Commentary: Mast cells and dendritic cells as tools to discriminate vital and post mortem lesions

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Abstract

The determination of vitality and wound age is one of the most central research areas in legal medicine, about which a large amount of scientific work has been submitted for many decades up until now. In the first minutes or hours, standard histological examination may not determine whether the wound was inflicted in the pre- or post-mortem period. Since the study of cellular infiltrate might be a key to discriminate the vitality of lesions and since mast cell is one of the cellular types that participate in the organization of cellular infiltrate, the behaviour of this cell is among the data which can be of help in that respect. Besides dendritic cells, there is another cell type involved in the response to injury even independent of antigen challenge e.g. on the arterial wall and in the heart. This commentary is focused on the recent proposal to use mast cells and dendritic cells as cellular tools for the discrimination of vital and post mortem wounds.

Estimating wound vitality and age is crucial for the proper course of legal proceedings [1-5]. Several scientific studies have been reported using different techniques to solve these problems [1-5]. Historically, Wacker [6] and Orsos [7] first claimed that the determination of wound vitality or wound age was indispensable in forensic practice, besides Raekallio who was the first scientist to address the complex issue of differentiating vital from post-mortal injuries, by investigating the activity of several enzymes at wound sites [8]. Finally, using immunohistochemistry, the study of inflammatory cell infiltrate and the relation with wound healing [9] has expanded dramatically [1-5, 9] and consequently the field of lesions timing investigations.

It is well known that histamine, an important vasoactive amine, participates in an acute inflammatory reaction. Endogenous histamine is responsible for initiating vascular changes that involve vasodilatation and increased vascular permeability and other mechanisms are then required to maintain them [10]. In 1965 Fazekas and Virágos-Kis [1] observed that there was an increase in the free histamine content in marks caused by hanging. Their work encouraged a number of forensic pathologists to begin biochemical studies on the possible use of the histamine content in the skin to differentiate antemortem from postmortem wounds and to estimate lesion vitality [1]. In particular, Berg and Bonte demonstrated that the histamine levels in vital skin wounds inflicted at least 60 min before death could increase up to 100% [1]. An experimental study with a murine model, using the microfluorometric method, indicated that the skin histamine level was upregulated after 30 min. No statistical relationship was found between MC number and histamine level [11]. To date, histamine is not a reliable marker in

forensic pathology.

Since MC is a source of histamine, Bonelli et al. demonstrated in vital lesions that dermal MC number increased progressively within a few hours from trauma (peak at 1–3 h) [12, 13] and underwent degranulation in the first hour after wounding [14]. In addition, a significantly increased expression of TNFα on MC in vital lesions of 5 min, with a peak at 1 h was found [15]. In other studies, Oehmichen et al. [16] reported early degranulation of MC in intravital wounds. In hard ligatures, Turillazzi et al. [17] showed a strong overexpression of tryptase, i.e. an enzyme localized in MC, in interstitial tissue. Finally, Gauchotte et al., using anti tryptase antibodies, found that MC degranulation rate in stab wounds was higher in wound margins and correlated with the time interval (minimal time, 1 min) [18]. Therefore MC histochemistry has been proposed in addition to classic histological methods to estimate the course of traumatic events before and after death during forensic expert analysis [19].

Since MC mediators are related to the differentiation and function of dendritic cells (DC) [20] and the close proximity of these cells is often found [14, 21], DC modifications should be useful to recognize vital from post mortem wounds, other than to be involved in the response to injury even independent of antigen challenge as in the arterial wall or more recently in myocardial infarction [22, 23]. Moreover Bacci et al. observed, in vital lesions, that epidermal and dermal MHC-II+ cells increased transiently in number within the first hour after wounding, then decreased. In the epidermis, the increase affected also Langerhans cells (LC), which however increased less, earlier and for a shorter time period than MHC-II+ cells while the volume density of MHC-II+ cells increased to almost twice the baseline 31-60 min after wounding [14].

Therefore these last results show that the ratio between CD1a positive and MHC-II positive cells in the epidermis, the relative volume of MHC-II positive cells in the dermis and the degranulation index of MC can be added to the tools useful to estimate the interval between a lesion and death and, the first two of them, to distinguish vital from post mortem lesions.

Consequently the evaluation of DC can be proposed as complementary to other investigations to discriminate between wounds which occurred in life and those which occurred after death and to estimate the time interval between injury and death.

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Legends

Figure 1. Intercellular contacts between dendritic cells (green labeled) and mast cells (red labeled) in a vital lesion, scale bar = 10 micron