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Case Report

The Importance of DNA Data Banks in the Identification of Unidentified Bodies: A Case Report

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ABSTRACT

Background: Since the first use of DNA analysis in biological samples in a criminal case, a revolution in forensic investigations was created by a sub-field called forensic genetics. Also, today, it is possible to identify people by creating databases of the genetic identity of people in society and matching them with the genetic profile extracted from unknown samples. One of the applications of genetics banks is to identify the bodies in accidents such as traffic accidents where the body cannot be recognized in terms of appearance. For this purpose, by taking a biological sample from the body and extracting its genetic profile, it can be matched with the genetic profile of the person already registered in the genetic bank, and the unknown body can be identified.

Case Presentation: Seventeen bodies that died due to car accidents and could not be identified in terms of appearance were referred to the legal medicine organization of Ilam Province, Iran, to determine the cause of death and identification. After taking muscle samples from all bodies due to the lack of a sizeable genetic bank in Iran, the first-degree families of the claimant bodies were invited to take blood samples for identification. Unknown bodies related to car accidents were successfully identified by using muscle samples from unknown bodies and comparing them with blood samples from first-degree families.

Conclusion: Nevertheless, with the creation and development of DNA data banks for all people, there is no need for the presence of the first-degree family in such incidents, and by comparing the unknown samples in the DNA data banks, it is possible to identify the unknown bodies more accurately, quickly and at a lower cost. Right now, we have a DNA data bank for criminals in Iran. However, the creation of a DNA data bank for everyone is emphasized in this study due to various applications, such as identifying unidentified bodies.

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Introduction

People identification has been critical throughout history. Until now, Human Branding, Anthropometry, Fingerprints, Blood groups, and iris scans have been used to identify people. Genetic identification, a new method based on genetic science, has many advantages over other methods. The advent of DNA fingerprinting identification has revolutionized the science of crime detection [1]. Fast, accurate, and powerful sequencing methods have enabled the human genome project (HGP) to obtain today's complete human genome sequence. DNA databases are developed today as a result. DNA databases are a type of biological storage that stores genetic information. In addition to therapeutic and drug design goals, DNA databases aim to identify individuals based on their genetic profiles [2]. This study aims to show the importance of genetic databases in identifying unidentified corpses from case reports.

Case Report

Seventeen bodies that died due to car accidents that could not be identified in terms of appearance were referred to the legal medicine organization of Ilam Province to determine the cause of death and identification (Figure 1). Muscle samples from all bodies were taken to extract the DNA profile after examinations and determining the cause of death. The samples were transferred to the genetics laboratory after coding. The unknown bodies' DNA profile was sequenced successfully using AmpFLSTR® Identifiler® PCR Amplification Kit [3]. This amplification kit simultaneously amplifies 15 short tandem repeats (STR) loci plus the Amelogenin gender-determining marker in a single, robust polymerase chain reaction PCR (Table 1). After calling for the families to request the bodies, identifying the families, drawing a pedigree, and taking a blood sample on the fast technology for analysis of nucleic acids (FTA) card, the DNA profile of all the families was extracted. The DNA profile matching of the unidentified bodies with family members was enough to identify all the unidentified bodies.

Discussion

People identification has been critical throughout history. Until now, Human Branding, Anthropometry, Fingerprints, Blood groups, and iris scans have been used to identify people. Genetic identification, a new method based on genetic science, has many advantages over other methods [4]. Our DNA knowledge is fascinating today due to genetic science advances. Forensic genetics, including Iran, is a sub-field of DNA knowledge worldwide. However, our understanding and knowledge of DNA sequences are constantly growing. Fast, accurate, and powerful sequencing methods have enabled the HGP to obtain today's complete human genome sequence. DNA data banks are developed today as a result. Sequencing of STR is used as the primary marker in DNA analysis in legal medicine, but other genetic markers are also used in specific cases [5]. Due to the high sensitivity of DNA sequencing techniques used today in legal medicine and the amplification of the target regions by PCR, the tiny remains of bodies can be used to obtain DNA analysis results, even if they are gained from bones [6]. The HGP and subsequent scientific efforts and discoveries in genetics and genomics have helped develop forensic DNA technology. HGP genomic information provided STR genetic markers for testing, and more recent studies provided population data to assess genetic variation. In addition, sensitive and powerful DNA sequencing tools and techniques play a crucial role in forensic genetics.

Autosomal and sexual chromosome STR markers are used for DNA analysis in legal medicine. Commercial kits analyze 15 to 22 STR loci. The advantages of analysis STRs are their high diversity, polymorphism, and discrimination, high sensitivity for analysis of tiny samples, low genetic mutations and lack of natural selection [5]. Forensic genetics has the following applications. Identification of the owner of biological samples obtained from the crime and rape scene, identification of bodies that cannot be identified in terms of appearance can be detected through comparison with previous reference samples of the person in the DNA data banks or first-degree family samples, paternity and maternity, and DNA phenotyping. A significant feature of DNA, which is used for identification of unknown bodies, is that due to its inheritance pattern, half of a person's genome is inherited from their mother and the other half from their father. First-degree biological families can be used as reference samples for identification [7].

DNA data banks are a type of biological storage that stores genetic information. In addition to therapeutic and drug design goals, DNA data banks identify individuals based on their genetic profiles [2]. Today, by developing DNA data banks of people and comparing them with the DNA profiles extracted from the biological samples obtained from the crime scene, it is possible to identify criminals [5, 8-10]. The number of reference samples collected in DNA data banks worldwide, including Iran, is rising. Most samples are collected from criminals to identify them for reoffending. DNA data banks can also

Figure 1. A body died due to car accidents cannot be identified in terms of appearance

Table 1. The AmpFlSTR identifiler kit loci

Locus Designation	Chromosome Location	Allele in Identifiler® Allelic Ladder	Dye Label
D8S1179	8	8-19	6-FAM™
D21S11	21q11.2-q21	24, 24.2, 25-28, 28.2, 29, 29.2, 30, 30.2, 31, 31.2, 32, 32.2, 33, 33.2, 34, 34.2, 35, 35.2, 36-38	
D7S820	7q11.21-22	6-15	
CSF1P0	5q33.3-34	6-15	
D3S1358	3p	12-19	VIC®
TH01	11p15.5	4-9, 9.3, 10, 11, 13.3	
D13S317	13q22-31	8-15	
D16S539	16q24-qter	5, 8-15	
D2S1338	2q35-37.1	15-28	
D19S433	19q12-13.1	9-12, 12.2, 13, 13.2, 14, 14.2, 15, 15.2, 16, 16.2, 17, 17.2	NED™
vWA	12p12-pter	11-24	
TPOX	2p23-2per	6-13	
D18S51	18q21.3	7, 9, 10, 10.2, 11-13, 13.2, 14, 14.2, 15-27	
Amelogenin	X: p22.1-22.3 Y: p11.2	X, Y	PET®
D5S818	5q21-31	7-16	
FGA	4q28	17-26, 26.2, 27-30, 30.2, 31.2, 32.2, 33.2, 42.2, 43.2, 44.2, 45.2, 46.2, 47.2, 48.2, 50.2, 51.2	

Note: All short tandem repeats (STR) loci included in the AmpFLSTR identifiler PCR amplification kit are co-amplified in a single PCR and analyzed simultaneously in a single gel-lane or capillary electrophoresis injection with ABI PRISM systems.

be utilized for other purposes, such as identifying bodies that have not been identified. In mass disasters, such as floods, earthquakes, car accidents, and plane crashes, many bodies cannot be identified; the only certain way to identify body remains is a DNA fingerprint. For this purpose, the unidentified body sample should be compared with a sample from the DNA data bank related to themselves or their first-degree family [11]. The most common method in forensic genetic laboratories worldwide is to compare the unknown sample with first-degree families. However, this method has problems, such as the unavailability of first-degree families, additional testing costs, etc. In the case of the creation and development of the DNA data banks of all the people, there is no need for the presence of the first-degree family in such incidents, and by comparing the unknown samples in the DNA data banks, it is possible to identify the unknown bodies more accurately, quickly and at a lower cost.

Conclusion

Unknown bodies related to car accidents were successfully identified by using muscle samples from unknown bodies and comparing them with blood samples from first-degree families. Nevertheless, with the creation and development of DNA data banks for all people, there is no need for the presence of the first-degree family in such incidents, and by comparing the unknown samples in the DNA data banks, it is possible to identify the unknown bodies more accurately, quickly and at a lower cost. Right now, we have a DNA data bank for criminals in Iran. Nevertheless, the creation of a DNA data bank for everyone is emphasized in this study due to various applications, such as identifying unidentified bodies.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors' contributions

Study concept and study design: Amin Bakhtiyari and Hanie Bakhtiyari; Data analysis, data interpretation and critical revision: Masoud Ghadipasha and Amin Bakhtiyari; Drafting of the manuscript: Hanie Bakhtiyari; Statistical analysis: Hanie Bakhtiyari.

Conflict of interest

The authors declared no conflict of interest.

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