

**Measurements of tissue blood flow by the hydrogen clearance technique (HCT): a comparative study including laser Doppler flowmetry (LDF) and the Erlangen micro-lightguide spectrophotometer (EMPHO).**

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The purpose of this study was to compare the hydrogen clearance technique (HCT) with two different, well-established techniques, i.e., the laser Doppler flowmetry (LDF) and the Erlangen micro-lightguide spectrophotometer (EMPHO), for tissue blood flow measurements in an experimental setting. For the animal experiments, we chose a rat model for arterial and venous flap thrombosis, using the epigastric groin flap. Forty male dark Aguty rats were included in the study. The animals were divided into eight groups, each with a different vascular thrombotic model. HCT was used to collect 1,467 measurements, and 2,934 graphs were recorded; 27 measurements (54 graphs) had to be discarded due to faulty electrode placements and electronic noise. In 19 of the 27 discarded measurements the cause of failure was moving of the awaking animal with disruption of the decay signal. The LDF and EMPHO measurements were performed continuously during each measuring phase. Simple and multiple linear regression and paired t-tests were used to compare the three techniques. The reproducibility of registered blood flow values in phases 1, 3, 6 and 7 varied between 7.8% and 13.6% which is in about the same range as LDF and EMPHO. We could not find a significant difference between the three techniques in this regard. The correlation coefficient for HCT and LDF was  $r = 0.89$ . For HCT and EMPHO we found  $r = 0.67$ . Sensitivity and specificity values for HCT were both 1.0 in detecting arterial and venous flap thrombosis; for LDF we found values of 0.89 and 0.92, respectively. Sensitivity and specificity values for EMPHO were 0.92 and 0.95, respectively. After careful evaluation of three different techniques (HCT, LDF, and EMPHO) for measurements of local tissue blood flow we came to the conclusion that HCT must be favoured as a reliable tool for quantitative measurement of local tissue blood flow and early diagnosis of arterial and venous flap thrombosis.

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