

Original Research Paper

Postmortem Interval Assessment Criteria : A Retrospective Study

1. Vasil Olkhovsky, Professor and Head*
2. Oleksandr Kliuiev, Professor and Director**
3. Edgar Grygorian, Postgraduate Student*
4. Mykola Gubin, Associate Professor*
5. Ella Simakova-Yefremian, Senior Scientist and Deputy Director on Scientific Work**
6. Vadym Khosha, Head of Postgraduate Department**

*Department of Forensic Medicine, Medical Law, Kharkiv National Medical University, Kharkiv, Ukraine

**Hon. Prof. M. S. Bokarius Kharkiv Research Institute of Forensic Examinations, Ministry of Justice of Ukraine, Kharkiv, Ukraine

ABSTRACT :

Introduction, Materials and Methods : In this study, an analysis of forensic medical reports was conducted in order to define new criteria for postmortem interval (PMI) assessment, to improve the accuracy of its determination by forensic medical experts. In the study, 2972 forensic medical examinations of corpses were analyzed. The location of the corpse, Degree of fatness, Body length, Age and Histological changes of some internal organs were observed. Dynamometry method was used for Postmortem Interval (PMI) estimation. The results were calculated using Spearman rank correlation coefficient.

Results : There was a significant moderate correlation of histological changes of some internal organs; weak correlation of corpse location, degree of fatness, body length; and significant very weak correlation of age ($p < 0.05$).

Corresponding Author:

Edgar Grygorian,

Postgraduate Student,

Department of Forensic Medicine, Medical Law, Kharkiv National Medical University, Kharkiv, Ukraine.

Contact : +38-0577551695

Email : 8520148@gmail.com

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INTRODUCTION :

The determination of postmortem interval (PMI) is one of important tasks forensic medical experts deal with. Exact PMI defining is extremely important in cases of violent death^[1]. But today there is a chance of inaccurate interval determination, interval could be mistaken by several hours and even more^[2]. This, in particular, is due to the fact that, in each case, there is a possible influence of various factors on the development of postmortem changes^[3-5]. Taking into account only a few factors that influence the development of postmortem changes (for example, only time of year and location of corpse) is not giving reliable results in the evaluation of PMI by forensic medical experts^[6]. There is also an influence of some factors that are not considered in most methods used for determining PMI, such as body length^[7]. Most researches that study biochemical markers, histochemical and other changes in body tissues and fluids, also neglect additional factors which could reduce the preciseness of estimated PMI^[8-12].

The purpose of this work to define the new criteria to improve

PMI assessment accuracy.

MATERIAL AND METHODS :

Present study was conducted on 2972 forensic medical reports from 1-1-2017 to 31-12-2018 on deceased persons aged more than 18 years. Persons died due to violent death and massive blood loss were excluded because that could effect the measurement of postmortem interval. In order to analyze the PMI assessment criteria, protocols of the on-scene examination of corpse, the police inquiries provided to forensic medical experts and the reports on corpses drawn up by on-duty personnel in morgue were reviewed. Information on sex, age, forensic diagnosis, time interval from the moment of death to the examination of the corpse at a place of corpses' detection, postmortem changes and environmental features of a place of corpses' detection, when available, were studied.

Based on documentation, the following parameters were included in analysis: age, degree of fatness (reduced, normal, increased), body length, ambient temperature, location of the

corpse (in building/on street). The correlation between potential criteria compared to dynamometry results were calculated and analysed.

Dynamometry is the method where examiner presses with his thumb at livor mortis and looks if livor mortis changes its color (so-called 'blanching') and examiner looks on how long would livor mortis recover its initial (violet) color. This method is used as the basic method of postmortem interval evaluation. And it is the basis for a development of other methods

RESULTS:

The study consisted of two parts, in the first one, the documents which came with a corpse were studied, in the second part, the factors' influence on dynamometry was studied. In the first part, documents which came with a corpse were studied for all 2972 cases. In the second part, only 2440 cases of non-violent death were studied. Among these 2440, 1492 were males and 948 were females. Average age of females was 76 years and males 64 years.

There were two places of examination of corpse, first was at the place of its identification, second was in the morgue, during autopsy. Report of the inspection of corpse at the place of its identification was provided to the expert who made the autopsy in 2541 cases.

Postmortem changes were described in the reports of examination of corpse at the place of its identification only in 2494 cases

Livor mortis did not change color - when the examiner applied the Dynamometry method.

In large number of cases, i.e 1897 cases rigor mortis was absent. Putrefactive changes were developed in 1743 cases. (due to changes in Ukrainian laws, the time interval between the death and autopsies became longer)

Rigor Mortis could be developed in all examine muscles, but it could be easily changed. And it could be partially developed, i.e only developed on some muscles.

The average age was 70 years (women 76 years, men 64 years). Non-violent deaths accounted for 2440 cases (82.1%); 948 (31.9%) of which were women, 1492 (50.2%) were men. The average time interval from death to autopsy was 74 hours 30 minutes. Place of detection of the corpse: in building 2562 cases (86.2%), on street 359 cases (12.1%), other 51 cases (1.7%). The report of the inspection of the corpse at the place of its identification was provided to forensic medical experts in 2541 cases (85.5%), corpses' postmortem changes were described in 2494 cases (83.9%). The PMI evaluation was required by police in 2612 cases (87.9%). The average recovery time of corpses' livor mortis at the place of corpses'

detection was 22.5 seconds. The ambient temperature, at the place of corpses' detection, was measured in 1590 cases (53.5%).

According to the medical records, the average body length was 167.2 cm.

Degree of fatness : decreased in 565 cases (19%), normal in 1917 cases (64.5%), increased in 490 cases (16.5%).

The livor mortis, on the autopsy, did not change their color in 2801 cases (94.2%), changed color on their edges (partially) in 130 cases (4.4%), description of cadaver stains was absent in 41 examinations (1.4%).

Rigor mortis was absent in 1897 cases (63.8%), poorly developed in 484 cases (16.3%), well developed in 529 cases (17.8%), partially developed in the muscles of the lower extremities in 62 (2,1%).

Putrefactive changes were observed in 1743 cases (58.6%), as: green-colored skin 1537 (51.7%) and/or green-colored (putrefactive) venous network 571 (19.2%) and/or epidermis detachment 461 (15.5%) and/or putrefactive subcutaneous emphysema 110 (3.7%); absence of putrefactive changes 1229 (41.4%).

Using the Spearman rank correlation coefficient, following correlations were calculated:

1. Correlation between known PMI, according to supporting documentation (hours), and livor mortis recovery time at dynamometry (seconds) was 0.60 a significant moderate positive correlation ($p < 0.05$).
2. Correlation between degree of postmortem changes manifestation on internal organs, according to histological findings (autolytic changes of the brain, pituitary gland, heart, lungs, liver, kidneys, spleen, adrenal glands, pancreas, prostate gland, uterus) and livor mortis recovery time at dynamometry (seconds): 0.65 a significant moderate positive correlation ($p < 0.05$).
3. Correlation between degree of fatness (reduced, normal, increased) and livor mortis recovery time at dynamometry (seconds): -0.35 a significant weak negative correlation ($p < 0.05$).
4. Correlation between body length (centimeters) and livor mortis recovery time at dynamometry (seconds): -0.29 a significant weak negative correlation ($p < 0.05$).
5. Correlation between location of corpse ('0' in building, '1' on street) and the livor mortis recovery time at dynamometry (seconds): -0.29 a significant weak negative correlation ($p < 0.05$).
6. Correlation between age (years) and livor mortis recovery time at dynamometry (seconds): -0.17 a significant very weak

negative correlation ($p < 0.05$).

CONCLUSION : Based on the above data, we came to following conclusion:

There was a significant moderate correlation of histological changes of some internal organs; weak correlation of corpse location, degree of fatness, and body length; and significant very weak correlation of the age ($p < 0.05$). Abovementioned criteria could be further studied and implemented to the modern PMI-estimating methods, in order to improve their preciseness.

Conflict of interest : none.

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Ethical clearance : The study is based on archival documents; authors met ethical requirements on confidentiality of information received in the course of research

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Table 1 : Correlation Between Studied Factors and Dynamometry of Livor Mortis

	Dynamometry of Livor Mortis
Known PMI	0.60
Degree of Postmortem Microscopic Changes of Internal Organs	0.65
Degree of Fatness	-0.35
Location of Corpse	-0.29
Age	-0.17

