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Research article

Pericardial fluid analysis: an attempt to correlate with postmortem interval

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Abstract:
The paramount medico legal issue in any postmortem examination relates to the determination of time since death because of the inquiries that arise during the investigation of any medico legal case related to the time of committal of crime. This study tries to analyze whether changes in parameters of the constituents of pericardial fluid has any bearing as to the time since death. The pH, pO2, pCO2 and HCO3 were used to correlate with the postmortem interval. No statistical correlation was observed between the parameters and postmortem interval. More research is suggested in this field with larger sample size and immediate analysis of pericardial fluid could probably yield results that could be of help to estimate postmortem interval.

Key words: Postmortem interval; pericardial fluid; autopsy.

Introduction

Medico legal autopsy has a basic objective to reconstruct the circumstances of death with a reasonable degree of accuracy. It involves the process of collection of evidence from the cadaver and interpretation of this evidence to answer a series of questions raised by the Investigating officer. These include cause of death, the survival time, the role of pathology in the process of death and the postmortem interval1. Postmortem interval or time since death is one of the paramount issues to be answered during an autopsy as it gives the Investigating officer an opening in his investigation as to the circumstances of death. It not only include, but also exclude a suspect/s as also it helps to confirm or disprove an alibi and verify the suspects version2. However the current methods of estimation of time since death are less reliable, especially in cases of longer postmortem interval, the precision of estimated
postmortem interval is less\textsuperscript{2,3}. Relatively recent technique of estimating postmortem interval include postmortem biochemistry\textsuperscript{4}, which is the measurement of endogenous constituents in dead bodies\textsuperscript{5}. Various body fluids are employed for these studies like vitreous humor, cerebrospinal fluid, synovial fluid and pericardial fluid, of these vitreous humor is the most widely studied body fluid.\textsuperscript{6}

This study deals with pericardial fluid, a relatively unexplored vista in estimating time since death. The advantages of pericardial fluid over vitreous humor and cerebrospinal fluid are the easy access and large volume; and over blood is its decreased tendency to microbial contamination and bacterial degradation. This feature allows a large battery of tests to be conducted on each specimen because of the volume of fluid available\textsuperscript{7}.

**Material and methods**

The samples for the study (60) was sourced and demarcated into a control (20) and study (40) groups. The pericardial fluid for the control group was obtained from the patients undergoing coronary artery bypass surgery in the Department of Cardiothoracic surgery, Kasturba hospital, Manipal, whereas the pericardial fluid for the study group was obtained from cadavers that were subjected to medico legal autopsy in the Department of Forensic Medicine, Kasturba Medical College, Manipal. The cadavers for the study included only fresh and those that were preserved in the cold chamber. Cases of known pericardial diseases and pericardial or cardiac trauma were excluded from both the study and control group.

The pericardial fluid thus collected from the control and study group were subjected to analysis for pH, pCO\textsubscript{2}, pO\textsubscript{2}, and HCO\textsubscript{3} using arterial blood gas analyzer (Burnett R W, Covinton A K, Fogh A. Approved IFCC recommendations on whole blood sampling, transport and storage for simultaneous determination of pH, blood gases and electrolytes\textsuperscript{8}. (Radiometer ABL 800 Roche, Germany).

**Results**

Pericardial fluid analysis of both the study and control group was recorded and statistically analysed using SPSS (Statistical Package for Social Sciences Version 15). The control and study group consisted of 20 and 40 cases respectively (Table 1). The age of the individuals in the control group ranged from 26 to 76 years (Mean years) and in the study group ranged from 11 to 84 years (Mean years).

<table>
<thead>
<tr>
<th>Group</th>
<th>Total no. of cases</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>20</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Study</td>
<td>40</td>
<td>34</td>
<td>6</td>
</tr>
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</table>

The range of pH, pO\textsubscript{2}, pCO\textsubscript{2}, and HCO\textsubscript{3} values in the control group were 7.20 to 7.87, 39.0 to 171.0 mm Hg, 8.4 to 83.9 mm Hg and 20.2 to 142 mEq/L respectively (Table 2).

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>pH</th>
<th>pCO\textsubscript{2} (mm Hg)</th>
<th>pO\textsubscript{2} (mm Hg)</th>
<th>HCO\textsubscript{3} (mEq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>7.53</td>
<td>83.9</td>
<td>39</td>
<td>31.8</td>
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<tr>
<td>2.</td>
<td>7.04</td>
<td>39.5</td>
<td>76</td>
<td>25.0</td>
</tr>
<tr>
<td>3.</td>
<td>7.06</td>
<td>33.5</td>
<td>90</td>
<td>49.5</td>
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<tr>
<td>4.</td>
<td>7.48</td>
<td>36.20</td>
<td>88</td>
<td>26.4</td>
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<tr>
<td>5.</td>
<td>7.57</td>
<td>24.9</td>
<td>103</td>
<td>49.7</td>
</tr>
<tr>
<td>6.</td>
<td>7.53</td>
<td>23.9</td>
<td>114</td>
<td>22.2</td>
</tr>
<tr>
<td>7.</td>
<td>7.55</td>
<td>36.10</td>
<td>87</td>
<td>55.80</td>
</tr>
<tr>
<td>8.</td>
<td>7.05</td>
<td>32.60</td>
<td>103</td>
<td>22.10</td>
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<tr>
<td>9.</td>
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<td>35.30</td>
<td>106</td>
<td>25.00</td>
</tr>
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<td>7.47</td>
<td>33.60</td>
<td>100</td>
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<td>11.</td>
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<td>30.50</td>
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<td>12.</td>
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<td>38.50</td>
<td>275</td>
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<td>7.59</td>
<td>23.90</td>
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</table>
The study group had postmortem interval ranging from 4 hours 25 minutes to 47 hours 35 minutes. The ranges of pH, pO\textsubscript{2}, pCO\textsubscript{2}, and HCO\textsubscript{3} values were 6.01 at 14 hours 45 minutes to 7.9 at 41 hours 10 minutes, 2 mm Hg at 14 hours and 45 minutes to 249 mm of Hg at 4 hours and 35 minutes, 2 mm of Hg at 12 hours and 45 minutes to 210 mm of Hg at 14 hours 45 minutes and 0.3 mEq/L at 14 hours to 88 mEq/L at 41 hours 10 minutes respectively (Table 2).

Statistical analysis revealed the peak pH was observed at a postmortem interval of more than 30 hours (Figure 1), the peak pO\textsubscript{2} was observed at a postmortem interval less than 6 hours (Figure 2), the peak pCO\textsubscript{2} was observed at a postmortem interval between 6 to 12 hours (Figure 3) and a peak HCO\textsubscript{3} was observed at a postmortem interval of more than 30 hours (Figure 4).

![Figure 1. Postmortem interval and pH in the study group](image1)

![Figure 2. Postmortem interval and pO\textsubscript{2} in the study group](image2)

![Figure 3. Postmortem Interval and pCO\textsubscript{2} in the study group](image3)
There was no statistical significance obtained for any of the parameters of pericardial fluid analysis.

**Discussion**

Estimation of time since death is an important parameter during autopsy which can be achieved by various methods, one such method is postmortem chemistry. Many studies have been conducted in the past on different body fluids to estimate time since death, but our study makes an effort to determine the reliability of pericardial fluid parameters like pH, pO$_2$, pCO$_2$, and HCO$_3$ in estimating postmortem interval.

Perusal of literature revealed a study conducted by Tonya J.D conducted during open heart surgeries in 11 patients and concluded that the mean serum bicarbonate levels were 25±6 mEq/L.9 The values of bicarbonate levels of the control group in our study varied from 20.2 mEq/l to 142 mEq/l. The probable reasons for the wide variations could be the sample size, age of the individuals and gender difference, if any. Efforts to procure the normal physiological values of various parameters of pericardial fluid were futile.

The values of pH that varied from 7.2 to 7.87, pO$_2$ varied from 39 mm of Hg to 171 mm of Hg, and pCO$_2$ varied from 8.4 mm of Hg to 83.9 mm of Hg. Efforts to compare the values of the above parameters was unsuccessful.

The wide variations of the various parameters can be attributed to various factors like the presence or absence of non-cardiac endocrine diseases, built of the individual, age, sex and climatic condition, and the different analytical technique adopted for the analysis of the pericardial fluid. The time lag between collection and analysis of fluid also be a variable for the wide variations in the results of our study.

The pH value in the study group varied from 6.01 at 14 hours and 45 minutes to 7.90 at 41 hours and 10 minutes.

The bicarbonate values in the study group varied from 0.3 mEq/L at 14 hrs to 88 mEq/L at 41 hours and 10 minutes.

The pO$_2$ values in the study group varied from 2 mm of Hg at 14 hours and 45 minutes to 249 mm of Hg at 4 hours and 35 min, while pCO$_2$ varied from 2 mm of Hg at 12 hours and 45 minutes to 210 mm of Hg at 14 hours and 45 minutes.

The values obtained from the study of pericardial fluid for the above parameters were inconclusive to correlate with the postmortem interval as the values showed very high variations.

This wide variation could be attributed to various factors such as climatic condition, cause of death, place of death, age, sex, built, nutrition, nature of apparels worn at the time of death, temperature of the body, nature of surrounding media and postmortem changes, previous pathology in the body, circadian rhythm, drugs, duration of agonal period, infusion therapy, and postmortem sampling time.

Literature did not reveal any other studies conducted of the pericardial fluid parameters such as pH, pO$_2$, pCO$_2$ and bicarbonate. The assumption that pericardial fluid is well protected in the pericardial sac and hardly gets affected by postmortem changes persuaded us to undertake this study as other body fluid like blood and cerebrospinal fluid which are easily affected by postmortem changes.

The statistical analysis of different parameters did not reveal any significant correlation with postmortem interval.
References

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Conflict of interest: None