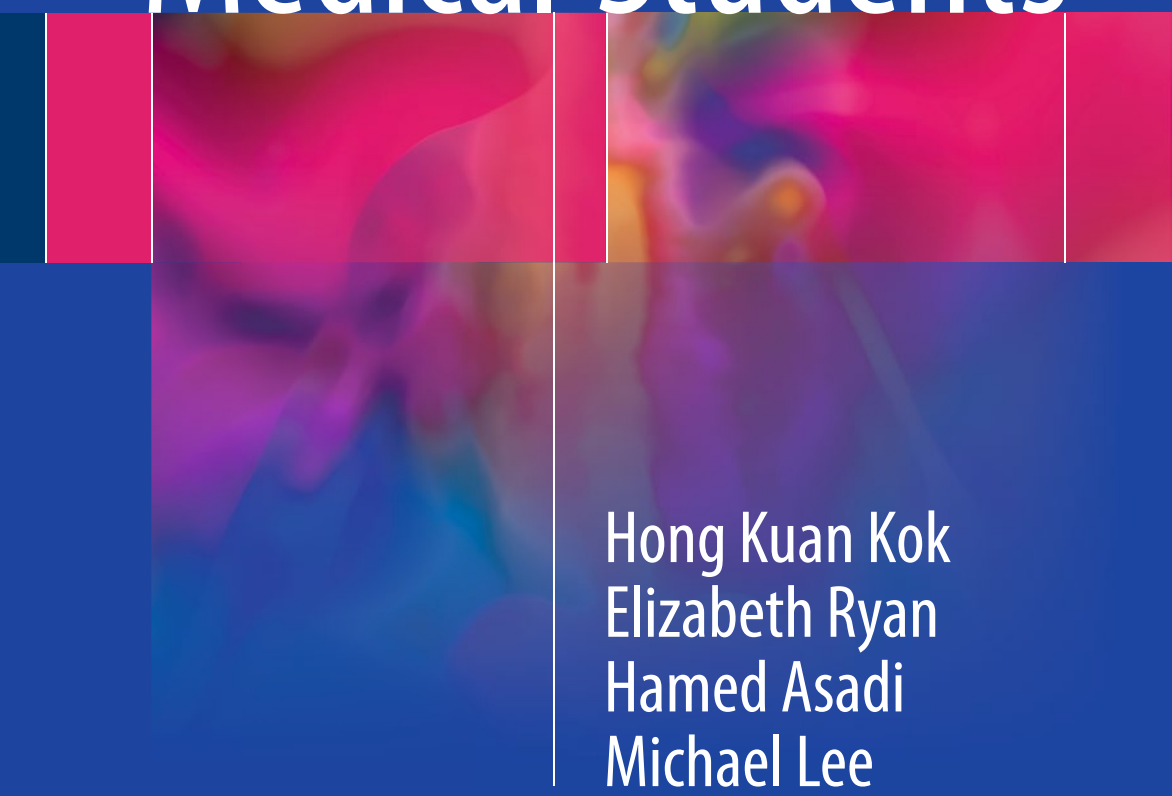
Interventional Radiology for Medical Students



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To my parents, Sonny and Karen; my wife, Limy; and my family, Adrian and Tiffany

– Hong Kuan Kok

To my family and colleagues for their much valued support and to all students of the wonderful field of Interventional Radiology

– Elizabeth Ryan

To my beautiful wife Anousha and our lovely Tara and Daniel

– Hamed Asadi

To Aoife, Ronan, Daire and Sarah

– Michael Lee

Foreword

IR has grown over the last forty years from a small cadre of enthusiasts who were on the outside of mainstream medicine to the current situation where IR is now an essential part of modern healthcare delivery. For any specialty, teaching the next generation of doctors is vitally important. It has been shown that medical students are much more likely to choose a career in a specialty if they have been taught or mentored by doctors within that specialty. As interventional radiology comes of age, dedicated IR teaching is a must for all medical schools so that qualified doctors are familiar with the scope of IR and can refer appropriately. This is even more important in the current era because of the rapid growth in the breadth and depth of IR procedures, which are used to treat a diverse group of diseases and conditions.

This book covers the main topics of interventional radiology in a case-based format for optimal learning and retention. Biopsy and drainage, angioplasty and stenting, embolisation, musculoskeletal IR and neuro intervention, including stroke thrombectomy, are all covered. The book has been edited and written by IR experts who have delivered the IR teaching programme at Beaumont Hospital over a number of years. It is our hope that this book will familiarize medical students, general practitioners and other interested parties with the dynamic specialty of IR and what IR can contribute to patient care.

We hope that you enjoy the book and through reading this book you will gain an understanding of modern IR practice and where it fits in hospital practice.

Dublin Ireland — Michael Lee

Preface

Interventional radiology or "IR" has been practiced since 1954 when a Swedish radiologist called Sven Seldinger devised a system to puncture the femoral artery and gain access with a catheter to perform diagnostic angiography. This simple invention provided safe access to the arterial system and diagnostic radiology morphed into interventional radiology. IR has grown and matured since its inception, and in the last twenty years has become a vitally important part of patient care. In fact, for many diseases, one cannot receive appropriate care without using IR services.

As IR moves to becoming a specialty in its own right, it is important that IR take up its teaching duties and teaches the next generation of doctors. We decided to write this book because of the enthusiastic reception of IR teaching by medical students attached to RCSI (Royal College of Surgeons in Ireland) medical schools in Dublin, Bahrain and Malaysia. We have been teaching IR to our medical students in a dedicated curriculum for the past four years and this book is based on that experience. The book is in a case-based format, which we believe enhances the learning experience for medical students. All of the important topics in modern IR are covered.

As IR grows and attains specialist status in its own right we hope that IR teaching in medical schools will become the norm rather than the exception.

Dublin Ireland — Michael Lee

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Introduction to Interventional Radiology

1

Mark Sheehan and Michael Lee

1.1 Introduction

- The field of medicine is constantly changing, evolving and outcomes for patients are improving with the increasing use of minimally invasive surgical techniques. Interventional Radiology (IR) or image guided minimally invasive surgery has demonstrated enormous innovation over the last 20 years and has developed multiple new minimally invasive alternatives to traditional surgical procedures.
- IR is now a must in all reasonably sized hospitals to ensure optimal patient care.
- The competent medical student needs to know:
  - The basic principles of IR.
  - The role of IR within clinical practice.
  - Image guidance techniques used in IR.
  - Consent and patient preparation for IR procedures.
  - Importance of radiation protection.

1.2 History of Interventional Radiology

- Since the Seldinger technique was first developed in 1953 by a Swedish radiologist of the same name, IR has made significant advancement. Some of the common procedural terms used in IR are listed below:
  - Angioplasty (opening an artery, vein or other tubular structure with a balloon),

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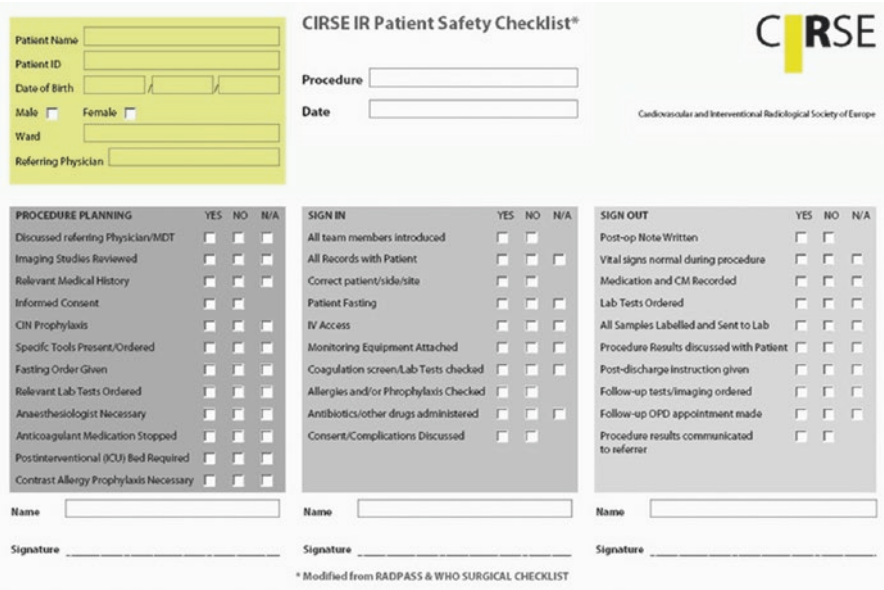
  - Stent placement (using a stent in an artery, vein or tubular structure to support angioplasty)
  - Biopsy and Drainage - using image guidance to obtain a tissue or fluid sample to aid diagnosis or drain an abscess, obstructed biliary system (biliary drainage) or obstructed renal (nephrostomy) system
  - Embolisation (blocking an artery that is bleeding, delivering payload to an artery supplying a tumor)
  - Tumor ablation or Interventional Oncology (ablating or destroying tumours by using thermal energy).
- Charles Theodore Dotter, also known as the "Father of interventional radiology" performed the first angioplasty in 1964. Dr. Dotter later went on to receive a Nobel prize nomination in 1978 for the development of this procedure.
- In 1966 the first embolisation techniques were pioneered to treat tumours and spinal cord vascular malformations.
- In the 1970s embolisation of the arteries supplying the gastrointestinal (GI) tract was used to treat massive GI bleeds.
- In the 1980s, Transjugular Intrahepatic Portosystemic shunt (TIPS) was first used to treat life threatening variceal bleeding in patients with portal hypertension.
- In the early 90s, Endovascular aneurysm repair (EVAR) was first used to treat abdominal aortic aneurysms (AAA) and is now the preferred treatment for elective AAA repair.
- In the late 90s, the use of radiofrequency ablation for the treatment of varicose veins first began and its use is now widespread.
- The training of Interventional Radiologists has also evolved greatly over this time. Typically an IR trainee undertakes 3–4 years of basic Radiology training followed by at least two higher training (also known as Fellowship) years in IR.
- Training follows a national or supranational curriculum such as the CIRSE (Cardiovascular and Interventional Radiology Society of Europe) curriculum where trainees are expected to gain competency in the imaging, technical and clinical aspects of IR and patient management.
- Assessment of competency of IR training is now available in most jurisdictions through the European Board of Interventional Radiology (EBIR) in Europe, Australia and New Zealand, the Certificate of Added Qualification in Vascular & Interventional Radiology (CAQ in VIR) exam in the USA and examinations or continuous appraisal in other countries.

1.3 Patient Preparation and Safety Checklist

- Patient preparation for IR procedures is similar to patient preparation for surgical procedures.
- Informed consent must be obtained form all patients, preferably form the doctor performing the procedure or a delegate with suitable knowledge of IR.



CIRSE IR Patient Safety Checklist*

CIRSE
Cardiovascular and Interventional Radiological Society of Europe

Patient Name
Patient ID
Date of Birth
Male ☐ Female ☐
Ward
Referring Physician

Procedure
Date

PROCEDURE PLANNING	YES	NO	N/A
Discussed referring Physician/MDT	☐	☐	☐
Imaging Studies Reviewed	☐	☐	☐
Relevant Medical History	☐	☐	☐
Informed Consent	☐	☐	
CIN Prophylaxis	☐	☐	☐
Specifc Tools Present/Ordered	☐	☐	☐
Fasting Order Given	☐	☐	☐
Relevant Lab Tests Ordered	☐	☐	☐
Anaesthesiologist Necessary	☐	☐	☐
Anticoagulant Medication Stopped	☐	☐	☐
Postinterventional (ICU) Bed Required	☐	☐	☐
Contrast Allergy Prophylaxis Necessary	☐	☐	☐

Name
Signature

SIGN IN	YES	NO	N/A
All team members introduced	☐	☐	
All Records with Patient	☐	☐	☐
Correct patient/side/site	☐	☐	
Patient Fasting	☐	☐	☐
IV Access	☐	☐	☐
Monitoring Equipment Attached	☐	☐	☐
Coagulation screen/Lab Tests checked	☐	☐	☐
Allergies and/or Phrophylaxis Checked	☐	☐	
Antibiotics/other drugs administered	☐	☐	☐
Consent/Complications Discussed	☐	☐	

Name
Signature

SIGN OUT	YES	NO	N/A
Post-op Note Written	☐	☐	
Vital signs normal during procedure	☐	☐	☐
Medication and CM Recorded	☐	☐	☐
Lab Tests Ordered	☐	☐	☐
All Samples Labelled and Sent to Lab	☐	☐	☐
Procedure Results discussed with Patient	☐	☐	☐
Post-discharge instruction given	☐	☐	☐
Follow-up tests/imaging ordered	☐	☐	☐
Follow-up OPD appointment made	☐	☐	☐
Procedure results communicated to referrer	☐	☐	

Name
Signature

* Modified from RADPASS & WHO SURGICAL CHECKLIST

Fig. 1.1 Typical patient safety checklist used in IR which includes a pre-procedure checklist, time out and post procedure checklist

- Routine blood investigations such as a full blood count, renal profile and a coagulation screen are usually required for most procedures.
- Occasionally and subject to local guidelines, blood investigations may not be required for some simple procedures such as superficial biopsies or venous procedures where haemostasis is easily achieved by local compression.
- The awareness of iodinated contrast material (CM) allergy is crucial before any proposed procedure where CM is used (endovascular procedures).
- A safety checklist (Fig. 1.1) has been developed and is now in routine use to ensure patient safety.

1.4 IR Practice

- IRs work in Interventional suites or 'angiographic laboratories' with the support of dedicated specialist nursing staff and radiographers or technologists (Fig. 1.2).
- These procedure suites are designed like operating theatres and most contemporary rooms have a clean air designation to improve procedure sterility.
- Many IRs also now lead a clinical service where they see patients in outpatient clinics, admit patients for many procedures and perform ward rounds on patients post-procedure. Collaboration and teamwork with referring clinicians and disciplines are essential.

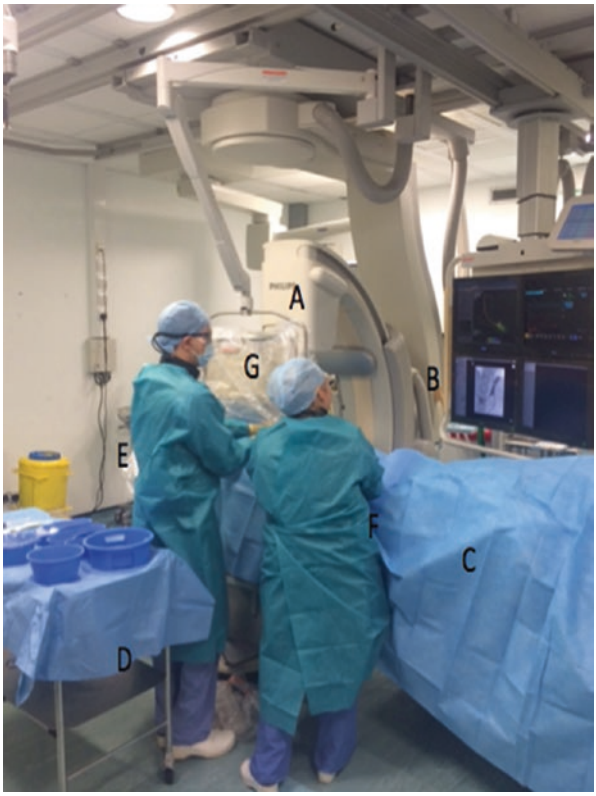


Fig. 1.2 Example of a percutaneous nephrostomy procedure being performed in an Interventional Radiology suite. *A* C-arm, *B* Monitor displaying live images, *C* Bed/ Patient, *D* Sterile trolley and IR equipment, *E* Interventional Radiologist, *F* Scrub Nurse, *G* Radiation protection screen

Key Points

- IR is a relatively new minimally invasive, image-guided specialty that has grown from Radiology.
- IR is often termed "Pinhole Surgery"
- IR is mandatory for modern healthcare delivery.
- IRs train in diagnostic and interventional radiology with some years of clinical practice also desirable.

Suggested Reading

1. European Board of Interventional Radiology. www.cirse.org.
2. IR curriculum and syllabus. www.cirse.org.
3. Patient safety checklist. www.cirse.org.

Principles, Signs and Symptoms of Peripheral Vascular Disease

2

Mark Sheehan, Hong Kuan Kok, and Michael Lee

2.1 Introduction

- Peripheral arterial disease (PAD) includes a group of conditions of different aetiologies which can affect the vessels of the upper and lower limb. PAD is most commonly used to describe atherosclerotic disease of the lower extremity arteries.
- PAD can be divided into acute and chronic presentations; the principal pathology being a compromised supply of oxygenated blood to the extremities leading to tissue ischaemia and necrosis if severe.

2.2 Risk Factors

- Smoking
- Hyperlipidemia
- Hypertension
- Age
- Diabetes Mellitus
- Male
- Family history
- Homocysteinemia

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