

Vascular Access in Neonates and Children

Daniele G. Biasucci
Nicola Massimo Disma
Mauro Pittiruti
Editors

 Springer

Daniele G. Biasucci
Nicola Massimo Disma • Mauro Pittiruti
Editors

Vascular Access in Neonates and Children

 Springer

Editors

Daniele G. Biasucci
Intensive Care Unit, Department
of Emergency, Anesthesiology
and Intensive Care
Fondazione Policlinico Universitario
“A. Gemelli” IRCCS
Rome, Italy

Nicola Massimo Disma
Head of Research and Innovation
Unit, Department of Anesthesia
Istituto Giannina Gaslini
Genova, Italy

Mauro Pittiruti
Department of Surgery
Catholic University Hospital
Rome, Italy

ISBN 978-3-030-94708-8

ISBN 978-3-030-94709-5 (eBook)

<https://doi.org/10.1007/978-3-030-94709-5>

© Springer Nature Switzerland AG 2022

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Part I General Considerations on Venous Access in Neonates and Children

1	Vascular Access in Pediatric Patients: Classification and Indications	3
	Mauro Pittiruti	
2	Evidence Based Rationale for Ultrasound Guided Vascular Access in Children	25
	Nicola Massimo Disma and Mauro Pittiruti	
3	Principles of Ultrasonography and Settings of Ultrasound Devices for Children	31
	Gurinder Singh Malhi and James Bennett	
4	Ultrasound Anatomy of Arterial and Deep Veins of the Limb and the Cervico-Thoracic Region in Children	49
	Thierry Pirotte	
5	Near-InfraRed Technology for Access to Superficial Veins: Evidence from the Literature and Indications for Pediatric Venous Access	77
	Massimo Lamperti and Mauro Pittiruti	
6	Tip Navigation and Tip Location Methods	87
	Mauro Pittiruti	
7	Chest Ultrasound for Early Diagnosis of Complications	99
	Daniele G. Biasucci	
8	Technique and Devices for Securement of the Catheter and Protection of the Exit Site	115
	Mauro Pittiruti	

Part II Venous Access in Neonates

- 9 Peripheral Venous Access in Neonates** 139
Giovanni Barone, Vito D'Andrea, and Mauro Pittiruti
- 10 Umbilical Venous Catheters** 147
Roberta Centorrino, Valentina Dell'Orto, and Daniele De Luca
- 11 Epicutaneo-Cava Catheters** 169
Vito D'Andrea, Giorgia Prontera, Serena Rubortone,
and Mauro Pittiruti
- 12 Ultrasound Guided Venous Access in Neonates** 189
Christian Breschan and Mauro Pittiruti

Part III Venous Access in Children

- 13 Peripheral Venous Access: Short Cannulas,
Mini-Midlines, Midlines** 211
Davide Celentano and Mauro Pittiruti
- 14 Peripherally Inserted Central Catheters (PICC) in Children** 227
Massimo Lamperti and Mauro Pittiruti
- 15 Centrally and Femorally Inserted Central Catheters
(CICC and FICC) in Children** 245
Mauro Pittiruti
- 16 Totally Implantable Venous Access Devices** 271
Alessio Pini Prato, Elisa Cerchia, Claudio Carlini,
and Mauro Pittiruti

Part IV Arterial Access

- 17 Umbilical Arterial Catheters** 287
Roberta Centorrino, Valentina Dell'Orto, and Daniele De Luca
- 18 Peripheral Arterial Lines** 301
Daniele G. Biasucci

Part V Special Considerations in Pediatric Vascular Access

- 19 Access for Dialysis and Apheresis** 315
Xavier Torterüe and Pierre Tissières
- 20 Intraosseous Access** 321
Diego Neuhaus and Thomas Engelhardt

21	Prevention and Treatment of Catheter-Related Complications	331
	Mauro Pittiruti, Giancarlo Scoppettuolo, and Davide Celentano	
22	Compatibility of Drugs	361
	Mauro Pittiruti and Giancarlo Scoppettuolo	
23	Organization of a Hospital-Based Vascular Access Team	367
	Massimo Lamperti and Mauro Pittiruti	
24	Special Problems of Venous Access in Intensive Care and Emergency	375
	Daniele G. Biasucci	
25	Special Problems of Venous Access in Oncology and Hematology	391
	Alessandro Crocoli and Mauro Pittiruti	
26	Special Problems of Venous Access in Parenteral Nutrition	403
	Mauro Pittiruti and Giancarlo Scoppettuolo	
27	Sedation and General Anesthesia for Vascular Access in Children	409
	Elizabeth Prentice	

List of Contributors

Giovanni Barone Neonatal Intensive Care Unit, Ospedale ‘Infermi’, Rimini, Italy

James Bennett Anesthesia Department, Birmingham Children’s Hospital, Birmingham, UK

Daniele G. Biasucci Intensive Care Unit, Department of Emergency, Anesthesiology and Intensive Care, Fondazione Policlinico Universitario ‘A. Gemelli’ IRCCS, Rome, Italy

Christian Breschan Klinikum Klagenfurt, Klagenfurt, Austria

Claudio Carlini Alessandria Children Hospital, AON SS Antonio e Biagio e Cesare Arrigo, Alessandria, Italy

Davide Celentano Pediatric Intensive Care Unit, Fondazione Policlinico Universitario ‘A. Gemelli’ IRCCS, Rome, Italy

Roberta Centorrino Division of Pediatrics and Neonatal Critical Care, Medical Centre ‘A.Béclère’, South Paris University Hospital, APHP and South Paris-Saclay University, Paris, France

Elisa Cerchia Alessandria Children Hospital, AON SS Antonio e Biagio e Cesare Arrigo, Alessandria, Italy

Alessandro Crocoli Operative Unit of General and Thoracic Surgery, Bambino Gesù Children’s Hospital IRCCS, Rome, Italy

Vito D’Andrea Neonatal Intensive Care Unit, University Hospital Fondazione Policlinico Gemelli IRCCS, Rome, Italy

Valentina Dell’Orto Division of Pediatrics and Neonatal Critical Care, Medical Centre ‘A.Béclère’, South Paris University Hospital, APHP and South Paris-Saclay University, Paris, France

Nicola Massimo Disma Anesthesia and Intensive Care, Pediatric Hospital ‘G.Gaslini’, Genova, Italy

Thomas Engelhardt Department of Anesthesia, Royal Aberdeen Children's Hospital, Aberdeen, UK

Massimo Lamperti Anesthesiology Institute, Cleveland Clinic, Abu Dhabi, UAE

Daniele De Luca Division of Pediatrics and Neonatal Critical Care, Medical Centre "A.Béclère", South Paris University Hospital, APHP and South Paris-Saclay University, Paris, France

Gurinder Singh Malhi Anesthesia Department, Birmingham Children's Hospital, Birmingham, UK

Diego Neuhaus Department of Anesthesia, University Children's Hospital, Zurich, Switzerland

Thierry Pirotte Department of Anesthesia, Cliniques Universitaires Saint-Luc—Université Catholique de Louvain, Brussels, Belgium

Mauro Pittiruti Department of Surgery, Catholic University Hospital, Rome, Italy
Department of Surgery, Fondazione Policlinico Universitario "A. Gemelli" IRCCS, Rome, Italy

Alessio Pini Prato Alessandria Children Hospital, AON SS Antonio e Biagio e Cesare Arrigo, Alessandria, Italy

Elizabeth Prentice Department of Anesthesia, Royal Children's Hospital, Melbourne, VIC, Australia

Giorgia Prontera Neonatal Intensive Care Unit, University Hospital Fondazione Policlinico Gemelli IRCCS, Rome, Italy

Serena Rubortone Neonatal Intensive Care Unit, University Hospital Fondazione Policlinico Gemelli IRCCS, Rome, Italy

Giancarlo Scoppettuolo Department of Infective Diseases, Fondazione Policlinico Universitario "A. Gemelli" IRCCS, Rome, Italy

Pierre Tissières Pediatric Intensive Care and Neonatal Medicine, Le Kremlin-Bicêtre, France

Xavier Torterüe Pediatric Intensive Care and Neonatal Medicine, Le Kremlin-Bicêtre, France