Interventional Radiology for Medical Students

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Overview

- Interventional Radiology (IR) is the fastest growing and one of the most exciting specialties in Radiology.
- It has just recently been accredited with sub-specialty status.
- Interventional radiologists are trained in diagnostic Radiology (3yrs training) and then specialise in Interventional techniques (3yrs).
- This workbook will start with an introduction to IR, followed by a series of questions and case based problems for you to answer.
What is it?

- Interventional Radiology (IR) involves image guided procedures. It is the ‘doing’ part of Radiology.
- These procedures are generally split up into percutaneous procedures i.e. going directly through the skin into the target organ or an endovascular i.e. via blood vessels.
- Minimally invasive image guided techniques are increasing being used where surgery was previously the only option.
- Trauma is one area where IR has become very useful in stabilising bleeding patients.
Percutaneous procedures

- Several different imaging modalities are utilised depending on the target organ.
- Ultrasound is excellent for superficial or solid organ procedures for example placing drains in infected gallbladders (cholecystostomy), kidneys (nephrostomy) and abscesses.
- In deeper areas of the abdomen and pelvis where bowel gas may be obscuring our view, CT can be used to place a drain.
- In many situations, multi-modality approaches are used e.g. percutaneous trans-hepatic cholangiograms (PTC). This technique is often combines ultrasound and fluoroscopy to obtain access into the biliary system via the skin and then liver directly.
- New techniques in this area include the ablation therapies. These generally employ CT or US guidance to deliver a probe to a tumour and use thermal or cryotherapy to cause tumour necrosis.
Endovascular Procedures

- Involves gaining access to the arterial or venous system, usually via the femoral or jugular vessels.
- Using a combination of wires and steerable catheters, most places in the body can be reached and treated.
- The number of procedures in this area is growing rapidly.
- Combinations of balloons can be used for angioplasty, stents can be deployed to open narrowed or bleeding vessels, different embolic agents can be used to block vessels and various treatments can be delivered directly to the target area included high dose chemotherapy or radiotherapy.
- New techniques in this area include prostate artery embolisation for benign prostatic hypertrophy (BPH) and chemo-saturation liver therapy.
What the Medical Student Needs to Know About IR

- For finals - not much!
- Only that IR exists and to have some idea about the different areas where it is useful.
- During your post-graduate training it will become more prevalent in clinical practice and some early awareness will undoubtedly be useful.
The Interventional Radiologist needs to master one technique which is the basis for almost all of procedures. You may have already used it/seen it on the wards. This is called the SELDINGER technique.

1. Write or draw a brief description of the Seldinger technique
Question 2

(i) What is fluoroscopy?

(ii) Can you think of other examples of when it is used in radiology?

(iii) What allows us to ‘see’ blood vessels and what is important to check before using it?
3. Embolisation

A whole group of IR procedures involve ‘embolisation’.

(i) What does this mean?

(ii) Can you think of any groups of embolic materials?

(iii) What does ‘non-target’ embolisation mean, and why is it bad news?
Case 1

Boris is 56, a lorry driver who is overweight and spends a lot of time sitting for long journeys. One day he notices that his calf becomes painful, swollen, and a little red. He goes to his GP who sends him to the acute medical unit.
Case 1

(i) What do you think the diagnosis is?

(ii) What is the best radiological examination to confirm your suspicion?
Case 2

At this stage Boris is haemodynamically stable and not short of breath. He is started on anti-coagulation therapy and is discharged home.

A few weeks later, despite his INR being in the therapeutic range, he develops sudden onset pleuritic chest pain, shortness of breath, feels generally unwell and is hypoxic. He attends the Emergency department who suspect he has suffered a pulmonary embolus (PE). His CXR is normal.
Case 2 Continued

(iii) What imaging options are available for confirming this diagnosis?

(iv) If a patient has a confirmed PE whilst on treatment dose anti-coagulation, what IR option is available for protecting against further PEs?

(v) Where would you use your Seldinger technique to obtain vascular access and implant this device?
This is a pig tail catheter contrast flush run of the IVC.

(vi) The level of a particular pair of important vessels must be located, one is labelled as (A), what is it?
Case 1, Image 2

An implantable device is in situ with and without contrast. These are usually temporary, sometimes they are permanent.

(vii) How can we remove it? Can you see anything on the device which may help?

(Hint – image three may help)
Case 1: Image 3

This shows a common problem where the device has been deployed and has ‘tilted,’ making removal difficult.

(viii) How it can be straightened?

(ix) Can you think of any other indications for this device, other than recurrent PE on anti-coagulation?
Case 1: Image 4

4 (a) Balloon inflated to straightened device

4 (b) Device now collapsed ready for removal
Case 2: The Green Man

George is an 89 year man who has 60 pack years smoking history, has type II diabetes, ischaemic heart disease, hypertension and is blind in one eye. He has a long history of infected and poorly healing ankle ulcers on his right leg.

Question (i) Name three non-invasive imaging methods which could be used to interrogate this patient’s lower limb arteries?
Case 2: Image 1

Common femoral artery (CFA)

Profunda

Superficial femoral artery (SFA)

Popliteal
Case 2: Image 2

PT - posterior tibial artery

TP - tibioperoneal trunk

AT - anterior tibial artery
Case 2, Images 1 and 2

• Images 1 & 2 – this shows a normal lower limb angiogram from a common femoral artery (CFA) access.

• Questions:
  
  – (ii) Now look at Image 3 of George, how are his vessels different? Can you name the vessels A-C?
  
  – (iii) Can you see a major abnormality which could be treated to improve flow to the patient’s ankle?
  
  – (iv) How could you improve flow?
(v) What are the tibial vessels like? (i.e. the patient’s run off - there should be 3!)

Compare with the normal angiogram (images 1 and 2).
Case 2: Image 5
Shows the result of your procedure.
Case 3: The Red Patient

Ralph is 17 and sees his GP who refers him to a Urologist because he has felt what feels like ‘a bag of worms’ in the left side of his scrotum. It causes him some discomfort and he would like it treated.

Question (i) Which imaging investigation is best to assess his scrotum?
Case 3: Image 1

(ii) This is the result of your investigation, what do you think it shows?
Case 3 - Questions

(iii) Why does it usually occur on the left side?

(iv) What IR treatment option is available?

(v) Where would you use your Seldinger technique to gain access? Which vessel is A?
Case 3: Image 2

Catheter in IVC
Case 3: Image 3

(v) Which vessel is B?
Case 3: Image 4 — coils have been inserted to occlude the vessel. Notice the lack of distal contrast past the coils.
Case 4: The Yellow Patient

Yasmin is 35 and has many years of alcohol abuse. She has cirrhosis of her liver with several admissions due to variceal bleeding and decompensated liver failure. She has regular ascitic drainages to relieve tense ascites. She has portal hypertension and the Hepatologists have tried several therapies and have now requested assistance by IR.
Case 4: Questions

(i) The liver has a ‘dual’ blood supply. What vessel provides 2/3 of the blood supply to the liver?

(ii) What are the 3 main smaller vessels which combine to form this major vessel?

(iii) When pressure in the portal venous system increases, porto-systemic shunts occur causing varices. Can you think of any sites of variceal formation and hence bleeding? Image 1: shows two slices of her CT scan through her liver, note the varices, ascites and shrunken nodular cirrhotic liver.
Two slices of her CT scan through her liver, note the varices, ascites and shrunken, nodular, cirrhotic liver.
Case 4: Questions

(iv) To reduce portal pressure, IR can form a tract/shunt between the systemic blood system and the portal venous system called a TIPSS, what does this acronym mean?

(v) As the name suggests, the right internal jugular vein is usually used to gain access to the vena cava then right or middle hepatic veins (see image 2). How do you think access to the portal system is achieved (see image 3)?
Case 4: Image 2

- Catheter in IVC
- Middle hepatic vein
- IVC
Case 4: Image 3 - a needle is passed through the catheter and positioned ‘blindly’ into where the portal vein branch should lie!

Needle – hepatic vein to portal vein

Portal vein branches
Case 4: Questions

(vi) Now that you have accessed the portal system, how do you keep it open (see image 4)?

(vii) As seen on the CT, once the portal system is accessed large varices are visualised which may become a source of bleeding (haematemesis in this case). How can we fix those (see image 5)?
Case 4: Image 4

TIPS stent in situ
Case 4: Image 5

Note the lack of flow following coil insertion.
Case 5: The White Patient

Wilfred is a 72 year old male who has been involved in a road traffic collision at 70mph. He has obtained multiple blunt force injuries and is transferred to the Emergency department. He was initially unstable but after resuscitation he stabilised and the Emergency Department performs a F.A.S.T scan in resus. They find some fluid around the liver and proceed by requesting a multi-trauma CT scan.

Question (i) What is a F.A.S.T scan?
Case 5: Image 1

Liver

Stomach

Spleen
Case 5: Questions

(ii) What important two findings are shown in this CT image (image 1)?

(iii) The IR Consultant has been asked to provide emergency treatment, what procedure should be performed?

(iv) You have gained access into the right common femoral artery and navigate to the coeliac axis. What three vessels make up the conventional coeliac axis?
(v) A contrast run was performed. What is the large arrow pointing at?
(vi) A super-selective micro catheter was passed into the area of abnormality and coiled. Why can you embolise parts of liver and it not be too troublesome for the patient (think back to the case of the yellow patient!)?
The End