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Opinion Article

Sequencing Analysis of Bodily Fluid RNA in Identification of the Forensic Crime Justification

Melanie Cortellini*

Department of Forensic Medicine, University of Bonn, Bonn, Germany

ABOUT THE STUDY

Ribonucleic Acid (RNA) is a nucleic acid that is present in all living cells and is structurally similar to DNA. Unlike DNA, RNA is mostly single-stranded. RNA molecules have a backbone composed of alternating phosphate groups and sugar ribose, rather than the deoxyribose found in DNA.

RNA analysis provides insight into the diseases and mechanisms leading to death and may be a valuable tool for diagnosing the cause of death in forensic pathology. Other potential applications include determining the age of wounds, injuries, and post-mortem intervals. Molecular identification of body fluids by analysis of cell-specific mRNA expression is an emerging technique that supplements DNA analysis in forensic cases. Techniques currently used to collect biological evidence from the scenes of violent crimes such as murder, rape, and kidnapping are simply used to secure evidence for future DNA analysis. While DNA is very useful for forensic casework, biological samples contain another valuable molecule RNA.

The use of RNA in forensic analysis of specimens is now increasing. In the past, RNA was thought to degrade too quickly to be useful in the forensic community. The research presented in this paper seeks to prove the opposite. Although RNA is not as stable as DNA, degradation rates in *ex-vivo* samples are a function of molecular size and type and are predictable in certain body fluids and tissues. The main aim is to determine whether size-dependent predictable RNA decay could be used as an indicator of the postmortem interval, or time after death. A method has been established for the efficient isolation and accurate quantification of RNA from dental pulp. The relationship between these factors and his PMI was demonstrated by quantifying residual molecules in large and small segments of beta-actin mRNA from the aged dental pulp of dead pigs and by quantifying post-mortem changes in pulp color. Some of the studies have shown that the rate of RNA degradation may be a temperature-dependent process. We found that the rate of RNA degradation was better explained by the cumulative temperature to which the pigs were exposed than by the number of days.

The use of RNA to confirm the identity of body fluids overcomes some of the limitations encountered in conventional testing. This review describes an RNA-based technique for forensic identification of body fluids. Among them, endpoint RT-PCR, real-time RT-PCR, and sequencing are the most important approaches. To resolve this dilemma, we used cell-specific mRNA expression technology to identify specific body fluids from the recovered biological material. The frequency and presence of mRNA types can reveal gene expression patterns unique to each cell type and fluid throughout the body.

RNA-based methods such as mRNA profiling are being investigated to offer many advantages compared to previous methods that use DNA in forensic analysis. The mRNA profiling technology is known for its high specificity in detecting cell types and body fluids, its ability to extract both DNA and RNA, and its ability to detect multiple body fluids and markers in a common assay format. Another advantage of using RNA as a method for forensic identification is that micro-RNA-based assays for identifying body fluids can offer high specificity due to differences in microRNA expression profiles in different parts of body fluids. In addition, degradation is a problem when working with mRNA, and its instability can pose problems for forensic identification. This microRNA can be used as an alternative to large mRNAs because it is difficult to degrade due to its small size, but reproducibility issues require validation of the method.

Correspondence to: Melanie Cortellini, Department of Forensic Medicine, University of Bonn, Bonn, Germany, E-mail: Melaniecortelin@yahoo.com

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