

Alessandro Frullini

# MANUAL OF AMBULATORY PHLEBOLOGY



English Edition by **Marlin W. Schul**

**Collaborators:** Giovanni Alongi, Andrea Del Corso, Rossella Di Stefano, Angelina Floris, Mario Forzanini, G. Andrea Gerardi, Andrea Gori, Edy Pablo Lucca, Carlo Manfrè, Alessandro Mascitelli, Ramin Namavar, Sabino Paradiso, Alessandro Pieri, Maurizio Ronconi, Gianluigi Rosi, Emanuele Nazario Scarlata, Luigi Scevola, Jaroslav Strejček



Officina editoriale Oltrarno

# MANUAL OF AMBULATORY PHLEBOLOGY

Alessandro Frullini

Copyright © Officina Editoriale Oltrarno S.R.L., Florence, Italy, 2023

*This book is copyrighted. No part of this book may be reproduced in any form or by any means, including photocopying, or used in any other way. The publishing house reserves the right to undertake, in its protection, legal actions, to those who do not conform to this rule. In addition, the editor, authors, and publisher are not responsible for errors or omissions or any consequences from the application of the information in this book and do not warrant, in an expressed or implied manner, the totality, accuracy and completeness of the content of the publication. The application of this information remains the doctor's professional responsibility. The devices and drugs mentioned in this book may be unavailable in some countries.*

The Publisher

Editorial project:  
**Davide Di Maggio**

Layout:  
**Roberta Dolce**

Illustrations by  
**Valerio Cioni**

Graphic Web Page:  
**Roberta Dolce**

Customer management:  
**Andrea Ortolani**  
e-mail: andrea@oeofirenze.com

Production Secretary:  
**Carlotta Cirri**

Printed by  
**Cartografica Toscana**  
for  
**Officina Editoriale Oltrarno S.R.L. – Firenze**

ISBN: 9791280318213

www.oeofirenze.com  
e-mail: info@oeofirenze.com



OEO is a carbon neutral publishing house and all its books are printed in Florence on FSC paper (Forest Stewardship Council)

ALESSANDRO FRULLINI

# MANUAL OF AMBULATORY PHLEBOLOGY

ENGLISH EDITION BY MARLIN W. SCHUL

**COLLABORATORS:**

G. ALONGI, A. DEL CORSO, R. DI STEFANO,  
A. FLORIS, M. FORZANINI, G.A. GERARDI,  
A. GORI, E.P. LUCCA, C. MANFRÈ, A. MASCITELLI,  
R. NAMAVAR, S. PARADISO, A. PIERI, M. RONCONI,  
G. ROSI, E.N. SCARLATA, L. SCEVOLA, J. STREJČEK



Officina Editoriale Oltrarno  
Firenze

*To Loredana*

## AUTHOR

### ALESSANDRO FRULLINI MD

Degree with honors in medicine and surgery, University of Florence.

Specialized with honors in vascular surgery, University of Florence.

Specialized with honors in general surgery, University of Florence.

Didactic director and teacher in Phlebology courses at the CPMA post-university school in Bologna.

Contract professor at the Department of Biomedical Sciences of the University of Sassari.

Honorary President and founder of AFI – Italian Phlebological Association.

Honorary member of the Italian Society of Phlebology.

Awarded the Platinum Award of the American College of Phlebology in 1999.

Awarded the American College of Phlebology Gold Award in 2000 and 2010.

Author and co-author of Phlebology books and over 180 scientific publications in national and international journals.

He carries out his phlebological activity in the offices of Florence, Figline and Incisa Valdarno, Prato and Belluno.

[www.venevaricose.it](http://www.venevaricose.it) - [dr.afrullini@gmail.com](mailto:dr.afrullini@gmail.com)



## ENGLISH EDITOR

### MARLIN W. SCHUL MD

Fellow - American College of Emergency Medicine.

Fellow - American Vein & Lymphatic Society.

Distinguished Fellow - American Venous Forum.

Diplomate - American Board of Venous & Lymphatic Medicine.

Past President - American Vein & Lymphatic Society.

[mschul@lafayetteveins.com](mailto:mschul@lafayetteveins.com)



## COLLABORATORS



### **GIOVANNI ALONGI MD**

Phlebologist  
Palermo, Messina, Agrigento  
drgiovannialongi@gmail.com

Has collaborated to chapter 18

Angiologist and cardiologist, specialist in diseases of the cardiovascular system. Founder of the Angiocor centers.



### **ANDREA DEL CORSO MD**

Vascular surgeon  
Pisa  
adelcorso2000@hotmail.com

Has collaborated to chapter 14

Specialist in General Surgery at the U.O. of Vascular Surgery department and phlebological clinic coordinator of the University Hospital in Pisa.



### **ROSSELLA DI STEFANO MD**

Specialist in general and emergency surgery  
Pisa  
rosselladistefano59@gmail.com

Has collaborated to chapter 5

Associate Professor in Cardiovascular disease and Laboratory head of Cardiovascular Research - UniPi. Former Director Sports Medicine department and School of Specialization in Sports and Exercise Medicine - UniPi



## **ANGELINA FLORIS MD**

Angiologist  
Cagliari  
angelina.floris@tiscali.it

Has collaborated to chapters 5, 22

She carries out her practice in the Medical Angiology office at the ASL of Cagliari.



## **MARIO FORZANINI MD**

Phlebologist  
Brescia  
mario.forzanini@tin.it

Has collaborated to chapters 12, 18

Specialist in Vascular Surgery, Service of Angiology and Phlebological Surgery, S. Anna Clinical Institute, Brescia.



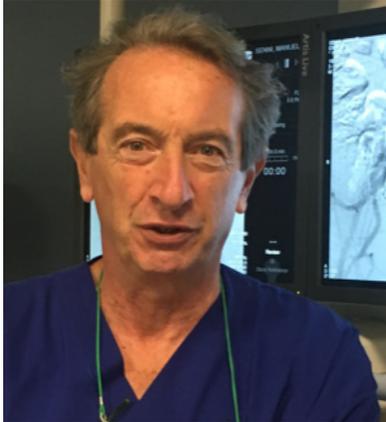
## **G. ANDREA GERARDI MD**

Phlebologist  
Perugia  
gerardiandrea@hotmail.com

Has collaborated to chapters 3, 5, 24

Specialist in general surgery and head of vein clinic. Training teacher European UEMS at Usl southeast Tuscany area. AFI coordinator for Umbria region. Offices in Toscana-Umbria-Marche.

## COLLABORATORS



### **ANDREA GORI MD**

Vascular interventional radiologist  
Florence  
dr.andreagori@gmail.com

Has collaborated to chapter 4

Author of numerous national and international publications. Consultant for GVM Care&Research and Villa Donatello Clinic, Florence.

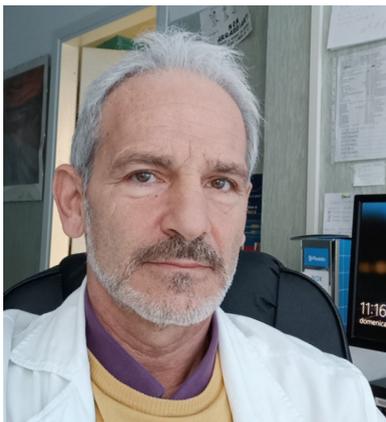


### **EDY PABLO LUCCA MD**

Vascular and general surgeon  
Udine  
edylucca@icloud.com

Has collaborated to chapter 11

Vascular surgeon at the Azienda Sanitaria Universitaria, Central Friuli, Udine Hospital.



### **CARLO MANFRÈ MD**

Vascular surgeon  
Roma  
manfrestudio@gmail.com

Has collaborated to chapter 17

Specialist in general surgery at University of Rome "La Sapienza". Vascular surgery department San Camillo de Lellis Hospital in Rieti.



### **ALESSANDRO MASCITELLI MD**

Phlebologist, Internal medicine  
Livorno, Pontedera  
alessandromascitelli@gmail.com

Has collaborated to chapter 7

Director of the Phlebological Center of the Villa Tirrena clinic of Livorno (SSN Tuscany Region).  
Phlebologist, Specialist in Internal Medicine UniPi



### **RAMIN NAMAVAR MD**

Angiologist and phlebologist  
Taranto, Lecce, Brindisi  
raminnamavar01@gmail.com

Has collaborated to chapters 2, 3, 21, 24

Dr. Namavar is a freelance angiologist and phlebologist; he practices in the provinces of Taranto, Lecce and Brindisi.



### **SABINO PARADISO MD**

Phlebologist and specialist in surgery  
Trani  
paradisosabino@libero.it

Has collaborated to chapter 9

Director of the Paradiso Medical Center in Trani (BT), where he works as a phlebologist and general surgeon.

## COLLABORATORS



### **ALESSANDRO PIERI MD**

Medical angiologist  
Florence  
aogpieri@gmail.com

Has collaborated to chapter 4

Medical angiologist, Florence. Former Head of Tuscan CRR for noninvasive Angiological Diagnostics (AOUC – Florence).



### **MAURIZIO RONCONI MD**

General surgeon  
Brescia  
maurizio.ronconi@unibs.it

Has collaborated to chapters 19, 23

Director of the Complex Operating Unit of general Surgery at Hospital of Gardone Val Trompia - Spedali Civili of Brescia - Contract Professor at University of Brescia. Current AFI president



### **GIANLUIGI ROSI MD**

Phlebologist  
Perugia  
rosiflebite@libero.it

Has collaborated to chapter 10

Specialist in Angiology University of Grenoble. Founder of the Rosi Vascular Center; Angiology consultant at SSN USL1 - Umbria.

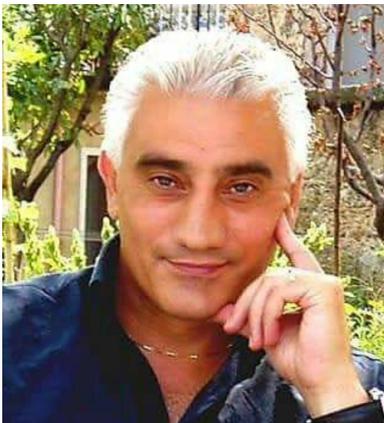


## **EMANUELE NAZARIO SCARLATA MD**

Angiologist  
Reggio Calabria  
scarlataemanuele@virgilio.it

Has collaborated to chapter 6

Head of the Angiology clinic - Metropolitan Hospital - Reggio Calabria. Contract Professor of Physiology in Biomedical Sciences at University of Catanzaro.



## **LUIGI SCEVOLA MD**

Vascular and general surgeon  
Salerno  
luigiscevola@gmail.com

Has collaborated to chapter 20

Head of Vascular Diagnostics, Angiology and Phlebology at Asl Sa 3. Freelance professional.



## **JAROSLAV STREJČEK MD**

Dermatologist and phlebologist  
Czech Republic  
jaroslav.strejcek@phlebomedica.cz

Has collaborated to chapter 15

President of the Czech Society of Phlebology, founder and director of the Center for Dermatologic Angiology.

---

The authors would like to thank for their friendly participation  
Dr. Guido Cantalamessa, Dr. Daniela Telleschi  
and engineer Franco Peroschi.

---

# INDEX

Author .....	5
English editor .....	5
Collaborators.....	6
Foreword.....	24
Foreword to the English edition.....	25
Introduction. Phlebology as a choice .....	27

## **1 - THE ANATOMY OF LOWER LIMBS VENOUS CIRCULATION 31**

1.1 The anatomy of lower limbs venous circulation .....	32
1.1.1 Microscopic structure of a vein and valve.....	33
1.2 Overview of the venous circle of the lower limbs .....	37
1.2.1 Veins of the deep system.....	37
1.2.2 The superficial venous circulation.....	38
1.3 Outline of embryology of the venous circulation of the lower limbs .....	40
1.4 The venous circulation of the foot .....	42
1.4.1 The foot pump mechanism.....	43
1.5 The great saphenous vein (GSV).....	45
1.6 The anterior accessory saphenous vein (AASV).....	50
1.7 The small saphenous vein (SSV) .....	52
1.8 The vein of Giacomini .....	55
1.9 The lateral veins of the lower limb .....	56
1.10 The iliac veins .....	56
1.11 The perforating veins .....	57
1.12 Anatomical variations in the premenstrual phase and in pregnancy .....	59
1.13 Nervous structures of phlebological interest.....	59
1.13.1 The saphenous nerve .....	59
1.13.2 The sural nerve.....	59
Essential bibliography .....	60

## **2 - PATHOPHYSIOLOGY OF THE VENOUS CIRCULATION OF THE LOWER LIMBS 65**

2.1 General.....	66
2.2 The venous pumps .....	68

2.3 The venous valves .....	71
2.4 Hemodynamic frameworks .....	72
2.5 Venous shunt.....	77
2.5.1 Classification of veno-venous shunts .....	79
Essential bibliography .....	86

### **3 - OBJECTIVE EXAMINATION IN PHLEBOLOGY** **89**

3.1 Introduction .....	90
3.1.1 Inspection.....	91
3.1.2 Palpation .....	101
3.1.3 Percussion .....	103
3.1.4 Auscultation .....	103
3.2 Dynamic maneuvers .....	103
3.2.1 Homans maneuver .....	103
3.2.2 Perthes maneuver .....	104
3.2.3 Trendelenburg maneuver .....	104
3.2.4 The cough test .....	106
3.3 The phlebological patient .....	106
3.3.1 The standard patient .....	107
3.3.2 The standard false patient .....	107
3.3.3 The depressed patient.....	108
3.3.4 The patient with inadequate aesthetic expectations .....	108
3.3.5 The patient with large asymptomatic varicose veins.....	109
3.3.6 Patients with varicose veins but symptoms with different origin.....	110
3.3.7 The patient with multiple recurrences .....	110
3.3.8 The patient with ulcer .....	110
3.3.9 The impossible patient.....	111
Essential bibliography .....	112

### **4 - INSTRUMENTAL DIAGNOSTICS IN PHLEBOLOGY** **115**

4.1 Introduction .....	116
4.2 Ultrasonographic examination of the venous systems of the lower limbs.....	117
4.3 Methodology of echocolordoppler study of the lower limbs.....	118
4.4 Augmentation maneuvers .....	119
4.5 ECD findings of the venous system of the lower limbs .....	120

4.6 Ultrasound study of lymph nodes in phlebological and lymphological patients .....	123
4.7 The study of Baker's cysts in phlebological patients.....	128
4.8 Radiological investigations in phlebology .....	133
4.9 The plethysmography .....	135
Essential bibliography .....	136

## **5 - CHRONIC VENOUS INSUFFICIENCY 139**

5.1 Introduction .....	140
5.2 The pathogenesis of CVI.....	142
5.2.1 Endothelial activation .....	143
5.2.2 Hypoxia of endothelial cells.....	144
5.2.3 Leucocyte activation.....	145
5.2.4 Activation of smooth muscle cells.....	147
5.2.5 The role of mastocytes .....	147
5.3 The tissue transformations in CVI.....	147
5.3.1 Metalloproteinase (MMP) .....	148
5.4 Genetics .....	149
5.5 Costs of CVD .....	150
5.6 The CEAP classification .....	151
5.7 Clinical elements of CVD.....	154
Essential bibliography .....	161

## **6 - THE LOWER LIMBS EDEMA 167**

6.1 The liquids of the human body: volume and composition.....	168
6.1.1 Extracellular fluid.....	168
6.1.2 Interstitial fluid.....	169
6.2 The capillary circulation.....	169
6.3 The lymphatic system .....	172
6.4 Edema.....	174
6.4.1 Clinical features of edema.....	174
6.4.2 Classification of edema.....	176
6.5 Phlebedema and phlebolymphe­dema.....	181
6.6 Lymphedema .....	182
6.6.1 Primary lymphedema.....	186

6.6.2 Secondary lymphedema.....	188
6.6.3 The prevention of complications in the lymphedema.....	189
6.7 Pharmacologic edema.....	190
6.8 Lipedema .....	190
6.9 Edema from biomechanical alteration of the lower limbs.....	194
6.10 “Benign” edema .....	194
6.11 Differential diagnosis.....	195
6.12 Instrumental and laboratory diagnostics.....	198
6.12.1 High resolution ultrasound of soft tissue .....	198
6.12.2 Lymphoscintigraphy .....	199
6.12.3 Baro-podometric examination .....	199
6.12.4 Laboratory.....	200
6.12.5 CT/MRI.....	200
6.13 Therapeutic strategies of edema.....	200
Essential bibliography .....	203

## **7 - THROMBOPHILIA** **205**

7.1 Introduction .....	206
7.2 Physiology of hemostasis .....	207
7.2.1 The vascular phase .....	207
7.2.2 The platelet phase .....	207
7.2.3 The plasma or coagulation phase.....	208
7.2.4 The fibrinolytic phase.....	209
7.3 Stasis .....	210
7.4 Thrombophilia.....	210
7.4.1 Hypercoagulability .....	211
7.4.1.1 A - Increased thrombogenic stimulus (function gain) .....	212
7.4.1.2 B - Natural anticoagulant deficit (loss of inhibition) .....	213
7.4.1.3 C - Fibrinolysis deficit.....	215
7.4.1.4 D - Other (endothelial) mechanisms .....	215
7.5 Grade of thrombotic risk .....	217
7.6 Acquired risk factors.....	217
7.7 When to apply for a hereditary thrombophilia test .....	217
7.8 Acquired thrombophilia during Covid 19.....	218
Essential bibliography .....	218

## 8 - COMPRESSIVE THERAPY IN PHLEBOLOGY

223

8.1 The concepts of elasticity, inelasticity and hysteresis in phlebological compressive therapy .....	224
8.2 Compressive therapy in phlebology .....	225
8.2.1 Resting and working pressures.....	228
8.2.2 Rigidity of a compressive system (stiffness).....	229
8.3 Elastic bandages .....	231
8.3.1 Contention and compression.....	233
8.3.2 Concentric and eccentric compression.....	233
8.3.3 Classification of the bandages according to the hysteresis curves .....	234
8.3.4 The effects of compression in phlebology .....	234
8.3.5 Measuring the pressure of a bandage.....	236
8.3.6 The light cohesive bandages .....	236
8.3.7 The adhesive-elastic bandages.....	236
8.3.8 Mobile bandages.....	237
8.3.9 Zinc oxide bandage.....	238
8.3.10 Multilayer bandages.....	239
8.3.11 The silicone bandages.....	239
8.4 Rules for the placement of a bandage .....	239
8.4.1 Bandage techniques.....	241
8.5 Medical stockings.....	242
8.5.1 Classification of medical stockings.....	244
8.5.2 The prescription of an elastic sock.....	254
8.5.3 Adjustable compressive systems .....	258
8.5.4 Electrostimulators and compression .....	258
Essential bibliography .....	262

## 9 - SCLEROTHERAPY

265

9.1 Historical notes.....	266
9.2 Effectiveness and QoL studies.....	268
9.3 Organization of a sclerotherapy practice .....	269
9.3.1 The choice of the clinic .....	269
9.3.2 The organization of spaces.....	270
9.3.3 The choice of equipment .....	270

9.3.4	Computerization of the activity.....	271
9.3.5	Working protocols and peer review.....	271
9.3.6	Staff training .....	272
9.4	The mechanism of action of sclerosant drugs.....	272
9.5	Sclerosant drugs .....	278
9.5.1	Polidocanol .....	278
9.5.2	Sodium tetradecylsulfate .....	280
9.6	The sclerosing foam .....	281
9.6.1	The characteristics of the foam.....	282
9.6.2	The three-way stopcock method .....	288
9.6.3	Production of sclerosing foam with the three-way method (tourbillion method) .....	289
9.6.4	Production with a two-way connector .....	290
9.6.5	Production of standardized foam with the varixio method .....	290
9.6.6	Sclerovein and sterivein .....	291
9.6.7	How to use the foam .....	291
9.7	Complications .....	292
9.7.1	Superficial phlebitis after sclerotherapy .....	293
9.7.2	Edema of the foot.....	294
9.7.3	Paresthesia or hypoesthesia .....	294
9.7.4	Early recanalization and scleroresistance .....	294
9.7.5	Non-occlusive extension of sclerosis and deep venous thrombosis .....	295
9.7.6	Pre-syncopal states and lipothymia .....	296
9.7.7	Visual and neurological disorders.....	296
9.7.8	Sensation of metallic taste .....	298
9.7.9	Nausea.....	298
9.7.10	Fever .....	298
9.7.11	Liver pain.....	298
9.7.12	Special phenomena related to the type of sclerosant medium used.....	298
9.7.13	Allergic reaction .....	298
9.7.14	Pulmonary embolia.....	299
	Essential bibliography .....	299

## **10 - SCLEROTHERAPY OF THE SAPHENOUS TRUNKS 303**

10.1 Introduction .....	304
10.2 The technique of the ultrasound guided injection .....	305
10.2.1 The bidimensionality of the image .....	306
10.2.2 The longitudinal technique .....	308
10.2.3 The transversal technique .....	310
10.2.4 The lateral technique .....	312
10.3 Indirect injection .....	315
10.3.1 Use of the butterfly needle .....	315
10.3.2 Use of cannulas and catheters .....	316
10.3.3 Mechanochemical ablation .....	318
10.4 The strategy .....	318
10.5 The hybrid procedures .....	320
10.6 Sclerotherapy with foam of the great saphenous vein .....	322
10.7 Foam sclerotherapy of small saphenous vein .....	328
10.8 Sclerotherapy with foam of the anterior accessory saphenous vein .....	328
10.9 Sclerotherapy in particular clinical conditions .....	331
10.10 The sclerotherapy session .....	335
10.10.1 Before sclerosis .....	335
10.10.2 After sclerosis .....	336
10.11 Echocolor Doppler findings of a vein after sclerotherapy .....	337
10.12 The reaction of the vein to the sclerosant injection .....	339
Essential bibliography .....	342

## **11 - SCLEROTHERAPY OF RECURRENCES AND PERFORATORS 345**

11.1 Recurrences after treatment of venous insufficiency .....	346
11.1.1 Definition of recurrence .....	346
11.1.2 Neoangiogenesis .....	350
11.2 A new hypothesis on the genesis of cavernoma .....	350
11.3 Sclerotherapy in junctional recurrences .....	352
11.4 Recurrences after sclerotherapy, thermal ablation or surgery .....	354
11.5 Sclerosis of incompetent perforators .....	355
Essential bibliography .....	359

**12 - SCLEROTHERAPY OF RETICULAR VARICES AND TELEANGECTASIAS 365**

12.1 Definition ..... 366

12.2 Classification ..... 367

12.3 Pathological anatomy ..... 369

12.4 Pathogeneses ..... 371

12.5 Clinical and instrumental diagnosis ..... 375

    12.5.1 The clinical appearance ..... 375

    12.5.2 Instrumental diagnostics ..... 381

12.6 Therapy ..... 382

    12.6.1 General principles of sclerotherapy of teleangectasias and reticular varices..... 383

    12.6.2 Materials..... 384

    12.6.3 Strategy..... 386

    12.6.4 Before the session..... 389

    12.6.5 Injection technique ..... 389

    12.6.6 After the session..... 393

    12.6.7 Compression..... 394

12.7 Complications ..... 396

    12.7.1 Skin necrosis ..... 397

    12.7.2 Matting ..... 399

    12.2.3 Pigmentation ..... 400

12.8 Results ..... 403

Essential bibliography ..... 404

**13 - SCLEROSIS OF THE VEINS OF THE BACK OF THE HAND 407**

13.1 Introduction ..... 408

13.2 Venous anatomy of the hand ..... 409

13.3 Treatment of prominent veins..... 410

    13.3.1 The phlebectomy of the prominent veins of the back of the hand ..... 410

    13.3.2 Intravenous laser treatment ..... 411

    13.3.3 Sclerotherapy associated with filler injection ..... 411

    13.3.4 Sclerotherapy of the prominent veins of the back of the hand..... 411

Essential bibliography ..... 416

<b>14 - THERMAL ABLATION</b>	<b>417</b>
14.1 Introduction .....	418
14.2 Laser .....	418
14.2.1 Electromagnetic radiation .....	419
14.2.2 Characteristics of laser .....	420
14.2.3 Classification of laser sources according to CEI 76-2 standard .....	420
14.3 Radiofrequency .....	421
14.4 Instructions for the procedure .....	425
14.5 Intravenous laser .....	430
14.5.1 The laser procedure.....	431
14.6 Radiofrequency ablation .....	435
14.7 Thermoablation of the superficial veins .....	436
14.8 Which saphenous segments it is preferable not to treat with thermoablative techniques? .....	437
14.9 Alternative thermal ablative techniques .....	437
14.10 Complications of thermal ablation .....	437
Essential bibliography .....	440
<b>15 - ECOTHERAPY (HIFU)</b>	<b>445</b>
15.1 Introduction .....	446
Essential bibliography .....	450
<b>16 - THE VENOUS CLOSURE WITH GLUE</b>	<b>453</b>
16.1 The cyanoacrylate .....	454
16.1.1 Classification of adhesives.....	454
16.1.2 Mechanism of action of the cyanoacrylate .....	456
16.2 Procedures for the application of the cyanoacrylate .....	456
16.3 Results of closure with cyanoacrylate (CAC) .....	457
16.4 The complications of venous closure with cyanoacrylate.....	458
Essential bibliography .....	462
<b>17 - SURGERY OF VENOUS INSUFFICIENCY</b>	<b>467</b>
17.1 Introduction .....	468
17.2 Surgical interventions in venous insufficiency .....	469

17.3 Hybrid treatments.....	471
Essential bibliography .....	472

**18 - THE LASER TREATMENT OF TELEANGECTASIAS 475**

18.1 Introduction .....	476
18.2 The transdermal laser for teleangectasies .....	478
18.3 Pulsed light.....	480
18.4 Contraindications to laser .....	481
18.5 Using the laser.....	481
18.6 Clacs technique.....	482
18.7 Complications of the transdermal laser .....	483
Essential bibliography .....	484

**19 - VENOUS ULCER 487**

19.1 Introduction .....	488
19.2 Diagnosis of venous ulcer .....	490
19.3 Etiological treatment .....	492
19.3.1 Treatment of venous reflux.....	492
19.3.2 Perilucerative sclerotherapy .....	494
19.3.3 Ablation of the perforators .....	494
19.3.4 Compression treatment .....	494
19.3.5 Topical treatment .....	495
19.3.6 Advanced medication devices .....	496
19.3.7 Cell therapy: stem cells.....	496
19.3.8 Cell therapy with monocytes.....	499
19.3.9 Skin grafts and dermal and epidermal substitutes.....	499
19.3.10 Therapy with negative pressure .....	502
19.3.11 Carboxytherapy .....	503
19.4 The typical “phlebological” treatment of a venous ulcer .....	504
Essential bibliography .....	505

**20 - THE VENOUS THROMBOSIS 509**

20.1 Introduction .....	510
20.2 Risk factors .....	511
20.3 Pathogenesis of venous thrombosis .....	513

20.4 The diagnostics of venous thrombosis.....	514
20.5 Role of d-dimer in the diagnosis of venous thrombosis .....	516
20.6 The paraneoplastic thrombosis (cancer associated thrombosis – CAT) .....	517
20.7 Deep venous thrombosis (DVT).....	518
20.7.1 DVT clinical picture .....	519
20.8 Superficial venous thrombosis (SVT) .....	521
20.9 Regression patterns of venous thrombosis .....	525
20.10 Thrombus-prophylaxis in phlebology.....	525
Essential bibliography .....	526

## **21 - THE POST-THROMBOTIC SYNDROME 531**

21.1 Introduction .....	532
21.2 The diagnosis of PTS.....	533
21.3 Physiopathology of post-thrombotic syndrome.....	535
21.4 Treatment of PTS.....	539
21.5 Prevention of PTS.....	539
Essential bibliography .....	540

## **22 - GUIDELINES IN THE TREATMENT OF CHRONIC VENOUS DISEASE 543**

Essential bibliography .....	546
------------------------------	-----

## **23 - GUIDELINES IN THE TREATMENT OF VENOUS ULCER 547**

23.1 Introduction .....	548
23.2 Compressive therapy.....	548
23.3 Local therapy.....	549
23.4 Physical activity .....	550
23.5 Drugs .....	550
23.6 Surgery and treatment of venous hypertension.....	551
23.7 Re-evaluation .....	552

## **24 - GUIDELINES ON VENOUS THROMBOEMBOLISM (VTE) 553**

24.1 Introduction .....	554
24.2 Diagnosis of VTE .....	554
24.3 Treatment of VTE.....	555
Essential bibliography .....	559

## FOREWORD

Phlebology has always been one of those branches of medicine that are most suited to a mechanism where a wealth of knowledge is transmitted directly from teacher to student. If this has often been the only dynamic in the past, today's knowledge has evolved to such an extent that the phlebologist must acquire a series of particular skills to truly be effective.

In fact, the modern phlebologist must be able to perform echo-color doppler diagnostics, be able to perform echo-guided treatments and to place intravenous fibers or catheters. Moreover the phlebologist must comprehend haemodynamics, how to make compression and ulcer therapy in an impeccable way, in short, he must be able to take charge of the phlebological patient in its entirety and in a timely manner. Ultimately, this means having to be constantly updated on the state of the art and on the knowledge that, in modern medicine, is changing more and more rapidly. There has for some time been a need for a focused phlebology handbook that reflects current knowledge and could serve as a comprehensive reference for both seasoned and young enthusiastic doctors who find fascination in this subject. This volume reveals an in-depth discussion of the major phlebological themes, the result of a collaboration with many of the most important Italian phlebologists. We tried to use a clear language and to give space for the practical elements in order to make it a tool for daily use.

We have compiled an extraordinary collection of quality iconography (which the reader will also find in the web space using the QR code inserted in the pages of each chapter) and to include simplified tables and diagrams. In thanking all those who have collaborated on the work and particularly to my friend Marlin Schul MD for caring the english edition, I wish you a good reading.

***Alessandro Frullini MD***

## FOREWORD TO THE ENGLISH EDITION

It has been an honor reading this handbook and reflecting on how much has changed since my early medical school years. My friend, Dr. Frullini, is correct that in many areas of higher education there is more focus is given to low prevalence conditions. The issues that affect the venous and lymphatic systems of the lower extremity are common, yet an education gap permeates the majority of well-intentioned medical schools.

As I reflect on when I was trained in the 1980's it came down to three vein experiences. Leg ulcers were felt to all need whirlpool therapy and antibiotics and were not expected to heal. There was no common belief that managing venous hypertension could make a difference, yet today we have level I evidence in the EVRA trial that managing the reflux component not only improves ulcer healing, but it is also proven to be cost effective.

As I was exposed to blood clots on various rotations (mainly surgical) the only thing that remains today is that blood clots are bad and kill people. What was once managed in the hospital with IV anticoagulation and bed rest is now generally managed in the home setting with novel oral anticoagulants, ambulation, and compression. Furthermore, we have an opportunity to prevent thrombotic events from 'surgery' with risk stratification tools like the Caprini score. There have been so many advances in the management of thrombotic events and prevention strategies.

More than 40 years ago it was felt that varicose veins were merely cosmetic and did not cause symptoms. The only treatments at that time were traditional surgical stripping and small vein sclerotherapy. Most vein surgery was done in the operative theatre, under general anesthesia, with prolonged recovery period, and a high recurrence rate. Contrast that to today, the majority of care is provided in an office setting under local anesthesia. Duplex ultrasound offers greater insight to the pathology and we are empowering patients to choose how they want to be treated based upon their values. We can debate the mechanisms of leg symptoms in the face of venous hypertension, but there is more to this given what we know today. Patients with varicose veins and advanced venous disorders, e.g. skin changes with or without ulcers are at far greater risk of major adverse cardiac events. We know that varicose veins by themselves have meaningful quality of life impairment, and the question is: when should we intervene? Everything has changed!

As I reflect, I believe this is one of the most practical and comprehensive handbooks on venous and lymphatic disorders. The authors have blended ex-

traordinary experience to build this comprehensive piece of work. The drawings, photos, and videos augment any given topic and enhance educational experience. Whether you are in the spring of your career as a young enthusiast clinician or the seasoned provider near the end of a career, there is something here for everyone. I will personally lean on this handbook as the new lead reference manual and make the supplemental imagery a focus of routine education for our practice.

I wish to thank the authors for such a thorough effort and attention to detail. Well done!

***Marlin W. Schul, MD, MBA***