

Dynamics of oxygen saturation, fluid and blood pressure during hemodialysis and their associations with clinical outcomes

Citation for published version (APA):

Zhang, H. (2018). *Dynamics of oxygen saturation, fluid and blood pressure during hemodialysis and their associations with clinical outcomes*. Datawyse / Universitaire Pers Maastricht. <https://doi.org/10.26481/dis.20181218hz>

Document status and date:

Published: 01/01/2018

DOI:

[10.26481/dis.20181218hz](https://doi.org/10.26481/dis.20181218hz)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Summary

Summary

The investigations presented in this thesis aim to provide deeper insights into the pathophysiological effects of the hemodialysis (HD) treatment, using novel information measured by the Crit-Line monitor™ (CLM). These data include continuous measurements of blood oxygen saturation and relative blood volume (RBV) at very high frequency during HD. Regarding measurements of blood oxygen saturation it is of note that - depending on the type of vascular access - the CLM can determine either central-venous or arterial oxygen saturation. Deployment of the CLM in a large population of U.S. HD patients allowed for conduction of research into the potential clinical relevance of intradialytic blood oxygen saturation and RBV. The studies presented in this thesis focused on the associations between intradialytic measurements reflecting arterial and venous oxygen saturation, systolic blood pressure (SBP), and RBV with clinical outcomes.

In **Chapter 2** and **Chapter 3**, the associations of intradialytic arterial oxygen saturation with clinical outcomes such as intradialytic hypertension, hospitalization and mortality were studied. We found that in a large cohort of chronic HD 10% of the studied patients experience prolonged intradialytic hypoxemia, a condition defined by an arterial oxygen saturation below 90% lasting for more than 1/3 of the dialysis treatment. A significant association between prolonged intradialytic hypoxemia and the clinical outcomes all-cause hospitalization and mortality was observed. We also showed for the first time a lower risk with higher intradialytic arterial oxygen saturation and intradialytic hypertension (defined as a peri-dialytic SBP increase ≥ 10 mmHg), and persistent intradialytic hypertension (defined as average peri-dialytic SBP increase ≥ 10 mmHg throughout the entire 6-months observation period).

The relationship between central venous oxygen saturation and mortality and ultrafiltration volume are discussed in **Chapter 4** and **Chapter 5**. We found that in chronic HD patients lower central venous oxygen saturation levels are associated with poorer survival. Also inverse relationship between intradialytic central venous oxygen saturation change and ultrafiltration volume corrected for body weight, meaning that most patients at high ultrafiltration volume weight experienced a more pronounced intradialytic central venous oxygen saturation decline.

Intradialytic RBV was also associated with patient survival, which was studied in **Chapter 6**. Our study found that hazard ratios for all-cause mortality were significantly below 1 in patients whose RBV levels were 93-96% at the first hour, 89-94% at the second hour, and 86-92% at the third hour, respectively, indicate a significantly better survival in patients with RBVs within these favourable ranges compared to those with RBVs outside.

Lastly, the relation between peri-dialytic SBP and outcome was investigated in **Chapter 7**. The main finding of this study is the interaction of peridialytic SBP changes in relation to pre-dialysis SBP level with mortality, depicting baseline clinical differences

among patients. In patients whose pre-dialysis SBP is low an increase in SBP during HD is associated with improved outcomes as compared to patients experiencing a further decline; whereas, contrastingly, a further increase of SBP in patients who already begin HD with a high SBP level is associated with adverse outcomes.