Diagnostic and Prognostic Value of Quantitative Computed Tomography Parameters of Adrenal Glands in Patients from Internist-led ICU with Sepsis and Septic Shock

Autor:	Moritz Milberg
Institut / Klinik:	Klinik für Radiologie und Nuklearmedizin
Doktorvater:	Prof. Dr. S. Schönberg

Sepsis remains a leading cause of critical illness, hospital mortality and a major challenge for modern medicine and it is the leading cause of death in the non-coronary intensive care unit. According to the sepsis-3 definition, it is defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection and septic shock as sepsis in combination with cardiovascular failure resulting in an inadequate tissue perfusion and metabolic dysfunction. In septic conditions, adrenal glands play a crucial role in providing the required hormonal stress response to infection. In this context, the hyperenhancement of adrenal glands in contrast-enhanced CT scans is a known phenomenon associated with poor prognosis. Furthermore, studies have shown a correlation between adrenal gland volume and mortality for patients with septic shock.

The aim of this prospective study was to obtain quantitative data using contrast-enhanced multi-slice spiral CT scans of adrenal glands in intensive care patients with septic conditions and to use these data to define threshold values that can contribute to the diagnosis, classification, severity of sepsis, and assessment of its course.

For this purpose, a total of 76 patients (49 men, 27 women) admitted to an internist-led intensive care unit were included in the study. They were divided into the groups "no sepsis" (7 patients), "sepsis" (23 patients), and "septic shock" (24 patients) according to the new 2017 sepsis-3 definition criteria.

Inclusion criteria were a non-surgical ICU admission, a suspected septic clinical picture, and a clinically indicated i.v. contrast-enhanced computed tomography scan of the abdomen. End points were survival at day 8, after 28 days, and after 6 months. A total of 44 patients subsequently underwent three adrenal density analysis methods of varying complexity.

These were first, measuring a representative but subjective area within the organ, a "ROI" (region of interest), second, the more elaborate semi-automated quantification of adrenal gland volume, and third, organ segmentation with subsequent histogram analysis.

The results of this study can be summarized in three key statements. First, high adrenal density values ("adrenal enhancement"), regardless of the method used, were shown to be highly specific for the presence of septic shock. Second, the semi-automated segmentation method showed the highest discriminatory power with respect to the classification of sepsis grades, and the adrenal volume calculated by it was shown to be a surrogate marker for short-term, but also for long-term survival in the subgroup of patients with septic shock. Third, none of the methods studied could clearly discriminate between sepsis grades, and the method of histogram analysis showed no added diagnostic or prognostic value.