death i.e. to compare the obtained results and assume their usefulness in our routine work.

MATERIAL AND METHOD OF WORK

The paper analyses 10 cases brought for autopsy at the Forensic Medicine Institute and Criminology in Skopje, with known time of death.

Measuring of body t° of the corpse was done by a digital thermometer, measuring the following:

- rectal t° - by putting the digital thermometer sound 10 cm deep in the rectum,

- measuring of rectal temperature two times at an interval of 1 hour in controlled environmental conditions,

- measuring of temperatures was done in constant conditions before opening the body of the corpse i.e. before starting the autopsy.

- temperature of the environment was measured simultaneously.

- The algorithms used for estimation of time of death used in this paper are the following:

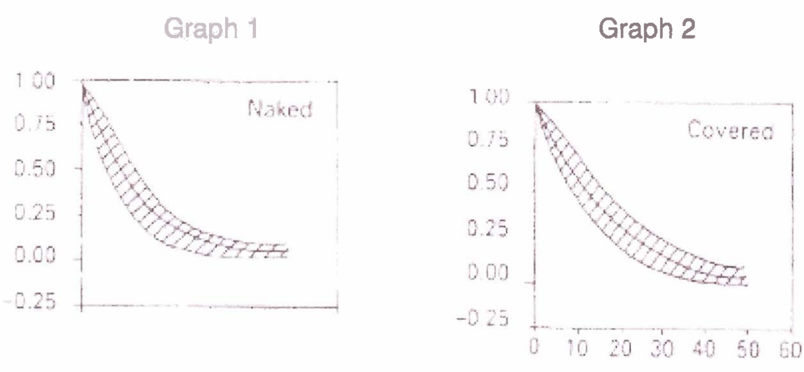
Method 1: TSD = ((rectal t° at the time of death in °F) – (rectal t° at the time t1 in °F))/1,5

Method 2: TSD = ((rectal t° at the time of death in °C) – (rectal t° in the time t1 in °C)) + 3; (number 3 was added because of the plateau).

De Saram: $\frac{TSD}{t2-t1}=\frac{\log\theta 0-\log\theta 1}{\log\theta 1-\log\theta 2}$. All the temperatures have

been taken in °F, where θ0 = rectal temperature at the time of death; θ1 = rectal temperature at the time t1 after death; θ2 = rectal temperature at time t2 after death; t2 – t1 = time interval of 1 hour. De Saram recommends to add 45 minutes because of the possibility of any delay in cooling.

Al-Alousi and Anderson: the temperature difference ratio = (θ1 - θF1) / (θ0 -θF1). All the temperatures have been measured in °C where θ1 = rectal t° at the time t1; θ0 = rectal t° at the time of death; θF1 = t° of the environment at time t1. The temperature difference ratio is compared to the cooling curve of the rectum, using different cooling curves of the rectum depending on whether the body was naked (graph 1) or clothed (graph 2).

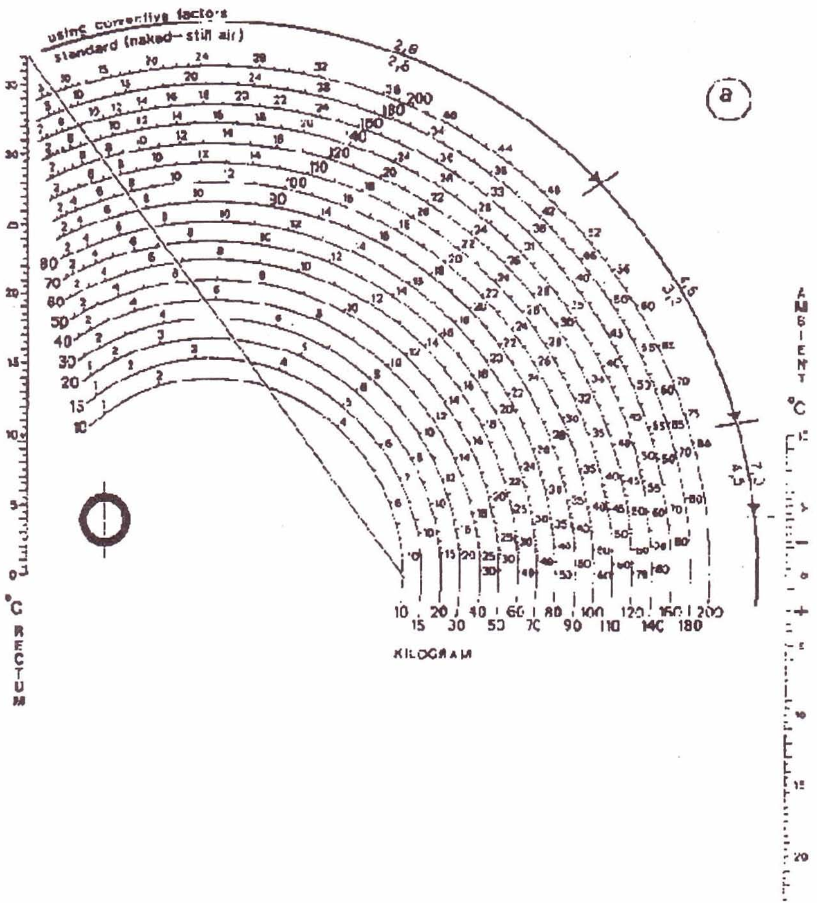


Hours after death

Average cooling curvers for rectum in naked and covered bodies

Henssge: calculation by nomogram method. The nomogram makes corrections of any of the environmental temperatures. It requires measuring of the deep rectal temperature and takes the normal temperature at the time of death to be 37.2°C. *Henssge*-nomogram is based on a formula following the sigmoid shape of the cooling curve. This formula consists of two exponential parts. The first one represents the post mortem plateau and the second constant shows the exponential drop of the °t after the plateau according to the *Newton law on cooling*. In individual cases, the constant showing the exponential drop of temperature after the drop, can be simply calculated by the body weight. The first constant describes the post mortem plateau and is assumed to significantly depend on the second constant with slow cooling bodies (e.g. adiposous) which have longer plateau than the quick cooling bodies (low body weight). Using the previously published data stipulating that the relative length of the post mortem plateau depends of the t° of the environment,

Henssge made two nomograms, one of them for temperature above 23°C, the other for below 23°C. In each case there is a correction for the effect of the environmental temperature to the cooling speed and the corrective factor of the body weight.



Temperature-time of death relating nomogram (for ambient temperatures up to 23°C)

RESULTS AND DISCUSSION

Table 1: Data from ten corpses used to apply different algorithms

Corpse	Time of death	Age	Weight (kg)	Heigh t (cm)	Temp 1 (T_1)°C)	Temp 2 (T_2)°C	Interval between T_1 and T_2 (h)	Average environment-al temp (°C)	Clothing
1	16.01.20 01 7.20 h	65	65	168	16.01.200 1 12.20 h 31,6°C	16.01.200 1 13.20 h 30,5 °C	1	17°C	covered
2	06.06.20 0 06 h	55	75	172	06.06.200 0 12 h 34°C	06.06.200 0 13 h 33 °C	1	21°C	naked
3	31.12.20 00 08 h	20	58	165	31.12.200 0 14 h 32,2°C	31.12.200 0 15 h 31,1 °C	1	22°C	naked
4	02.02.20 01 03 h	53	80	172	02.02.200 1 10 h 32,5 °C	02.02.200 1 11 h 31,5 °C	1	21 °C	covered
5	27.12.20 00 5,30 h	45	57	160	27.12.200 0 12,30 h 32 °C	27.12.200 0 13,30 h 31,2 °C	1	21 °C	naked
6	07.12.20 00 5,00 h	35	80	175	07.12.200 0 12 h 30,6 °C	07.12.200 0 13 h 29,5 °C	1	16 °C	covered
7	26.02.20 01 19,00 h	36	75	174	27.02.200 1 10 h 30 °C	02.02.200 1 11 h 29,5 °C	1	23 °C	covered
8	30.10.20 00 15,30 h	24	75	180	31.10.200 0 11,30 h 26 °C	31.10.200 0 12,30 h 25,1 °C	1	17°C	covered
9	30.10.20 00 16,30 h	75	70	173	31.10.200 0 12,30 h 24,5 °C	31.10.200 0 13,30 h 23,7 °C	1	17°C	covered
10	30.10.20 00 16,30 h	34	76	175	31.10.200 0 12,30 h 25 °C	31.10.200 0 13,30 h 24,1 °C	1	17°C	covered

Data were gathered from 10 studied cases. The analysis consisted of measuring the rectal temperature at two points of time as well as the temperature of the environment; the age, body weight and height were measured and recorded as well as the fact if the bodies were clothed or naked and the time interval of rectal temperature measuring after the time of death. All of the analyzed cases were with normal body temperature at the moment of death.

The probable time of death was calculated by using 5 different algorithms where the body cooling was the basic parameter for determining the time of death. The last graph in Table 2 shows the number of hours since death of the studied cases.

Table 2: Results of applying 5 algorithms with the actual time of death

Corpse	Method 1	Method 2	De Saram	Al-Aluousi and Anderson	Henssge	Actual postmortem interval
1	6,5 h	8,4 h	6 h	6 h	7 h	5 h
2	3,6 h	6 h	4 h	5 h	7 h	6 h
3	5,76 h	7,8 h	5,3 h	7 h	8,5 h	6 h
4	5,4 h	7,5 h	5,6 h	7 h	10 h	7 h
5	6 h	8 h	6,85 h	7 h	8 h	7 h
6	7,68 h	9,4 h	6,8 h	8 h	11 h	7 h
7	8,4 h	10 h	15,7 h	13 h	15 h	15 h
8	13,2 h	14 h	11,7 h	17 h	18 h	20 h
9	15 h	15,5 h	15 h	20 h	20 h	20 h
10	14,4 h	15 h	12,8 h	19 h	19 h	20 h

From the results shown in Table 2 it can be observed that by using the first three algorithms (*method 1*, *method 2* and *De Saram*), the obtained values are close to the exact time of death (divergence 2-3 hours) in case of a post mortem period less than 6-7 hours. Increasing the length of post mortem period results in bigger divergence from the exact time of death.

The obtained results given in the above mentioned Table show that if *Henssge*-nomogram is used, smaller divergences from the exact time of death are obtained in case of post mortem period longer than 10 hours.

Also, the Table 2 shows that the most precise values of the time of death are obtained by using the *Al-Alousi and Anderson* algorithm, regardless of the length of post mortem time with the studied cases.

CONCLUSION

Comparing the results obtained by using the five different algorithms for estimation of the time of death, the conclusion is that the *Al-Alousi and Anderson* algorithm gives values closest to the exact time of death i.e. the time of death can be estimated with smallest possible divergence (2-3 hours) from the exact time of death.

In our future work the series of cases will be extended in order to determine which of the algorithms would prove most adequate to use in the everyday routine.

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