WorkShop
Purification Therapies
From Research to Clinical Evidence
September 30th/October 1st
Centro Congressi Cariplo
Milano

Quantification of dissolved oxygen: state of the art and potential application to organ ex-vivo machine perfusion

Valentina Marassi[1,2], Andjela Kurevija[3], Arianna Lembo[1], Stefano Giordani[1], Emilio Panetta[3], Barbara Roda[1,2], Pierluigi Reschiglian[1,2], Mauro Atti[3], Andrea Zattoni[1,2]

1 Department of Chemistry "G. Ciamician", University of Bologna; 2 byFlow srl; 3 Aferetica srl

BACKGROUND

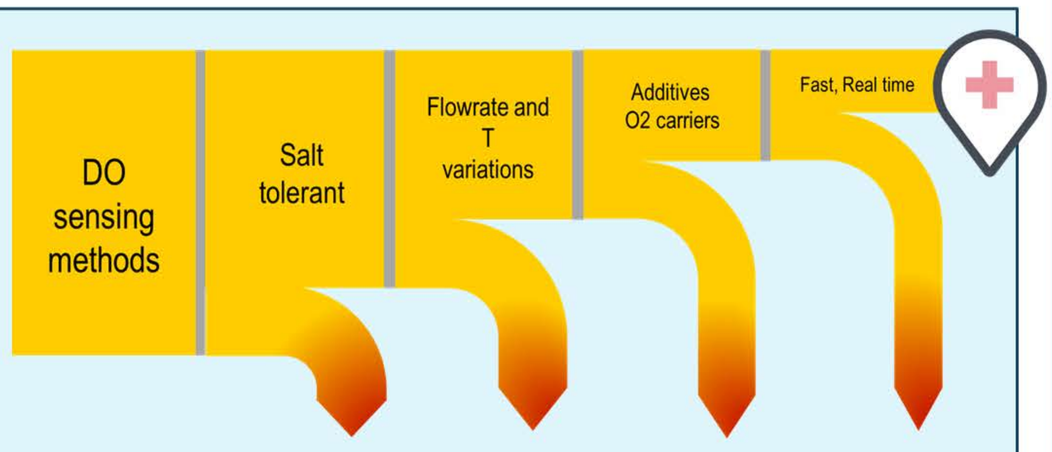
A reliable measurement of perfusate oxygenation ensures a high-quality process in O-MP, while the amount of oxygen consumption could be a useful tool for organ quality evaluation. It is crucial to provide a high-accuracy, real-time method for its quantification. This study aims at presenting and discussing the main oxygen detection and quantification methods, with a focus on the technical needs for their translation to the clinical practice.

METHODS

We summarized the available oxygen sensing techniques, in terms of mechanisms and fields of application. The analysis of compatibility with the use in O-MP was conducted considering two main factors: oxygen solubility and diffusivity in different types of conditions (temperature and types of perfusate).
A method comparison study was conducted simulating O-MP conditions and environment, in the most critical settings for the techniques identified.

RESULTS

Three classes of methods were reviewed:
- Titration
- Electrochemical analysis (Blood gas analyzer - BGA)
- Photochemical analysis (fluorescence sensors)

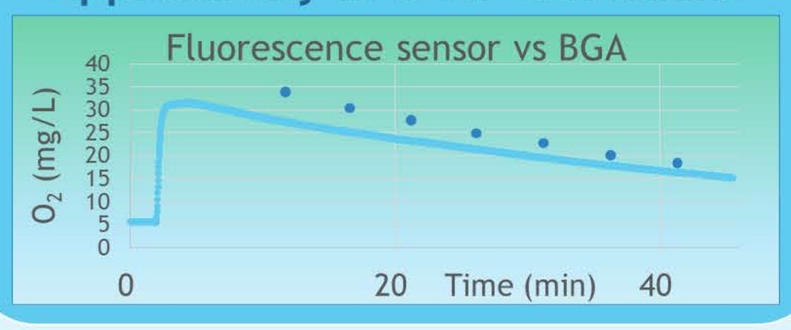


Many factors influence applicability:
- Perfusion solution composition
- Different temperature modes in perfusion protocols
- Oxygen solubility and diffusivity

Titration was validated as a reference method and compared to BGA and fluorescence sensors, chosen as possible methods of oxygen quantification in O-MP

Method comparison
Titration vs
- Fluorescence sensors
- Blood Gas Analyzer

Applicability in O-MP conditions



O_2 quantification in O-MP

CONCLUSIONS

This study represents an assessment of current oxygen sensing methods and their applicability to clinical settings. It is a starting point for further validation of oxygen sensing technologies in order to establish a gold standard for oxygen consumption quantification in O-MP. BGA and Fluorescence sensors showed good promise. The latter could be integrated to perfusion machines, but it still needs further technical optimization to achieve full integrability with O-MP instruments.