



### G53 Development and Validity of a Postmortem Radiological Alteration Index: The RA-Index

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After attending this presentation, attendees will understand that it is possible to quantify the state of alteration of bodies using postmortem multidetector computed tomography (MDCT) imaging and will learn how to use the new Radiological Alteration-Index.

This presentation will impact the forensic science community by showing that presence of gas from only seven sites is a valid mean to measure the distribution of gas in the entire body. The RA-index is a rapid and easy to use instrument to indicate radiologically the alteration state of the body, which remains reliable for non-experienced users and valid for non-traumatically and traumatically deceased.

Postmortem imaging examinations, performed before autopsy, are more and more used in forensic medicine. Multidetector Computed Tomography (MDCT) is the most often used technique, and preferred to MRI for a number of reasons, including the rapid achievement of the examination, its relatively easy handling and its lower cost. Furthermore, the spatial resolution and high sensitivity of MDCT allows the detection of small collections of gas in bodies which is relevant because such small quantity of gas cannot be detected during standard autopsy techniques.

When investigating cause of death, it is fundamental to be able to distinguish gas formed during postmortem cadaveric alteration and gas due to a vital air embolism. It has previously been shown that cadaveric alteration and gas formation can thus be quantified. This procedure is nevertheless time consuming and requires qualified personnel. There is a need to simplify procedures to detect gas and make them accessible to non-trained physicians.

The objective of the present study was therefore to develop an easy to use radiological alteration index (the RA-index) adapted for cases seen in forensic medicine and verify whether this index can reliably be measured by non-experienced forensic pathologists.

The RA-index, ranging from 0 to 100, quantifies the state of cadaveric alteration analysing only seven sites. It was derived from postmortem MDCT data from 119 non-traumatically deceased people. One hundred additional scanned bodies (including 50% traumatically deceased) were retrospectively examined by two independent observers. Presence of gas on 82 sites was assessed by a radiologist, whereas a forensic pathologist only investigated the seven sites used for the RA-index.

The RA-index was derived using seven sites that were shown to be highly predictive of the overall presence of gas in all 82 sites ( $R^2=0.979$  in the derivation set, and  $R^2=0.843$  in the validation set). From the 119 cases analyzed in the derivation set, 25 had a RA-index of 0, 64 had a RA-index of 15 or less (no or slight alteration), 18 had a RA-index of over 30 (heart cavity full of gas), and six over 80 (invasion of gas to all tissues). Even if assessment semi-quantitative evaluation of gas presence in each site showed moderate reliability (Cohen's kappa ranged from 0.406 to 0.781), the overall RA-index was very reliable ( $ICC_{2,1} = 0.945$ ;  $CI_{95\%} 0.919$  to  $0.962$ ).

This study derives and validates an index quantifying the state of cadaveric alteration of bodies exclusively based on postmortem MDCT imaging, and ascertains the reliability of the results obtained by a radiologist and a forensic pathologist with no experience in postmortem imaging. Furthermore, the results were extended to traumatic deaths. Indeed, the seven selected sites for calculating the RA-index are sufficiently distributed all over the body to overcome the bias due to gas expansion from open wounds. Therefore, the RA-index is also applicable in cases of trauma such as gunshot or sharp trauma.

The RA-index, presented in this study, is the first approach that allows quantifying the alteration in an objective way. It can be used to indicate the state of the examined body for radiological reports and cases included in different research studies. This means that the selection of cases for different studies could depend on the RA-index and some diagnosis such as the presence of gas embolism should only be made in cases showing a low RA-index. The RA-index can also be important to decide if a body should undergo further examinations such as postmortem CT-angiography.

**Thanatology, Postmortem MDCT, Putrefaction Gas Index**