University of Groningen

Neonatal anemia and red blood cell transfusions: finding the optimal balance

Kalteren, Willemien

DOI:
[10.33612/diss.190936376](https://doi.org/10.33612/diss.190936376)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2021

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):
Kalteren, W. (2021). *Neonatal anemia and red blood cell transfusions: finding the optimal balance*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.
<https://doi.org/10.33612/diss.190936376>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Neonatal anemia and red blood cell transfusions: finding the optimal balance

Willemien S. Kalteren

Colofon

Neonatal anemia and red blood cell transfusions: finding the optimal balance

Willemien S. Kalteren

Cover Design: Amanda Gautier | Gautier Scientific Illustration

Lay-out: Joey Roberts | Publiss.nl

Printed by: Ridderprint | www.ridderprint.nl

© 2021 W.S. Kalteren, the Netherlands

All rights reserved. The copyright of the articles that have been published has been transferred to the respective journals. No part of this thesis may be reproduced, stored, or transmitted in any way of by any means without the prior permission of the author, of when applicable, of the publishers of the of the scientific articles.

Parts of this thesis have been carried out with financial support from the University of Groningen, the University Medical Center Groningen, the Junior Scientific Masterclass, and de Tekke Huizinga Stichting. Financial support for printing this thesis was kindly provided by the University of Groningen, University Medical Center Groningen, the Research Institute Science in Healthy Ageing and healthcaRE (SHARE), and Mrs. T.M. Kalteren.

**rijksuniversiteit
 groningen**

Neonatal anemia and red blood cell transfusions: finding the optimal balance

Proefschrift

ter verkrijging van de graad van doctor aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus prof. dr. C. Wijmenga
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op

maandag 29 november 2021 om 14.30 uur

door

Willemien Sijgje Kalteren

geboren op 29 augustus 1989
te Kampen

Promotores

Prof. dr. A.F. Bos

Dr. E.M.W. Kooi

Beoordelingscommissie

Prof. mr. dr. A.A.E. Verhagen

Prof. dr. E. Lopriore

Prof. dr. E.M. Dempsey

Paranimfen

Mirthe J. Mebius

Sanne Kruissink

Table of contents

Chapter 1	General introduction and outline of the thesis	9
Part I	Literature overview	21
Chapter 2	Anemia and red blood cell transfusions, cerebral oxygenation, brain injury and development, and neurodevelopmental outcome in preterm infants: A systematic review <i>Front Pediatr 2021; 9: 644462</i>	23
Part II	Anemia and RBC transfusions in preterm infants during their NICU stay	51
Chapter 3	Neonatal hemoglobin levels in preterm infants are associated with early neurological functioning <i>Neonatology 2021; In press</i>	53
Chapter 4	Neonatal anemia relates to intestinal injury in preterm infants <i>Provisionally Accepted</i>	69
Chapter 5	Red blood cell transfusions benefit neurological functioning of preterm infants <i>Submitted</i>	87
Chapter 6	The short-term effects of RBC transfusions on intestinal injury in preterm infants <i>Provisionally Accepted</i>	103
Chapter 7	Red blood cell transfusions affect intestinal and cerebral oxygenation differently in preterm infants with and without subsequent necrotizing enterocolitis <i>Am J Perinatol 2018; 35: 1031-1037.</i>	121
Chapter 8	Cerebral oxygen saturation limit for preterm red blood cell transfusion. A randomized controlled trial <i>Submitted</i>	139

Part III	Perinatal anemia in term infants with neonatal encephalopathy	157
Chapter 9	Perinatal anemia is associated with neonatal and neurodevelopmental outcomes in infants with moderate to severe perinatal asphyxia <i>Neonatology 2018; 114: 315-322.</i>	159
Chapter 10	Early cerebral oxygen saturation and electrocortical activity for exploring outcomes in infants with anemic and non-anemic neonatal encephalopathy <i>Submitted</i>	173
Chapter 11	General discussion and future perspectives	191
Appendices	Summary in English	216
	Samenvatting in het Nederlands	220
	Abbreviations	224
	Dankwoord	226
	About the author	232
	List of publications	234
	SHARE dissertations	236