

**VASCULAR & INTERVENTIONAL RADIOLOGY  
FELLOWSHIP ATTACHMENT PROGRAMME IN SGH**

Components	Information	
<b>1. Division/ Department</b>	Radiological Sciences / Vascular & Interventional Radiology	
<b>2. Title of Programme</b>	Fellowship Training in Vascular & Interventional Radiology	
<b>3. Relevant Registrations</b>	<ul style="list-style-type: none"> <li>• Temporary Registration with Singapore Medical Council (SMC)</li> <li>• Training employment pass application with Ministry of Manpower, Singapore (MOM) (upon successful Temporary Registration with Singapore Medical Council)</li> </ul>	
<b>4. Overview</b>	<p>Provide all rounded training in interventional radiology at Singapore General Hospital (SGH), the largest and oldest hospital in Singapore, with over 10,000 interventional procedures per year. The fellowship provides a holistic experience in interventional radiology including clinical and hands on technical exposure. IRC has 7 interventional suites equipped with state of the art machines including the Siemens Zeego and two Toshiba hybrid angio-CT systems. All IR suites are equipped with Ultrasound scanners for US guided/assisted interventions. The VIR section is staffed by 20 Interventional Radiologists and 3 Neuro Interventional Radiologists.</p>	
4.1 Background information		
4.2 Goal/ aim(s)		<ol style="list-style-type: none"> <li>1. Exposure to full range of interventional radiology procedures.</li> <li>2. Develop complete clinical care for patients including clinics, consent and follow up.</li> <li>3. Advance skills in imaging relevant to interventional radiology.</li> </ol>
4.3 Duration		6 - 12 months
4.4 Hyperlinks/URL Sites		<a href="https://www.sgh.com.sg/patient-care/specialties-services/vascular-and-interventional-radiology/pages/vascular-and-interventional-radiology-fellowship.aspx">https://www.sgh.com.sg/patient-care/specialties-services/vascular-and-interventional-radiology/pages/vascular-and-interventional-radiology-fellowship.aspx</a>
<b>5. Target Audience</b>	-	
5.1 Pre-requisite /eligibility requirement(s)	<p>General requirements for Temporary Registration for training (required by SMC):</p> <ul style="list-style-type: none"> <li>• A basic medical degree from an accredited medical university or medical school</li> <li>• Passed the relevant national licensing examination in the country of conferment of basic degree, where applicable</li> <li>• Evidence of at least 12 months houseman-ship / internship with a certificate of satisfactory completion of houseman-ship or equivalent</li> <li>• Been registered as a medical practitioner in the country where he is currently practising</li> <li>• Been certified to be of good standing by the Medical Council or the relevant national authority</li> </ul> <p><b>Note:</b> The doctor should be in active clinical practice (and been registered as a medical practitioner in the countries of practice) for the 3 years preceding the application for medical registration in Singapore.</p> <p>In addition to the above criteria, <b>Clinical Fellows</b> must:</p>	

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	<p>a) Have a minimum of 3 years working experience as a medical officer (or equivalent)</p> <p>b) Fulfil English Language requirements of SMC if the medium of instruction for the basic medical qualification is <u>not</u> in English</p> <p>c) Preferably have obtained a postgraduate diploma or medical degree in his country or overseas</p> <p>d) Be sponsored by (i) the government, or (ii) regional health authority or (iii) an appropriate institution in the home country. For (d)(iii), the doctor must be on current full-time employment (40 hours or more per week) with the sponsoring institution.</p> <p>As a Clinical Fellow, the doctor will be allowed to be involved in patient care and make entries in patients' case note, communicate care plans to patients and fellow healthcare professionals, and perform procedures under <u>direct</u> supervision or Level 1 supervision under SMC's Supervisory Framework.</p> <p><b>Department's requirement, if any (only for Clinical Fellow in this subspecialty):</b></p> <ul style="list-style-type: none"> <li>• Postgraduate medical qualification in Radiology e.g. FRCR, MMed or equivalent</li> <li>• 5 years of radiology residency training or equivalent at start of fellowship (eg. for 3 year training programs, a further 2 year postgraduate training experience required)</li> </ul>
<p><b>6. Learning Objectives</b></p>	<ul style="list-style-type: none"> <li>• Vascular and non-vascular interventional radiology exposure.</li> <li>• Full clinical exposure from diagnosis, multidisciplinary discussion, consent and follow up.</li> <li>• Training in imaging relevant to VIR (EVAR follow up, vascular malformation, HPB imaging).</li> <li>• Participation in continuing medical education, audits, morbidity and mortality meetings.</li> <li>• Completion of research (minimum poster presentation).</li> </ul>
<p><b>7. Course/Training Syllabus</b></p>	<p><b><u>Basic Level</u></b></p> <p>a) Develop a thorough understanding of the venous anatomy of the head, neck, chest, abdomen, pelvis and extremities.</p> <p>b) Develop an understanding of the devices available for long-term venous access.</p> <p>c) Be knowledgeable about common health problems treated by the interventional radiology service, including:</p> <ul style="list-style-type: none"> <li>• Pleural effusion</li> <li>• Ascites</li> <li>• Solid tumors requiring biopsy</li> <li>• Thyroid disease</li> <li>• Abscess</li> <li>• Pneumothorax</li> <li>• Pseudo-aneurysm</li> </ul> <p>d) Work to develop basic interventional radiology skills considered necessary in the practice of general radiology, including:</p> <ul style="list-style-type: none"> <li>• US-guided venous access – internal jugular, peripheral, femoral</li> <li>• Non-tunneled central and peripheral venous catheter placement</li> <li>• Ultrasound-guided thoracentesis</li> <li>• Ultrasound-guided paracentesis</li> </ul>

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	<ul style="list-style-type: none"> <li>• CT-guided biopsy</li> <li>• Ultrasound-guided biopsy</li> <li>• CT-guided abscess drainage</li> <li>• CT-guided and fluoroscopy-guided chest tube placement</li> <li>• Ultrasound-guided thrombin injection</li> </ul> <p><b><u>Intermediate Level (1)</u></b></p> <p>a) Develop a thorough understanding of the arterial anatomy of the head, neck, chest, abdomen, pelvis and extremities</p> <p>b) Develop a thorough understanding of the devices commonly used in the interventional suite while performing vascular procedures, including: needles, sheaths, diagnostic catheters, guide wires, snares, balloons, stents, arterial closure devices, thrombectomy catheters and embolic devices.</p> <p>c) Be knowledgeable about common vascular health problems treated by the interventional radiology service, including:</p> <ul style="list-style-type: none"> <li>• Venous thromboembolic disease</li> <li>• Peripheral arterial disease</li> <li>• Mesenteric ischemia</li> <li>• Renal failure</li> <li>• Acute traumatic hemorrhage</li> <li>• Acute gastrointestinal bleeding</li> <li>• Acute pulmonary haemorrhage</li> <li>• Uterine fibroids</li> <li>• Pelvic congestion syndrome</li> </ul> <p>d) The fellow should work to develop basic interventional radiology skills considered necessary in the practice of vascular interventional radiology, including:</p> <ul style="list-style-type: none"> <li>• Femoral artery and vein access – micropuncture technique, sheath placement</li> <li>• AV dialysis graft / fistula access</li> <li>• Arterial and venous catheter manipulation</li> <li>• Microcatheter technique</li> <li>• Use of arterial closure devices</li> <li>• Catheter directed thrombolysis</li> <li>• Use of mechanical thrombectomy devices</li> <li>• IVC filter placement and retrieval</li> <li>• Use of balloons and stents – vascular</li> <li>• Use of embolic materials – coils, particles</li> <li>• Uterine fibroid embolization</li> <li>• Gonadal vein embolization</li> <li>• Use of snares for intravascular foreign body retrieval</li> </ul> <p><b><u>Intermediate Level (2)</u></b></p> <p>a) Develop a thorough understanding of hepatobiliary anatomy and genitourinary anatomy.</p> <p>b) Develop a thorough understanding of the devices commonly used in the interventional suite while performing hepatobiliary and genitourinary procedures,</p>

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	<p>including: needles, sheaths, diagnostic catheters, guide wires, balloons, stents, and drainage catheters.</p> <p>c) Be familiar with common non-vascular health problems treated by the interventional radiology service, including:</p> <ul style="list-style-type: none"> <li>• Chronic biliary obstruction</li> <li>• Acute biliary ductal injury – bile leak</li> <li>• Cholecystitis</li> <li>• Nephroureteral calculus disease</li> <li>• Renal obstruction – non-calculus</li> <li>• Ureteral injury – urine leak</li> <li>• Bladder outlet obstruction and incontinence</li> <li>• Chronic malignant pleural effusion and ascites</li> </ul> <p>d) The fellow should continue to develop their basic radiology procedure skills and vascular interventional radiology skills. The fellow should also work to develop additional interventional radiology skills considered necessary in the practice of non-vascular interventional radiology, including:</p> <ul style="list-style-type: none"> <li>• Transhepatic cholangiogram</li> <li>• Biliary drainage catheter placement</li> <li>• Cholecystostomy tube placement</li> <li>• Antegrade pyelogram</li> <li>• Nephrostomy tube placement</li> <li>• Ureteral stent / catheter placement</li> <li>• Suprapubic Foley catheter placement</li> <li>• Use of balloons and stents – non-vascular</li> </ul> <p><b><u>Advance Level</u></b></p> <p>a) Develop an understanding of sclerosing agents.</p> <p>b) Develop a thorough understanding of the devices and materials used to perform hepatic chemoembolization, hepatic Y-90 radioembolization, solid tumor radiofrequency ablation, transjugular liver biopsy and shunt creation, percutaneous vascular malformation sclerotherapy, endovascular management of aortic aneurysm, and treatment of vertebral compression fractures.</p> <p>c) The fellow should become familiar with common vascular and non-vascular health problems treated by the interventional radiology service, including:</p> <ul style="list-style-type: none"> <li>• Hepatic metastatic disease</li> <li>• Primary hepatocellular malignancy</li> <li>• Portal hypertension – cirrhosis, Budd Chiari</li> <li>• Pulmonary and renal malignancy – primary and metastatic</li> <li>• Abdominal aortic aneurysm</li> <li>• Thoracic aortic aneurysm</li> <li>• Vascular malformations</li> <li>• Symptomatic benign renal and hepatic cysts</li> </ul> <p>d) The fellow should continue to develop their basic radiology procedure skills, vascular interventional radiology skills and non-vascular interventional radiology skills. The fellow should work to develop additional interventional radiology skills, including:</p> <ul style="list-style-type: none"> <li>• Technique for hepatic chemoembolization</li> <li>• Advanced mesenteric vascular evaluation and pretreatment protective embolization</li> </ul>

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	<ul style="list-style-type: none"> <li>• Technique for hepatic Y-90 radioembolization</li> <li>• Transjugular liver biopsy</li> <li>• TIPSS creation</li> <li>• Placement and use of radiofrequency ablation probes</li> <li>• Endovascular management of abdominal aortic aneurism</li> <li>• Endovascular management of thoracic aneurysm and penetrating ulceration</li> <li>• Percutaneous sclerotherapy for vascular malformations</li> <li>• Sclerotherapy for benign renal and hepatic cysts</li> </ul>
<p><b>8. Training Method</b></p>	<p><b>Method of Supervision:</b> Direct observation and feedback. Clinical Fellow will be supervised by an assigned supervisor at all times.</p> <p><b>Observed Only:</b> Fellows are allowed to scrub in for all procedures performed in the Interventional Radiology Centre.</p> <p><b>Hands-On Experience:</b> Fellows will assist in the following procedures under supervision:</p> <ul style="list-style-type: none"> <li>• Venous access (PICC, tunneled and non- tunneled central catheters).</li> <li>• Image guided biopsies (including transjugular liver biopsy).</li> <li>• Image guided drainages.</li> <li>• Dialysis access / central venous angioplasty, stenting, thrombolysis.</li> <li>• Lower limb angioplasty/stenting (including subintimal and infrapopliteal angioplasty).</li> <li>• Lower limb thrombolysis.</li> <li>• Pulmonary angiography and thrombolysis.</li> <li>• Biliary drainages and stenting.</li> <li>• HVPG.</li> <li>• Transarterial Chemoembolisation (TACE).</li> <li>• Y 90 radioembolisation.</li> <li>• Nephrostomies and ureteric stenting.</li> <li>• Uterine fibroid embolization.</li> <li>• Other embolisation (eg trauma, tumour, bleeding GIT, PPH, bronchial etc).</li> <li>• Fallopian tube recanalization.</li> <li>• Aortic stent grafts.</li> <li>• Radiofrequency ablation of liver and renal tumours.</li> <li>• Endovenous laser treatment of varicose veins.</li> <li>• CTA/MRA examinations.</li> </ul> <p>Fellows will spend most of their time in the Interventional suites performing procedures under the supervision of VIR consultants, initially as assistants and subsequently as primary operators for basic VIR procedures once they are proficient in basic IR techniques.</p>

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	<p>Fellows will be rostered to tag on to on call VIR consultants on call to assist in emergency IR procedures.</p> <p>Clinical Duties:</p> <ul style="list-style-type: none"> <li>Involved in the pre, intra, post procedure assessment and management of patients.</li> <li>Daily ward rounds to review patients post (and increasingly pre) procedure.</li> <li>Interactive involvement in the VIR outpatient clinic along with the VIR consultant.</li> </ul> <p>Fellows will be required to attend and participate in the weekly VIR breakfast meeting and the monthly Biopsy Audit, Morbidity and Mortality rounds and Research Meeting. At these forum case discussions, didactic teaching and journal readings will be conducted. Fellows will also be encouraged to attend the inter-departmental multi-disciplinary Radiology rounds (with Vascular Surgery, Urology, Gastroenterology, Hepatology, Hepatobiliary and colorectal surgery) to better understand holistic patient management.</p> <p>Research:</p> <p>Fellows will be given research time off to conduct at least one research or audit project. They will be encouraged to present abstracts/posters at local/regional conferences and submit manuscripts for publication.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #cccccc;"> <th colspan="3">TRAINING ACTIVITIES &amp; METHODOLOGY</th> </tr> <tr style="background-color: #cccccc;"> <th style="width: 40%;">Name of activity</th> <th style="width: 30%;">Frequency / No. of sessions / Length of session</th> <th style="width: 30%;">Teaching methodology</th> </tr> </thead> <tbody> <tr> <td>VIR Ward Rounds – pre, intra and post procedure assessment and management of patients</td> <td>Daily</td> <td>Mentorship and observation  Increasing independence based on competency  Case based discussion</td> </tr> <tr> <td>Interdisciplinary/ clinicoradiology rounds (eg. Vascular Surgery-VIR, Urology-Radiology, Gastro/Hepato-Radiology, etc)</td> <td>Daily</td> <td>Mentorship and observation  Case based discussion</td> </tr> <tr> <td>Outpatient clinics</td> <td>Weekly (4 hours)</td> <td>Mentorship and observation  Increasing independence based on competency</td> </tr> </tbody> </table>	TRAINING ACTIVITIES & METHODOLOGY			Name of activity	Frequency / No. of sessions / Length of session	Teaching methodology	VIR Ward Rounds – pre, intra and post procedure assessment and management of patients	Daily	Mentorship and observation  Increasing independence based on competency  Case based discussion	Interdisciplinary/ clinicoradiology rounds (eg. Vascular Surgery-VIR, Urology-Radiology, Gastro/Hepato-Radiology, etc)	Daily	Mentorship and observation  Case based discussion	Outpatient clinics	Weekly (4 hours)	Mentorship and observation  Increasing independence based on competency
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	Angiography suites at Interventional Radiology Center	Daily	Mentorship and observation  Increasing independence based on competency
	On call session	Weekly (1 – 2 sessions)	Mentorship and observation  Increasing independence based on competency
8.1 Night Duties Requirement	Fellows may tag along consultant on call to assist emergency procedures at night.		
8.2 Running of Clinics Requirement	Fellows may be required to assist in running of clinics under consultant supervision.		
<b>9. Assessment and Evaluation</b>	<p>Clinical Fellow will need to demonstrate their proficiency level based on the following competencies:</p> <p><b>1) Patient Care</b></p> <ul style="list-style-type: none"> <li>• History taking, examination and review of relevant imaging.</li> <li>• Demonstrates empathy towards patient and relatives.</li> <li>• Able to communicate effectively at all points of patient care.</li> </ul> <p><b>2) Medical Knowledge</b></p> <ul style="list-style-type: none"> <li>• Diagnostic imaging relevant to interventional radiology.</li> <li>• Familiar and competent in basic life support and conscious sedation.</li> <li>• Demonstrates understanding of diseases &amp; procedures relevant to VIR.</li> <li>• Aware of alternative treatment options and multidisciplinary approach to treatment.</li> </ul> <p><b>3) Practice-Based Learning and Improvement</b></p> <ul style="list-style-type: none"> <li>• Commitment to clinical governance and risk management</li> <li>• Understanding methods for dose reduction and image optimisation</li> <li>• Work according to ALARA principle</li> <li>• Evaluate patients before and after procedure, obtain valid consent and communicate effectively with referring physicians and patients and develop strategies to deal with complex clinical situations and difficult attitudes.</li> </ul> <p><b>4) Interpersonal and Communication Skills</b></p> <ul style="list-style-type: none"> <li>• Communicate effectively with all staff including radiographers, nurses, health care assistants, administrative staff</li> <li>• Work with other medical teams in multidisciplinary approach</li> </ul>		



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	<p><b>5) Professionalism</b></p> <ul style="list-style-type: none"> <li>Respects patient confidentiality at all times</li> <li>Maintains professionalism when communicating with staff, patients and family</li> </ul> <p><b>6) Systems-Based Practice</b></p> <ul style="list-style-type: none"> <li>Understanding the risks of pathogens, drugs and other hazardous material and the risk of injury to patients and staff is essential including how to manage and control infection including cross infection.</li> </ul> <p>The other key competency areas include:</p> <ol style="list-style-type: none"> <li>Fellows should review previous radiology studies and discuss the findings with supervising consultant faculty before each procedure.</li> <li>Fellows should assist with completion of outpatient pre-procedure documentation.</li> <li>Fellows should complete the post-procedure note after each procedure.</li> <li>Fellows should evaluate appropriateness of inpatient requests for procedure and obtain informed consent. Fellows must maintain and complete the logbook for basic IR procedures.</li> <li>Fellows should be knowledgeable of the daily interventional procedure schedule.</li> <li>consent.</li> <li>Fellows should consult supervising faculty when questions arise beyond the scope of the Fellow's current level of training.</li> </ol>						
9.1 Assessment approaches	<p><b>Formative assessment:</b></p> <ul style="list-style-type: none"> <li>Regular evaluation between Clinical Fellow and Supervisor / Head of Department</li> <li>Reflective journal- logbook recordings of training activities</li> </ul> <p><b>Summative assessment:</b> Periodical assessment reports as required by Singapore Medical Council</p> <p><b>Feedback:</b></p> <ul style="list-style-type: none"> <li>End-of-training feedback form as required by Singapore Medical Council</li> <li>End-of-training feedback session with SGH-PGMI</li> </ul>						
9.2 Evaluation Process 9.2.1 General overall grading system	<p>The general overall grading system evaluates the Clinical Fellow's performance upon completion of the fellowship programme. All Clinical Fellow will be given a general overall grading status at the end of the fellowship programme based on the grading criteria requirements incorporating the six competencies based knowledge, skills and performance that Clinical Fellow must demonstrate throughout the programme.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #4F81BD; color: white;"> <th style="width: 20%;">Grading Status</th> <th style="width: 40%;">Description</th> <th style="width: 40%;">Grading Criteria Requirements</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>CMP</b></td> <td>Completes the programme</td> <td> <ul style="list-style-type: none"> <li>Satisfies 6 core competencies</li> </ul> </td> </tr> </tbody> </table>	Grading Status	Description	Grading Criteria Requirements	<b>CMP</b>	Completes the programme	<ul style="list-style-type: none"> <li>Satisfies 6 core competencies</li> </ul>
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9.2.2 Options for Clinical Fellow who was graded with a (USP) for unsatisfactory performance	This will be reviewed by faculty on a case by case basis.									
9.3 Criteria for Early Termination	<p>The attachment programme will be terminated early on the ground of the Clinical Fellow's poor performance, misdemeanour, misconduct, negligence or breach of any terms stipulated or referred to in the Fellowship Letter of Offer and Institution Terms and Conditions.</p> <p>The Clinical Fellow may also request to terminate the attachment programme for reasons such as serious illness or other personal obligations. The institution will review all requests for early termination with the Clinical Fellow and the Supervisor / Head of Department.</p>									
<b>10. Course Administration</b>	<p>Type of Certification: Certificate of Training</p> <p>Training Fee: S\$3,000 (before prevailing GST) per month</p> <p>Programme Funding source: Self-funded</p>									
<b>11. Number of Clinical Fellow to be accepted at any one time</b>	8									