

POCKET **RADIOLOGIST**™

Interventional

Top 100 Procedures

Rogers

Roberts

Schloesser

Wong



PocketRadiologist™

Interventional

Top 100 Procedures

Peter Rogers MD

Interventional Radiologist and Neuroradiologist
Hines Veterans Hospital
Hines, Illinois

Clinical Instructor, Interventional Radiology and Neuroradiology
Loyola University, Residency Program
Maywood, Illinois

Anne Roberts MD

Professor of Radiology
University of California, San Diego
Thornton Hospital
La Jolla, California

Peter Schloesser MD

Assistant Professor Interventional Neuroradiology
University of Utah School of Medicine
Salt Lake City, Utah

Wade Wong DO FACR

Professor of Radiology
University of California, San Diego
San Diego, California

With contribution by: *Michael Preece*

With 200 drawings and radiographic images

Drawings: *Lane R Bennion MS*
 Richard Coombs MS
 James A Cooper MD

Image Editing: *Ming Q Huang MD*
 Danielle Morris
 Melissa Petersen



W. B. SAUNDERS COMPANY
An Elsevier Science Company



A medical reference publishing company

First Edition

Text - Copyright Peter Rogers 2003

Drawings - Copyright Amirsys Inc 2003

Compilation - Copyright Amirsys Inc 2003

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or media or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from Amirsys Inc.

First Printing: November 2002

Composition by Amirsys Inc, Salt Lake City, Utah

Printed in China

ISBN: 0-7216-0034-4

袖珍放射专家——干涉介入的 100 个主要诊断

[美]罗杰斯 著

Amirsys Inc 出版

上海世界图书出版公司 重印发行

2004 年 4 月第 1 版

上海市尚文路 185 号 B 楼 邮政编码 200010

各地新华书店经销 (限中华人民共和国内发行)

图字: 09-2004-034 号

ISBN 7-5062-6530-3 /R · 60

定价: 140.00 元

Preface

The **PocketRadiologist™** series is an innovative, quick reference designed to deliver succinct, up-to-date information to practicing professionals "at the point of service." As close as your pocket, each title in the series is written by world-renowned authors. These experts have designated the "top 100" diagnoses or interventional procedures in every major body area, bulleted the most essential facts, and offered high-resolution imaging to illustrate each topic. Selected references are included for further review. Full color anatomic-pathologic computer graphics model many of the actual diseases.

Each **PocketRadiologist™** title follows an identical format. The same information is in the same place - every time - and takes you quickly from key facts to imaging findings, differential diagnosis, pathology, pathophysiology, and relevant clinical information. The interventional modules give you the essentials and "how-tos" of important procedures, including pre- and post-procedure checklists, common problems and complications.

PocketRadiologist™ titles are available in both print and hand-held PDA formats. Currently available modules feature Brain, Head and Neck, Orthopedic (Musculoskeletal) Imaging, Pediatrics, Spine, Chest, Cardiac, Vascular, Abdominal Imaging and Interventional Radiology. 2003 topics will include Obstetrics, Gynecologic Imaging, Breast, and much, much more. Enjoy!

Anne G Osborn MD
Editor-in-Chief, Amirsys Inc

Notice and Disclaimer

The information in this product ("Product") is provided as a reference for use by licensed medical professionals and no others. It does not and should not be construed as any form of medical diagnosis or professional medical advice on any matter. Receipt or use of this Product, in whole or in part, does not constitute or create a doctor-patient, therapist-patient, or other healthcare professional relationship between Amirsys Inc. ("Amirsys") and any recipient. This Product may not reflect the most current medical developments, and Amirsys makes no claims, promises, or guarantees about accuracy, completeness, or adequacy of the information contained in or linked to the Product. The Product is not a substitute for or replacement of professional medical judgment. Amirsys and its affiliates, authors, contributors, partners, and sponsors disclaim all liability or responsibility for any injury and/or damage to persons or property in respect to actions taken or not taken based on any and all Product information.

In the cases where drugs or other chemicals are prescribed, readers are advised to check the Product information currently provided by the manufacturer of each drug to be administered to verify the recommended dose, the method and duration of administration, and contraindications. It is the responsibility of the treating physician relying on experience and knowledge of the patient to determine dosages and the best treatment for the patient.

To the maximum extent permitted by applicable law, Amirsys provides the Product AS IS AND WITH ALL FAULTS, AND HEREBY DISCLAIMS ALL WARRANTIES AND CONDITIONS, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO, ANY (IF ANY) IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE, OF LACK OF VIRUSES, OR ACCURACY OR COMPLETENESS OF RESPONSES, OR RESULTS, AND OF LACK OF NEGLIGENCE OR LACK OF WORKMANLIKE EFFORT. ALSO, THERE IS NO WARRANTY OR CONDITION OF TITLE, QUIET ENJOYMENT, QUIET POSSESSION, CORRESPONDENCE TO DESCRIPTION OR NON-INFRINGEMENT, WITH REGARD TO THE PRODUCT. THE ENTIRE RISK AS TO THE QUALITY OF OR ARISING OUT OF USE OR PERFORMANCE OF THE PRODUCT REMAINS WITH THE READER.

Amirsys disclaims all warranties of any kind if the Product was customized, repackaged or altered in any way by any third party.

PocketRadiologist™

Interventional

Top 100 Procedures

The diagnoses in this book are divided into 8 sections in the following order:

Venous
Dialysis
Arterial
Neuroangiography
Spine & Pain Management
Genitourinary
Chest
Abdomen

Table of Contents

Venous

Local Anesthetics	3
<i>Peter Rogers MD</i>	
Arm Venogram	6
<i>Peter Rogers MD</i>	
Central Line Complications	9
<i>Peter Rogers MD</i>	
Chest Ports	12
<i>Peter Rogers MD</i>	
Femoral Vein Puncture	15
<i>Peter Rogers MD</i>	
Foreign Body Retrieval	18
<i>Anne Roberts MD</i>	
IV Placement	21
<i>Peter Rogers MD</i>	
Inferior Venacavagram	24
<i>Peter Rogers MD</i>	
IVC Filter Placement	27
<i>Anne Roberts MD</i>	
Jugular Vein Puncture	30
<i>Peter Rogers MD</i>	
Leg Venogram	33
<i>Peter Rogers MD</i>	
PICC Line Ultrasound	36
<i>Peter Rogers MD</i>	
PICC Line Venogram	39
<i>Peter Rogers MD</i>	
Subclavian Vein Puncture	42
<i>Peter Rogers MD</i>	
Transjugular Liver Biopsy	45
<i>Peter Rogers MD</i>	
Radiation Protection	48
<i>Peter Rogers MD</i>	

Dialysis

Dialysis Catheter Exchange	53
<i>Peter Rogers MD</i>	
Dialysis Catheter Removal	56
<i>Peter Rogers MD</i>	
Dialysis Graft Angioplasty	59
<i>Anne Roberts MD</i>	
Dialysis Graft Thrombolysis	62
<i>Anne Roberts MD</i>	

Dialysis Graft Lyse and Wait	65
<i>Anne Roberts MD</i>	
Femoral Dialysis Catheter	68
<i>Peter Rogers MD</i>	
Jugular Dialysis Catheter	71
<i>Peter Rogers MD</i>	
Recanalized Vein Catheter	74
<i>Peter Rogers MD</i>	
Subclavian Dialysis Catheter	77
<i>Peter Rogers MD</i>	
Translumbar Dialysis Catheter	80
<i>Peter Rogers MD</i>	

Arterial

Abdominal Aortogram	85
<i>Peter Rogers MD</i>	
Brachial Artery Puncture	88
<i>Peter Rogers MD</i>	
Lower GI Bleeding	91
<i>Anne Roberts MD</i>	
Hepatic Chemoembolization	94
<i>Anne Roberts MD</i>	
Iliac Artery Angioplasty	97
<i>Peter Rogers MD</i>	
Leg Arterial Thrombolysis	100
<i>Anne Roberts MD</i>	
Lower Extremity Arteriogram	103
<i>Peter Rogers MD</i>	
Mesenteric Angiography	106
<i>Peter Rogers MD</i>	
Perclose	109
<i>Peter Rogers MD</i>	
Puncture Site Compression	112
<i>Peter Rogers MD</i>	
Renal Artery Stent	115
<i>Peter Rogers MD</i>	
Renal Artery Embolization	118
<i>Peter Rogers MD</i>	
Thoracic Aorta Angiography	121
<i>Peter Rogers MD</i>	
Trauma Embolization	124
<i>Anne Roberts MD</i>	
Uterine Artery Embolization	127
<i>Anne Roberts MD</i>	
Ultrasound Puncture Femoral Artery	130
<i>Peter Rogers MD</i>	
Upper Extremity Arteriography	133
<i>Peter Rogers MD</i>	

Neuroangiography

Cerebral Angiography Basics 139
Peter Rogers MD

Aneurysm Coiling 142
Peter Schloesser MD

Angioplasty for Vasospasm 145
Peter Schloesser MD

Carotid Angiography Head 148
Peter Rogers MD

Carotid Angiography Neck 151
Peter Rogers MD

Carotid Stenting 154
Peter Schloesser MD

Epistaxis Embolization 157
Peter Schloesser MD

Meningioma Embolization 160
Michael Preece

Paraganglioma Embolization 163
Peter Schloesser MD

Microcatheter Use 166
Peter Schloesser MD

Papaverine for Vasospasm 169
Peter Schloesser MD

Spinal Angiogram 172
Peter Schloesser MD

Stroke Thrombolysis 175
Peter Schloesser MD

Vertebral Angiogram 178
Peter Schloesser MD

Inferior Petrosal Sinus Sampling 181
Peter Schloesser MD

Vertebral Stenting 184
Peter Schloesser MD

Wada Test 187
Peter Schloesser MD

Spine & Pain Management

C1-2 Puncture 193
Peter Schloesser MD

Cervical Discography 196
Peter Schloesser MD

Cervical Facet Injection 199
Peter Schloesser MD

Cervical Myelogram 202
Peter Schloesser MD

CT Cisternography	205
<i>Peter Schloesser MD</i>	
Lumbar Translaminar Steroids	208
<i>Peter Rogers MD</i>	
Lumbar Discography	211
<i>Wade Wong DO FACR</i>	
Lumbar Facet Joint Injection	214
<i>Wade Wong DO FACR</i>	
Stellate Ganglion Block	217
<i>Wade Wong DO FACR</i>	
Celiac Plexus Block	220
<i>Wade Wong DO FACR</i>	
Hypogastric Sympathetic Block	223
<i>Wade Wong DO FACR</i>	
Impar Ganglion Block	226
<i>Wade Wong DO FACR</i>	
Lumbar Median Branch Nerve Block	229
<i>Wade Wong DO FACR</i>	
Lumbar Myelogram	232
<i>Peter Rogers MD</i>	
Lumbar Puncture (LP)	235
<i>Peter Rogers MD</i>	
Lumbosacral Selective Nerve Block	238
<i>Wade Wong DO FACR</i>	
Lumbosacral Caudal Steroids	241
<i>Peter Rogers MD</i>	
Needle Control	244
<i>Peter Rogers MD</i>	
Sacroiliac Joint Injections	247
<i>Wade Wong DO FACR</i>	
Lumbar Spine Biopsy	250
<i>Wade Wong DO FACR</i>	
Lumbar Sympathetic Block	253
<i>Wade Wong DO FACR</i>	
Thoracic Myelography	256
<i>Wade Wong DO FACR</i>	
Vertebroplasty	259
<i>Wade Wong DO FACR</i>	

Genitourinary

Kidney Biopsy	265
<i>Peter Rogers MD</i>	
Percutaneous Nephrostomy	268
<i>Peter Rogers MD</i>	
Ureteral Stent	271
<i>Peter Rogers MD</i>	

Table of Contents

Chest

Lung Biopsy CT Guided 277
Peter Rogers MD

Lung Biopsy Fluoroscopic Guided 280
Peter Rogers MD

Thoracentesis 283
Peter Rogers MD

Shoulder Arthrogram 286
Peter Rogers MD

Chest Tube 289
Peter Rogers MD

Abdomen

Biliary Drainage 295
Peter Rogers MD

Abscess Drainage 298
Peter Rogers MD

Gastrostomy 301
Anne Roberts MD

Gastrojejunostomy 304
Anne Roberts MD

Liver Biopsy 307
Peter Rogers MD

Pancreas Biopsy 310
Peter Rogers MD

Percutaneous Cholecystostomy 313
Peter Rogers MD

Transgluteal Abscess Drainage 316
Peter Rogers MD

Transhepatic Cholangiogram 319
Peter Rogers MD

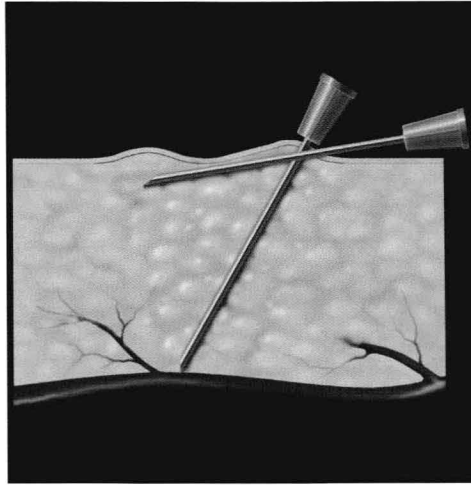
PocketRadiologist™

Interventional

Top 100 Procedures

VENOUS

Local Anesthetics



Use of a long needle e.g. 1½ inches, allows same needle to be used for superficial and deeper administration of local anesthetic. Typically a 25, 27 or 30 gauge needle is used.

Key Facts

- Attention to detail in administration of local anesthetic (LA) provides improved pain prevention for patients
- Use 27 to 30-gauge (G) needles
- Inject LA slowly

Pre-Procedure

Indications

- LA is given for almost all interventional radiology (IR) procedures

Contraindications

- Allergy to LA agent

Getting Started

- Things to Check
 - History of allergies to a local anesthetic or other medication
 - Discuss pain prevention with patient
 - Inform patient that you will try to minimize their discomfort
 - Inform patient to notify you when in pain so it may be treated
- Equipment List
 - 1½ inch, 25 to 30 G needle
 - Lidocaine 1% or 2% in plastic container with a rubber stopper
 - Procedure kits often come with lidocaine in a glass ampule because this method of storage provides longer shelf life
 - Downside of glass is need to use filter needle and may cut yourself
 - Local anesthetic should be in a control syringe or at least a different color or size or labeled syringe so that distinct from other syringes
 - Control syringes have finger holes which facilitate one-handed withdrawal of plunger for confirming not intravascular

Local Anesthetics



1% lidocaine is used when a relatively large subcutaneous area is infiltrated such as for a chest port. 2% lidocaine is helpful when a relatively small area is infiltrated such as for a biopsy or a pain management spinal injection procedure.

Procedure

Patient Position

- Usually prone or supine with procedure area surrounded by sterile drape

Procedure Steps

- Draw up LA with a short length, 18 G needle
 - Short length, large bore needles allow LA to be drawn up rapidly
 - Inject a few cc of air into plastic container of LA to speed up withdrawal
 - However, do not inject air into glass medication vials as these lack compliance and medication will leak around needle
 - Note number of cc in syringe as will be guide to how much injected
- Connect syringe with 25 to 30 G needle
 - Procedure kits often include short, 25 G needles with light blue hub
 - Preferable to use 1½ inch long, 27 to 30 G needles as these hurt less
 - Added length of 1½ inch needle allows subcutaneous (SQ) and deeper infiltration with same needle
- If plan to also provide intravenous sedation, then give IV medications first
 - Will provide some analgesia before LA needle placed

1% Versus 2% Lidocaine

- In general, if only a small area needs LA use 2% lidocaine
- If need infiltrate more extensive area, such as for chest port placement, 1% lidocaine is preferable to provide more volume

Needle Placement

- Can gently pinch skin with fingers where will insert local anesthetic needle
 - Large, myelinated touch fibers send input to dorsal horn that helps obscure signal from smaller, unmyelinated pain fibers
 - This is consistent with gating theory of pain
- Place LA needle into skin 1 cm away from where will actually puncture or cut for procedure
 - Allows controlled delivery of deep and SQ LA

Local Anesthetics

- Do not put LA needle straight down at puncture site because as withdraw to make SQ wheal may "backspray" yourself with LA
- Make a good skin wheal as majority of pain receptors located here
- If need to stick needle through skin more than once, go through an area already anesthetized for subsequent needle sticks
- Also inject LA along the planned tract for procedure, including periosteal area when appropriate, because it is innervated
 - Can use a long, small diameter needle to inject tract
- Important to inject LA very slowly, because rapid injection is painful
- Because LA preferentially blocks small pain fibers, and not larger pressure sensitive fibers, patient will feel pressure during procedure
- "Preemptive analgesia" refers to providing analgesia before procedure starts with goal of preventing pain rather than just treating as it occurs
- Anxiety increases pain and can be decreased by talking in a calm manner
- Intravenous benzodiazepines such as midazolam also decrease anxiety
- Give LA some time to work
 - A good method is to give LA, and then spend a moment setting up equipment table
 - Lidocaine skin infiltration usually has taken it's effect within one minute

Additional Options

- Pain of local anesthetic is part due to storage with a weak acid
 - Can counter by add 1 cc sodium bicarbonate 8.4% per 10 cc lidocaine
- Warming local anesthetic to body temperature can also decrease pain
- Lidocaine wears off in 0.5 to 3 hours, so give additional with long cases

Lidocaine Dosing

- 1% lidocaine contains 10 mg/cc and 2% lidocaine contains 20 mg/cc
- Maximum dose for lidocaine is 4 mg per kg
- Therefore, in a 70 Kg adult $(4 \text{ mg/kg})(70 \text{ kg}) = 280 \text{ mg}$ is maximum dose
 - This is 28 cc of 1% lidocaine in a 70 kg adult
- Also remember that LA is absorbed into the vascular system very rapidly in some sites such as intrapleural and intercostal

Lidocaine is Bacteriostatic

- Lidocaine is bacteriostatic and acidic and thus should not be injected into fluid collection, e.g. pleural fluid, that is to be sent for laboratory analysis

Post-Procedure

- Observe patient for signs of LA toxicity

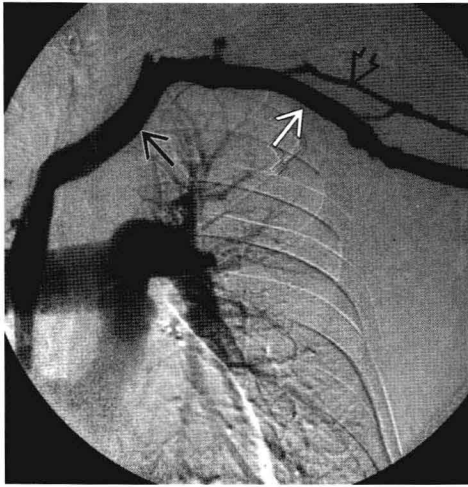
Common Problems & Complications

- Allergic reactions and side effects of LA infiltration for IR are very rare
- Early symptoms of LA toxicity include numbness of tongue, "metallic taste", lightheadedness and dizziness
- These as well as blurred vision and tinnitus can serve as a warning that patient at risk for seizure, respiratory arrest and coma
- Ask patient about symptoms when give relatively large amounts of LA to help identify a potential problem early, and begin treatment with oxygen

Selected References

1. Colaric KB et al: Pain reduction in lidocaine administration through buffering and warming. Am J Emer Med 16:353-6, 1998
2. Fialkov JA et al: Warmed local anesthetic reduces pain of infiltration. Annals of Plastic Surgery 36(1):11-13, 1996
3. Tetzlaff JE: Clinical effects of LA pH adjustments: Review. Anesthesiology Review 20(1):9-15, 1993

Arm Venogram



Normal left arm venogram. It shows brachiocephalic vein (black arrow), axillary vein (white arrow) and cephalic vein (open arrow). Note: Normal cephalic vein resembles a hockey stick. Main pulmonary arteries are also opacified.

Key Facts

- Main goal is usually to display venous anatomy of antecubital region and subclavian-brachiocephalic vein junction
- Spot films and tourniquets are used for venogram of arm
- Digital subtraction angiography (DSA) is used for venogram of subclavian and brachiocephalic veins and superior vena cava (SVC)

Pre-Procedure

Indications

- Vein mapping for dialysis graft, cardiac or peripheral vascular surgery
- Nondiagnostic or equivocal ultrasound: For example, to differentiate acute versus chronic deep vein thrombosis (DVT)
- Ultrasound unable to be done due to surgical dressing or painful wound
- Venogram can be requested for more detailed evaluation of subclavian and brachiocephalic veins than provided by ultrasound

Contraindications

- Severe contrast allergy is a relative contraindication
 - Procedure may be done following a steroid and Benadryl prep and with use of nonionic contrast
- Moderate renal failure is a relative contraindication
 - If procedure needs to be done, patient should be hydrated prior to procedure

Getting Started

- Things to Check
 - If antecubital puncture likely to be necessary then check if patient is taking Coumadin
 - If taking Coumadin, check INR
 - Check renal function
 - Performance of this procedure requires at least 2 medical persons, so make sure you have an assistant