THE SIGNIFICANCE OF DNA PROFILING BY SHORT TANDEM REPEAT ANALYSIS IN IDENTIFYING MASS CASUALTIES

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Ms. Blessy John Kaalla

Disasters are unpredictable; they can be natural, accidental, or man-made events that occur with or without a warning and cause or threaten to cause death, injury, or damage to property, the environment, or lives. Disaster Victim Identification is a process for recovering and identifying deceased people or human remains in mass casualty incidents. The establishment of the victim's identity is critically necessary on humanitarian grounds for all the grieving relatives and legal issues to achieve closure.

Identification is done by primary identifiers like comparative dental analysis, fingerprint, and DNA (Deoxyribonucleic acid) analysis, or by secondary identifiers like personal description, medical findings, records, clothing, and evidence found on the body.

Body identification in fire disaster incidents becomes more difficult because the bodies are in poor condition, being extremely charred and having only remnant burnt soft tissues and bones.

Fig.1:Deoxyribonucleic acid

Deoxyribonucleic acid, or DNA, is a molecule that can only be found in nucleated cells and codes for a protein called a gene and is located on each segment of a chromosome. The human genome contains polymorphism in which the position of nucleotide sequences are different. It uses polymorphisms called short tandem repeats (STRs), which are regions of non-coding DNA that contain repeats of the same nucleotide sequence present at different genetic loci, for identification.
In this study, Byramjee Jeejeebhoy Government Medical College and Sassoon General Hospital, Pune used DNA identification by polymerase chain reaction (PCR) technique involving STR analysis to identify 17 charred burnt bodies from a tragic fire incident that occurred in a sanitizer manufacturing factory.

MATERIAL AND METHODS

The autopsy included all 17 of the charred and completely burned bodies, it was difficult to identify them using secondary identification techniques as the bodies were deformed.
The complete autopsy was performed by labelling the bodies with serial numbers. The following bones were preserved and sent to regional forensic science laboratory:

- Piece of sternum - 09 cases
- Part of humerus bone - 02 cases
- Part of femur bone - 04 cases
- Part of tibia - 01 cases
- Part of fibula - 02 cases
- Teeth - 08 cases

Blood samples of next of kin were drawn for comparative DNA analysis. They were typed by PCR at 15 STR loci and one amelogenin locus distinct to each gender.

OBSERVATION

On external examination, it was observed all bodies showed superficial to deep burn injuries with charring, complete blackening, and heat ruptures exposing internal organs. Sex could be determined only of 4 bodies, 2 males and 2 females.

On internal examination, uterus and ovaries were observed in 14 cases and prostate in 2 cases with the help of which preliminary sex allocation was done.

DNA from bone and tooth was analysed at 15 autosomal STR markers, D7S820, D19S433, CSF1PO, D13S317, D8S1179, VWA, TPOX, D3S1358, D19S43, D5S818, TH01, FGA, D16S539, D2S1338 and D18S51, which helped to establishing identity of 16 victims. X/Y specific amelogenin gene markers were used for sex determination.

DISCUSSION

Meticulous planning and execution by police personnel and medical experts are required to establish identity in a mass casualty incident.

In this study, the bodies were charred causing both autolytic and deleterious changes, degrading the DNA. The advantage of using STR is it resolves the DNA fragment by polyacrylamide gel, differing by as little as one nucleotide in length allowing precise allele designation.

PCR provides better sensitivity and specificity for phenotyping and genotyping techniques by enabling analysis of extensively degraded samples.

DNA samples are often extracted from the pulp tissue of the teeth (molar and premolar) as they are resistant to microbial action, incineration, decomposition and weather changes. They are less likely to get contaminated as they are protected by dentin-the hardest structure of the human body.

In this study, it was seen both internal and external examination helped in sex determination but identifying the victim was not possible. Identification of all the seventeen victims was done by performing DNA analysis by typing at 15 STR loci for each victim.

CONCLUSION

DNA profiling serves as vital evidence enhancing the criminal justice system's accuracy by identifying potential suspects, linking suspects to the crime, identification of the unidentified body or human remains, etc. It serves as the gold standard for individualising victims even when the body is highly fragmented, degraded, and extremely damaged, as in fire incidents.

This study demonstrated the utility of PCR amplification of STR loci when involved in the investigation of mass casualties when reference DNA samples are available, providing rapid potential identification of human remains.

REFERENCES

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