

## The challenges presented by decomposition

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Accepted: 15 October 2012 / Published online: 5 November 2012  
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A feature of forensic practice that is often remarked upon by non-pathologists is the requirement to sometimes undertake examinations of bodies that have undergone considerable changes due to decomposition. The value of such an exercise is sometimes questioned. The following editorial reviews issues that may arise in the postmortem evaluation of such cases based on studies and observations that the authors have undertaken and made over time.

Decomposition refers to the variety of processes of degradation that commence as soon as an organism has died. The combined effects of putrefaction from bacterial overgrowth, and autolysis from tissue self-digestion, result in a predictable sequence of events commencing with venous marbling and blistering of the skin, followed by purging of fluids through the mouth and nose, gaseous distention of subcutaneous tissues and body cavities, and insect colonization. Under specific circumstances less common changes such as mummification or adipocere (“grave wax”) formation occur [1, 2].

Death scene evaluations may be more complicated when decomposition is present as it may be a marker for social isolation and domestic disorder. This is best demonstrated by the Diogenes syndrome, where elderly reclusive individuals living in squalor may not be found for some time

after their deaths [3]. Lesions caused by the postmortem activity of both domestic and nondomestic animals living in the house may be found [4], and inexperienced scene examiners may conclude that purging of reddish fluid from the mouth and nose represents bleeding from an assault. Determining the time of death cannot be done with any precision, although entomological examination of insects and the temperature of maggot masses may provide some guide to this [1, 2]. Stiffening of the limbs from subcutaneous gas accumulation, so-called “putrefactive rigor mortis”, should not be misinterpreted as true rigor due to ATP depletion [5].

Decomposition also complicates autopsy evaluations by distorting and changing tissue morphology. Tissues and organs may be absent in advanced cases, and dissections are often more difficult to perform as the normal anatomy has either been considerably modified or disguised. Putrefied and liquefied fat may make tissues and floors slippery creating a potentially dangerous work environment. This may be particularly so in temporary mortuaries used for disaster victim identification, as proper cleaning facilities may not be available.

Despite marked tissue changes, determination of the cause and manner of death has been shown to be achievable [6], although cases were not stratified according to the degree of decomposition in this retrospective study. The exact effect of decompositional changes on particular tissues is also not always known and it may be possible that lesions such as non-calcific, grumous coronary artery atherosclerotic plaques may liquefy and so disappear by the time that the arteries are being examined at autopsy. If this is the case, then determining the degree of antemortem coronary artery stenosis may simply not be possible. Sometimes even the finding of coronary arteries in a decomposed heart may be a challenge. On occasion,

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putrefactive changes may be associated with conditions such as diaphragmatic herniation of the intestines into the chest cavity due to increased intra-abdominal pressure from gas filled loops of bowel [7], or postmortem extrusion of an infant (so-called “coffin birth”), again due to raised cavity pressure [8].

The evaluation of trauma in suspicious cases must be undertaken cautiously as insects and animals preferentially seek out moist skin defects caused by knives or bullets. Removal of tissues from these sites with subsequent putrefaction may completely change the nature of the original defects. In addition, insects may create defects in skin and tissues that resemble inflicted wounds [9]. Tissue discoloration from hemoglobin breakdown may mimic or disguise bruises, particularly in dependent areas where there has been significant pooling of blood [10]. Swelling of subcutaneous tissues may result in splitting of incompletely healed wounds if there has been recent surgery, producing an artifact that may resemble an inflicted stab or slash wound. The often symmetrical and precise nature of such wounds with visible suture material, and a possible history of recent surgery, may reduce this confusion [11]. In cases with marked putrefactive changes the best that may be achieved is to exclude obvious trauma and to assign death as “undetermined, presumed natural”.

The identification of decomposed bodies is often a problem, particularly if the remains have been spread over a wide area when death has occurred outdoors. Teeth are, however, remarkably stable and dental identifications, as occurred in the thousands of decomposed bodies left after the tsunami in Thailand, are very reliable. Another problem that may result from mass disasters involving explosives (as was found after the Bali bombings) occurs if there has been commingling of decomposing fragments. External features such as tattoos may sometimes provide unique identifiers, as may orthopedic or other prostheses [12, 13]. It may be useful, therefore, for all badly decomposed bodies to undergo radiological examination prior to autopsy in an attempt to locate any such foreign material that may assist with identification. DNA may also be surprisingly stable under a variety of conditions and samples should always be collected to enable testing, no matter how badly decomposed the remains appear [14].

Accelerated decomposition at autopsy may occasionally provide a useful clue for the presence of an underlying condition such as diabetes mellitus, or the effect of an environmental factor such as the proximity of a body to a room heater, that may not have been previously suspected [15]. Unfortunately the issue of decomposition is an increasing problem in the mortuary due to the increasing size of bodies presenting to forensic facilities, reflecting the disturbing rise in body mass index in the community. Obesity speeds up decomposition as it slows down body

cooling rates and may be associated with diabetes mellitus and sepsis, both of which encourage microorganism growth within tissues [16].

Other problems may arise with ancillary testing. For example, microbiological and biochemical analyses are not possible, and toxicological results must be interpreted with care. Substances such as alcohol may be generated by bacteria [17] and levels of certain drugs may also be markedly affected by both redistribution and bacterial degradation [18]. Obtaining fluids for analysis in dried or mummified remains may be difficult.

Problems at autopsy due to decomposition have existed since the very first forensic investigations were undertaken and persist to this day, even with the development of sophisticated adjuncts to traditional autopsies such as computerized tomography and magnetic resonance imaging. Although newer techniques may provide alternative ways of viewing bodies, organs and tissues, the artifacts induced by putrefaction and autolysis still require interpretation. Despite a prosecutor’s best efforts it must be recognized that there is always the risk that alteration of postmortem tissues by these processes may potentially compromise and/or confuse evaluations. An autopsy examination is always worthwhile, however, as identification and forensically important diagnoses are still possible even in cases with significant decomposition.

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