

Stroke syndromes

'This comprehensive work will provide its owner with a ready source of reference for a multitude of questions that might arise in the evaluation and localization of individual stroke patients'
(*European Neurology*)

'A detailed compilation of descriptions that puts into one place a wealth of information on the clinical observations that can be collected into meaningful stroke syndromes'
(*Vascular Medicine*)

'An excellent sourcebook for anyone interested in stroke'
(*Neuroradiology*)

The first edition of *Stroke Syndromes* was widely welcomed as a new and authoritative reference in the assessment and diagnosis of stroke. This revised and updated edition remains the definitive guide to patterns and syndromes in stroke. A comprehensive survey of all types of neurological, neurophysiological and other clinical dysfunction due to stroke, the book is organized to make pattern recognition easier. It contains descriptions of clinical problems encountered in stroke patients and their differential diagnosis, and will enable clinicians to differentiate between possible locations on the basis of symptoms and signs.

A companion volume *Uncommon Causes of Stroke* completes this highly authoritative reference work, which clinicians in neurology will find essential to the understanding and diagnosis of stroke.

Julien Bogousslavsky is Professor and Chair in the University Department of Neurology, and Professor of Cerebrovascular Diseases, University of Lausanne, Switzerland. He was Co-founder of the European Stroke Conference and of the journal *Cerebrovascular Diseases*.

Louis R. Caplan is Professor of Neurology at Harvard Medical School and Chief of the Stroke Service, Beth Israel Deaconess Medical Center, Boston. He is Vice-President of the American Neurological Association.

Cambridge University Press
978-0-521-77142-9 - Stroke Syndromes, Second Edition
Edited by Julien Bogousslavsky and Louis R. Caplan
Frontmatter
[More information](#)



Second edition

Edited by

Julien Bogousslavsky

University of Lausanne, Switzerland

and

Louis R. Caplan

Harvard Medical School and Beth Israel Deaconess Medical Center, Boston, MA, USA



Cambridge University Press
 978-0-521-77142-9 - Stroke Syndromes, Second Edition
 Edited by Julien Bogousslavsky and Louis R. Caplan
 Frontmatter
[More information](#)

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
 The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
 The Edinburgh Building, Cambridge CB2 2RU, UK
 40 West 20th Street, New York, NY 10011-4211, USA
 477 Williamstown Road, Port Melbourne, VIC 3207, Australia
 Ruiz de Alarcón 13, 28014 Madrid, Spain
 Dock House, The Waterfront, Cape Town 8001, South Africa
<http://www.cambridge.org>

© Cambridge University Press, 1995, 2001

This book is in copyright. Subject to statutory exception
 and to the provisions of relevant collective licensing agreements,
 no reproduction of any part may take place without
 the written permission of Cambridge University Press.

First published 1995
 Reprinted 1996, 1998
 Second edition 2001
 Reprinted 2002

Printed in the United Kingdom at the University Press, Cambridge

Typeface Utopia 8.5/12pt. *System* QuarkXPress™ [s e]

A catalogue record for this book is available from the British Library

Library of Congress Cataloguing in Publication data
 Stroke syndromes / edited by Julien Bogousslavsky, Louis Caplan – 2nd ed.
 p. cm.

Includes bibliographical references and index.

ISBN 0 521 77142 0 (hb)

1. Cerebrovascular disease – Diagnosis. 2. Diagnosis, Differential. 3. Symptoms.

I. Bogousslavsky, Julien. II. Caplan, Louis R.

[DNLM: 1. Cerebrovascular Accident – diagnosis. 2. Syndrome. WL 355 S9213735 2000]

RC388.5 .S8567 2000

616.8'1–dc21 00-058499

ISBN 0 521 77142 0 hardback

ISBN 0 521 80258 X boxed set (with *Uncommon causes of stroke*)

Every effort has been made in preparing this book to provide accurate
 and up-to-date information which is in accord with accepted
 standards and practice at the time of publication. Nevertheless, the
 authors, editors and publisher can make no warranties that the
 information contained herein is totally free from error, not least
 because clinical standards are constantly changing through research
 and regulation. The authors, editors and publisher therefore disclaim
 all liability for direct or consequential damages resulting from the use
 of material contained in this book. Readers are strongly advised to pay
 careful attention to information provided by the manufacturer of any
 drugs or equipment that they plan to use.

Cambridge University Press
978-0-521-77142-9 - Stroke Syndromes, Second Edition
Edited by Julien Bogousslavsky and Louis R. Caplan
Frontmatter
[More information](#)

To Lucie Belime-Laugier and Carl and Bess Caplan.
Who have passed on but remain as
an eternal inspiration.

To our patients.
They have taught us much about stroke, dealing with
adversity, courage, and the meaning of health, life, and
death. We shall always be in their debt.

JB LC

Contents

<i>List of contributors</i>	<i>page x</i>
<i>Preface</i>	<i>xvii</i>

PART I CLINICAL MANIFESTATIONS

1 Stroke onset and courses	3
Haruko Yamamoto, Masayasu Matsumoto, Kazuo Hashikawa and Masatsugu Hori	
2 Clinical types of transient ischemic attacks	8
Graeme J. Hankey	
3 Hemiparesis and other types of motor weakness	22
Teresa Pinho e Melo and Julien Bogousslavsky	
4 Sensory abnormality	34
Jong Sung Kim	
5 Cerebellar ataxia	48
Dagmar Timmann and Hans Christoph Diener	
6 Headache: stroke symptoms and signs	60
Conrado J. Estol	
7 Eye movement abnormalities	76
Charles Pierrot-Deseilligny	
8 Cerebral visual dysfunction	87
Jason J.S. Barton and Louis R. Caplan	
9 Visual symptoms (eye)	111
Shirley H. Wray	
10 Vestibular syndromes and vertigo	129
Marianne Dieterich and Thomas Brandt	
11 Auditory disorders in stroke	144
Robert A. Levine and Rudolf Häusler	
12 Abnormal movements	162
Joseph Ghika and Julien Bogousslavsky	

13 Seizures and stroke	182	PART II VASCULAR TOPOGRAPHIC SYNDROMES	
Anne L. Abbott, Christopher F. Bladin and Geoffrey A. Donnan		29 Arterial territories of human brain	375
14 Disturbances of consciousness and sleep-wake functions	192	Laurent Tatu, Thierry Moulin, Julien Bogousslavsky and Henri Duvernoy	
Claudio Bassetti		30 Superficial middle cerebral artery syndromes	405
15 Aphasia and stroke	211	Jean-Philippe Neau and Julien Bogousslavsky	
Andrew Kertesz		31 Lenticulostriate arteries	428
16 Agitation and delirium	222	Patrick Pullicino	
John C.M. Brust and Louis R. Caplan		32 Anterior cerebral artery	439
17 Frontal lobe stroke syndromes	232	John C.M. Brust, Tohru Sawada and Seiji Kazui	
Paul J. Eslinger and Raymond K. Reichwein		33 Anterior choroidal artery territory infarcts	451
18 Memory loss	242	Philippe Vuadens and Julien Bogousslavsky	
José M. Ferro and Isabel P. Martins		34 Thalamic infarcts and hemorrhages	461
19 Neurobehavioural aspects of deep hemisphere stroke	252	Alain Barth, Julien Bogousslavsky and Louis R. Caplan	
José M. Ferro		35 Caudate infarcts and hemorrhages	469
20 Right hemisphere syndromes	264	Chin-Sang Chung, Hye-Seung Lee and Louis R. Caplan	
Stephanie Clarke		36 Posterior cerebral artery	479
21 Poststroke dementia	273	Claudia J. Chaves and Louis R. Caplan	
Didier Leys and Florence Pasquier		37 Large and panhemispheric infarcts	490
22 Disorders of mood behaviour	285	Stefan Schwarz, Stefan Schwab and Werner Hacke	
Florence Ghika-Schmid and Julien Bogousslavsky		38 Multiple, multilevel and bihemispheric infarcts	499
23 Agnosias, apraxias and callosal disconnection syndromes	302	Emre Kumral	
Patrik Vuilleumier		39 Midbrain infarcts	512
24 Muscle, peripheral nerve and autonomic changes	323	Marc Hommel and Gérard Besson	
Thierry Kuntzer and Bernard Waeber		40 Pontine infarcts and hemorrhages	520
25 Dysarthria	334	Chin-Sang Chung and Louis R. Caplan	
Paola Santalucia and Edward Feldmann		41 Medullary infarcts and hemorrhages	534
26 Dysphagia and aspiration syndromes	341	Bo Norrving	
Mark J. Alberts and Jennifer Horner-Catt		42 Cerebellar stroke syndromes	540
27 Respiratory dysfunction	353	Pierre Amarenco	
François Vingerhoets and Julien Bogousslavsky		43 Extended infarcts in the posterior circulation (brainstem/cerebellum)	557
28 Clinical aspects and correlates of stroke recovery	363	Barbara E. Tettenborn	
Marta Altieri, Vittorio Di Piero, Edoardo Vicenzini and Gian Luigi Lenzi		44 Border zone infarcts	564
		E. Bernd Ringelstein and Florian Stögbauer	
		45 Classical lacunar syndromes	583
		John M. Bamford	

Contents

46 Putaminal hemorrhages	590	52 Cervical artery dissection syndromes	660
Kazuo Minematsu and Takenori Yamaguchi		Tobias Brandt, Erdem Orberk and Werner Hacke	
47 Lobar hemorrhages	599	53 Syndromes related to large artery thromboembolism within the vertebrobasilar system	667
Carlos S. Kase		Louis R. Caplan	
48 Intraventricular hemorrhages	612	54 Spinal stroke syndromes	691
Peter C. Gates		Matthias Sturzenegger	
49 Subarachnoid hemorrhage syndromes	618	<i>Index</i>	705
Jan van Gijn and Gabriel J.E. Rinkel			
50 Brain venous thrombosis syndromes	626		
Caroline Arquizan, Jean-François Meder and Jean-Louis Mas			
51 Carotid occlusion syndromes	651		
François Nicoli and Julien Bogousslavsky			

Contributors

Anne L. Abbott (née Harris)
Neurology Department
Repatriation Campus Austin
and Repatriation Medical
Centre
Locked Bag 1
Heidelberg West
Victoria 3081
Australia

Mark J. Alberts
Division of Neurology
Department of Medicine,
PO Box 2900
Duke University Medical Center
Durham, NC 27710
USA

Marta Altieri
Università degli studi di Roma
Department of Neurological Science
V Cattedra di Clinica Neurologica
V. le dell'Università, 30
00185 Rome
Italy

Pierre Amarenco
Neurology Services
Saint-Antoine Hospital
Rue du Fbg St-Antoine 184
F-75571 Paris
France

Caroline Arquizan
Neurology Services
Sainte Anne Hospital
1 Rue Cabanis
75674 Paris Cedex 14
France

Contributors

John M. Bamford

St James's University Hospital
 Beckett Street
 Leeds LS9 7TF
 UK

Alain Barth

Inselspital Neurological Clinic and
 Poliklinik
 3010 Berne
 Switzerland

Jason J.S. Barton

Beth Israel Deaconess Medical Center
 East Campus
 330 Brooklyn Avenue
 Boston, MA 02215
 USA

Claudio Bassetti

Inselspital Hospital of L'le
 Neurological Clinic and Poliklinik
 CH 3010 Bern-Schweiz
 Switzerland

Gérard Besson

Central University Hospital of
 Grenoble
 Department of Clinical and Biological
 Neurosciences
 Neurological Services
 BP 217X
 38043 Grenoble Cedex 9
 France

Christopher R Bladin

Neurology Department
 Box Hill Hospital
 Nelson Road
 Box Hill, Victoria 3128
 Australia

Julien Bogousslavsky

Department of Neurology
 University of Lausanne
 CHUV BH 13
 CH-1011 Lausanne
 Switzerland

Thomas Brandt

Department of Neurology
 Klinikum Grosshadern
 Ludwig Maximilians University Munich
 Marchioninstr. 15
 D-81377 Munich 70
 Germany

Tobias Brandt

Neurological Clinic
 Im Neuenheimer Feld 400
 69120 Heidelberg
 Germany

John C.M. Brust

Department of Neurology
 Harlem Hospital Center
 506 Lenox Avenue
 New York, NY 10037
 USA

Louis R. Caplan

Beth Israel Deaconess Medical Center
 East Campus
 330 Brooklyn Avenue
 Boston, MA 01125
 USA

Claudia J. Chaves

Beth Israel Deaconess Medical Center
 East Campus
 330 Brooklyn Avenue
 Boston, MA 01125
 USA

Chin-Sang Chung

Department of Neurology
 Samsung Medical Center
 Sungkyunkwan University School of
 Medicine
 50 ILWON-dong
 Kangnam-ku
 Seoul, South Korea 135-710

Stephanie Clarke

Division of Neuropsychology
 CHUV-Nestlé
 CH-1011 Lausanne
 Switzerland

Hans C. Diener

Neurological Clinic
 University Clinic Essen
 Hufelandstr. 55
 D-45122 Essen
 Germany

Marianne Dieterich

Department of Neurology
 Klinikum Grosshadern
 Ludwig Maximilians University Munich
 Marchioninstr. 15
 D-81377 Munich 70
 Germany

xii Contributors

Geoffrey A. Donnan
 Department of Neurology and
 Neurosciences
 Neurosciences Building
 Repatriation Campus Austin
 and Repatriation Medical
 Centre
 Locked Bag 1
 Heidelberg West
 Victoria 3081
 Australia

Henri Duvernoy
 Anatomy Laboratory
 Central University Hospital
 Jean Minjoz Hospital
 25030 Besancon
 France

Paul J. Eslinger
 Hershey Medical Center
 500 University Drive
 Hershey, PA 17033
 USA

Conrado J. Estol
 Centre for Neurological Treatment and
 Rehabilitation
 Pacheco de Melo 1860
 Buenos Aires 1128
 Argentina

Edward Feldmann
 Department of Clinical Neurosciences
 Brown University School of Medicine
 110 Lockwood Street 324
 Providence, RI 02903
 USA

José M. Ferro
 University of Lisbon
 Faculty of Medicine
 Av. Prof. Egas Moniz
 1699 Lisbon Codex
 Portugal

Peter C. Gates
 Department of Neuroscience
 Geelong Hospital
 Geelong
 Victoria 3220
 Australia

Joseph Ghika
 Department of Neurology
 University of Lausanne
 CHUV BH 13
 CH-1011 Lausanne
 Switzerland

Florence Ghika-Schmid
 Department of Neurology
 University of Lausanne
 CHUV BH 13
 CH-1011 Lausanne
 Switzerland

Werner Hacke
 Neurological Clinic
 Im Neuenheimer Feld 400
 69120 Heidelberg
 Germany

Graeme J. Hankey
 Royal Perth Hospital
 Neurology
 Box X2213 GPO
 Perth 6847
 Western Australia

Kazuo Hashikawa
 Division of Strokeology
 Department of Internal Medicine and
 Therapeutics (A8)
 Osaka University Graduate School of
 Medicine
 2-2, Yamadaoko, Suita
 Osaka 565-0871
 Japan

Rudolf Häusler
 Department of ENT
 Department of Otorhinolaryngology
 Head and Neck and Cranio-Maxillo-
 Facial Surgery
 University Hospital of Berne
 University of Berne
 3010 Berne
 Switzerland

Contributors

Marc Hommel

Central University Hospital of
 Grenoble
 Department of Clinical and Biological
 Neurosciences
 Neurological Services
 BP 217X
 38043 Grenoble Cedex 9
 France

Masatsugu Hori

Division of Strokology
 Department of Internal Medicine and
 Therapeutics (A8)
 Osaka University Graduate School of
 Medicine
 2-2, Yamadaoko, Suita
 Osaka 565-0871
 Japan

Jennifer Horner-Catt

Department of Speech and Language
 Therapy
 University of Canterbury
 Private Bag 4800
 Christchurch
 New Zealand

Carlos S. Kase

Department of Neurology
 Boston University School of Medicine
 715 Albany Street
 Robinson Building 605
 Boston, MA 02118-2526
 USA

Selji Kazui

National Cardiovascular Center
 Fujishirodai 5-7-1, Suita
 Osaka 565-8565
 Japan

Andrew Kertesz

St Joseph's Health Centre
 Department of Clinical Neurological
 Sciences
 University of Western Ontario
 268 Grosvenor Street
 London, Ontario
 Canada NA 4V2

Jong Sung Kim

Department of Neurology
 Asan Medical Center
 Song-Pa PO Box 145
 Seoul 138-600
 South Korea

Emre Kumral

Stroke and Neuropsychology Unit
 Department of Neurology
 School of Medicine
 Ege University
 Bornova
 Izmir 35100
 Turkey

Thierry Kuntzer

Service de Neurologie
 CHUV BH 07/306
 CH-1011 Lausanne
 Switzerland

Hye-Seung Lee

Department of Neurology
 Samsung Medical Center
 Sungkyunkwan University School of
 Medicine
 50 ILWON-dong
 Kangnam-ku
 Seoul
 South Korea 135-710

Gian Luigi Lenzi

Department of Neurological Sciences
 University of Rome
 La Sapienza
 Via Cavour, 325
 00184 Rome
 Italy

Robert A. Levine

Eaton Laboratory of Auditory
 Physiology
 Massachusetts Eye and Ear Infirmary
 Harvard University
 Boston, MA
 USA

Didier Leys

Neurology Services
 Salengro Hospital
 Rue Oscar Lambret
 59037 Lille
 France

xiv Contributors

Isabel P. Martins

Department of Neurology
 Santa Maria Hospital
 Av. Prof. Egas Moniz
 P-1699 Lisbon
 Portugal

Jean-Louis Mas

Neurology Services
 Centre Raymond Garcin-1 CHSA
 Sainte Anne Hospital
 1 Rue Cabanis
 75674 Paris Cedex 14
 France

Masayasu Matsumoto

Division of Strokeology
 Department of Internal Medicine and
 Therapeutics (A8)
 Osaka University Graduate School of
 Medicine
 2-2, Yamadaoko, Suita
 Osaka 565-0871
 Japan

Jean-François Meder

Radiology Services
 Centre Raymond Garcin-CHSA
 Sainte Anne Hospital
 1 Rue Cabanis
 75674 Paris Cedex 14
 France

Kazuo Minematsu

Cerebrovascular Division
 Department of Medicine
 National Cardiovascular Center
 Fujishirodai 5-7-1, Suita
 Osaka 565-8565
 Japan

Thierry Moulin

Neurology Services
 Central University Hospital
 Jean Minjoz Hospital
 25030 Besancon
 France

Jean-Philippe Neau

Clinical Neurology Services
 Jean Bernard Hospital
 BP 577
 86021 Poitiers
 France

François Nicoli

Neurology Services
 Pr. J.L. Gastaut
 Sainte Marguerite Hospital
 F-13009 Marseilles
 France

Bo Norrving

Department of Neurology
 University Hospital
 S-22185 Lund
 Sweden

Erdem Orberk

Neurological Clinic
 Im Neuenheimer Feld 400
 69120 Heidelberg
 Germany

Florence Pasquier

University of Lille
 Lille
 France

Vittorio Di Piero

Università degli studi di Roma
 Department of Neurological Science
 V Cattedra di Clinica Neurologica
 V. le dell'Università, 30
 00185 Rome
 Italy

Charles Pierrott-Deselligny

Clinique Paul Castaigne Clinic
 Neurology Services
 Hospitals Group
 Pitié-Salpêtrière
 47-83 Boulevard de l'Hôpital
 75651 Paris Cedex 13
 France

Teresa Pinho e Melo

University of Lisbon
 Neurology Clinic
 Santa Maria Hospital
 Av. Prof Egas Moniz
 P-1699 Lisbon
 Portugal

Patrick Pullicino

Department of Neurology
 Buffalo General Hospital
 100 High Street
 Buffalo, NY 14203
 USA

Contributors

Raymond K. Reichwein
 Section of Neurology H037
 Hershey Medical Center
 500 University Drive
 Hershey, PA 17033
 USA

E. Bernd Ringelstein
 Neurology Clinic
 Westfälische Wilhelms-University
 Münster
 Albert Schweitzer Str. 33
 D-48129 Münster
 Germany

Gabriel J.E. Rinkel
 University Department of Neurology
 University Medical Centre
 Box 85500
 3508 GA Utrecht
 The Netherlands

Paolo Santalucia
 Department of Clinical Neurosciences
 Brown University School of Medicine
 110 Lockwood Street 324
 Providence, RI 02903
 USA

Tohru Sawada
 National Cardiovascular Center
 Fujishirodai 5-7-1, Suita
 Osaka 565-8565
 Japan

Stefan Schwab
 Neurological Clinic
 Im Neuenheimer Feld 400
 69120 Heidelberg
 Germany

Stefan Schwarz
 Neurological Clinic
 Im Neuenheimer Feld 400
 69120 Heidelberg
 Germany

Florian Stögbauer
 Neurology Clinic
 Westfälische Wilhelms-University
 Münster
 Albert Schweitzer Str. 33
 D-48129 Münster
 Germany

Matthias Sturzenegger
 Inselspital Neurological Clinic and
 Policlinic
 3010 Berne
 Switzerland

Laurent Tatu
 Neurology Services
 Central University Hospital
 Jean Minjoz Hospital
 25030 Besancon
 France

Barbara E. Tettenborn
 Kantonsspital St Gallen
 CH-9007 St Gallen
 Switzerland

Dagmar Timmann
 Neurological Clinic
 Universitätsklinikum Essen
 Hufelandstr. 55
 D-45122 Essen
 Germany

Jan van Gijn
 Department of Neurology
 University Medical Centre
 PO Box 85500
 3508 GA Utrecht
 The Netherlands

Edoardo Vicenzini
 Università degli studi di Roma
 Department of Neurological Science
 V Cattedra di Clinica Neurologica
 V. le dell'Università, 30
 00185 Rome
 Italy

François Vingerhoets
 Department of Neurology,
 University of Lausanne
 CHUV BH 13
 CH-1011 Lausanne
 Switzerland

Philippe Vuadens
 Department of Neurology
 University of Lausanne
 CHUV BH 13
 CH-1011 Lausanne
 Switzerland

xvi Contributors

Patrik Vuilleumier
University of Davis
Neurology Department 127
VA Medical Center Building E
150 Muir Road
Martinez, CA 94553
USA

Bernard Waeber
Division of Clinical Pathophysiology
CHUV BH 19/640
CH-1011 Lausanne
Switzerland

Shirley H. Wray
Harvard Medical School
Department of Neurology
Director, Unit for Neurovisual
Disorders
Massachusetts General Hospital
Boston, MA 02114
USA

Takenori Yamaguchi
Cerebrovascular Division
Department of Medicine
National Cardiovascular Center
Fujishirodai 5-7-1, Suita
Osaka 656-8565
Japan

Haruko Yamamoto
Pharmaceuticals and Medical Devices
Evaluation Center
National Institute for Health Services
MHW 3-8-21
Toranomon
Minato-ku
Tokyo 105-8409
Japan

Preface

The success of *Stroke syndromes* over the 5 years elapsed since its publication is the reason for this second edition. Indeed, numerous comments made to us by colleagues, from trainees to international experts, have confirmed to us the interest and importance of a book deeply rooted in the clinical practice with stroke patients – especially in the era of starwars medicine aiming to help examination of these patients and facilitate diagnosis of their condition. The best compliment to medical teachers is when their work is liked by students and junior residents. However, we thought that there was room for improvement, and we have tried to reshape *Stroke syndromes*, so that some omissions have been filled, and so that it is still more user-friendly. Besides, we have divided the initial book into two volumes, the first focusing on syndromes and their brain and vascular correlates, the second on the particular vascular etiologic syndromes which formed Part III of the first edition. However, the book, still meant as a guide, remains what it was, ‘a bound source and store of patterns and syndromes for non-experts in stroke to refer to when they encounter an unfamiliar pattern’, of three different types:

- (i) patterns of symptoms and signs;
- (ii) lesion patterns found in patients with infarcts and hemorrhages in various loci and various vascular territories;
- (iii) patterns and syndromes that occur in unusual conditions that are known to cause stroke but that are not encountered very often.

We thank all authors who have agreed to adapt, rewrite and modify their initial chapters, as well as the numerous new contributors. Five years ago, we were grateful for the availability of fax machines, allowing rapid Lausanne–Boston communications, while now we are grateful for the availability of email; we also wrote that, for stroke management, ‘the window of opportunity is short, probably less than

xviii Preface

24 hours, while we know today that it is below 6 hours in most instances. Many other advances have been achieved. With this in mind, we hope that this completely updated and rewritten edition will continue to be of help in the care of patients with stroke.

Julien Bogousslavsky, *Lausanne*
Louis R. Caplan, *Boston*