

Case Study

A Case Study: DNA Analysis - a Key to Save Innocent in Rape Case

Vaishali B. Mahajan¹, Amulya A. Pande², Kewalram R. Gorle³,
Manoj R. Bhandarkar³, Laxmikant B. Rewatkar⁴

¹Assistant Chemical Analyser, Regional Forensic Science Laboratory, Government of Maharashtra, Home Department, Dindori Road, Nashik - 440002, Maharashtra, India

²Assistant Chemical Analyser, Regional Forensic Science Laboratory, Government of Maharashtra, Home Department, Irwin Chowk, Amravati - 444602, Maharashtra, India

³Assistant Director, ⁴Deputy Director,
Regional Forensic Science Laboratory, Government of Maharashtra, Home Department, Dhantoli, Nagpur – 440012, Maharashtra, India

Corresponding Author: Vaishali B. Mahajan

ABSTRACT

The maternal uncle was falsely implicated by a victim aged 16 in the crime of rape under section 376 of Indian Penal Code after detection of pregnancy during regular medical check-up at government shelter home. He was saved from being punished for the crime which was not at all committed by him only with the help of mismatch of his DNA paternity with the aborted fetus of victim. DNA paternity test had given new direction to case and in further investigation the real accuse who was her brother-in-law found matched paternity with aborted fetus. It was the DNA test that brought relief to suspect who was falsely implicated by victim to save her sister's family life. The charge of 376 shifted to real accuse i.e. brother-in-law of Victim. Hon'ble court sentenced him rigorous imprisonment for seven years and fined him Rs.2000/- for raping a minor on the basis of DNA paternity test report.

Key words:- DNA Profiling, Polymerase Chain Reaction, Short Tandem Repeats.

INTRODUCTION

DNA profiling was first developed and used in 1984 by Dr. Alec Jeffreys [1,3-6] while working in Department of Genetics at University of Leicester. [7] It is used for parentage testing and criminal investigation to identify person or to connect a person with crime. [2] The first method used for DNA profiling was RFLP analysis which involved detection of variable number of tandem repeats. These VNTRs vary in length among different individuals. In 1983 Kary Mullis developed a PCR technique in which specific portions of DNA sample can be amplified. Today, the system of DNA profiling used is based on PCR and it used Short Tandem Repeats which are simple

sequences commonly 4 bases repeats. [9-11] Another STR's can also be use in which 3 and 5 bases are repeated. [8] These STR fragments separated and detected using capillary electrophoresis. This technique compares strands of genetic material between the child and alleged father. Comparing strands from various locations of the genetic material allows accuracy rating of 99.9%. [12] DNA typing allows an alleged father to be excluded with 100% certainty. [13] This technique not only helps to prove guilt of accused but his innocence too.

In the instant case, victim being orphan, while staying in Government shelter home at Nagpur, during regular medical

check-up found pregnant of 16 weeks. Government shelter authorities registered complaint to police station. During inquiry, the girl blamed her maternal uncle who had taken her away for 2 months for family function. Accordingly, police arrested him for charge of rape. After victim's abortion, DNA profiling division of Regional Forensic Science Laboratory, Nagpur received aborted fetus and blood samples of victim and suspected accused. In the analysis, suspected accused failed to match the paternal alleles present in fetus, resulting in exclusion of paternity. And then twist in case arises after getting DNA report. During further investigation, police had doubt on her brother-in-law who had taken her to home after completion of her 10th class exams. DNA analysis proved that brother-in-law's DNA profile matched all the paternal alleles present in aborted fetus proving his involvement in crime.

MATERIALS AND METHODS

- AmpFISTR PCR Reaction Mix
- AmpliTaq Gold DNA polymerase
- AmpFISTR Primer set
- Formamide
- Size Standard
- Allelic Ladder

After filing complaint against maternal uncle, victim aborted her fetus which was collected, preserved and forwarded by medical officer for DNA profiling along with blood samples each of victim and suspect in DNA kit of DNA unit, Regional Forensic Science Laboratory, Nagpur. Analysis started after checking seals and labels of all exhibits.

Extraction of DNA:-

From aborted fetus, DNA was extracted. Similarly, DNA was extracted from blood samples of victim and suspected accused using organic extraction method. To each sample, Forensic buffer, Proteinase K and 10% SDS was added. The Sample was Vortexed, quick spinned and incubated at 56°C for 4 hours until tissue got fully dissolved in buffer. Then Phenol:

Chloroform: Isoamyl Alcohol (25:24:1) added. Proteins denatured and collected in organic phase while nucleic acids remain in aqueous phase. To the aqueous phase 2M Sodium Acetate and chilled Isopropanol added to precipitate DNA. Precipitated DNA is finally dissolved in Tris EDTA buffer (pH-8).

Quantification:-

Extracted DNA is quantified using 1% Agarose, 1X TAE buffer, Ethidium bromide and Bromophenol blue. Accurately quantified DNA is used for profiling.

PCR based STR Analysis:-

Extracted DNA from tissue of fetus and blood samples was amplified using AmpFISTR® Identifiler kit with the help of PCR machine to amplify DNA. [14] Reaction mixture used for identifiler were PCR Reaction mix 10.5µl, Taq Gold DNA polymerase 0.5 µl, Primer set 5.5 µl and 10 µl of DNA sample was added to it. Samples incubated at 95°C for 11 min. Then run for 28 cycles at 94°C, 54 °C and 72 °C as temperature of denaturation, annealing and extension respectively. Amplified DNA samples then kept at 60 °C for an hour and then at 4 °C till separation of STRs. It produces millions of DNA fragments of different sizes. Amplified products were separated and detected using 3130 Genetic Analyzer. [15] Simultaneous amplification of 16 STR Loci was completed and analyzed. [16,17]

RESULTS AND DISCUSSIONS

Table 1

STR LOCUS	GENOTYPE		
	Victim	Aborted Fetus	Maternal uncle of victim (Suspected accused)
D8S1179	14,14	10,14	11,13
D21S11	29,32.2	29,30	30,31.2
D7S820	9,10	9,12	11,11
CSFIPO	12,15	12,15	13,13
D3S1358	14,15	14,15	16,18
THO1	9,10	6,10	9,9
D13S317	10,11	11,12	8,11
D16S539	9,11	11,12	11,11
D2S1338	19,23	19,22	23,24
D19S433	14,14	14,14	12,13
vWA	17,17	16,17	17,17
TPOX	11,11	8,11	10,11
D18S51	21,21	15,21	16,16
AMELOGENIN	X,X	X,X	X,Y
D5S818	11,11	11,13	10,13
FGA	23,23	20,23	25,26

DNA extracted from tissue of aborted fetus and blood samples of victim and suspected accused was typed at 15 STR Loci and gender specific Amelogenin locus using PCR amplification technique. (Table1).

Out of 15 different genetic systems analyzed with PCR, suspected accused who was maternal uncle of victim failed to match the obligate paternal alleles present in aborted fetus at 13 STR Loci. Victim matched obligate maternal alleles present in aborted fetus at all 15 STR Loci. (Table 1).

Above observations concluded that victim is biological mother but suspected accused is excluded to be biological father of fetus.

The DNA report had given new direction to investigation. Police started searching real father of fetus. They came to know that after maternal uncle dropped victim to government shelter home after completion of marriage function, her brother in law had taken her to his home as her 10th class exams had got over. And being doubted on him, they sent his blood sample for DNA profiling in the DNA kit.

As per above extraction method and PCR analysis, his DNA profile was obtained which was matched with aborted fetus (Table 2).

Table 2

STR LOCUS	GENOTYPE		
	Victim	Aborted fetus	Brother in law of victim
D8S1179	14,14	10,14	10,14
D21S11	29,32.2	29,30	28,30
D7S820	9,10	9,12	9,12
CSF1PO	12,15	12,15	12,13
D3S1358	14,15	14,15	15,16
TH01	9,10	6,10	6,9
D13S317	10,11	11,12	12,12
D16S539	9,11	11,12	11,12
D2S1338	19,23	19,22	22,24
D19S433	14,14	14,14	14,14
vWA	17,17	16,17	14,16
TPOX	11,11	8,11	8,8
D18S51	21,21	15,21	13,15
AMELOGENIN	X,X	X,X	X,Y
D5S818	11,11	11,13	10,13
FGA	23,23	20,23	20,23

It was observed that victim’s brother in law matched the obligate paternal alleles present in fetus at all 15 STR Loci (Table

2). Thus, he was concluded to be biological father of fetus.

CONCLUSIONS

Victim despite being exploited by a close kin had tried to shield him first before the police and subsequently during trial for the sheer reason that her elder sister’s family life should not get spoil. It was DNA profiling that brought relief to a person who was falsely implicated by victim and shifted charges of 376 IPC to real accuse i.e brother-in-law of victim. Hon’ble court punished him for 7 years rigorous imprisonment and Rs. 2000/- fine for ignoring moral responsibility and engaged in an act which led to pregnancy of victim who was already caught in difficult situation in life at a tender age having to stay in government shelter for children in need, care and protection.

On conclusion, DNA profiling is a reliable and robust genetic tool which has an important central role in the society to solve crime and forensic case works.

ACKNOWLEDGEMENTS

We are thankful to our Director, Directorate of forensic science laboratories, Mumbai, Home Department, Government of Maharashtra, India for his guidance and encouragement all the time extended to us. We would like to show our gratitude to Babu Bangar, Deputy Superintendent of Police, Home Department, Maharashtra, India for valuable guidance and co-operation.

REFERENCES

1. “Eureka moment that led to the discovery of DNA fingerprinting”. The observer, 24 May 2009.
2. DNA pioneer’s ‘eureka’ moment BBC. Retrieved 14 October 2011.
3. Tautz D (1989), ‘Hypervariability of simple sequences as a general source for polymorphic DNA markers’. *Nucleic Acids Research*, 17:6463-6471.
4. Patent Jackle H and Tautz D (1989) ‘Process for Analyzing Length

- Polymorphism in DNA Regions' europaische patent No. 0438512.
5. Eureka moment that led to the discovery of DNA fingerprinting | Science | The Guardian.
 6. The man behind DNA fingerprints: an interview with Professor Sir Alec Jeffreys | Investigative Genetics | Full Text.
 7. Alec Jeffreys and Genetic Fingerprinting- University of Leicester.
 8. Tautz D, (1989) "Hyper-variability of simple sequences as a general source for polymorphic DNA markers". *Nucleic Acids Research* 17: 6463-6471. Doi: 10.1093/nar/17.16.6463.
 9. Butler, J. M. *Fundamentals of Forensic DNA Typing; Forensic DNA Typing; Elsevier Academic Press : Sun Diego, 2009.*
 10. Gill P. Role of Short Tandem Repeat DNA forensic casework in the UK-past, present and future perspectives. *Biotechniques* 2002, 32 : 366-372.
 11. Butler J; Genetics and genomics of core short tandem repeat loci used in human identity testing. *J Forensic sci.* 2006, 51: 253-265.
 12. Lygo JE, Johnson PE, Holdaway DJ, Woodroffe S, Whitaker JP, et.al (1994). The validation of short tandem repeat (STR) loci for use in forensic case work, *Int J Legal Med* 107 : 77-89.
 13. Butler JM, Shen Y, Mccard BR (2001) *Forensic DNA typing: biology and technology behind STR markers, London : Academic Press.*
 14. Mullis K, Faloona F, Scharf S, Saiki R, Horn G et. Al (1986). Specific enzymatic amplification of DNA in vitro : the polymerase chain reaction, *Cold spring Harb Symp Quant Biol* 51 pt 1 : 263-273.
 15. Reynolds R, Sensabaugh G, Blake E (1991) Analysis of genetic markers in forensic DNA samples using Polymerase Chain Reaction *Anal Chem* 63 : 2-15.
 16. Budowle B, Allen RC (1988) Analysis of amplified fragment length polymorphism (VNTR/STR loci) for human identity testing. *Methods Mol Biol* 98 : 155-171.
 17. Gill P, Kimpton CP, Urquhart A, Oldrod N, Millican ES, et.al (1995) Automated short tandem repeat (STR) Analysis in forensic casework-a strategy for future. *Electrophoresis* 16: 1543-1552.

How to cite this article: Mahajan VB, Pande AA, Gorle KR et al. A case study: DNA analysis - a key to save innocent in rape case. *Int J Health Sci Res.* 2017; 7(6):370-373.
