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Oxygen extraction rates in inflamed human skin using the tuberculin reaction as a model.

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The microcirculation of inflamed human skin was assessed non-invasively using the techniques of laser Doppler flowmetry, hydrogen clearance flowmetry, visible-light spectrophotometry and transcutaneous oximetry. Increases in red cell flux (from a mean of 1.1 in normal skin to 11.5 V in inflamed skin) and haemoglobin saturation (from 49 to 87 and from 38 to 60% with macro- and micro-light-guide spectrophotometry, respectively), contrasted with decreases in transcutaneous pO2 (from 86 to 39 mm Hg). The more intense reactions tended to lead to a lower value of oxygen tension at the surface of the skin than the weaker reactions. A barrier to oxygen diffusion, presented by the infiltrating inflammatory cells, has previously been suggested as the reason for this. The oxygen extraction rate was estimated from spectrophotometry and blood flow measurements, using the Fick principle, and this showed an increase (from 42 to 130 arbitrary units, AU). When the skin was heated to 44 degrees C there was no change seen in this parameter in inflamed skin compared with normal skin (from 114 to 133 and from 14.1 to 14.5 AU), although it tended to increase in the stronger reactions while decreasing in the weaker ones. Extraction measured by a cuff occlusion method (with the same skin temperature) did show an increase however (from 28 to 57 and from 3.2 to 7.2 AU), and this was more pronounced in the stronger reactions. It is suggested that there may be a critical transit time for a red cell, during which it is able to effectively off-load its oxygen. In conditions of very high flow the transit time is reduced and oxygen extraction may be compromised further when diffusion is already limited.

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