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Original Article

Forensic identification of severely decomposed bodies

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Abstract

Aim: The decay of a body is defined as decomposition in the field of forensic medicine. In this study, it is aimed to examine the sociodemographic data in severely decomposed bodies and identify the biological materials that can be collected for identification.
Materials and Methods: In this study, the files of cases autopsied at the Forensic Medicine Institute in Şanlıurfa between 2018-2022 were retrospectively analyzed. Severely decomposed cases were identified.
Results: Of the cases, 18 were male and 3 were female. 11 cases occurred in summer, and 4 in spring. 10 of the cases were suspicious deaths found at home or in the field while 8 were bodies recovered from water. Blood samples could only be taken from 9 cases for identification procedures. Muscle tissue samples were taken from 12 cases, bone tissue from 18 cases, and 2 cases each had dental and hairy skin samples collected. The psoas muscle was selected as the muscle tissue, while sternum samples were collected from 15 cases and femur samples from 3 cases.
Conclusion: Identification in cases of severe decomposition is as important as determining the cause of death. In situations where medical identification can't be performed, forensic identification becomes extremely significant. The biological samples to be taken in forensic identification, the number and quality of these samples, and the preservation of these samples for Deoxyribonucleic Acid (DNA) analysis are important considerations.

Keywords: Identification, deoxyribonucleic acid, autopsy, decomposition

INTRODUCTION

The breakdown of complex and advanced organic compounds into simpler elements occurs through the action of proteolytic and other enzymes produced by bacteria. This process results in the tissues breaking down into gases, liquids, and salts, thus disappearing. Biological entities must decay after death to re-enter the ecological system [1,2]. After a person's death, early and late signs of death manifest. Decomposition is an inevitable consequence following cellular autolysis [1-3].

Decomposition traditionally consists of four stages:

Stage 1: Generally begins 36-48 hours after death, marked by a green discoloration about the size of a palm on the right side of the abdomen. Hydrogen sulfide formed combines with hemoglobin separated from the blood to create sulfohemoglobin. The initial sign in the abdomen gradually expands and spreads throughout the body. The visibility of vessels on the body's surface is referred to as the decomposition map, while the movement of fluids within blood vessels is called postmortem circulation. Gases collected in the abdomen bloat the body, causing blood-tinged frothy fluid to emerge from the mouth and nose, referred to as postmortem circulation. The epidermis begins to peel in layers, and internal organs start to decay. Fluid accumulates in the pleura. The order of organ decay is the trachea, stomach, intestines, spleen, liver, brain, heart, lungs, kidneys, bladder, esophagus, pancreas, diaphragm, and bronchi. Among soft organs, the uterus remains

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intact during decomposition. This stage is typically completed within three weeks.

Stage 2: This stage begins with the bursting of the abdomen, which can be quite loud. Once the abdomen ruptures, the abdomen and thorax collapse, and the lungs shrink. The liver softens, while the uterus remains in place. The sex of the individual becomes externally identifiable.

Stage 3: In this stage, the liver is lost, and the skeleton begins to become visible.

Stage 4: This stage begins when the sex can no longer be determined upon external examination, and the skeleton is broadly exposed. Bones, hair, and teeth remain for long periods without decomposing. Generally, it takes about five years for a buried body to decompose entirely into a skeletal state [1-5].

Although the progression of decomposition usually occurs this way, the rate can differ between various regions of the same body. Additionally, exceptional circumstances such as mummification and adipocere formation can also result from decomposition [4,6]. Changes due to decomposition can lead to misinterpretations during autopsies, particularly in advanced stages where most injuries may be obscured. This may also present challenges during the identification process [7,8].

This study aims to examine the sociodemographic data in severely decomposed bodies and to identify the biological materials that can be collected for identification.

MATERIAL AND METHOD

In our study, the files of cases autopsied at the Forensic Medicine Institute in Şanlıurfa from 2018 to 2022 were analyzed retrospectively. Severely decomposed cases were identified. Relevant documents such as autopsy reports, autopsy photographs, toxicological examination reports, crime scene investigation reports, witness statements, expert reports, and biological samples taken for Deoxyribonucleic Acid (DNA) analysis for forensic identification were reviewed.

Ethics committee approval was obtained with the decision numbered 21589509-2023/414 of The Council of Forensic Medicine dated 10/05/2023.

RESULTS

Thirteen of the cases were of Turkish nationality, while eight were Syrian. Eighteen cases were male, and three were female. Due to the inability to determine the age of the individuals through external examination, no age information could be provided. Analyzing the yearly distribution, there were no severely decomposed bodies reported in 2018 and 2019. However, two cases occurred in 2020, ten in 2021, and nine in 2022. Eleven cases occurred during the summer, four in the spring, five in the autumn, and one in the winter (Table 1). Ten cases were identified as suspicious deaths where the bodies were found at home or in a field. Eight were bodies recovered from water, two were exhumation cases, and one was found hanging (Table 1).

Table 1. Sociodemographic data of the cases

Case	Nationality	Sex	Month	Season	How the event happened
Case -1	Turkish	Female	9	Autumn	Exhumation
Case -2	Turkish	Male	10	Autumn	Hanging
Case -3	Syrian	Male	1	Winter	Home or in a field
Case -4	Syrian	Female	5	Spring	Home or in a field
Case -5	Turkish	Male	5	Spring	Recovered body from water
Case -6	Turkish	Male	5	Spring	Recovered body from water
Case -7	Syrian	Male	7	Summer	Recovered body from water
Case -8	Turkish	Male	7	Summer	Recovered body from water
Case -9	Turkish	Male	8	Summer	Recovered body from water
Case -10	Syrian	Male	8	Summer	Home or in a field
Case -11	Syrian	Male	8	Summer	Home or in a field
Case -12	Syrian	Male	9	Autumn	Recovered body from water
Case -13	Turkish	Male	5	Spring	Home or in a field
Case -14	Syrian	Male	6	Summer	Exhumation
Case -15	Turkish	Male	7	Summer	Home or in a field
Case -16	Turkish	Male	7	Summer	Home or in a field
Case -17	Syrian	Male	6	Summer	Home or in a field
Case -18	Turkish	Male	8	Summer	Home or in a field
Case -19	Turkish	Female	8	Summer	Recovered body from water
Case -20	Turkish	Male	9	Autumn	Home or in a field
Case -21	Turkish	Male	10	Autumn	Recovered body from water

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For identification, blood samples could be obtained from only nine cases. Given the possibility of blood mixing with decomposition fluids in severely decomposed bodies, additional samples were collected in all cases to facilitate DNA comparison. Muscle tissue was sampled in 12 cases, bone tissue in 18 cases, teeth in 2 cases, and hairy skin in 2 cases. The psoas muscle was selected as the muscle tissue sample, while the sternum was sampled in 15 cases and the femur in 3 cases as the bone tissue sample (Table 2).

Table 2. Samples taken for identification

Case	Blood	FTA	Muscle	Bone	Teeth	Hairy skin	Bone sample
Case -1	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -2	Positive	Positive	Positive	Positive	Negative	Negative	Sternum
Case -3	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -4	Negative	Negative	Negative	Positive	Negative	Positive	Femur
Case -5	Positive	Positive	Negative	Negative	Negative	Negative	-
Case -6	Positive	Positive	Negative	Positive	Negative	Negative	Sternum
Case -7	Positive	Positive	Positive	Positive	Negative	Negative	Sternum
Case -8	Positive	Positive	Negative	Positive	Negative	Negative	Sternum
Case -9	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -10	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -11	Negative	Negative	Negative	Positive	Negative	Negative	Femur
Case -12	Positive	Positive	Negative	Negative	Negative	Negative	-
Case -13	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -14	Negative	Negative	Negative	Positive	Positive	Negative	Sternum
Case -15	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -16	Positive	Positive	Negative	Negative	Negative	Negative	-
Case -17	Negative	Negative	Negative	Positive	Positive	Negative	Femur
Case -18	Positive	Positive	Positive	Positive	Negative	Negative	Sternum
Case -19	Negative	Negative	Positive	Positive	Negative	Negative	Sternum
Case -20	Negative	Negative	Positive	Positive	Negative	Positive	Sternum
Case -21	Positive	Positive	Positive	Positive	Negative	Negative	Sternum

External examination during the autopsy revealed significant decomposition findings. Internal examination showed that the brain had liquefied, the consistency of other internal organs had softened, and their structures had become fragile and deteriorated. The heart in all cases exhibited a sac-like structure. Toxicological analyses did not detect alcohol, narcotics, or stimulants; however pharmaceutical agents were identified. Histopathological examinations revealed autolysis findings in all organ samples collected. For the determination of the exact cause of death, all cases were referred to a higher committee for evaluation.

DISCUSSION

In cases of severely decomposed bodies, investigative authorities frequently request opinions regarding identification, cause and manner of death, and the postmortem interval. Autopsies conducted on decomposed bodies are invariably more challenging compared to standard autopsies. Severe decomposition presents additional complications. Changes caused by decomposition, as well as alterations resulting from the activity of maggots, larvae, and insects, can complicate dissection and alter physical findings [9].

In our study a male predominance was observed, consistent with findings in similar studies [9-11]. This may be attributed to factors such as social isolation, poor health, financial difficulties, and insufficient family support. Studies also indicate that elderly individuals living alone are at a higher risk of being found helpless or deceased at home [12].

In this series, most decomposed bodies were found either in open areas or inside homes, with a subsequent proportion recovered from water. Similar to our findings, previous studies have also reported decomposed bodies being found in homes or recovered from water [10,11]. The delay in retrieving bodies from such isolated locations often leads to advanced stages of decomposition. Additionally, bodies submerged in water may not be immediately discovered despite intensive search efforts and might only be noticed once they float to the surface.

In our study, the majority of decomposed bodies were found during warmer seasons, particularly in the summer. This is consistent with the literature, which highlights the accelerating effect of high temperatures on decomposition, resulting in a higher frequency of cases during summer months [9,13,14].

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Decomposition occurs more frequently and progresses faster in hot summer months, with cases being 2.3 times more common compared to winter.

Identification in severely decomposed or skeletonized bodies poses greater challenges compared to other cases. Decomposition significantly alters an individual's physical characteristics, making visual identification highly difficult and sometimes impossible [9]. Fingerprint analysis and dental comparisons are considered the most scientifically reliable methods for identification [15]. However, dental comparison is not applicable to every case in our country. Facial reconstruction and superimposition techniques also assist in identifying individuals in cases of skeletonized remains [4,16].

In this study, blood samples on FTA cards, teeth, muscle tissue, bone tissue, and hairy skin samples were collected for DNA comparison to aid in the identification of decomposed bodies. Currently, DNA analysis using bones and teeth is a widely employed method for identification in such cases [16].

CONCLUSION

Identification of severely decomposed and skeletonized bodies is highly challenging. However, it can be achieved through DNA comparison using appropriate biological samples. Autopsies performed on decomposed bodies help exclude multiple possibilities, thus aiding in the interpretation of the cause of death.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
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Ethical Approval
Ethics committee approval was obtained with the decision numbered 21589509-2023/414 of The Council of Forensic Medicine dated 10/05/2023.

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