H6   Analysis of Possible Impact Factors on the Regeneration Process of Hematomas in the Subcutaneous Fatty Tissue

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After attending this presentation, attendees will recognize that dating of hematomas in the subcutaneous fatty tissue is particularly important for the reconstruction of criminal acts, such as child abuse cases, where accurate timing of injuries can define or at least set limits on a period of time during which a crime took place. Hence, accurate timing of injuries can lead to an inclusion or exclusion of potential suspects.

This presentation will impact the forensic science community by underlining the importance of radiologic methods in forensic medicine.

In clinical forensic medicine, it is often important to determine the time of origin of soft tissue injuries. As subcutaneous hematomas are usually not relevant for clinicians, only limited knowledge exists regarding the detection and dating of traumatic lesions in the subcutaneous fatty tissue using Magnetic Resonance Imaging (MRI).

However, visual assessment of external hematoma color, the currently used method for estimating hematoma age, is unreliable due to its great inter-observer variability and is affected by individually varying color perception.[1,2] Novel attempts at hematoma age estimation are striving to create a reliable and objective model using MRI. First studies showed that the contrast of hematomas in MRI can be used to obtain objective information on hematoma characteristics.[3] Based on these initial results, that the regeneration process of hematomas may also depend on various influencing factors such as hematoma shape or the structure of the subcutaneous fatty tissue, the goal of this study was to explore the impact of these and other potential factors on contrast behavior of subcutaneous hematomas over time in order to date traumatic lesions for the forensic reconstruction of events.

In 30 healthy volunteers (18 male, 12 female, age: 26.3±3.8 years) without coagulation disorders or medication influencing blood clotting, 4mL of autologous blood were injected into the subcutaneous fatty tissue of the thigh. MRI was performed directly after the injection and after 3, 24, 72, 168, and 336 hours on a 3T MR scanner using a multifunctional coil. The MR sequence protocol consisted of a Proton Density-weighted Turbo Spin Echo sequence with Spectral Adiabatic Inversion Recovery (PDwTSE SPAIR) fat saturation and a PDwTSE with water saturation (watersat) in oblique and axial orientation. Data were analyzed by measuring signal intensities in nine Regions of Interest (ROIs) (0.4cm^2), three each in the hematoma, fat, and muscle tissue. After pooling the measurements of each tissue, the contrast coefficient according to Michelson was calculated.[4] Additionally, visual evaluation of hematomas and lobular structure of the subcutaneous fatty tissue were performed. After identifying potential influencing factors, such as gender, age, Body Mass Index (BMI), fat lobuli structure, hematoma shape, and thickness of the subcutaneous fatty tissue, statistical analysis using non-parametric tests were performed. In these tests, the Michelson coefficients, grouped by the different influencing factors, were investigated at different points in time.

Two types of fat lobuli (spherical/fusiform) and two different shapes of hematomas (compact/diffuse) were identified. Diffuse hematomas were more frequently seen in women than in males and were associated with the thickness of the subcutaneous fatty tissue layer of more than 1cm in the thigh. In females, diffuse hematomas were associated with spherical fat lobuli and compact hematomas with fusiform lobuli, while in men only fusiform lobular structure could be found, showing both types of hematoma shapes. Statistical significant differences of the contrast behavior of the hematomas versus fat over time were only found when dividing the participants into two groups regarding their BMI (normal weight, overweight).

Several factors were assumed to be influencing on the hematoma regeneration process; however, in artificial hematomas investigated over two weeks, only the BMI was identified as a significant factor for differences in the contrast behavior over time.

Nevertheless, one has to take into consideration that actual hematomas might differ concerning their regeneration process. Therefore, in a subsequent study with actual hematomas, the potential influencing factors need to be re-evaluated.

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Reference(s):

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4. Michelson. Studies in Optics. U of Chicago Press (1927).

Hematoma, MRI, Age Estimation

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