Autopsy Based Retrospective Analysis of Demographics and Cause of Death in Decomposed Bodies

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ABSTRACT

Context vital forensic clues can be found in decomposed remains, but their determination is made all the more difficult by the effects of decomposition essentially making it the bad guy in any autopsy of decomposed bodies. Accurate forensics has suffered, in part, because the means of doing it have always been underfunded and the ways of determining clues, inadequately studied. Yet here is an effort to change that.

For this study, 43 cases of decomposition that had undergone autopsy at GMCH Sundargarh between June 2022 and May 2024 were analysed. The identified stages of decomposition in our cases were early, moderate, and advanced; we then gathered demographic data and other information from autopsy of each case. We statistically assessed this information, along with findings from the autopsies, to reach some conclusions about our cases.

In this study of 43 cases, 74.4% of the individuals were aged 18–60 years, and 79.1% were male. The breakdown of decomposition occurrences revealed that the majority were found in summer (69.8%). Determining the cause of death proved elusive, with 30.2% of cases being undetermined. The next most frequent ascertainable cause was asphyxia, which was listed for 20.9% of the cases; roughly the same number died from non-penetrating, cranio-cerebral injuries. Overall, the most cases of decomposition had been severely invaded by insects and wild animals (79.1%).

This study emphasizes the intricacies associated with determining the cause of death in remains that have undergone decomposition. It underscores the necessity of employing advanced analytic techniques and an interdisciplinary approach to bolster the effectiveness of death investigations when the body has decayed.

Keywords: *Decomposition, Forensic Analysis, Autopsy, Cause of Death*

INTRODUCTION

A crucial aspect of forensic investigations is looking into the deceased's remains, especially when the body has undergone decomposition. When decomposition begins, one can be sure that the death of the individual has occurred.[1] Decomposition is defined as a process by which complex organic body tissues are broken down into simpler inorganic compounds or elements due to the actions of ferments produced by the microorganism or due to autolysis.[2] Rate of decomposition depends on multiple factors. Temperature between 21°C and 43°C is favourable for

decomposition, thus exposure to high temperature and low humidity accelerates the process of decomposition.[2] Decomposition can be broadly divided in three stages early, moderate and advanced for study purpose. Early decomposition meaning that the body organs appear grossly normal but are soft to touch except brain which will be reddish greyish liquid mass in 2 to 3 days.[3] Moderate means visceral organs become blackish and soft lined by a more or less intact membrane but are identifiable except prostate and nongravid uterus which may take longer time for decomposition.[4] In advanced decomposition, the visceral organs are not identifiable or either of one mummification, adipocere and Skeletonization has occurred.[5] In female it is slightly faster due to more subcutaneous fat which contains moisture, thereby retaining body heat for longer time.[6]

Doctors working in forensics face a complex, often dark art when a body has decomposed. Routine external examination and even histopathological analysis (which looks at the tissues of a body part or organ) may not provide good evidence for drawing conclusions about the cause of death. Some traditional decomposition investigations might not even yield good results. In all the previous studies adult age group comprise majority of decomposed cases which may be because of more social and economic engagements due to more movement. To determine cause of death in decomposed body is very difficult because of artifacts. It is also very difficult to analyze injuries and actual findings due to alteration by putrefaction which is the most common artifact in decomposed bodies.[6]

In this work, it is tried to take on these tough challenges. Examine the decomposed corpses of the dead during autopsy and try to understand not just who they were but also figure out what circumstances led to their death. We delve into their age and sex, their past medical history, and the toxicological findings and interpret all these variables to try to recognize some sort of useful pattern. Emphasis is to enhance the forensic approach to what has happened to the dead in cases where decomposition has obscured a lot of evidence and, in doing so, help the affected people i.e. lawyers, police and doctors who work in the realm of death to get a grip on what has happened.

MATERIALS AND METHODS

Before GMCH Sundargarh came into existence, most decomposed bodies from this region were sent to VIMSAR Burla for postmortem examination. After the establishment of the medical college, the author undertook a retrospective study from June 2022 to May 2024 at the mortuary of DHH, Sundargarh, which is attached to GMCH Sundargarh. This center performs

postmortem examinations for bodies referred not only from the Sundargarh district but also from several neighbouring districts. When a body had been identified, the age and sex of the decedent were confirmed using available records and information provided by relatives during autopsy. When the body was unidentified, the age and sex of the decedent were determined using autopsy findings.

This study collected information from postmortem records using a structured proforma. The collected data was then subjected to statistical analysis using the software "CDC Epi Info. version 7.2.6.0".

RESULTS

Between June 2022 and May 2024, the teaching hospital of the Government Medical College in Sundargarh, Odisha, performed autopsy of 637 cases. Out of these, 43 (6.35%) were decomposition cases selected for in-depth study. The dataset analysed documents the characteristics of these 43 decomposing bodies, details the demographics, decomposition features and lists the potential causes of death. The majority of these individuals were in the prime of life, 74.4% aged 18-60 years followed by 16.3% cases who were over 60 years at the time of death, and lastly, the 9.3% cases were under age 18. The majority of cases (79.1%) were males, while 20.9% of the cases comprised of females (Table 1). Seasonal trends show that most incidents occurred during summer (69.8%), with few cases during winter (20.9%) followed by the rainy season (9.3%) (Figure 1).

This research divided decomposition into three distinct stages i.e. early, moderate, and advanced. The stages of decomposition were distributed relatively evenly, with 32.6% of cases in the early stage, 32.6% in the moderate stage, and 34.9% in the advanced stage (Table 2). The causes of death varied, with the most frequent being cases where cause of death was not ascertained (30.2%), followed by asphyxia (20.9%) and cranio-cerebral damage (20.9%). Less common causes were hemorrhage and shock (11.6%) and other miscellaneous causes (16.3%) (Figure 2). Bloating in the dead bodies was predominantly seen in the genitalia (32.6%) and in combination over genitalia and abdominal regions (27.9%). The distribution of bloating is such that certain presumed anatomical areas of the abdomen are affected, while other presumed anatomical areas of the abdomen were not (2.3% in the genitalia and lower limb area, which is actually a rare anatomical area). Marbling was most often noted over the entire body (37.2%), followed by near the thigh (25.6%) and the upper limbs (11.6%). In 16.3% of cases, there was no marbling.

Table 1: Age Group and Gender Distribution

Age Group (Years)	No of Cases	Percentage (%)	Gender	No of Cases	Percentage (%)
<18	4	9.3%	male	34	79.1%
18-60	32	74.4%	female	9	20.9%
>60	7	16.3%			

Table 2: Stage of Decomposition

Stage of Decomposition	No of Cases	Percentage (%)
EARLY	14	32.6%
MODERATE	14	32.6%
ADVANCED	15	34.9%

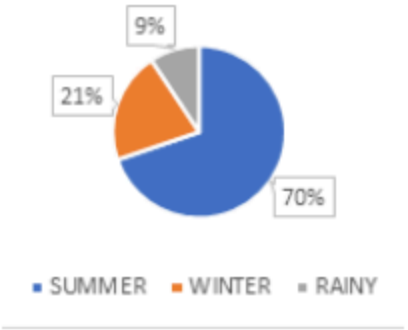

Figure 1: Season Distribution

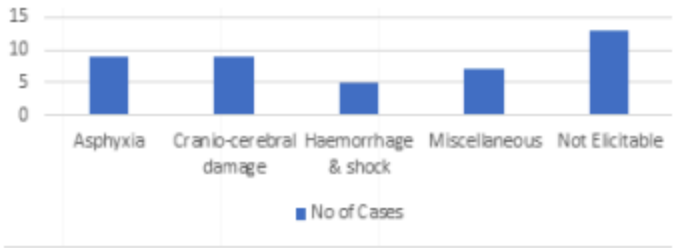

Figure 2: Distribution of Cause of Death

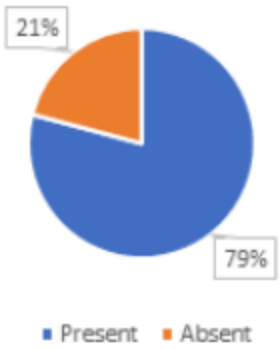

Figure 3: Presence of insects/wild animal bites

In 9.3% of cases, it was noted only sporadically.

Insects and wild animal activity showed up in 79.1% of the cases studied (Figure 3). In the advanced stages of decomposition, the influence of the environment was likely to play a substantial role in creating the appearance of those bodies.

DISCUSSION

A thorough examination of 43 case office records, in various states of decomposition, was performed in a retrospective study that spanned the two years from June 2022 to May 2024. The cases were selected from a larger grouping of 637 autopsy examinations performed at the teaching hospital of the Government Medical College in Sundargarh.

Out of the 43 cases, 25 (58.14%) cases were identified while 18 (41.86) were unidentified. The cases present a demographic profile where individuals aged 18-60 are most heavily represented (74.4%). This finding is consistent with many kinds of forensic studies that tend to skew younger due to the kinds of risks and traumas that tend to affect this age group.[7,8] Meanwhile, older individuals (>60 years) account for 16.3% of the cases, and those under 18 account for 9.3%. On the whole, the cases reflect typical age distributions shaded by forensics and vulnerable life stages. Males accounted for 79.1% of the cases. This is in consonance with the study done by Ambade VN *et al.*[7] and Singh BK *et. al.*[8] The demographic imbalance should prompt a serious look into sociocultural factors that shed light on the kinds of deaths that are missed.

Seasonal patterns were apparent, with the largest number of incidents occurring during the summer months (69.8%), followed by winter (20.9%) and the rainy season (9.3%). Similar pattern was also found by Ambade VN *et.al.*[7] in Maharashtra and Singh BK *et al.*[8] in Madhya Pradesh. The pronounced incidence in summer is likely due to ease of decomposition in the warm weather, which was not seen in the other two seasons. However, the number of rainy season cases was so low, and the number of summer cases was so high, that it makes more sense to discuss them as a pair. The majority of evidence points to the conclusion that a mix of warm, dry conditions and a lack of saturated soil allows potential human remains to be found during the summer and not during the rainy season.

Decomposition occurred in three distinct stages. The early stage was characterized by few external changes and a soft, well-preserved body. The organs inside the body seemed to be intact. In the second, or moderate, stage of decomposition, the body's organs had softened even more and were restricted by their membranes. The body itself had become a lot darker. The skin had turned black in some areas and was coming off. In the third stage, or advanced stage, many structures had lost their identifiable shapes. The organs that had remained somewhat recognizable in the previous stage had also lost their shapes and intermingled. In this study, 34.90% of

decomposed bodies were found in advance stage followed by 32.60% of decomposed bodies were found in moderate and early stage, which is in contrast with study conducted by Ambade VN *et al.*[7] in Maharashtra. Ambade VN *et al.*[7] found that 83.8% of the decomposed bodies were recovered before 72 hours and only in 16.2% cases the time since death was more than 72 hours. The present study has similar findings to that of study done by Singh BK *et al.*[8] in Indore region.

The cause of death was ascertained in 69.80% cases in this study. The cause of death was ascertained in only 51.72% of cases in the study conducted by Singh BK *et al.*[8] in Madhya Pradesh. The study conducted by Ambade VN *et al.*[7] in Maharashtra ascertained the cause of death in 85.6% of cases. Among them asphyxia (20.9%) and cranio-cerebral damage (20.9%), it is seen the causes of death agreed with the known patterns of regional accidental and violent deaths.[8] We see fewer occurrences of other clearly defined causes, such as haemorrhage and shock (11.6%). However, in the study conducted by Ambade VN *et al.*[7] in Maharashtra found that drowning (35.6%) was the commonest cause of death in decomposed bodies. The causes of death that we do know orient us towards understanding regional patterns of dying, even if they are indicative of knowing less about the patterns of dying themselves. Pink teeth can be found in decomposed cases due to haemolysis after exudation of haemoglobin derivatives through dentine tubules.[9] In this study no cases were found to have pink teeth. For anatomical location and appearance, the greatest regional variances in decomposition can be found when considering any and all anatomical types that might be present in the marbling effect that was observable across the body (37.2%) resonating with the findings of the study done by C Job in Kerela which found absence of marbling in 48.94% cases. [10]

In 79.1% of the documented cases, we saw the involvement of insects and wild animals especially in those cases where we were looking at moderate to advanced decomposition. Their roles are critical and profound ideally heliotropic, as entomological and faunal activity drive post-mortem events.[11,12] We know forensic entomology and archaeology work in tandem to push the interdisciplinary nature of these sciences toward the common goal of understanding and reconstructing what happened to a body after death.

This study emphasizes the interplay complex, which seems to be influencing mortality patterns in this region. It is essential that future research forward our understanding of the decomposition process, augmenting the dataset and incorporating advanced analytical

techniques such as microbial profiling. Equally important, however, is to explore controlled experimental setups as another avenue of investigation.

CONCLUSION

This study yielded significant insights into the intricate and problematic process of working with decomposed bodies in forensic examinations. It appears to be an initial effort to lay out the essential groundwork for the future study of decomposition within the Sundargarh region and its surrounding districts. The work assesses the appearance of the decomposed body at varying states of decomposition from early to advanced stages. It also takes a look at a number of variables such as the appearance of the body under different seasonal conditions, the effect of our regional environment (such as high temperature), and observed insect and animal activity on the rate and appearance of decomposition. When combining all these factors, we see a clear predominance in the appearance of certain common characteristics when dealing with decomposed male bodies (which are more common than female bodies) between the ages of 18 and 60 years. This investigation does a straightforward job of laying out a simple appearance checklist, a kind of "what-to-look-for" guide for those working with decomposed bodies. In conclusion this study offers significant insights into the decomposition of human remains and the various factors that affect the process. It serves as an excellent resource in the field of forensic medicine, whether in practice or in research.

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