

Wendy C. Ziai · Christy L. Cornwell *Editors*  
**Neurovascular Sonography**

This book provides a comprehensive and concise review of the fundamental concepts and clinical indications for Transcranial Doppler (TCD) imaging. An overview of the physics of ultrasonography as it pertains to TCD is presented, as well as neuroanatomy and cerebrovascular physiology in healthy and diseased states. Recommended protocols for neuroimaging are reviewed and serves as a guide for existing neurovascular laboratories and medical systems seeking to develop laboratories that are in need of a guide to establish their own protocols.

The most common, relevant and challenging clinical conditions where TCD is incorporated to assist with patient management are discussed. In addition, chapters provide a framework for building a neurovascular laboratory, including necessary equipment, steps to obtain national accreditation by accrediting bodies, and reimbursement procedures for tests performed. The book concludes with "clinical pearls" and "tricks of the trade", which serve as a commentary to guide physicians and neurosonologists on best-practices for TCD acquisition and interpretation.

Ziai · Cornwell  
*Eds.*



Neurovascular Sonography

# Neurovascular Sonography

Wendy C. Ziai  
Christy L. Cornwell  
*Editors*

ISBN 978-3-030-96892-2



▶ [springer.com](http://springer.com)

 Springer

---

## Contents

<b>Principles of Transcranial Doppler Sonography</b> . . . . .	1
Andrei V. Alexandrov and John Bennet	
<b>Overview of Pertinent Cerebral Vascular Anatomy</b> . . . . .	33
Pirouz Piran and Wendy C. Ziai	
<b>Cerebral Waveforms for Hemodynamic Assessment.</b> . . . .	45
Aarti Sarwal	
<b>Transcranial Doppler for Monitoring in the Neurocritical Care Unit</b> . . . . .	61
Toufic Chaaban, Danilo Cardim, and Shraddha Mainali	
<b>Transcranial Doppler in Subarachnoid Hemorrhage</b> . . . .	81
Jan Bittar and Yousef Hannawi	
<b>Reversible Cerebral Vasoconstriction Syndrome (RCVS) and Vasculitis.</b> . . . . .	99
Tamara Strohm	
<b>Monitoring for Emboli Detection (Without and With Microbubbles)</b> . . . . .	115
Alexander Razumovsky	
<b>Evaluation of Cerebral Circulatory Arrest.</b> . . . . .	133
Armando Mario Cacciatori Castro	
<b>Intracranial Stenosis.</b> . . . . .	145
Mark N. Rubin and Andrei V. Alexandrov	

<b>Therapeutic TCD for Patients with Acute Cerebral Ischemia.</b> . . . . .	159
Mark N. Rubin and Andrei V. Alexandrov	
<b>Clinical Application of Cerebrovascular Physiology</b> . . . . .	175
William K. Cornwell III	
<b>Adult Traumatic Brain Injury.</b> . . . . .	185
Creagh Boulger and Varun Shah	
<b>Traumatic Brain Injury – Pediatric</b> . . . . .	197
Francisco Abecasis	
<b>Cerebrovascular Reactivity Assessments in Traumatic Brain Injury.</b> . . . . .	209
Alwyn Gomez and Frederick A. Zeiler	
<b>Transcranial Doppler Protocols and Procedures: Vasomotor Reactivity</b> . . . . .	229
Brenda Rinsky	
<b>Continuous Cerebral Autoregulation Monitoring Using TCD.</b> . . . . .	241
Lucia Rivera-Lara and Frederick A. Zeiler	
<b>Optic Nerve Sheath Diameter for Increased Intracranial Pressure</b> . . . . .	249
Becky J. Riggs and Megan F. Hunt	
<b>Cranial Ultrasound.</b> . . . . .	275
Aarti Sarwal	
<b>Applications of Transcranial Doppler Ultrasonography in Sickle Cell Disease, Stroke, and Critical Illness in Children.</b> . . . . .	291
Kerri L. LaRovere and Nicole F. O'Brien	
<b>Point of Care Transcranial Doppler</b> . . . . .	311
Aarti Sarwal	
<b>Cerebrovascular Physiology in the Setting of Temporary and Durable Mechanical Circulatory Support</b> . . . . .	315
William K. Cornwell III	

---

**Electroencephalography Versus Transcranial Doppler  
Ultrasonography; Indications and Applications  
for Intracranial Monitoring** . . . . . 333  
Omar Hussein

**Moyamoya Disease** . . . . . 367  
Deepak Gulati

**Vertebral Steal** . . . . . 381  
Sanjeev Sivakumar and Ryan Hakimi

**Transcranial Doppler in Acute Bacterial Meningitis** . . . . 391  
Eder Caceres

**TCD Equipment, Lab Accreditation, Reimbursement,  
and Practice Issues** . . . . . 401  
Pam Young, Amanda K. Phillips, and Ryan Hakimi

**Use of Transcranial Doppler in the Outpatient  
Ultrasound Lab** . . . . . 413  
Richard Genova

**Part I Protocols**

**Transcranial Doppler Non-Imaging for Adults** . . . . . 437  
Christy L. Cornwell

**Transcranial Color Doppler Imaging for Adults** . . . . . 461  
Colleen Douville

**TCD Procedures and Protocols: Protocol for  
Monitoring for Emboli Detection  
(and With Microbubbles)** . . . . . 491  
Larry N. Raber

**Protocol for Procedures: How to Obtain Measurements  
of the Optic Nerve Sheath Diameter in Adults  
and Children Utilizing Point-of-Care Ophthalmic  
Ultrasonography** . . . . . 497  
Becky J. Riggs and Megan F. Hunt

---

**Protocol for Extracranial Carotid Examination** . . . . . 515  
William K. Cornwell

**Index** . . . . . 527