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BLOOD FLOW PROFILES OF THREE CONTEMPORARY ADULTS OXYGENATORS

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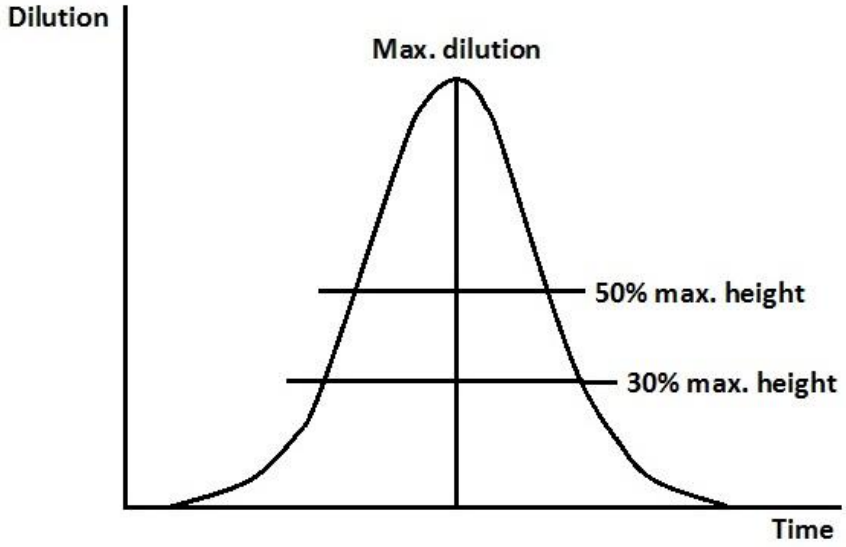
This study analyzed the effect of flow rates, pressure and pulsatile perfusion on the blood flow path through three contemporary oxygenators.

The oxygenators (Maquet Quadrox-i adult, Livanova Inspire 8F and Terumo FX25) were incorporated in an experimental setup, and 20 ml bolus injections of saline were used to create dilution curves using the Transonic Extracorporeal Life Support Monitor. From these curves flow profile parameters i.e. the oxygenator blood volume, the ratio of the area below the dilution curve before and after maximum dilution in total and at 30% and 50% of the maximum curve height were calculated. The oxygen gradient and the oxygen transfer per minute and per 100 ml blood were calculated at different blood flow rates using previously collected clinical data and compared to the flow profile parameters.

The flow profile parameters hardly changed at rising pre-oxygenator pressures in any oxygenator. Pulsatile flow led to significantly increased oxygenator blood volumes compared to continuous flow in all oxygenators. Higher volumetric blood flow rates resulted in a significant decline of the flow profile parameters values. In parallel, O_2 transfer/100 ml blood decreased, whereas the oxygen gradient and O_2 transfer/min increased.

Lower values of the flow profile parameters indicate that a higher percentage of the fluid flows through short pathways inside the oxygenator, making less efficient use of the gas exchange area. This explains the decreased oxygenator efficiency seen by the increased O_2 gradient and the decreased O_2 transfer/100 ml blood at higher flow rates. The increased amount of blood flowing through the oxygenator per minute at higher flow rates, however, counteracts the decreased oxygenator efficiency resulting in an increased O_2 transfer/min.

In conclusion, blood flow path through an oxygenator seems to be predominantly effected by the flow mode and rate, rather than oxygenator pressures. Examination of oxygenator blood flow patterns, therefore, supports further oxygenator development.


Dilution
Max. dilution
50% max. height
30% max. height
Time