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Forecast of PostMortem Interval Through Blood Biomarkers Using Artificial intelligence

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Abstract: *There is very much of importance ofs estimation of time since death as it is important aspect in the field of forensics and criminal investigations. Data processing through an artificial intelligence tool is a way to predict time. Because blood and urine contain many biochemical components, they are useful in estimating the post-mortem interval (PMI). Blood should be collected primarily from the femoral vein to measure PMI. Artificial intelligence devices are trained to learn and solve problems. The concept of the device used is to provide a profile of various metabolites in the blood such as Lactate dehydrogenase (LDH), cholesterol, triglycerides etc. and to determine the time of death by simply analysing various statistics and graphic studies. Blood pH is also a factor that we need to take into account, usually in early estimation of PMI and factors like temperature, decomposition etc. in late estimation of PMI. The use of artificial intelligence is due to its scalability, efficiency and automation. The use of biomarkers and biological fluids is a powerful and useful tool in the forensic investigation process of deaths and crimes.*

Keywords: *post-mortem interval, Lactate dehydrogenase, Artificial intelligence*

I. INTRODUCTION

Artificial intelligence has reached this region along with forensic technical know-how in almost all fields. Artificial intelligence has an impact on everyone's lifestyle. Whenever a researcher encounters a dead body, the primary plan is to determine the time elapsed between death and the discovery of the body. Postmortem language is nothing more than the moment in which this disappearance is perceived. This PMI and forensic report will help the courtroom to accept or reject the statements of suspects and witnesses [1]. Time-of-death prediction methods are mainly divided into 2 areas: early PMI and late PMI. Until tissue decomposition begins, this period is called early PMI. And late PMI has also been described as skeletonization. In early PMI, biochemical changes are waiting time factors, while mold and temperature are factors in late PMI. But waiting for the moment of death is more difficult

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with long PMI [2]. There are many ways to define the longest and shortest PMI. Biomarkers like brain, blood, urine, pancreas etc. Biomarkers are also classified into proteins and metabolites. Metabolites including NaCl (sodium chloride), K (potassium), NH3 (ammonia), urea and many others. and proteins including lactate dehydrogenase (LDH) and aspartate aminotransferase (AST). Biochemical changes can persist until the body completely breaks down. But many researchers claimed that blood is the best tissue to estimate the time of death. Cooling of the body, pooling of blood in the lower body, stiffening of the limbs, and eye chemistry are some of the adjustments you may see in early PMI. While specific levels of deterioration and decomposition can be observed at the end of PMI. The potential for hydrogen (pH) is also used when calculating the time. Determine the concentration of H+ ions, i.e., blood PH, that changes after death. And to compare all the parameters with the normal values, we can continue the analysis [3]. The idea of estimating the time of death during forensic examination is entirely based on the use of an artificial intelligence tool that measures organic markers in the blood such as LDH and AST as proteins and cholesterol as lipids, blood. After providing the profile to the tool, it will analyse the facts and give us the exact final result along with the time of death prediction. And then registration will be beneficial to take further actions in court or to declare the cause of death. Figure below demonstrates the process of forensic examination with prediction of post mortem interval.

Various studies have shown that blood is an ideal tissue for determining time of death. Studies confirmed that the total amount of protein in the blood was measured as an indicator of PMI. Among blood proteins, enzymes help determine PMI: LDH, an enzyme that is normally confined to the cytoplasm of cells and is most efficiently released after cell death, and AST, an Enzyme that converts aspartic acid to glutamate. In the first three days after death, the concentration of these enzymes in the blood increases many times. In addition to total protein intake, several studies have investigated postmortem blood glucose levels to determine time after death and confirmed that postmortem blood glucose estimates no longer provide a definitive record. does not This may be particularly due to the fact that postmortem blood glucose is associated with a number of factors that decrease or increase its level. Other studies showed a postmortem decrease in blood triglyceride and cholesterol levels over time. Some researchers have noted adjustments in blood pH as observed in postmortem animal cadavers.

II. LITERATURE SURVEY

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In 1965, J. A. Payne [4] studied carrion in a small pig, Sus scrofa Linnaeus, in which he studied different levels of decomposition. When carcasses were exposed to arthropods, they observed six stages of decomposition: cleaning, swelling, energetic decomposition, advanced decomposition, desiccation, and remains. Whereas, 5 grades have been assessed for carcasses not exposed to arthropods such as foaming, swelling and decomposition, drooping and dehydration, mummification, and desiccation and disintegration. But this study was limited to the "decomposition" of the aspect that is useful for estimating late PMI.

F. John et al., in research titled "Postmortem Determination of Blood Sugar and Urea Nitrogen" determined glucose and urea nitrogen in blood and cerebrospinal fluid in which they reported that postmortem blood glucose and cerebrospinal fluid samples. Confused with determination. Fluids gave more consistent values than blood samples and therefore Mortem C programming language predictions should be done with caution [5].

J. I. Coe et al. has done excellent work on the postmortem chemistry of blood, cerebrospinal fluid, and vitreous humor in the hope that biochemical abnormalities that may be present at some point in life can be detected by postmortem examination. are [6].

In a research titled, "Cardiac Blood pH as a Potential Indicator in the Postmortem C Programming Language," William R. Sawyer, et al., examined changes in blood and selected tissue pH in mice in the C language for 96 hours. And later, a human study suggested that it is a quick and easy technique to assess PMI [7].

J. I Coe et al compiled years of intensive research in 1993 and studied enzymes, biochemicals, serum, body fluids, blood, pigments, hormones, time of death, blood gases, metabolic problems, etc. Chemical components associated with PMI, but environmental factors have not been considered [8].

To improve the possibility of defining the time of death, we tested whether it is possible to predict PMI by immunohistochemical detection of insulin. As a result, pancreatic beta cells up to 12 days of age develop a beneficial immune response to insulin, whereas carcasses older than 30 days do not. These effects may be useful for postmortem programming language predictive estimation. But the limitations of the time or C programming language encountered throughout the study may also change according to the surrounding situation and due to exceptions, the formulation of the framework will be perfect. An e-book titled 'Corpse: Nature, Forensic Science, and the War to Mark the Time of Death' was published in 2001.

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In which J. S. Sachs stated, the chemicals and insects found near the frame could be weapons in our crime-fighting arsenal. And there will always be a link between the mechanism of decomposition, the circumstances of the scene where the crime took place and the results of the forensic analysis. In 2002, Arpad A. Vass, et al [9] completed a study of the decomposition chemistry of human remains with the goal of identifying biomarkers of decomposition that develop over time. The goal was to develop a valid methodology for measuring PMI. Over a period of four years, biomarkers such as amino acids, neurotransmitters and by-products have been investigated in various organs such as liver, kidney, heart, muscle, brain and many others. which found unique patterns useful in determining PMI based on cumulative degree hours (CDH). But the problem to overcome is getting ideal temperature data at crime scene rather than variation in pattern. And then analysis of the collected data is necessary.

M. S. Megyesi, et al [10] validated a complementary method to determine PMI based on the decomposition of scores and taking into account the temperature to which the rooms were exposed. This approach has already been applied, and when the data was analyzed, it was found that the decomposition depended on the deposition temperature rather than just the time. When used with accumulated diploma days, the decomposition curve can provide a lot of data on the PMI. In a case study of "The Effect of Body Size on Decomposition Rates in a South African Temperate Region",

A. Sutherland, et al [11] stated that there are many factors that affect decomposition rates, including temperature. . , rain and frame ads. And after looking at the rate of decomposition in pigs of different body sizes, the correlation was established that decomposition occurs faster at earlier levels of decomposition. And finally, the results came in: the little pigs rotted faster than the big ones. This indicated that body size affects decomposition rate. Traditional techniques for identifying postmortem modifying metabolites have not been widely adopted to estimate PMI. But the use of biochemical markers and special techniques gives specific and accurate results. The main focus is on biochemical changes and cellular changes in the blood. and hence the techniques described associated with initial PMI estimation in this unique research topic.

In 2013, M. J. Buchan et al [12] published their paper outlining unique strategies for estimating PMI. The current status was included with all types in this document. Early PMI

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and Late PMI. He has also cited technical issues. And destiny has the capacity to conquer deserving areas.

In 2015, D.L. Cockle, et al [13] proposed a test to determine a reliable method to estimate the correct PMI. They have used many formulas to estimate the time of death, but the effects have been discovered, because there are many elements that affect the body after death and it is difficult to consider all the elements, and they concluded that none of their results lead to a proposition of universality. For estimation of PMI. Nor is there any claimed daily formula.

III. MATERIALS AND METHODS

LDH dose LDH provides an early biomarker for estimating PMI. It converts pyruvate to lactate and NADH to NAD+. After death, cells release LDH into the bloodstream, where its concentration increases within hours of death. This phase is followed by a slight increase over the next 48 to 72 hours, reaching its highest concentration after this phase at autopsy[25]. The amount of LDH in the blood can be determined by a colorimetric method in which LDH reduces NADH to NAD+. The latter absorbs a specific probe to produce color (λmax = 340 nm)..

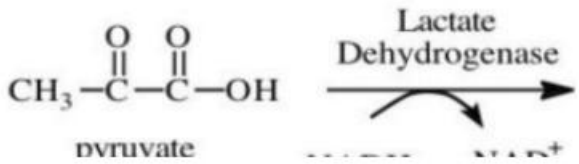

Fig.1 Mechanism for the reaction catalyzed by LDH

In our device concept, for blood LDH dosing, a measured volume of blood serum must be diluted and then applied to the strip inside the device. This strip contains pyruvate and NADH. LDH activity is measured at 340 nm by the rate of disappearance of NADH with respect to a calibration curve using LDH calibration. The reaction temperature is maintained at 370 C and the total reaction time is in the range of few minutes (2-3 minutes). ASTAST dose is released extracellularly in post-mortem cases. An increase in postmortem blood AST has been observed in the first 60 hours post mortem [26]. The amount of AST in the blood can be determined by a colorimetric method in which glutamate is measured by an enzyme-coupled reaction cycle (λmax = 510 nm) producing a blue product.

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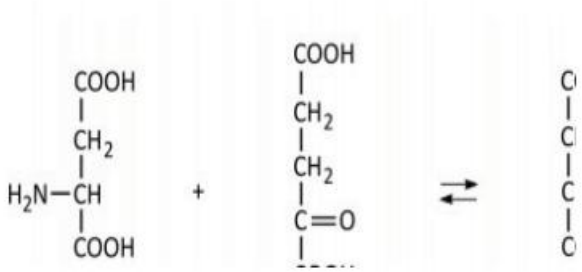

Fig.2 Mechanism for the reaction catalyzed by AST

Using this device, the colorimetric method of Reitman and Frankel (1957) at 370 C can be used for the determination of AST in cadaveric blood.

Triglyceride dosage Determination of total triglycerides in the blood uses enzymatic hydrolysis by lipase leading to release of glycerol and free fatty acids (1). A kinase then phosphorylates glycerol, resulting in the formation of glycerol-3-phosphate (2) which in turn is oxidized by glycerol phosphate oxidase. This reaction produces hydrogen peroxide (3). The peroxidase then catalyzes the combined redox reaction of H2O2 with 4-aminoantipyrine and N-ethyl-N-(3-sulfopropyl)-manisidine (ESPA), giving a purple color (4) (λmax= 530-550 nm)

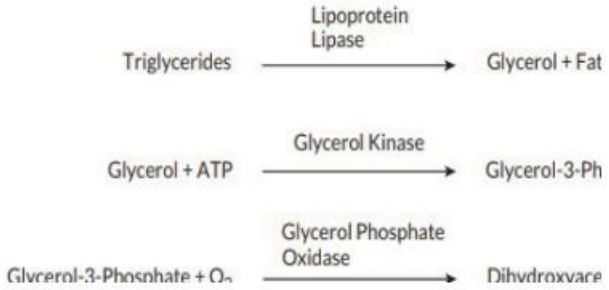

Fig.3 Dosage of total blood triglyceride.

In recent years, extensive work has focused on determining PMI through changes in the biochemical components of various body fluids such as blood. In the present study, we present the concept of simultaneous dosing of various blood metabolites such as LDH, AST, triglycerides, cholesterol level and pH level. Normal blood pH level is controlled within the normal range of 7.35 to 7.45. Alkaline pH above 7.45 and acidic pH below 7 can cause death [31]. After death, blood pH changes [24]. Studies have shown that blood pH changes from 7 to 5.5 after death [32]. Accumulation of acidic metabolites, particularly lactic acid, lowers blood pH. Postmortem levels of blood lactate dehydrogenase (LDH) are elevated, leading to the production of lactic acid. A recent study revealed that postmortem cardiac blood lactate

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concentrations increased 20-fold one hour after death and 70-fold 24 hours after death [33]. Our research concept is focused on studying the involvement of two blood enzymes (LDH and AST) which are mainly considered as potential biomarkers for the determination of PMI. Other biochemical markers useful in postmortem determinations include blood lipid metabolites such as triglycerides and cholesterol.

IV. CONCLUSION

Blood can be collected from the femoral vein when a homicide victim is found at a crime scene. Blood can then be directly analysed using the proposed AI-enabled device to measure LDH, AST, triglycerides, and cholesterol, but not glucose. The pH level of the blood can also be measured. These combined data can be interpreted and compared with different databases to estimate the PMI. The feasibility of this device should be evaluated on an institutional basis and a decision should be made regarding the use of this device.

REFERENCES

[1] D. L. Cockle and L. S. Bell, 2015, “Human decomposition and the reliability of a ‘Universal’ model for post mortem interval estimations, ”, pp. 136.e1–136.e9.

[2] M. J. Buchan and G. S. Anderson, 2013, “Time since death: a review of the current status of methods used in the later postmortem interval, ” pp. 1–22,.

[3] J. S. Sachs, Corpse: nature, forensics, and the struggle to pinpoint time of death. New York: Basic Books, 2001.

[4] B. Swift, The timing of death. In: Rutty GN, editor. Essentials of autopsy practice. London: Springer, 2006, pp. 189–214.

[5] A. Sutherland, P. J. Becker, 2013, “The effect of body size on the rate of decomposition in a temperate region of South Africa,”, pp. 257–262.

[6] C. Henssge and B. Madea, “Estimation of the time since death in the early post-mortem period,” Forensic Sci Int., vol. 144, pp. 167–175, 2004.

[7] M. S. Megyesi and N. H. Haskell, 2005, “Using accumulated degree-days to estimate the postmortem interval from decomposed human remains,”, pp. 618–626.

[8] J. A. Payne, “A summer carrion study of the baby pig sus scrofalinnaeus,” Ecology., vol. 46 (5), pp. 592–602, 1965.

ISSN: 2366-1313

[9] A. Galloway, W. H. Birkby, A. M. Jones, T.E. Henry, and B. O.Parks, “Decay rates of human remains in an arid environment,”J Forensic Sci., vol. 34(3), pp. 607–616, 1989.

[10] A. Sutherland, J.Myburgh, M.Steyn, P. J. Becker, “The effect of body size on the rate of decomposition in a temperate region of South Africa,”Forensic Sci Int., vol. 231(1–3), pp. 257– 262, 2013.

[11] E. D. Andrea and I. L Iain, “Estimation of postmortem interval using biochemical markers,”Australian Journal of Forensic Sciences., vol. 46(1), pp. 1-19, 2013

[12] M. J. Buchan and G. S. Anderson, “Time since death: a review of the current status of methods used in the later postmortem interval,”Can Soc Forensic Sci J., vol. 34(1), pp. 1–22, Nov. 2013.

[13] D. L. Cockle and L. S. Bell, “Human decomposition and the reliability of a ‘Universal’ model for post mortem interval estimations,”Forensic Sci Int.,vol.253, pp. 136.e1– 136.e9, Aug. 2015