

D.M – INTERVENTIONAL RADIOLOGY

THE TAMIL NADU Dr. MGR MEDICAL UNIVERSITY,
CHENNAI

Syllabus – D.M Interventional Radiology

The course will be elaborated under the following divisions:

1. Introduction
2. Program Objectives
3. Curriculum
4. Postings
5. Bioethics
6. Research work
7. Log Book
8. Competency Assessment
9. Theory Examination
10. Clinical Examination
11. Suggested books / journals / reading material

I. Introduction:

Interventional Radiology is a relatively young branch of Medicine. With constant improvement of technology, equipment and techniques, the speciality is rapidly growing and replacing a number of established therapeutic options with minimally invasive and less risky treatment options.

At the end of the program, the candidate would possess a comprehensive knowledge of the imaging modalities used in interventional radiology and develop the skills to do both diagnostic and therapeutic interventional procedures. He/she would have personally performed a sufficient number of interventional procedures and be able to diagnose and treat common adult and paediatric pathologies that are amenable to intervention. He/she would also possess sufficient knowledge and experience in research methodology and development.

II. Program objective:

- i) Broad knowledge base – ability to generate a relevant differential diagnosis and plan of treatment, based on an accurate history, physical examination and imaging findings, as well as a good understanding of indications and contraindications for diagnostic and therapeutic procedures.
- ii) Proficiency in diagnosis by multiple imaging modalities
- ii) Ability to think critically
- iii) Skill at performing interventional procedures
- iv) Ability to communicate effectively with patients and referring physicians
- v) Appreciation of humanistic (compassionate, cost conscious, service oriented) and ethical aspects (accountability integrity) of medicine.
- vi) Ability to work as part of a team as Interventional Radiology involves multidisciplinary management.

III. Curriculum:

Aim

The aim of the course is to enable the candidate to become clinically competent and to consistently interpret the results of invasive investigations accurately and reliably. The candidate should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

Objectives

The trainee requires a sound understanding of the basis of interventional radiology including:

- the embryology, anatomy, normal variants and physiology of the appropriate body system(s)
- the current interventional equipment used including:
 - percutaneous access needles and kits
 - catheters and guidewires
 - dilating devices
 - stents
 - embolisation materials
- specific techniques of access to and therapeutic intervention within various organs and structures
- local, national and where appropriate, international imaging and interventional guidelines

Relevant radiation physics for Interventional Radiology

1. Background Radiation and medical sources of Radiation

Background: Cosmic, Terrestrial, Internal, Radon. Medical Sources: Projection Radiography, Fluoroscopy, Interventional Radiology and Diagnostic Angiography, Digital Subtraction Angiography, and CT.

2. Physics of Angiography equipment: Xray tube, generators, image intensifier, flat panel detector, image magnification, Automatic brightness control, imaging chain, video cameras, artefacts, image processing, Subtraction, road maps and other techniques. Quality assurance in Interventional suite: table top doses, kVp accuracy, timer consistency, mA consistency, focal spot resolution, fluoroscopic beam alignment, safety survey.

3. Radiation units, dose limits and Biological effects

Radiation units: Exposure, Absorbed dose, Effective dose, Collective dose.

Dose Limits: Occupational, Non-occupational Staff, Members of the Public, Fetus, Patient- Adult, Child, Pregnancy and radiation, DRLs and “Trigger” Levels - Local and national.

Interactions of x-rays with matter, Deterministic effects and stochastic effects with examples.

4. Personnel and patient Dosimetry

Radiation Detectors – TLD, GaFchromic, transmission ion chamber, ionization chamber, survey meter, Gieger Muller counter.

Personnel Dosimetry: TLD badge, TLD regulations, Pocket dosimeter; dose map in the interventional suite.

Patient Dosimetry: Dose area product, cumulative KERMA, skin doses, interpretation of doses.

5. Factors Affecting Patient Dose: Fluoroscopy and Interventional Radiology- beam angulations, SID, Exposure factors, preset factors, dose settings, low dose protocols etc.

6. Principles of Radiation Protection: Time, Distance, Shielding - Facility, occupational Workers, Caregivers, Patients, Members of the Public, Appropriate Materials. As Low as Reasonably Achievable (ALARA): Culture of Safety – Justification, optimization and limitation, Procedure Appropriateness;

Safety accessories: Lead aprons, thyroid shield, Goggles, movable and fixed shield barriers, ceiling mounted barriers. Radiological safety measures in interventional suites.

7. Advisory Bodies and Regulatory Authorities

International Commission on Radiological Protection (ICRP), National Council on Radiation Protection and Measurements (NCRP), International Atomic Energy Agency (IAEA), Atomic energy regulatory board (AERB). AERB guidelines for room layout, licensing, type approval, eLora, RSO and Pre Conception Pre Natal Diagnostic Techniques Act (PCPNDT) Shielding: Design Philosophy-Occupancy and Workload.

Knowledge of the full range of radiological diagnostic and therapeutic techniques

available, in particular:

- the indications, contra-indications and complications of each method
- the factors affecting the choice of equipment, contrast media and route of approach
- the effects and side-effects of these methods

Particular emphasis should be placed on the strengths and weaknesses of the different methods in various pathological conditions. The appropriate choice of imaging and interventional techniques in the investigation and treatment of specific clinical problems should be emphasised.

The trainee is expected to keep abreast of other imaging techniques relevant to their practice.

The expected outcome at the end of this subspecialty training will be that the candidate can select the appropriate imaging strategy to demonstrate the relevant abnormalities, supervise (and perform where appropriate) the examination(s) and accurately report on the findings. The trainee should also be able to select the appropriate intervention and where required, be capable of carrying out that intervention safely to a successful conclusion.

Overview of training

For training purposes interventional radiology can be divided into vascular and non-vascular.

Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical and surgical and radiological meetings. Multidisciplinary meetings should be emphasised.

The following inter-relationships are important:

- Vascular surgery
- Urology
- Neurological sciences
- Gastroenterology
- General surgery
- Oncology and Haematology
- Obstetrics and Gynaecology
- TB and Chest Diseases

The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.

The trainee should be encouraged to attend appropriate educational meetings and courses.

The trainee should participate in and initiate relevant clinical audit.

Trainees will be expected to be familiar with current interventional radiology literature.

The trainee should be encouraged to participate in research, and to pursue one or more projects up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired. Presentation of research and audit results at state and national meetings should be encouraged.

The trainee should continue to participate in the on-call rota, with appropriate consultant back up.

Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of all imaging techniques used to a high professional standard
- the safe and effective practice of interventional techniques in the appropriate body system(s)
- good communication with patients and professional colleagues
- accurate informed consent to be obtained
- appropriate decisions about terminating the procedure for technical reasons or grounds of safety/comfort to the patient

A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging techniques for a clinical problem
- planning and outcomes of treatment
- promoting an understanding of relevant pathology

Procedural competence will need to be reviewed at intervals, and this regular review should also assess the number of cases required in order to ensure competence.

Radiologists who devote essentially all their time to interventional radiology will be expected to undertake a wide range of complex procedures. Acquisition of the necessary expertise requires such trainees to undertake a proportionately larger number of interventional procedures.

All interventional radiologists must have a thorough knowledge of the techniques required to perform sedation and analgesia procedures, as well as patient monitoring throughout and following the procedures, and should be familiar with existing guidelines.

The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

The groupings that follow are based on the concept of modular training, and the numbers for the more routine procedures (in parentheses) range from what might be expected as a guide for someone with more than one subspecialty interest up to that which might be expected for a dedicated interventional radiologist. The lists of procedures are by no means exhaustive and certain trainees may expand their repertoire to include certain musculoskeletal (eg vertebroplasty) and other techniques.

Subspecialty training in vascular interventional radiology

- diagnostic arteriography (50–150)
- percutaneous angioplasty (65–130)
- percutaneous central venous access (10–20)
- thrombolysis
- embolisation
- percutaneous sclerosants injection
- vascular stent insertion
- foreign body retrieval

- aspiration thrombectomy
- peripheral aneurysm exclusion
- transjugular intrahepatic portosystemic shunt
- chemoembolisation
- aortic stent grafting (thoraco-abdominal)
- Cerebral AVM – embolisation
- Intracranial aneurismal coiling

Chest Intervention

- Bronchial Artery embolisation
- Lung biopsy /pleural biopsy
- Chest drainage procedures
- Vertebro plasty
- Endo vascular aortoic repair

Oncology and Haematology

- Biopsy of the tumours in various sites
- Chemo embolisation
- RF/Cryo ablation
- venus stenting

Obstetrics and Gynaecology

- Uterine artery embolisation
- Vascular malformations
- Amniocentesis
- Chorionic villous biopsies
- fetal transfusion
- fetal reduction
- laser vascular ablation

Uroradiological intervention

- renal tract access, eg nephrostomy (20–40)
- ureteric dilatation/stent insertion (5–10)

- renal biopsy/cyst aspiration (5–10)
- drainage of collections
- varicocele embolisation
- fallopian tube recanalisation
- transrectal prostate biopsy (20–40)

Gastrointestinal intervention

- GI dilatations and stents (10–20)
- percutaneous gastrostomy (5–10)
- transjugular/plugged liver biopsy (5–10)
- radiofrequency ablation
- percutaneous biliary drainage procedures and/or stent insertion

Trainees should acquire experience in the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.

Regardless of the technique, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and can safely perform interventional techniques.

CLINICAL SKILLS FOR Interventional Radiology

1. Good familiarity and adequate skills in performing / interpreting vascular imaging modalities (Ultra Sound, Doppler, CT angiograms, MR angiograms, MRI)
2. Work up of cases and decide on feasibility for intervention
3. Active involvement in the inter-departmental discussions
4. On call interventional duty
5. Independent skills in diagnostic interventional procedures
6. Partial independent skills in therapeutic interventional procedures

IV. Postings:

Year	Area	Duration
Year 1	US (general) and doppler	2 months
	DSA	4 months
	CT, CTA and CT guided procedures	2 months
	Peripheral posting – ICU	1 month
	Peripheral posting – other department (Vascular Surgery)	1 month
	Fetal intervention	1 month
	Ultra sound guided procedures	1 month
Year 2	US (general) and doppler	2 months
	DSA	5 months
	CT, CTA and CT guided procedures	1 months
	MRI and MRA	1 month
	Fetal Intervention	3 month
Year 3	US (general) and doppler	2 months
	DSA	5 months
	Fetal Intervention	1 months
	CT, CTA and CT guided procedures	1 months
	MRI and MRA	1 months
	Postings in center doing more advanced intervention	2 months

Academic sessions

- To attend regular morning teaching sessions of the department everyday 8 -8.30am
- Dedicated interventional topic discussions and journal reading

V. Bioethics

1. Respect human life and the dignity of every individual.
2. Refrain from supporting or committing crimes against humanity and condemn all such acts.
3. Treat the sick and injured with competence and compassion and without prejudice and apply the knowledge and skills when needed.
4. Protect the privacy and confidentiality of those for whom we care and breach that confidence only when keeping it would seriously threaten their health and safety or that of others.
5. Work freely with colleagues to discover,develop, and promote advances in medicine and public health that ameliorate suffering and contribute to human well being.
6. Educate the public about present and future threats to the health of humanity.
7. Advocate for social,economic,educational and political changes that ameliorate suffering and contribute to human well being.
- 8.Teach and mentor those who follow us, for they are the future of our caring profession.

VI. RESEARCH WORK:

The candidate will be trained in the ability to

- Frame a research question.
- Plan a study to answer the question.
- Collect the relevant information and
- Evaluate appropriately the collected data to draw a conclusion.

The candidate should become conversant with the reporting of these results as a research paper, in journals and as a presentation in conferences.

The activities would consist of:

Planning and organizing relevant animal / clinical studies to be submitted as a dissertation at the end of the course.

Students should compulsorily attend the Research Methodology workshop conducted by the University within first six months of D.M Course.

VII. LOG BOOK:

The Postgraduate student of a Postgraduate Degree Course in Super specialties shall maintain Log Book of the work carried out by them and the training programme undergone during the period of training including details of surgical operations assisted or done independently by.

The Log Book shall be checked and assessed by the faculty members imparting the training.

Periodical evaluation of Log Book to be done by the Head of the Department as per 52nd SAB.

The Evaluation of the candidates in both theory and practical aspects will help the candidate in the improvement of his/her knowledge skills & attitude.

VIII. COMPETENCY ASSESSMENT:

1. Communication / Commitment / Contribution / Compassion towards patients and Innovation
2. Implementation of Newly learnt techniques
3. Documentation of case sheets / discharge Summary / Review
4. Number of cases presented in Clinical Meetings/ Journal Clubs / Seminars / Papers presented in Conference.
5. No. Of Medals/ Certificates won in the conference / Quiz competitions and other academic meetings with details.

*** The examiners shall peruse the records (log book) of the following components at the time of viva-voce examination to assess the performance of the candidates during their course of studies:**

1. Communication / Commitment / Contribution / Compassion towards patients and Innovation
2. Implementation of Newly learnt techniques
3. Documentation of case sheets / discharge Summary / Review

4. Number of cases presented in Clinical Meetings/ Journal Clubs / Seminars / Papers presented in Conference.

5. No. Of Medals/ Certificates won in the conference / Quiz competitions and other academic meetings with details.

*** This will be implemented from 2017-18 admission onwards. As resolved in the 55th meeting of the Standing Academic Board held on 18.07.2018.**

IX. THEORY EXAMINATION:

PAPER - I Basic Sciences (Consisting of vascular anatomy, Radiation physics and instrumentation related to interventional radiology)

PAPER -II Vascular interventional radiology

PAPER -III Non Vascular and Fetal interventional radiology

PAPER - IV Recent Advances in Interventional Radiology

Each paper will contain:

1. Essay questions	(2)	2 X 15 = 30 Marks
2. Short Notes	10)	10 X 7 = 70 Marks
	Total	----- 100 Marks -----

X. CLINICAL EXAMINATION

PARTICULARS	TIME FOR CANDIDATES TO EXAMINE THE CASES	TIME FOR EXAMINERS TO QUESTION THE CANDIDATES	MAXIMUM MARKS
Long Case	1 case x 30 minutes	45 minutes	100
Shot case	3 cases x 15 minutes (one worked out case, one doppler demonstraion & one interventional procedure demonstration)	One hour (15 minutes + 15 minutes + 30 minutes)	150
Spotters	25 x 1 minute	25 minutes	50
OSCE	5 session x 5 minutes	25 minutes	50
Viva voce		30 minutes	100
Log book			50
		Total	500

As per Medical Council of India Post Graduate Medical Education Regulations 2000 (amended upto 10th August 2016) clause **13.9 A Postgraduate student of a Postgraduate degree Course in broad specialties/ Super Specialties would be required to present one poster presentation** Overall: to read one paper at a National/State conference and to present one Research paper which should be published/accepted for publication/sent for publication during the period of his Postgraduate studies so as to make him eligible to appear at the Postgraduate Degree Examination.

Apart from Poster/Oral paper presentation in National/State conferences, the Research paper published by the candidate in the University Journal of Medical Sciences will be considered as equivalent to the Research Paper as mentioned in 13.9. clause.

Case Reports can also be published in University Journal of Medical Sciences but case reports will not be considered as Research Paper.

The candidate can also present Research Paper as per Clause 13.9 of Post Graduate Education Regulation 2000, and if the article sent for publication by the candidate as primary author or corresponding author which has not yet been published/accepted for publication, the candidate should submit a letter from the HOD, stating that the article sent for publication is of publishable merit and the proof of the Research Article submitted to the Journal for publication should be sent to the university forwarded through the HOD [as per 53rd SAB] The student can submit articles for the University journal anytime from the time of registration in the University till 6 months prior to theory examination.

OSCE: (5 Stations)

1. Radiation physics instrumentation and radiation protection.
2. Vascular interventional radiology – instruments and techniques
3. Non vascular interventional radiology - instruments and techniques
4. Regulatory bodies and recent advances
5. Contract agents, drugs and embolic materials

XI. Suggested books / journals / reading material:

Author Name	Name of the Books	Publishing Company
Alrbert L. Abrams	Abrams Angiography, Vascular and Interventional Radiology V- I	Medical Education and Research Inc.
Alrbert L. Abrams	Abrams Angiography, Vascular and Interventional Radiology V- II	Medical Education and Research Inc.
Alrbert L. Abrams	Abrams Angiography, Vascular and Interventional Radiology V- III	Medical Education and Research Inc.
Paul Ross	An Atlas of Normal Vertebral Angiograms.	Butter worth Group
Paul Ross	An Atlas of Normal Vertebral Angiograms.	Butter worth Group
Kazuhiko	Cerebral Angio – CT	Raven Press
G. Ansel	Complications in Diagnostic Imaging	Black well scientific Pub
G. Ansell	Complications in diagnostic radiology.	Blackwell scientific
Joseph K. Lee	Computed Body Tomography. Vol - I	Raven Press Books Ltd.
Joseph K. Lee	Computed Body Tomography. Vol – II	Raven Press Books Ltd.
Charles F. Lanzleri	Computed Tomography and Magnetic Resonance Imaging of the whole body Vol - I	Mosby – Year book Inc.
Charles F. Lanzleri	Computed Tomography and Magnetic Resonance Imaging of the whole body Vol – II	Mosby – Year book Inc.
T. A. Lie	Congenital Anomalies of the Carotid Arteries	Williams & Wilkins
Malcolm Carpenter	Core Text of Neuro Anatomy	Williams and Wilkins
Sandler	Correlative Imaging. Nuclear medicine Magnetic Resonance, Computed Tomography, Ultrasound	Williams & Wilkins
Traveras	Diagnostic Neuroradiology Vol – I	Williams & Wilkins
Traveras	Diagnostic Neuroradiology Vol – II	Williams & Wilkins
Grainger	Diagnostic Radiology 3rd edition Vol – I	Churchill Livingstone
Grainger	Diagnostic Radiology 3rd edition Vol – II	Churchill Livingstone
Grainger	Diagnostic Radiology 3rd edition Vol – III	Churchill Livingstone
M. Pinson	Emergency Interventional Radiology	Little Brown
JJ Connors	Interventional Neuroradiology Practical Techniques.	W.B. Saunders Company
Albert Mass	Interventional Radiologic Techniques. Computed Tomography and Ultrasonography.	Academic Press Inc.
Joseph I Ferrucci	Interventional Radiology of the Abdomen	Williams & Wilkins
Ernest J. Ring	Interventional radiology principles and Techniques	Little Brown
Wilfrido R Castaneda	Interventional Radiology Vol – I	Williams & Wilkins
Wilfrido R Castaneda	Interventional Radiology Vol – II	Williams & Wilkins
Zwiebel	Introduction to Vascular Ultrasonography. 3rd	

	edition.	
Scott Atlas	Magnetic Resonance Imaging of the Brain and Spine. Vol - I	
Scott Atlas	Magnetic Resonance Imaging of the Brain and Spine. Vol – II	
Bushberg, Seibert A, Leidholdt and Boone J.	The essential Physics of Medical Imaging	
David J Dowset, Patrick Kenny and Eugene Johnston.	The Physics of Diagnostic Imaging	Chapman and Hall Medical
Wolbarst AB, Capasso P and Wyant A.	Medical Imaging essentials for Physicians	Wiley Blackwell

Note : The Editions are as applicable and the latest editions shall be the part of the syllabus.