Forensic Science International: Genetics Supplement Series 4 (2013) e45–e46

Contents lists available at ScienceDirect

Forensic Science International: Genetics Supplement Series

journal homepage: www.elsevier.com/locate/FSIGSS

Forensic approach to analyzing rape cases

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ARTICLE INFO

Article history:
Received 30 August 2013
Accepted 2 October 2013

Keywords:
Rape
DNA
Acid phosphathase

ABSTRACT

With large number of criminal acts, such as rape and murder, identification of the perpetrator is very difficult to determine. The cause is the lack of sufficient quantity of biological traces provided as material evidence, or the biological material is decomposed and no result can be obtained by using other identification methods. Thus the case remains unsolved. The purpose of this research is to establish a reliable method for detecting semen presence in rape cases and to get DNA profile from the perpetrator of a crime. Vaginal swabs were taken using cotton swabs during gynecological examination or autopsy in 21 cases. The chemical detection of semen presence was performed using Phospathesmo Kits. The DNA extraction was performed using QIAAamp® DNA Mini Kit. The amplification was performed using AmpFistrIdentifiler Kit and AmpFistrYfiler Kit. The electrophoresis was performed using 310 ABI squenator. Results indicate that DNA profile was obtained in 4 cases where chemical tests did not prove semen presence using Phospathesmo Kits. In one case, neither semen presence was chemically proven nor DNA profile was obtained for autosomal STRs, but a profile for Y-STRs was obtained. Our analyses indicate that when the victim's body is examined within the first few hours or the first day, a genetic profile of the perpetrator of the criminal act is obtained. Besides using autosomal STRs, we recommend Y-STRs to be used in all rape cases, too, thus separating the male from female profile, and also the male kinship relatedness in cases of incest could be followed, the rape performed by several blood-related men or similar.

1. Introduction

With large number of criminal acts, such as rape and murder, identification of the perpetrator is very difficult to determine. The cause is the lack of sufficient quantity of biological traces provided as material evidence, or the biological material is decomposed and no result can be obtained by using other identification methods. Thus the case remains unsolved. In the forensic practice analysis of the autosomal STR's and Y-STR's are of great importance, since in large number of criminal acts the perpetrator is male [1,2]. Y-STR's represent a powerful method in the studies of human evolution as well as in everyday analysis in the forensic practice, when determining the kinship relations and paternity expertise, especially in cases where the possible biological father is dead [3–5].

2. Objective

The purpose of this research is to establish a reliable method for detecting semen presence in rape cases and get DNA profile from the perpetrator of a crime.

3. Materials and methods

Vaginal swabs were taken using cotton swabs during gynecological examination or autopsy in 18 cases in a period from 2004 to 2011. The chemical detection of semen presence was performed using Phospathesmo Kits. Upon obtaining positive results, a histological slide is prepared in order to prove the semen under microscope using the Hematoxylin–Eosin method. The DNA extraction was performed using QIAAamp® DNA Mini Kit. Quantification was performed using 2 μl of extracted DNA with Quantifiler Kit on 7500 RealTime PCR. Multiplex PCR amplification was performed using 1–3 ng of genomic DNA according to the manufacturer's protocol with AmpFistr Identifiler Kit and AmpFistr Yfiler Kit. Amplification was carried out in a 9600 Thermal Cycler (Applied Biosystems). For electrophoresis, 1 μl of the PCR product was combined with 12 μl of formamide and 0.5 μl of GeneScan 500 LIZ size standard. Detection of PCR products and genotyping were carried out on the ABI PRISM 310 Genetic Analyser using the ABI PRISM collection software and Genotyper 3.7 analysis software (Applied Biosystems).

4. Results

Results indicate that DNA profile was obtained in 4 cases where chemical tests did not prove semen presence using Phospathesmo Kits (Table 1).

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http://dx.doi.org/10.1016/j.fsigss.2013.10.023

Table 1
Results from rape cases in the period from 2004 to 2011.

No. of cases	Time	Acid phosphatase	Autosomal STR	Y-STR
1	After 24 h	+	+	+
2	After 24 h	+	+	+
3	10 h	+	–	–
4	12 h	–	–	+
5	3 weeks	–	+	+
6	After 24 h	+	+	+
7	After 24 h	+	+	+
8	8 h	–	–	–
9	After 24 h	+	–	–
10	6 h	+	+	+
11	After 48 h	–	–	–
12	After 24 h	+	+	+
13	After 24 h	–	+	+
14	After 7 days	+	+	+
15	10 h	+	+	+
16	13 h	–	+	+
17	After 36 h	–	+	+
18	After 24 h	–	–	–

In one case, neither semen presence was chemically proven nor DNA profile was obtained for autosomal STRs, but profile for Y-STRs was obtained. In two cases where a long period of time has passed between the criminal act and the making of analysis, in the first case 3 days and in the second 3 weeks, DNA profile of the perpetrator was obtained for the autosomal STRs and Y-STRs.

5. Discussion

There are number of procedures to be taken in order to prove rape case which include examination of the victim, the crime scene investigation and examination of the suspect. Each investigation procedure should be conducted under strictly defined protocol, with compulsory identification of the victim. In providing the material evidence the custody chain should be followed. The victim examination should be performed by a doctor who is specialist for forensic medicine, who will make body examination and gynecological examination of the external genitals. During the examination all injuries of the victim are described in detail and material for criminological and DNA expertise are collected including hair, swab from bite mark to prove saliva and vaginal swabs to prove sperm. In case when injuries of the internal genitals are detected, the victim should be referred to a gynecologist specialist for further specialist treatment. From the victim's clothing as well as of the material collected from the crime scene a detailed analysis is made.

The material evidence should not be contaminated during its collection, otherwise the would be useless for further forensic procedure [6].

The examination of the victim should be performed at the earliest possible time after the criminal act. The sperm at a room temperature may remain alive up to 24 h, in the mouth and inside the vagina 48 h and rarely up to 72 h. Sperm are heat-sensitive and can not endure high temperatures, while water, weak inorganic acids, aseptic solutions, quinine, nicotine, soap, etc. also adversely affect the sperm [7].

Proof that rape has happened are determined injuries at specific places on the victim's body – genitals, breasts, thighs and scratches on the neck, then detecting sperm presence with microscope and chemically by enzyme acid phosphatase. DNA analysis is necessary for final identification for the perpetrator of the rape. In case there is no positive reaction for semen, it does not mean that on the vaginal swabs there are no cells that belong to the suspect, because in the course of time the enzyme acid-phosphates degrades, or that the suspect did not ejaculate. Therefore, additional analysis should be made as well as extraction of DNA, for possible proving of the male profile from epithelial cells or semen [8].

Our analyses indicate that when the victim's body is examined within the first few hours or the first day, a genetic profile of the perpetrator of the criminal act is obtained.

Besides using autosomal STRs, we recommend Y-STRs to be used in all rape cases, too, thus separating the male from female profile, and also the male kinship relatedness in cases of incest could be followed, the rape performed by several blood-related men or similar.

Role of funding

Financial support was provided by self fond from the Institute of Forensic Medicine, Criminology and Medical Deontology, School of Medicine, University "St's. Cyril and Methodius", Skopje, Republic of Macedonia.

Conflict of interest

None.

Acknowledgement

This research was supported by Ksenija Nikolova and Antonela Janeva.

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