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Venous oxygen saturation

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Early detection and rapid treatment of tissue hypoxia are important goals. Venous oxygen saturation is an indirect index of global oxygen supply-to-demand ratio. Central venous oxygen saturation ($ScvO_2$) measurement has become a surrogate for mixed venous oxygen saturation (SvO_2). $ScvO_2$ is measured by a catheter placed in the superior vena cava. After results from a single-center study suggested that maintaining $ScvO_2$ values >70% might improve survival rates in septic patients, international practice guidelines included this target in a bundle strategy to treat early sepsis. However, a recent multicenter study with >1500 patients found that the use of central hemodynamic and $ScvO_2$ monitoring did not improve long-term survival when compared to the clinical assessment of the adequacy of circulation. It seems that if sepsis is recognized early, a rapid initiation of antibiotics and adequate fluid resuscitation are more important than measuring venous oxygen saturation.

Why measure venous oxygen saturation?

An essential function of the cardiovascular system is to provide the organism with sufficient oxygen. If oxygen demand exceeds oxygen supply, hypoxemia results with deleterious results for organ function. The measurement of venous oxygen saturation is an indirect way to determine global oxygenation. The degree of oxygen consumption during the circulation of blood through various organs provides an estimate of whether oxygen supply is adequate to meet acute demands. According to

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the German physiologist Adolf Eugen Fick (1829–1901), cardiac output (CO) can be measured by calculating the ratio between total oxygen consumption (VO_2) and the arteriovenous oxygen difference.

Overall, global oxygen extraction decreases arterial oxygen content by approximately 25%. The degree of oxygen consumption in different organs can vary considerably, from up to 60% in myocardium to <10% in the kidneys (Fig. 1). The pulmonary artery contains the venous blood of the whole body – a mixture from the superior and the inferior caval vein. The oxygen saturation of the pulmonary artery is therefore referred to as "mixed venous oxygen saturation" (SvO_2). The SvO_2 is commonly used as a marker for the whole-body oxygen extraction and can be measured with a pulmonary artery catheter (PAC). If the cardiovascular system cannot compensate for increased oxygen demand to the tissues (DO_2), the oxygen extraction by the tissues increases and, as a result, SvO_2 – indicating how much of delivered oxygen remains after tissues have extracted oxygen – decreases. Thus, a drop in SvO_2 indicates a mismatch between O_2 need and O_2 delivery [1]. In the absence of anemia and arterial hypoxemia, low venous oxygen saturation may also indicate a reduced CO. Several factors govern

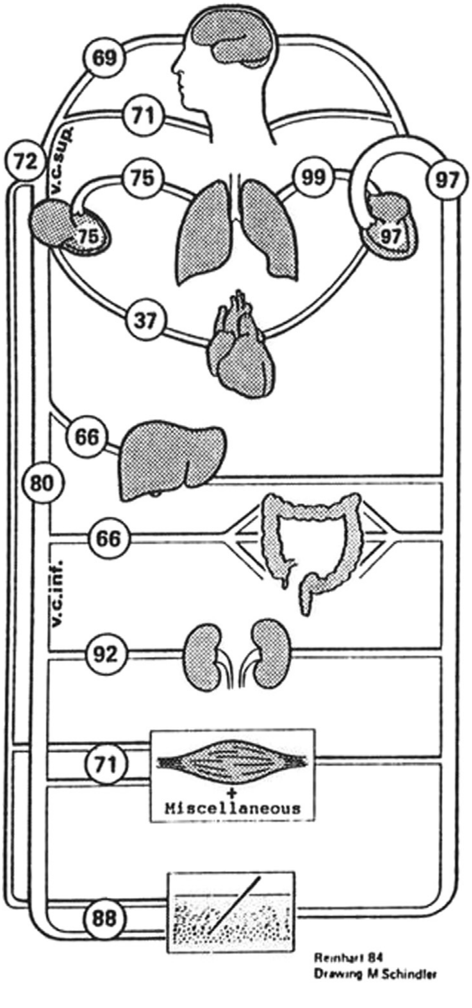

Fig. 1. Venous oxygen saturation in different venous systems. Individual oxygen saturation differ according to the different oxygen extractions of specific organs [40]. Copyright © 1985, Springer-Verlag Berlin Heidelberg. Reprinted with kind permission.