B1 Costal Cartilage as an Alternative Source for DNA Typing in Personal Identification

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Learning Overview: After attending this presentation, attendees will understand how to use the costal cartilage as an alternative source of sample for DNA typing in personal identification.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by showing that the costal cartilage can be valuable evidence for DNA typing.

In decomposed bodies, bones and teeth are the most reliable sources of nuclear DNA suitable for PCR typing of STR loci. However, DNA extraction from such kinds of specimen requires long and painstaking laboratory work and the final DNA yields are often extremely small. Costal cartilage as an alternative source of nuclear DNA in decomposed human remains has been evaluated. Cartilage is a specialized type of connective tissue formed by cells, the chondrocytes, lying in an amorphous matrix rich in collagen and elastic fibers. It can be surmised that this matrix may act as a physical barrier protecting DNA from chemical breakdown. Moreover, cartilage is lacking in blood vessels. For this reason, chondrocytes may be less prone to degradative factors such as microorganisms. Cartilage is very well preserved while the skin around the rib has a marbled appearance characteristic of the bloat stage of decomposition. Samples were collected from: (1) murder scenes where the corpse was found in a grave (2 cases, PMI = 2 to 4 years); (2) suicide scenes where the corpse was found in the forest and in flats (30 cases, PMI = 3 months to 3 years); (3) conflagration scenes where the corpse was found in the rubble (3 cases, PMI = 1 day to 7 days); and (4) rockfall in a coal mine (6 cases, PMI = 1 day to 67 days).

In this study, decomposed tissues were removed from the rib sample followed with pre-cleaning in sterile water twice and a final wash with 70% ethanol. A slice piece of costal cartilage was generated by using a surgical blade and incubated in 300 µl water, 300 µl incubation buffer and 20 µl proteinase K at 56˚ C in 1.5 ml micro-centrifuge tube until the sample was completely resolved. Column technology was used to isolate DNA from the supernatant. The final volume of DNA solution was 50 µl. Purified DNA was measured. The degree of DNA degradation was low and ranged between 0.7 and 1.1. Multiplex PCR was performed with the thermal cycler and the amplification products were separated by capillary electrophoresis. Electrophoretic data was analyzed using the software complete profiles of all 23 autosomal STRs and gender-specific amelogenin X and Y was obtained by using the authors' proposed technique.

In conclusion, the authors demonstrated that the costal cartilage could be a designate specimen for DNA isolation from human decomposed body especially in those cases where the corpse was discovered several years after death. Furthermore, DNA isolation from costal cartilage was simple, fast, less expensive, and no freezer was required. Regardless of the appearance and morphological state of the cartilage, a complete genetic profile was obtained in all cases. Costal cartilage sample should be standard source for isolating high quality and quantity genomic DNA from decomposed bodies.

Costal Cartilage, DNA Typing, Short Tandem Repeat