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ESC Report

ESC Core Curriculum for the Cardiologist

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Abbreviations and acronyms

2D	Two-Dimensional
3D	Three-Dimensional
AAT	Audit Assessment Tool
ABI	Ankle Brachial Index
ACAT	Acute Care Assessment Tool
ACS	Acute Coronary Syndrome
AF	Atrial Fibrillation
AR	Aortic Regurgitation
AS	Aortic Stenosis
AV	node AtrioVentricular node
AVNRT	AtrioVentricular Node Reentry Tachycardia
AVRT	AtrioVentricular Reentry Tachycardia
CABG	Coronary Artery Bypass Graft
CAD	Coronary Artery Disease
CanMEDS	Canadian Medical Education Directives for Specialists
Cardiac	MR Cardiac Magnetic Resonance
CbD	Case-based Discussion
CHF	Congestive Hear Failure
CICU	Cardiac Intensive Care Unit
CKD	Chronic Kidney Disease
CME	Continuing Medical Education
CMR	Cardiac Magnetic Resonance
CPD	Continuing Professional Development
CRT	Cardiac Resynchronisation Therapy
CRT-D	Cardiac Resynchronisation Therapy Defibrillator
CT	Computed Tomography
CTCA	Cardiac Computed Tomography Angiography
CV	CardioVascular
CVD	CardioVascular Disease
DOPS	Direct Observation of Procedural Skills
DVT	Deep Venous Thrombosis
EbD	Entrustment-based Discussion
EC	European Community
ECG	ElectroCardioGraphy
ECLs	ExtraCorporeal Life support
eCPR	extracorporeal CardioPulmonary Resuscitation
EEGC	European Exam in General Cardiology
EHRA	European Heart Rhythm Association
EPA	Entrustable Professional Activity
ESC	European Society of Cardiology
EU	European Union
FFR	Fractional Flow Reserve
GDMT	Guideline Directed Medical Therapy
HDL	High Density Lipoproteins
HF	Heart Failure
HFpEF	Heart Failure with preserved Ejection Fraction
HFrEF	Heart Failure with reduced Ejection Fraction
ICCU	Intensive Coronary Care Unit
ICD	Implantable Cardioverter-Defibrillator
ICU	Intensive Care Unit
IE	Infective Endocarditis
iFR	instantaneous wave-Free Ratio
IVUS	IntraVascular Ultrasound
LAA	occlusions Left Atrial Appendage occlusion
LDL	Low Density Lipoproteins
LGE	Late Gadolinium Enhancement
Lp(a)	Lipoprotein (a)
LQT	Long QT

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LST	Life Support Therapy
LV	Left Ventricle
MCQ	Multiple Choice Question
MCR	Multiple Consultant Report
Mini-CEX	Mini-Clinical Evaluation eXercise
MR	Mitral Regurgitation
MRI	Magnetic Resonance Imaging
MS	Mitral Stenosis
MSF	Multi-Source Feedback
OCT	Optical Coherence Tomography
OMT	Optimal Medical Therapy
OSCE	Objective Structured Clinical Examination
PAD	Peripheral Arterial Disease
PCI	Percutaneous Coronary Intervention
PET	Positron Emission Tomography
PM	PaceMaker
PR	Pulmonary Regurgitation
PS	Patient Survey
PS	Pulmonary Stenosis
QIPAT	Quality Improvement Project Assessment Tool
ROSC	Return Of Spontaneous Circulation
SCD	Sudden Cardiac Death
SPECT	Single-Photon Emission Computed Tomography
SVT	SupraVentricular Tachycardia
TO	Teaching Observation
TOE	Trans-Oesophageal Echocardiography
TR	Tricuspid Regurgitation
TS	Tricuspid Stenosis
UEMS	Union Européenne des Médecins Spécialistes (European Union for Medical Specialists)
UEMS-CS	UEMS Cardiology/ Cardiac Section
UN	United Nations
VT	Ventricular Tachycardia
WBA	Workplace-Based Assessment
WBC	White Blood Cell
WPW	Wolff Parkinson White

The concept of the core curriculum and the training requirements document

This 2020 update of the ESC Core Curriculum in Cardiology reflects contemporary and emerging requirements for the practice of cardiology and the resulting training needs. The changing nature of the profession and the changing environment of health care shaped this update of the previous version.[1] The document has four main parts:

(1) This chapter outlining the main training requirements and their presentation in Entrustable Professional Activities (EPAs).
(2) A chapter explaining the requirements for training centres.
(3) A chapter outlining the general skills, knowledge, and attitudes required in cardiology.
(4) Eight chapters outlining EPAs in the different areas of cardiology.

The core curriculum was written over the last 2 years in an iterative process involving over 80 representatives from the ESC and UEMS including education experts, specialty and subspecialty trainers, trainees, and patients. Their views, opinions, and comments were captured in an iterative process employing online 'Delphi' surveys, in-person discussions in small groups, meetings including the 6th and 7th ESC education conference, and high-level meetings within ESC and UEMS. The final document was approved by the ESC and UEMS boards in spring 2020.

1. Cardiology as a medical specialty

The clinical specialty of cardiology delivers expert care for patients presenting with heart and circulatory diseases. This core curriculum outlines the clinical competencies required to practice as a cardiologist. It is based on ESC clinical practice guidelines, covers the ESC topic list, and provides a framework for training, certification, continuous medical education, and recertification.

Completion of the curriculum equips a cardiologist to act as an expert in the diagnosis, assessment, and management of patients with disorders of the heart and circulation, and to perform risk assessment and disease prevention in their patients and their community. Although the curriculum by necessity includes sufficient knowledge of the sub-specialties to ensure that patients are referred appropriately for more advanced investigations and therapies, the expertise for these sub-specialized domains of cardiology is covered elsewhere and not included in this document.

2. Clinical competencies

Each trainee needs to acquire the clinical competencies for investigation, evaluation, diagnosis, treatment, and care of a wide range of patients with cardiovascular diseases (CVDs). Clinical competencies are complex abilities which are based on knowledge and skills, require appropriate attitudes, and involve different roles. Knowledge is necessary for these competencies but needs to be applied in combination with clinical skills and the appropriate attitudes. The core curriculum therefore covers knowledge, skills, and attitudes. The number of clinical competencies calls for assessment throughout training and thereby also encourages continuous learning which will continue after specialist certification. To enable these goals, the 2020 ESC Core Curriculum for the Cardiologist consists of EPAs.[2,3] Mindful of the need to make knowledge accessible, the curriculum contains a detailed map linking EPAs to the ESC topic list, thereby enabling cross-linking with knowledge and training databases including textbooks, structured and case-based learning courses, congress programmes, guidelines, and online materials. Consistent with the major chapters of the ESC topic list, the EPAs are arranged in eight chapters (Chapters 2–9) reflecting the major current clinical topics present in cardiological practice (*Table 1*).

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Table 1 Chapters

1	The Cardiologist in the wider context
2	Imaging
3	Coronary artery disease
4	Valvular heart disease
5	Rhythm disorders
6	Heart failure
7	Acute cardiovascular care
8	Prevention, rehabilitation, sports
9	Cardiac patients in other settings

The ESC Core Curriculum for the Cardiologist is organized around nine chapters. Chapters 2–9 are based on EPAs.

3. Entrustable professional activities

Trust is central for the provision of good care and an essential component of healing. Patients and other health professionals need to trust their physician, physicians need to have trust in each other, and healthcare systems rely on the trustworthiness of their specialists. Trainers develop increasing trust in a trainee during their training. To capture this often subconscious process, EPAs provide defined units of professional activity.[4] When a trainee can be trusted to perform a professional activity at the expected level of independence, the EPA is completed. Hence, a completed EPA documents the ability of a trainee to safely, effectively, and independently perform the professional activity.

EPAs have a particular focus on clinical skills, but incorporate the related knowledge, adequate attitudes, and professional roles in a holistic clinical context. Moreover, EPAs can be overseen, assessed, monitored, documented, and certified. For these reasons, EPAs are an excellent instrument for assessing a trainee repetitively during the training period.

Taken together, the EPAs contained in this core curriculum describe the requirements for independent professional cardiology practice. The curriculum thus constitutes a framework for acquiring the clinical competencies required for working as a cardiologist in Europe. All 62 EPAs in this core curriculum share a common structure (*Figure 1*). The clinical competence is defined in the title and specified in the description. This is followed by the knowledge, skills, and attitudes the trainee should possess to perform the professional activity. Tools are suggested for the assessment of each professional activity. Each EPA also indicates the minimal required level of independence a trainee is expected to reach when training is completed.

Since all these professional activities concern patients, and are performed in a social context, the relevant roles are described in the CanMEDS Roles section of each EPA.[5] They have been adapted for this core curriculum as described in Chapter 1 but remain consistent with the definitions in the CanMEDS Physician Competency Framework. Hence, these roles are important for all the professional activities and are part of all EPAs (*Figures 1 and 2*).

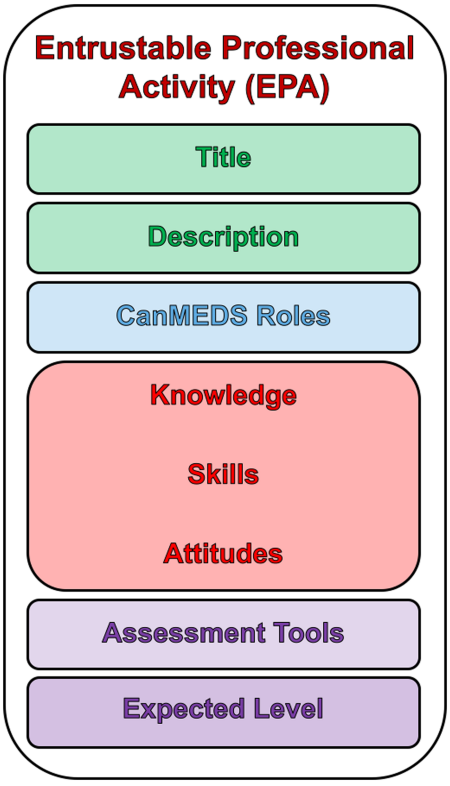

Figure 1 All 62 EPAs in this core curriculum share a common structure. The clinical competence is defined in the title and specified in the description. The CanMEDS Roles required for being competent are mentioned as well. This is followed by the knowledge, skills, and attitudes the trainee should possess to perform the professional activity. Tools are suggested for the assessment of each professional activity. Each EPA also indicates the level of independence a trainee is expected to reach when training is completed.

4. Level of independence

Each EPA defines a clinical activity. The required level of independence for executing this activity, however, is not identical for all the professional activities performed by a cardiologist. *Table 2* defines the five levels of entrustment or independence, starting from 'able to observe' (level 1) to 'able to perform the activity and supervise others (level 5)'. *Table 3* defines the level of independence for each EPA and *Table 4* for each investigation.

5. Assessment of clinical competencies using entrustable professional activities

Each entrustable activity requires knowledge, skills, integrity, reliability, and humility.[6] Assessment of clinical competencies is a very important aspect of the EPA concept. Entrustable professional activities enable easy, formative, and repeated assessment during the training period until the trainers are satisfied that the trainee is able to execute the professional activity in an independent manner and they can

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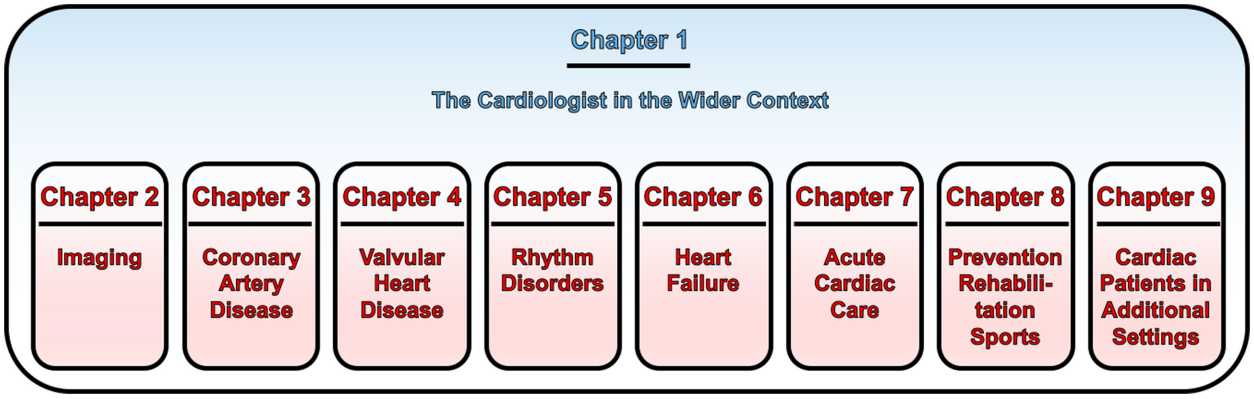

Figure 2 This core curriculum consists of 9 chapters. The professional roles of the cardiologist - based on the CanMEDS framework - are described in Chapter 1 and are all represented, to a variable extent, within each EPA of Chapters 2–9. The EPAs are arranged in eight chapters (Chapters 2–9) reflecting the major clinical topics in current cardiological practice.

Table 2 Levels of independence

Level 1: Trainee is able to observe
Level 2: Trainee is able to perform the activity under direct supervision proactive, close supervision, supervisor in the room
Level 3: Trainee is able to perform the activity under indirect supervision reactive, on-demand supervision, trainee has to ask for help, supervisor readily available, within minutes
Level 4: Trainee is able to perform the activity under distant supervision reactive supervision available remotely, e.g. within 20–30 min, on the phone or *post hoc*
Level 5: Trainee is able to supervise others in performing the activity

Five different levels of independence defined for a professional activity.

Table 3 Level of independence for each EPA

EPA	Level of independence				
	1	2	3	4	5
2. Imaging					
2.1. Assess a patient using one or multiple imaging modalities					
2.2. Assess a patient using echocardiography					
2.3. Assess a patient using cardiac magnetic resonance					
2.4. Assess a patient using cardiac computed tomography					
2.5. Assess a patient using nuclear techniques					
3. Coronary artery disease					
3.1. Manage a patient with symptoms suggestive of coronary artery disease					
3.2. Manage a patient with acute coronary syndrome					
3.3. Manage a patient with chronic coronary syndrome					
3.4. Assess a patient using coronary angiography					
4. Valvular heart disease					
4.1. Manage a patient with AR					
4.2. Manage a patient with AS					
4.3. Manage a patient with mitral regurgitation					
4.4. Manage a patient with mitral stenosis					
4.5. Manage a patient with tricuspid regurgitation					
4.6. Manage a patient with tricuspid stenosis					
4.7. Manage a patient with pulmonary regurgitation					
4.8. Manage a patient with pulmonary stenosis					

Continued

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Table 3 *Continued*

EPA	Level of independence				
	1	2	3	4	5
4.9. Manage a patient with multivalvular disease					
4.10. Manage a patient with a prosthetic valve					
4.11. Manage a patient with endocarditis					
5. Rhythm disorders					
5.1. Manage a patient with palpitations					
5.2. Manage a patient with transient loss of consciousness					
5.3. Manage a patient with atrial fibrillation					
5.4. Manage a patient with atrial flutter					
5.5. Manage a patient with supraventricular tachycardia					
5.6. Manage a patient with ventricular arrhythmia					
5.7. Manage a patient with bradycardia					
5.8. Manage a patient with a cardiac ion channel dysfunction					
5.9. Manage a patient with a pacemaker					
5.10. Manage a patient with an ICD					
5.11. Manage a patient with a CRT device					
6. Heart failure					
6.1. Manage a patient with symptoms and signs of heart failure					
6.2. Manage a patient with heart failure with reduced ejection fraction					
6.3. Manage a patient with heart failure with preserved ejection fraction					
6.4. Manage a patient with acute heart failure					
6.5. Manage a patient with cardiomyopathy					
6.6. Manage a patient with pericardial disease					
6.7. Manage a patient with right heart dysfunction					
6.8. Manage a patient with a cardiac tumour					
6.9. Manage cardiac dysfunction in oncology patients					
7. Acute cardiovascular care					
7.1. Manage a patient with haemodynamic instability					
7.2. Manage a patient with survived cardiac arrest					
7.3. Manage a critically ill cardiac patient					
7.4. Manage a patient after a percutaneous cardiovascular procedure					
7.5. Manage a patient after cardiac surgery					
7.6. Manage end-of-life care in a cardiac patient					
8. Prevention, rehabilitation, sports					
8.1. Manage cardiovascular aspects in an athlete (Sport Cardiology)					
8.2. Manage a patient with arterial hypertension					
8.3. Manage a patient with dyslipidaemia					
8.4. Manage cardiovascular aspects in a diabetic patient					
8.5. Manage a cardiac patient in primary prevention					
8.6. Manage a cardiac patient in secondary prevention					
8.7. Prescribe a prevention and rehabilitation programme for a cardiovascular patient					
9. Cardiac patients in other settings					
9.1. Manage a patient with aortic disease					
9.2. Manage a patient with trauma to the aorta or the heart					
9.3. Manage a patient with peripheral artery disease					
9.4. Manage a patient with thromboembolic venous disease					
9.5. Manage a patient with pulmonary thromboembolism					
9.6. Manage a patient with pulmonary hypertension					
9.7. Manage a patient with adult congenital heart disease					
9.8. Manage a pregnant patient with cardiac symptoms or disease					
9.9. Perform a cardiological consultation					

Each EPA is assigned an expected level of independence from level 1 to level 5: (1) Observe; (2) Direct supervision; (3) Indirect supervision; (4) Distant supervision; and (5) Able to teach (no supervision).

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Table 4 Level of independence for each investigation

Investigations	Levels of independence				
	1	2	3	4	5
ECG					
Ambulatory ECG					
Exercise ECG testing					
Cardiopulmonary exercise testing					
Ambulatory BP monitoring					
Transthoracic echocardiography					
Trans-oesophageal echocardiography					
Stress echocardiography					
Vascular ultrasound					
Coronary CT					
Cardiac CT					
Cardiac MR					
Nuclear imaging					
Right heart catheterization					
Endomyocardial biopsy					
Coronary angiography					
Percutaneous interventions					
Structural interventions					
Cardiac surgery					
Pacemaker programming					
ICD/CRT programming					
Temporary pacemaker implantation					
Permanent pacemaker implantation					
ICD/CRT implantation					
Electrophysiological studies					
Electrophysiological interventions					
Electrical cardioversion					
Pericardiocentesis					

Each investigation is assigned an expected level of independence from level 1 to level 5: (1) Observe; (2) Direct supervision; (3) Indirect supervision; (4) Distant supervision; and (5) Able to teach (no supervision).

entrust him/her with this clinical activity. We strongly encourage that assessment is integrated into routine clinical care. It is important to recognize that the competence of the trainee will further increase after completion of training due to continued learning, gaining of additional clinical experience, and continued medical education. Consistent with this clinical reality, knowledge when to consult more experienced colleagues or other experts is integrative to all EPAs. The key question for trainers assessing a trainee by an EPA, therefore, is whether the trainee is ready to (i) execute the respective professional activity in an independent manner and (ii) assume the expected professional responsibilities.

The tools for assessment depend on the nature of the professional activity; suitable tools are proposed in the assessment section of each EPA. To facilitate assessment with EPAs in the clinical context, *Table 5* indicates what should be aimed at and what should be avoided in the assessment situation. When the competence of a trainee is evaluated by EPAs, the assessment focuses on clinical skills, even though knowledge and attitudes are also tested. Nevertheless, assessment of the trainee should usually be complemented by a specific knowledge centred examination, such as the European Examination in General Cardiology (EEGC) (*Figure 3*). Similarly, attitudes should be additionally evaluated by multi-source feedback given by healthcare professionals and patients, helping trainees to develop the appropriate attitudes for clinical practice (*Figure 3*).

6. Role of the trainers

Entrustable professional activities are an opportunity for trainers. In the past, training was based on a syllabus, and the training level was often 'counted' by the number of investigations and procedures performed by the trainee.[7] That system was convenient to administer, but the quality of a trainee's clinical performance, their attitudes and their ability to work independently were not assessed. Entrustable professional activities , in contrast, capture how far a trainee can be trusted to perform a professional activity considering his or her skills, knowledge, and attitudes. It is the responsibility of the trainer to provide an environment in which the trainee can reach the expected level of independence during the training period. If a trainee does not reach this goal, however, EPAs provide a framework to extend the

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Table 5 Do's and Don'ts for the EPAs of the ESC Core Curriculum

For trainers	
Do's	**Don'ts**
Define the EPAs that are feasible and relevant for your setting; any clinical situation is an opportunity for an assessment	Don't think you are on your own; share challenges, tips, and tricks with peers
Use the Knowledge/Skills/Attitudes section of the EPAs as a resource for specific feedback	Don't use the Knowledge/Skills/Attitudes section as a checklist
Integrate the assessment real time in your daily work	Don't postpone the assessment
When observing a trainee always look for knowledge and attitudes, not only skills	Don't assess manual/technical skills only
Use your expert judgement to rate the level of the trainee's independence	Don't worry about subjectivity
For trainees	
Do's	**Don'ts**
Integrate the assessment in the workflow	Don't postpone assessments
Ask your trainer to rate the level of independence for every EPA you perform - and the reason for the level	Don't only ask for ratings in EPAs you are already competent in
Ask all your trainers to rate you at several occasions	Don't only ask for ratings from your favourite trainer
Identify the relevant EPAs for each setting	
Use your EPA profile for driving your learning and completing your competence	
Use Knowledge/Skills/Attitudes section of the EPAs to guide you in your training	

What should be aimed at and avoided by trainers and trainees in the assessment situation.

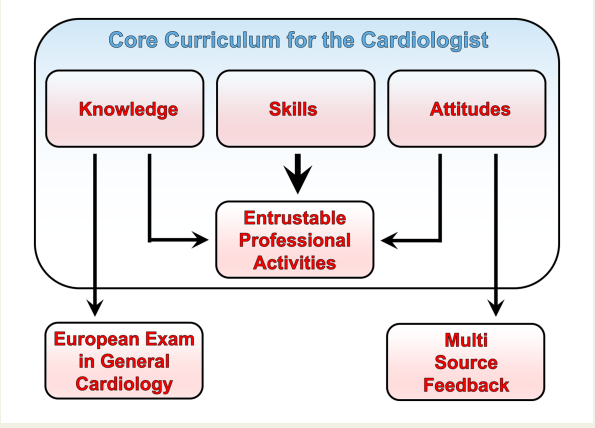

Figure 3 Entrustable professional activities define the knowledge, skills, and attitudes required for the respective clinical competencies. Due to their focus on skills, they are particularly useful for assessments in a clinical context. The latter should be complemented with a knowledge-based examination such as the European Exam in General Cardiology as well as with multisource feedback.

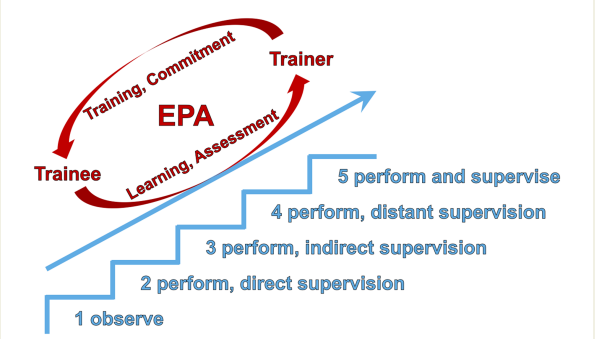

Figure 4 Trainees develop an increasing degree of independence during their training. In parallel, trainers develop increasing trust in the competence of their trainees. This process requires the commitment of both sides involved. Commitment of the trainers for teaching and assessing the trainees is essential since the trainers need to be able to confirm that the trainees can be trusted to perform the professional activities at the expected level of independence.

training until the trainers are able to confirm that the trainee can be trusted to perform the professional activity independently. With the adoption of EPAs, trainers may have greater demands on their time and energy for education, but they are rewarded with more meaningful assessments and defined responsibility for their trainees (*Figure 4*). The authors of this core curriculum hope that it is used in clinical practice for assessing clinical competencies and that it inspires both trainees and their trainers to reach responsible entrustment decisions.

Union of European Medical Specialists European Training Requirements

1. Preamble

The Union of European Medical Specialists (UEMS) is a non-governmental organization representing national associations of medical specialists at the European Level. With a current

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membership of 34 national associations and operating through 41 Specialist Sections and European Boards, the UEMS is committed to promote the free movement of medical specialists across Europe while ensuring the highest level of training which is required to optimize the quality of care for the benefit of all European citizens. The UEMS areas of expertise include Continuing Medical Education, Postgraduate Training, and Quality Assurance.

It is the UEMS's conviction that the quality of medical care and expertise is directly linked to the quality of training provided to medical professionals. Therefore, the UEMS is committed to improve medical training through the development of European Standards in the different medical disciplines. No matter where doctors are trained, they should have at least the same core competencies.

In 1994, the UEMS adopted its Charter on Postgraduate Training to provide recommendations for good medical training. Its six chapters set the basis for the European approach to Postgraduate Training. Five chapters are common to all specialties, with a 6th chapter completed by each Specialist Section according to the specific needs of their discipline.

Over 25 years after the introduction of this Charter, the UEMS Specialist Sections and European Boards continue developing European Standards in medical training that reflect modern medical practice and current scientific knowledge. In doing so, the UEMS Specialist Sections and European Boards do not aim to supersede the National Authorities' competence in defining the content of postgraduate training in their own State, but rather to complement these and ensure that high-quality training is provided across Europe.

At the European level, the legal mechanism ensuring the free movement of doctors through the recognition of their qualifications was established in the 1970s by the European Union Sectorial Directives, with one Directive specifically addressing medical Training. However, in 2005, the European Commission proposed a unique legal framework for the recognition of the Professional Qualifications to facilitate and improve the mobility of all workers throughout Europe. This Directive, 2005/36/EC, established the mechanism of automatic mutual recognition of qualifications for medical doctors according to training requirements within all Member States, based on the duration of training in the Specialty and the title of the qualification.

Given the long-standing experience of UEMS Specialist Sections and European Boards, and the European legal framework enabling Medical Specialists and Trainees to move from one country to another on the other, the UEMS is uniquely positioned to provide specialty-based recommendations. The UEMS values professional competence as 'the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served'.[8] While professional activity is regulated by national law in EU Member States, it must comply with International treaties and UN declarations on Human Rights as well as the World Medical Association International Code of Medical Ethics.

This document derives from the previous Chapter 6 of the Training Charter and provides definitions of specialist competencies as well as how to document and assess them. It provides the basic Training Requirements and should be regularly updated by UEMS Specialist Sections and European Boards to reflect scientific and medical progress.

2. Cardiology background

The objectives of the UEMS Cardiology Section (UEMS-CS) and ESC include the progressive harmonization of the content and quality of training in cardiology within the member states of the European Union (EU) and other European countries. To this end, the UEMS-CS will continue to co-operate with the European Society of Cardiology (ESC) and the individual national cardiology societies and professional bodies to define the training requirements for the specialty of cardiology. This will include the contents of training, the assessment of competence, and an outline of the desirable context for training - the requirements of trainees, trainers, and training institutions.

This process of standardization and harmonization of cardiology training runs in parallel with European developments in the certification, recertification, continuing medical education (CME), and continuing professional development (CPD) of cardiologists.

It is accepted that there is a prevailing trend for increased subspecialized in cardiology, and this is supported by both UEMS-CS and ESC whenever it is consistent with improved standards of clinical practice. However, in order to meet the needs of patients and the wide variety of models of service provision across Europe, it is essential that all cardiologists obtain broad-based training across all of cardiology, irrespective of any further sub-specialization, and it is this training in cardiology that is defined here.

3. Cardiology training aims

The training requirements for the specialty of Cardiology aim to produce a competent specialist cardiologist. A cardiologist, a subspecialization of a physician, predominantly cares for patients with cardiovascular disorders and the concepts of Cardiology and Cardiovascular Medicine can be used interchangeably. Care of patients with cardiovascular disorders embraces a wide range of emergency and elective clinical activities. Cardiologists need knowledge of not only the underlying disease processes, available diagnostic and therapeutic modalities but also an appreciation of the importance of the epidemiology and potential for the prevention of CVD. Cardiologists require a broad understanding of the cardiovascular needs of individual patients and the communities in which they live. In order to provide optimal patient care, cardiologists need the ability to work as members or leaders of teams and systems involving other healthcare professionals. Cardiologists, who work as hospital-based specialists or in the community, need to integrate their work with community-based primary care colleagues and also other hospital-based physicians, anaesthetists, and imaging specialists including radiologists and nuclear medicine specialists. Cardiologists have a wide variety of opportunities for research and their training is designed to facilitate opportunities for academic careers.

4. Training requirements

Training in cardiology places responsibilities not only on trainees, but also on their trainers and training programmes. While it is important for training to be individualised, there are core principles which are essential to train cardiologists who are able to deliver the care required by our population.

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4.1. Requirements of cardiology trainees

Cardiology trainees must be physicians licensed to practice and fulfil all legal and regulatory requirements in their country of training. They must have successfully completed general professional training with an extensive knowledge of the acute and chronic presentations of a broad range of medical and surgical conditions, acquired through active participation in patient care.

All trainees must have the necessary linguistic abilities to communicate complex information effectively with patients and colleagues. They must always act honestly and in their patients' best interests, in accordance with national and international guidance on human rights and medical ethics.

Cardiology is a rapidly evolving medical specialty and trainees must equip themselves to be life-long adult learners. They must engage fully with the requirements of their curriculum and training programme, including the supervised delivery of clinical care, taking part in teaching and training opportunities, and the preparation for required assessments. Trainees should provide formal and informal feedback on their training. They have a responsibility to raise any causes for concern about patient safety, their training or the training of their colleagues to their supervisors in accordance with national laws and regulations.

4.2. Requirements of cardiology trainers

The delivery of high-quality training requires highly skilled trainers with the necessary time to deliver a structured programme covering the cardiology core curriculum and to undertake the assessments required to ensure that trainees have satisfactorily completed their training. Trainers should be experienced cardiologists undertaking clinical practice, they should undergo specific training and CPD in educational supervision and assessment, and their role should be recognized by national training authorities.

Trainers must have a good working knowledge of the core curriculum, including their responsibilities for teaching, supervision, and assessment. All aspects of training must be appropriately supervised and assessed. The level of this supervision must be appropriate for the documented competence of the trainee and the clinical situation, it must also routinely include the opportunity to personally discuss all cases. As training progresses, the trainee should have the opportunity for increasing autonomy, consistent with safe and effective patient care.

4.3. Requirements of cardiology training programmes

Cardiology training programmes, organized at a national or regional level, are responsible for the selection of an appropriate number of trainees and the delivery of postgraduate training and assessment in a supportive learning environment. All programmes must provide structured education to enable trainees to acquire the knowledge, skills, and attitudes to complete the competencies detailed in the EPAs included in the core curriculum. Postgraduate training in Cardiology must be at least 5 years - including training in Medicine or Medical sub-specialties, which precede full-time cardiology training (*Figure 5*). Trainees should have the opportunity to receive part of their training in recognized training institutions in other member states of the EU or elsewhere. These training periods must be approved in advance by the relevant training authority. Training programmes should make reasonable adjustments to accommodate the needs of trainees with disabilities and those wishing to undertake less than full-time training.

A national authority should determine each country's process for the selection and appointment of trainees in cardiology. This should be regulated in accordance with national workforce planning projections. The process should be based on merit, transparent, objective, and open to all doctors who have completed basic medical training.

A national cardiology training committee should oversee all training programmes and provide external support when required. Each training programme should have a director who is an experienced trainer, supported by the educational and clinical supervisors in the training institutions. The director has overall responsibility for a training programme, co-ordinating placements within and outside the programme, attendance at courses and congresses, overseeing structured learning, and investigating concerns expressed by trainees or trainers. The duration of the training programme and the trainees' working patterns must comply with all applicable EU directives and national laws.

All trainees should have a named educational supervisor who is selected and appropriately trained to be responsible for the overall supervision and management of their educational progress during a placement or series of placements. They should also have a range of clinical supervisors who are trainers selected and appropriately trained to be responsible for overseeing the trainee's clinical work and providing constructive feedback during a training placement.

Supervisors should have formal documented meetings with their trainees at least every 3 months. Activity, progress, assessments, individual strengths, and weaknesses should be discussed and recorded in an agreed summary. The educational supervisor should issue a formal report on progress at the end of each year of training and when there is a change of supervisor, which is shared with the trainee and the training director. Progress against the core curriculum should be assessed regularly based on the required EPAs. At the end of the training programme, each trainee will be assessed according to the independence levels documented in the EPAs. This will document the

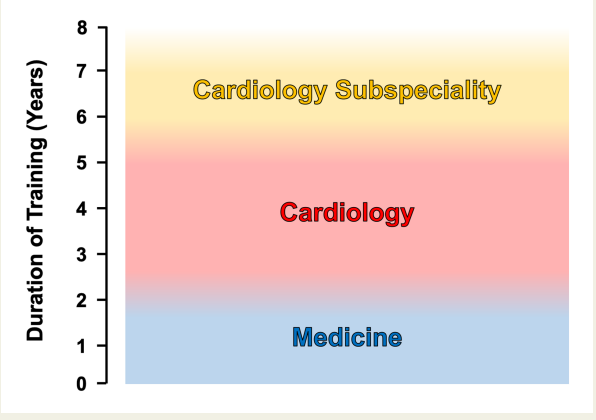

Figure 5 Postgraduate training in Cardiology must be at least 5 years. Training in Medicine or Medical sub-specialties precedes full-time cardiology training.

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competences achieved and whether the core curriculum has been completed satisfactorily.

4.4. Requirements of training institutions

Training may be delivered within a single institution but, more commonly, trainees may rotate between centres to acquire a full range of competencies. All training institutions should be nationally recognized and must provide a supportive learning environment including appropriate supervision, learning materials, dedicated time for learning, and structured assessments. There should be an appropriate number of fully trained cardiologists in each training institution to provide the educational and clinical supervision required by their trainees.

Each centre should undergo structured monitoring by the relevant authority including surveys and external evaluation of training and assessment at least every 5 years. Each centre should have an internal system of clinical audit and quality assurance including structured reporting of adverse or near miss events, morbidity and mortality meetings, and audits against national and international standards.

It is recognized that the case-mix and numbers of patients, investigations, procedures, and research opportunities will vary between centres. It is essential that programmes provide the full range of learning opportunities to all trainees over the duration of their training.

Training institutions should have a library and internet facilities offering access to the current world scientific literature, including major international cardiology and internal medicine journals, and should provide the necessary physical infrastructure for trainees including conference rooms and allocated office space with computer access.

In order to provide appropriate clinical experience, training institutions should have fully equipped facilities for treating outpatients, emergencies, and inpatients including a coronary care unit with electrocardiographic and haemodynamic monitoring. There should be on-site facilities for non-invasive diagnostic and therapeutic procedures including plain X-ray, electrocardiogram, exercise and pharmacological stress testing, cardiopulmonary exercise testing, ambulatory electrocardiography (ECG) monitoring, echocardiography, and programming of implanted pacemakers and cardiac defibrillators, temporary pacing, cardioversion, and defibrillation.

During their training programme, trainees must also receive appropriate training in cardiac magnetic resonance imaging, cardiac computed tomography (CT), nuclear cardiology, trans-oesophageal echocardiography, invasive coronary angiography, right and left heart catheterization and therapeutic procedures with exposure to cardiac surgery, a cardiothoracic intensive therapy unit with assisted ventilation, ultra-filtration, and haemodynamic support devices, and the wider Heart Team.

To gain sufficient experience, trainees should be involved in the clinical management of a large number or patients with a wide range of conditions including inpatients, new and review outpatients at least once each week, patients on the coronary care unit and provide cardiac consultations for other departments. Trainees should have a regular on-call commitment for cardiology throughout the programme, not only for general internal medicine or unselected medical emergencies. They should have at least 2 h each day for structured learning overseen by their supervisor, which may include explicit learning such as journal clubs, methodology of research and statistics, postgraduate teaching, training in communication skills, exercises in evidence-based medicine, discussion of guidelines for clinical practice; and implicit learning embedded in clinical work such as ward rounds, case-based discussions, or the supervised acquisition of diagnostic and therapeutic skills.

Research is fundamental to the practice of cardiology, as described in the CanMEDS framework (http://canmeds.royalcollege.ca/en/tools) in the role of a cardiologist as a 'scholar'. Trainees must acquire the skills to critically evaluate new research and its implications for clinical practice. They should also acquire a detailed understanding of the design and conduct of basic, translational, clinical, and epidemiological research either in their training institution or in collaboration with other centres or universities. Training programmes should provide sufficient flexibility to allow periods of full-time or part-time research with appropriate adjustment of the total training time.

5. Learning opportunities

Training in cardiology requires a broad exposure to many different types of clinical learning in order to acquire the knowledge, skills, and attitudes required of a cardiologist. It is important that trainees and trainers recognize training opportunities and take the time to develop clinical skills and understanding.

5.1. Knowledge

Personal study is essential to supplement and extend clinical learning. This includes reading textbooks, guidelines, and journals, writing reviews and other teaching materials, computer-based learning including ESC e-Learning platform, practicing and writing examination questions. Trainees should attend local, national, and international cardiology educational events to see the latest research, hear key opinion leaders and meet their peers and trainers from other programmes. Learning in small groups led by a supervisor facilitates discussion and understanding of complex clinical problems. Cardiology trainees should take part in case presentations, small group discussions, presentations at clinical and academic meetings, critical incident analysis, bedside teaching, small group sessions of data interpretation, participation in audit meetings, journal clubs, and research presentations. Trainees must acquire a thorough understanding of the rationale and methodology of audit and undertake a minimum of one in-depth audit every 2 years of training. This should include review of guidance with recommendations for revision where indicated.

5.2. Skills

Although clinical training requires structured teaching, it is important to recognize that all patient interactions, whether personal or observed, are opportunities for clinical learning which can be enhanced by following the patient through the course of their illness and critical reading about clinical problems. Trainees should have the opportunity to assess both new and follow-up outpatients and to discuss each case with their supervisor to allow feedback on diagnostic reasoning and planning investigations. Ward rounds should include discussion and feedback on clinical and decision-making skills. Trainees should also take part in multidisciplinary meetings which are excellent opportunities to discuss clinical problems with clinicians in

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other disciplines. Undertaking supervised practical procedures, including the care and counselling of patients and carers before and after the procedure, is essential to gain competence in these aspects of the curriculum. Role play with advances in the methodology of simulation training and technology, facilitate task and team training in a safe environment. As trainees gain experience, they progress from observing to performing and from simple to more complex cases. Trainees should maintain a logbook of all practical procedures (*Table 4*).

5.3. Attitudes

The attitudes and behaviours required of a cardiologist must be developed throughout training by interactions with patients in a variety of clinical settings, and the wider clinical team including medical, nursing, and other health professional colleagues within cardiology and from other disciplines. Trainees should learn from their trainers and their peers to provide the best possible care for their patients.

6. Assessment

Meaningful assessment is a requirement of any training programme and must be closely aligned to the curriculum (*Table 1*). Cardiologists are required to perform a wide range of clinical and procedural tasks independently. These tasks are EPAs which include knowledge, skills, and attitudes (*Figure 3*). Trainees must document frequent workplace-based assessments throughout training to allow them to gather evidence of competence, receive feedback, and continually gain autonomy in their professional practice (*Figure 4*).

The aims of EPA-based assessment are to:

- Focus learning by providing clarity on training requirements
- Enhance learning by providing formative feedback on performance
- Assess trainees' actual performance in the workplace
- Ensure trainees are acquiring competencies at an appropriate rate
- Identify any requirements for targeted or additional training
- Provide evidence for decisions on progression through the training programme
- Provide objective, summative evidence that trainees have met the curriculum standards during the training programme.

A wide range of tools is available to assess progress in the levels of independence (*Table 2*) required for each EPA of the curriculum (*Table 3*). These should be used routinely as part of the learning process with timely and specific feedback on performance.

6.1. Knowledge

Acquisition of knowledge is a prerequisite for training. In addition to continuous acquisition of knowledge during training, attending approved, high-quality educational events, and using online resources, e.g. those approved by the European Accreditation Council for Continuing Medical Education (EACCME), are an increasingly useful source of knowledge. Trainees are strongly encouraged to test their knowledge with multiple choice questions (MCQs), related to the chapters of the core curriculum such as those provided on the ESCeL platform. The EEGC is a tried and tested tool to assess knowledge. It is delivered as a computer-based summative test of a broad range of general cardiology knowledge delivered once each year by computer in 120 MCQs over 3 h. It is a joint venture between the ESC and UEMS-CS and is a training requirement in many European countries. Trainees may also be required to take local or national tests of knowledge and may choose to certify in one or more cardiology sub-specialties through the ESC certification programmes.

6.2. Skills

Cardiology training requires the acquisition of a wide range of clinical and advanced procedural skills. Trainees must keep a record of their clinical experience in a logbook and undertake frequent workplace-based assessments throughout training to allow them to continually gather evidence of learning and receive formative feedback. These assessments should be kept in a training portfolio and should include case-based discussions (CbD) and mini-clinical evaluation exercises (mini-CEX) focused on learning points with individual patients, with assessment of clinical management, decision-making, team working, time management, record keeping, and handover over a clinic, ward-round or whole day, assessed using an acute care assessment tool. Video assessment and feedback may be used to facilitate discussion and learning. The acquisition of procedural skills should be assessed by direct observation using a summative (DOPS) assessment tool. The trainee should receive immediate feedback to identify strengths and areas for development. Cardiology trainees need to acquire skills in teaching as well as undertaking audits and quality improvement projects. These skills should be assessed by direct observation and discussion using suitable tools (teaching observation; audit assessment tool; quality improvement project assessment tool).

6.3. Attitudes

The development of trainees' attitudes and behaviours can be assessed by reports from multiple trainers (multiple consultant reports) but it is also important to obtain structured feedback from other members of the multidisciplinary team. Multi-source feedback should be arranged by the trainee's educational supervisor. This can provide valuable insights into generic skills such as communication, leadership, team working, and reliability, from more senior and more junior doctors, nurses, administration staff, and other clinical professionals. Feedback must be given by the supervisor to facilitate honest, constructive feedback. Patient surveys should also be conducted early and towards the end of training to assess patients' perceptions of the trainee's communication skills.

1. Chapter 1: The cardiologist in the wider context

1.1. Preamble

This curriculum presents the framework for a physician to train to manage diseases of the heart and circulation and specialise as a cardiologist. Beyond the specialty-specific proficiencies required to be a medical expert outlined in subsequent chapters, there are several general competencies that underpin a physician's ability to perform well as a doctor.

In the majority of training programmes in Europe, these core generic competencies are addressed during the common trunk, with further instruction during speciality training, both as a part of specialty-specific training modules, but also in a standalone manner.

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A number of core generic competencies are suitable for dedicated instruction and certification. Communication, management, and leadership skills are central to the practice of clinical medicine. Formal instruction in medical ethics is important to generate a consistently ethical approach to practice. Implementing principles of quality and safety in medicine is not automatic - a deliberate and informed approach is necessary including instruction in clinical audit and data registration. Doctors must have a commitment to life-long learning, and the ability to critically appraise new evidence. They benefit from an understanding of research methodology and involvement in clinical research. Increasingly, doctors take on roles as advocates who must interact with policymakers and politicians, and engagement in hitherto unfamiliar fields, such as health economics and health technology assessment, is important. Cardiology, more than many other branches of medicine, is adopting digital technology in diagnosis, management, and communication with patients, and trainees must be prepared for the significant changes in practice this will involve.

The Royal College of Physicians and Surgeons of Canada has produced a widely accepted standard framework of 'roles', CanMEDS, that in their words 'identifies and describes the abilities physicians require to effectively meet the health care needs of the people they serve'.

Whereas the CanMEDS roles can be assessed and taught individually as outlined below, it is important to know that they are **all** represented to a different extent in **each** of the EPAs of Chapters 2–9. Entrustable professional activities are proposed as the preferred method of assessing specialty competencies, which means that many of the generic competencies (CanMEDS roles) are assessed as a part of an EPA in everyday practice.

We have adopted the CanMEDS framework to represent the core generic competencies that cardiology trainees must acquire and provide below a matrix to understand their relevance to the Cardiology curriculum and offer suggestions as to how these might be assessed.

1.2. CanMEDS roles

These roles are based on the CanMEDS framework: http://canmeds.royalcollege.ca/ http://canmeds.royalcollege.ca/en/tools

The roles of a Cardiologist described in Chapter 1 are all represented, to a variable extent, within each EPA of Chapters 2–9 but can also be assessed and taught individually.

Role	Description/ competencies	Key competencies	Examples of possible assessment methods	Examples of possible teaching methods
1.1. Medical expert	As medical experts, cardiologists integrate all of the CanMEDS roles, applying medical knowledge, clinical skills, and professional values in their provision of high-quality and safe patient care. This is the central cardiologist role and defines the cardiologist's scope of practice.	(1) Practise medicine within their defined scope of practice and expertise (2) Perform a patient-centred clinical assessment and establish a management plan (3) Plan and perform procedures and therapies for the purpose of assessment and/or management (4) Establish plans for ongoing care and, when appropriate, timely consultation (5) Actively contribute, as an individual and as a member of a team providing care, to the continuous improvement of healthcare quality and patient safety (6) Apply novel digital methods of diagnosis, treatment communication and process to achieve optimal clinical outcomes	• Multi-source feedback • Direct observation – Workplace-based assessment (WBA) • Objective Structured Clinical Examination (OSCE) • Clinical Letter analysis	• Lecture or large group session • Guided reflection • Simulation • Ward rounds (bedside teaching) • Coaching

Continued

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Role	Description/ competencies	Key competencies	Examples of possible assessment methods	Examples of possible teaching methods
1.2. Communicator	As communicators, cardiologists form relationships with patients and their families that facilitate the gathering and sharing of essential information for effective health care.	(1) Establish professional therapeutic relationships with patients and their families (2) Elicit and synthesize accurate and relevant information, incorporating the perspectives of patients and their families (3) Share healthcare information and plans with patients and their families (4) Engage patients and their families through shared decision-making in developing plans that reflect the patient's healthcare needs and goals (5) Document and share written and electronic information about the medical encounter to optimize clinical decision-making, patient safety, confidentiality, and privacy	• Direct observation - WBA • OSCE • Multi-source feedback • Clinical letter analysis	• Lecture or large group session • Small group activity • Coaching • Presentations • 'Mastering Communication' Course
1.3. Collaborator	As collaborators, cardiologists work effectively with other healthcare professionals to provide safe, high-quality, patient-centred care.	(1) Work effectively with physicians and other colleagues in the healthcare professions (2) Work with physicians and other colleagues in the healthcare professions to promote understanding, manage differences, and resolve conflicts ('Heart Team') (3) Hand over the care of a patient to another healthcare professional to facilitate continuity of high-quality and safe patient care	• OSCE • Multi-source feedback • Direct observation - WBA	• Lecture or large group session • Guided reflection • Coaching • Simulations

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Role	Description/ competencies	Key competencies	Examples of possible assessment methods	Examples of possible teaching methods
1.4. Leader	As leaders, cardiologists engage with others to contribute to a vision of a high-quality healthcare system and take responsibility for the delivery of excellent patient care through their activities as clinicians, administrators, scholars, or teachers.	(1) Contribute to the improvement of healthcare delivery in teams, organizations, and systems (2) Engage in the stewardship of healthcare resources (3) Demonstrate leadership in professional practice (4) Manage career planning, finances, and human health resources in a practice	• Multi-source feedback • Direct observation - WBA	• Lecture or large group session • Small group teaching • M&M-Rounds • Self-directed learning • Quality improvement courses • Leadership in clinical practice courses
1.5. Health advocate	As health advocates, cardiologists contribute their expertise and influence as they work with communities or patient populations to improve health. They work with those they serve to determine and understand needs, speak on behalf of others when required, and support the mobilization of resources to effect change.	(1) Respond to an individual patient's health needs by advocating with the patient within and beyond the clinical environment (2) Respond to the needs of the communities or populations they serve by advocating with them for system-level change in a socially accountable manner	• Multi-source feedback • OSCE • Portfolio • Essays • Direct observation - WBA	• Lecture or large group session • Guided reflection and discussion • Small group learning • Communication courses • Leadership courses
1.6. Scholar	As scholars, cardiologists, demonstrate a life-long commitment to excellence in practice through continuous learning and by teaching others, evaluating evidence, and contributing to scholarship.	(1) Engage in the continuous enhancement of their professional activities through ongoing learning (2) Teach students, residents, the public, and other healthcare professionals (3) Integrate best available evidence into practice (4) Contribute to the creation and dissemination of knowledge and practices applicable to health	• Multi-source feedback • Portfolio • Direct observation—WBA	• Lecture or large group session • Guided reflection and dscussion • Coaching • Teaching scripts • Teach the teacher courses • Health research methods • Scientific writing courses • Internet search courses • Digital medicine courses
1.7. Professional	As professionals, cardiologists, are committed to the health and well-being of individual patients and society through ethical practice, high personal standards of behaviour, accountability to the profession and society,	(1) Demonstrate a commitment to patients by applying best practices and adhering to high ethical standards (2) Demonstrate a commitment to society by recognising and responding	• Direct observation - WBA • Multi-source feedback • Portfolio	• Lecture or large group session • Simulations • Ethics courses

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Role	Description/ competencies	Key competencies	Examples of possible assessment methods	Examples of possible teaching methods
	physician-led regulation, and maintenance of personal health.	to societal expectations in health care (3) Demonstrate a commitment to the profession by adhering to standards and participating in physician-led regulation (4) Demonstrate a commitment to physician health and well-being to foster optimal patient care		

2. Chapter 2: Imaging

2.1. Assess a patient using one or multiple imaging modalities

Description

Timeframe: from indication for using single or multiple cardiac imaging modalities to integration of reports in clinical context

Setting: inpatient setting, outpatient setting, acute, and elective situations

Including:

selecting, basic interpretation, and integration of information from multiple imaging modalities performing echocardiography, and CT coronary angiography

Excluding:

performing CMR, Cardiac CT, and nuclear cardiology scans

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Recognize the use of multiple modalities to assess and evaluate cardiac structure and function in health and disease including qualitative and quantitative techniques
- Applying pre- and post-test probability principle to choice of test
- Describe techniques to evaluate:
  - Cardiac chamber size and wall thickness
  - Left ventricular (LV) mass
  - Ventricular and atrial volumes
  - Measurement of left (LV) and right (RV) ventricular systolic function
  - LV and RV diastolic function
  - Native and prosthetic valves including qualitative and quantitative evaluation of structure and function (stenosis and regurgitation) from screening to indications for intervention
  - Suspected and definite infection of native and prosthetic valves
  - Cardiac infection/inflammation
  - Coronary artery disease, including calcification of coronary arteries (+calcium score); non-invasive angiography
  - The ischaemic myocardium, including regional wall motion abnormalities, scar, stunning, hibernation, perfusion, and viability
  - Myocardial and pericardial disease including screening for cardiomyopathies
  - Cardiac tumours/masses

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  - Congenital heart disease
  - Intracardiac shunts and simple congenital lesions
  - Aortic diseases
  - Diseases of the pulmonary circulation including pulmonary hypertension
  - The effects of surgical and interventional procedures
- Outline principles of stress testing as applied in cardiac imaging, including treadmill and bicycle exercise and vasodilator stress (dipyridamole, adenosine, and related agents) and sympathomimetic stress (dobutamine)
- Recognize radiation exposure with different imaging techniques and outline principles of radiation protection
- Recognize the possibilities for non-cardiac structures to cause artefacts or be visualized on scans

Skills

- Choose the safest, most accurate, efficient, and cost-effective imaging test or sequence of tests in circumstances where they provide added value for the patients—improving outcomes or decreasing costs
- Interpret results of imaging examinations and extract prognostic information
- Ensure safety through understanding the individual modalities and their potential side effects (radiation, renal function)
- Explain the modalities and reasons for their selection to patients and their families

Attitudes

- Combine imaging techniques, modalities, and protocols in a clinically useful and cost-effective way
- Avoid over- and underutilization of tests and, where applicable, keeping in mind radiation exposure
- Interact co-operatively with radiologists, nuclear physicians, paramedical, and other medical professionals
- Respect patient's modesty and privacy

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

2.2. Assess a patient using echocardiography

Description

Timeframe: from indication for using echocardiography until interpretation of generated reports

Setting: inpatient setting, outpatient setting, acute, and elective situations

Including:

performing and reporting a comprehensive transthoracic echocardiogram (supervision level: no supervision)

performing and reporting a trans-oesophageal echocardiogram (supervision level: indirect supervision)

performing and reporting a stress echocardiogram (supervision level: direct supervision)

Excluding: Complex valvular disease and complex congenital disease

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Recognize echocardiography as the primary cardiac imaging modality including in acute and emergency situations
- Describe the use of different techniques:
  - M-mode
  - Two- and three-dimensional modes
  - Doppler imaging (blood flow, tissue)
  - Contrast echocardiography
  - Trans-oesophageal echocardiography (TOE)

Continued

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– Deformation imaging (speckle-tracking- and Doppler-based strain analysis)
– Stress-echo modalities (exercise and/or pharmacological echo)
- Distinguish the particular challenges of emergency echocardiography

Skills
- Manipulate the echo probe and operate the machine to undertake:
– Transthoracic echocardiography
– Trans-oesophageal echocardiography
using the techniques listed above for the indications in Section 2.1
- Interpret the images obtained to provide a clinical report

Attitudes
- Integrate echocardiography with history taking, clinical examination, and ECG (at rest and during exercise) as the baseline evaluation of the cardiac patient
- Recognize the strengths and weaknesses of echocardiography in a clinical situation and in relation to other imaging modalities
- Be willing to refer for other imaging modalities when necessary
- Interact co-operatively with sonographers and paramedical staff for acquisition of the data

Assessment tools
- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence
- 5. Able to teach (no supervision)

2.3. Assess a patient using cardiac magnetic resonance

Description
Timeframe: from indication for cardiac magnetic resonance scans until interpretation of reports
Setting: inpatient setting, outpatient setting, acute, and elective situations
Including:
basic interpretation of images for obvious pathologies
Excluding: supervising and undertaking scans, reconstruction of images

CanMEDS roles
- Communicator
- Collaborator
- Professional

Knowledge
- Outline core physics and techniques:
– Basic CMR physics
– Image quality and artefacts
– CMR safety and safety of medical devices in CMR
– CMR contrast agents: indications and safety
– CMR methodology
- Outline CMR application to:
– Cardiac anatomy (including dark and bright blood techniques)
– Cardiac function
– Tissue characterization (including contrast-enhanced techniques) and pathognomonic signs for specific conditions (e.g. T1, T2, T2 star, late gadolinium enhancement distribution)
– CMR stress imaging (myocardial perfusion)
– Flow mapping on CMR and non-contrast angiography

Continued

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Skills

- Apply appropriate indications and avoid contraindications to CMR examinations
- Interpret to a limited extent CMR images in the clinical context

Attitudes

- Support cardiologists and radiologists undertaking CMR scans
- Co-operate with radiologists, paramedical, and other medical professionals

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 3. Indirect supervision

2.4. Assess a patient using cardiac computed tomography

Description

Timeframe: from indication for cardiac CT scans until interpretation of reports

Setting: inpatient setting, outpatient setting, acute, and elective situations

Including:

Undertaking, reconstructing, and interpreting CT coronary angiography. Basic interpretation of CT cardiac images of chambers and valves for obvious pathologies

Excluding: supervising and undertaking comprehensive cardiac scans, reconstruction of cardiac chambers and valve images

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe Cardiac CT imaging techniques:
  - Test bolus acquisition and bolus chasing
  - Heart rate control
  - Prospective ECG-triggered axial, and retrospectively ECG gated spiral scan modes
  - Cardiac X-ray CT with and without contrast enhancement
  - Coronary calcium score
  - Coronary artery disease and aortic disease (dissection)
  - CT fractional flow reserve (FFR)
  - Basics of cardiac morphology

Skills

- Apply appropriate indications for and avoid contraindications to cardiac CT
- Use gated CT in the presence of arrhythmias and tachycardia
- Reconstruct coronary CT images and interpret in the clinical context
- Interpret in a limited way reconstructed CT images of chambers and valves in the clinical context

Attitudes

- Interact co-operatively with radiologists, paramedical, and other medical professionals
- Appraise the side effects of contrast media and the risks of radiation to patient and personnel

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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2.5. Assess a patient using nuclear techniques

Description

Timeframe: from indication for cardiac nuclear imaging scans until interpretation of reports

Setting: indication for nuclear imaging techniques and interpretation and contextualization of reports from cardiac nuclear studies including hybrid studies

Including:

basic interpretation of images for obvious pathologies

Excluding: supervising and undertaking scans and, reconstructing images

CanMEDS roles

- Communicator
- Collaborator
- Professional

Knowledge

- Understand the basic principles of radionuclide imaging as applied to the cardiovascular system including radioisotopes and radiopharmaceuticals (201Tl, 99mTc-sestamibi, or 99mTc-tetrofosmin)
  a. Gamma cameras
  b. Image acquisition
  c. Reconstruction, display, and interpretation
- Describe the basic principles of different techniques:
  – Single-photon emission CT perfusion scintigraphy (SPECT) - gated SPECT (perfusion and LV function)
  – Positron emission tomography (PET): myocardial perfusion, glucose metabolism, and inflammation imaging
  – Hybrid techniques (PET-CT and SPECT-CT) for attenuation corrected imaging and for combined anatomical and functional imaging
  – radionuclide ventriculography using equilibrium planar and SPECT imaging
  – Imaging of sympathetic innervation
  – Labelled leucocyte imaging for myocardial abscesses and infection
  – Imaging of myocardial sarcoidosis
  – Imaging of pulmonary embolism, quantification of pulmonary perfusion and right-to-left shunting
  – Bone scanning for amyloid
- Understand the principles of:
  – Rest imaging
  – Stress imaging (exercise and pharmacological stress with vasodilators and sympathomimetic agents)
  – Two-day and 1-day protocols

Skills

- Select appropriate indications and avoid contraindications to nuclear cardiology techniques
- Supervise cardiovascular stress testing using dynamic exercise and pharmacological techniques
- Interpret to a limited extent nuclear cardiac images in the clinical context

Attitudes

- Co-operate with referring colleagues and with nursing staff, nuclear medicine physicians and technical and physics professionals
- Demonstrate awareness of the side effects of ionizing agents and recognition of the risks of radiation to patient and personnel

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 2. Direct supervision

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3. Chapter 3: Coronary artery disease

3.1. Manage a patient with symptoms suggestive of coronary artery disease

Description

Timeframe: from first patient contact until diagnosis or exclusion of coronary artery disease or other cause

Setting: outpatient setting, emergency department, inpatient setting

Including:

initial assessment based on clinical history and physical examination

differential diagnosis

performance and interpretation of basic initial investigations

formulation of management plan

Excluding: performing actual therapy of coronary artery disease

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health Advocate

Knowledge

- Describe the range and meaning of words used by a patient to describe symptoms
- Review the symptoms of coronary artery disease and the features that differentiate them from other cardiovascular and non-CVDs
- Know the differential diagnosis of chest paint
- Discuss the cardiovascular risk factors and their importance in the probability and diagnosis of coronary artery disease in the individual patient
- Describe the coronary artery disease pre-test probability risk score and the risk stratification scores of the different types of coronary artery disease (acute vs. chronic coronary syndromes)

Skills

- Take relevant history and perform appropriate clinical examination
- Integrate the patient's history with the findings of clinical examination and the results of relevant investigations in order to make the diagnosis
- Identify non-cardiac causes and refer the patient to the appropriate specialties
- Formulate a management plan
- Utilize relevant risk scores
- Make and record accurate observations about the clinical state of the patient
- Perform thorough clinical (and basic neurological) examination
- Record the history and findings of clinical examination in a structured electronic or written file
- Select basic initial investigations (routine venous blood tests, arterial blood gases, chest X-ray, ECG, echocardiography)

Attitudes

- Allow sufficient time for the patient to describe symptoms in their own words
- Respect the patient's socioeconomic, ethnical, cultural, and religious background
- Ensure the dignity of the patient during examination

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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3.2. Manage a patient with acute coronary syndrome

Description

Timeframe: from diagnosis of an acute coronary syndrome until effective treatment or referral
Setting: emergency department, outpatient setting, inpatient setting
Including:
assessment by clinical history and physical examination
performance and interpretation of basic diagnostic modalities
interpretation of additional diagnostic modalities
use of specific risk scores
administration of medical therapy
decision when interventional management is needed
monitoring
secondary prevention
Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Leader
- Health advocate

Knowledge

- Describe the pathophysiology of acute coronary syndrome (ACS)
- Discuss the non-atherosclerotic causes of ACS
- Define the diagnostic criteria of ACS
- Discuss the use of validated ACS risk scores
- Review the role of different diagnostic techniques (including ECG, troponin and other biomarkers, echocardiography, and other imaging techniques) in the management of a patient with ACS
- Describe the universal definition of myocardial injury and infarction
- Describe the properties, effects, indications, contraindications, and secondary effects of analgesics, anti-ischaemic drugs, anticoagulants, fibrinolytics, platelet inhibitors, statins, and other drugs administered in a patient with ACS
- Discuss the role and timing of diagnostic coronary angiography and revascularization in the management of ACS
- Describe early and late complications of ACS and their management
- Consider the impact of co-morbidities

Skills

- Take a relevant history and perform an appropriate clinical examination
- Use an ACS score for risk stratification and management of a patient with ACS
- Interpret the ECG and biomarker measurements
- Perform and interpret imaging techniques
- Monitor a patient with ACS
- Manage arrhythmias due to ACS
- Implement anti-thrombotic and anti-ischaemic therapy
- Formulate a management plan for a patient after discharge following an ACS

Attitudes

- Communicate promptly with staff in the ambulance service, emergency department, cardiac care unit, and catheter laboratory
- Involve the Heart Team in complex cases
- Expedite timely decisions on patients with an ACS
- Appreciate the distress that unexpected and serious illness causes both to a patient and their relatives
- Communicate with family and relatives on the risk and expected outcome
- Contribute to improving public awareness of the significance of chest pain and the importance of early presentation

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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3.3. Manage a patient with chronic coronary syndrome

Description

Timeframe: from diagnosis of a chronic coronary syndrome until effective treatment or referral

Setting: outpatient setting, inpatient setting, and emergency department

Including:

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical management

secondary prevention

indication for coronary angiography and/or revascularization strategies

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate

Knowledge

- Outline the epidemiology of and risk factors for chronic coronary syndromes
- Describe the molecular and cellular biology of chronic coronary disease
- Outline the essential features of normal coronary physiology
- Describe the pathophysiology of myocardial ischaemia, including stunning, hibernation, and viability
- Describe the events that precipitate angina
- Discuss the prognosis of chronic coronary syndromes
- Describe the indications for utilization of specific diagnostic procedures including rest ECG ambulatory ECG, stress test in its different modalities, echocardiography, cardiac computed tomography angiography, cardiac magnetic resonance imaging (MRI), and invasive coronary angiography
- Analyse the interpretation of non-invasive tests based on Bayes' theorem
- Discuss the interpretation of invasive tests
- Describe medical therapy of chronic stable angina
- Consider the indications for revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) and the factors that favour one approach over the other
- Discuss the importance of co-morbidities in the management and prognosis of chronic coronary syndromes

Skills

- Take a relevant history and perform an appropriate clinical examination
- Incorporate risk stratification to planning the individual management strategy
- Identify and treat risk factors for coronary artery disease including lifestyle modification
- Utilize appropriate therapies for secondary prevention (see specific EPAs) and myocardial ischaemia
- Manage arrhythmias associated with chronic coronary syndromes
- Select appropriate patients for referral for revascularization by PCI or CABG
- Make recommendations on the need for diagnostic tests during follow-up
- Perform and interpret basic diagnostic modalities and manage emergencies occurring during the test (see specific EPAs)
- Assess and manage co-morbidities with the help of other specialists

Attitudes

- Support the Heart Team and, where appropriate, other physicians
- Maintain consistent adherence to agreed evidence-based protocols in collaboration with off-site interventional cardiologists and cardiac surgeons in the absence of on-site cardiac surgery and/or interventional cardiology
- Participate actively in the Heart Team
- Include the patient in the decision process regarding the management of the disease (medical vs. PCI vs. CABG)

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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3.4. Assess a patient using coronary angiography

Description

Timeframe: from indication for use of coronary angiography until interpretation of generated reports

Setting: inpatient setting, elective situations

Including:

performance of an elective diagnostic coronary angiogram

interpretation of generated images and reports

Interpretation of reports from other invasive diagnostic modalities

Excluding: complex and acute situations (more complex cases would require support or referral)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Discuss the indications for coronary angiography
- Outline the principles of radiation physics and safety regulations
- Explain how to prevent and manage the nephrotoxic effects of contrast agents
- Describe the radiological anatomy of the heart, aorta, large vessels, coronary, femoral, radial, and brachial arteries
- Describe the different catheterization equipment (types of catheters used in coronary angiography, transducers, power injector, and physiological monitoring)
- Discuss the advantages and disadvantages of different sites and techniques of vascular access
- Classify the complications of coronary angiography and the principles of their management
- Outline the indications for invasive imaging [intravascular ultrasound (IVUS), optical coherence tomography (OCT)] or functional assessment (FFR, instantaneous wave-Free Ratio)

Skills

- Assess the possibility of contrast induced allergic reactions and take adequate prophylactic measures
- Individualize arterial access
- Use the equipment in order to minimize radiation exposure and the dose of nephrotoxic contrast agents
- Obtain arterial (femoral and radial) access and achieve haemostasis
- Perform simple coronary angiography, ventriculography, and aortography (including angiography of arterial and venous coronary bypass grafts)
- Recognize complications and manage life-threating arrhythmias occurring during coronary angiography
- Estimate risk scores for PCI and CABG treatment
- Inform and consent the patient

Attitudes

- Take responsibility for the appropriate ordering and performance of coronary angiography
- Co-operate effectively with the members of the Heart Team, nurses, and technicians
- Adopt a consistent analytical approach to selecting the appropriate management (medical, percutaneous, or surgical)

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 3. Indirect supervision

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4. Chapter 4: Valvular heart disease

4.1. Manage a patient with aortic regurgitation

Description

Timeframe: from diagnosis of aortic regurgitation (AR) until referral for surgical/interventional therapy

Setting: outpatient setting, inpatient setting, emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- List the causes of AR
- Describe the haemodynamics of AR
- Describe the pathophysiology of AR and its effect on the heart and circulation
- Describe the symptoms and clinical signs of AR
- Outline the natural history and prognosis of AR
- Describe the values and limitations of diagnostic modalities, in particular echocardiography
- Quantify the severity of AR and its effect on cardiac function
- Plan the follow-up under conservative management of a patient with AR
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of conservative, interventional, and surgical management
- Discuss the impact of aortic root dilatation, concomitant coronary artery disease, and other co-morbidities on the management and outcome of AR

Skills

- Take a relevant history and perform an appropriate physical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac magnetic resonance (MR)
- Decide on the strategy and frequency of follow-up
- Identify the appropriate timing for interventional or surgical therapy
- Optimize patient condition in preparation of interventional or surgical therapy
- Assess the benefits and risks of different therapeutic approaches

Continued

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Attitudes

- Allow adequate time for evaluation of symptoms using, when appropriate, the results of exercise testing
- Limit the investigations to those required to reach a definitive assessment and for planning a therapeutic intervention
- Educate the patient on the cause and likely natural history, and consequences of their AR
- Educate the patient on the necessity for compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on the benefits and risks of different therapeutic approaches
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

4.2. Manage a patient with aortic stenosis

Description

Timeframe: from diagnosis of aortic stenosis (AS) until referral for surgical/interventional therapy

Setting: outpatient setting, inpatient setting, emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- List the causes of AS
- Describe the haemodynamics of AS
- Describe the pathophysiology of AS and its impact on the heart and circulation
- Describe the symptoms and clinical signs of AS
- Outline the natural history and prognosis of AS
- Describe the values and limitations of diagnostic modalities; in particular echocardiography
- Quantify the severity of AS and its effect on cardiac function
- Plan the follow-up during conservative management of a patient with AS
- Explain the current guidance on endocarditis prophylaxis
- Discuss the indications for aortic valve replacement, with or without replacement of the ascending aorta
- Describe the indications, benefits, and risks of conservative, interventional, and surgical therapy
- Discuss the impact of aortic root dilatation, concomitant coronary artery disease, and other co-morbidities on the management and outcome of AS

Skills

- Take a relevant history and perform an appropriate physical examination
- Select appropriate diagnostic modalities
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography

Continued

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- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Identify the appropriate timing for interventional or surgical therapy
- Optimize patient condition in preparation of interventional or surgical therapy
- Assess the benefits and risks of different therapeutic approaches

Attitudes

- Allow time for careful evaluation of symptoms using, when appropriate, the results of exercise testing
- Limit investigations to those required for definitive diagnosis and planning for an intervention
- Educate the patient on the cause, and probable natural history of their AS
- Educate the patient on the necessity for regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic approaches
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

4.3. Manage a patient with mitral regurgitation

Description

Timeframe: from diagnosis of mitral regurgitation until referral for surgical/interventional therapy
Setting: outpatient setting, inpatient setting, and emergency department
Including:
initial assessment based on clinical history and physical examination
identification of causes and differential diagnosis
performance and interpretation of basic diagnostic modalities
interpretation of additional diagnostic modalities
medical therapy
Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Continued

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Knowledge

- List the primary and secondary causes of MR
- Describe the haemodynamics of acute and chronic MR
- Describe the pathophysiology of primary and secondary MR and its impact on the heart and circulation
- Describe the symptoms and clinical signs of MR
- Outline the natural history and prognosis of MR
- Describe the values and limitations of diagnostic modalities, in particular echocardiography
- Quantify the severity MR and its effect on cardiac function
- Plan the follow-up and medical management of a patient with MR
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of medical, interventional, and surgical therapy
- Discuss the impact of concomitant coronary artery disease and other co-morbidities on the management and outcome of MR

Skills

- Take a relevant history and perform an appropriate physical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Identify the appropriate timing for interventional or surgical therapy
- Optimize patient condition in preparation for interventional or surgical therapy
- Manage heart failure (HF) with medical therapy and devices in a patient with secondary MR
- Assess the benefits and risks of different therapeutic approaches according to patient characteristics

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Apply only the diagnostic modalities required for reaching a definitive diagnosis and for planning a therapeutic intervention
- Educate the patient on the cause of their MR and the predicted clinical course
- Educate the patient on the necessity for optimal compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on the benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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4.4. Manage a patient with mitral stenosis

Description

Timeframe: from diagnosis of mitral stenosis (MS) until referral for surgical/interventional therapy

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- List the causes of MS
- Describe the haemodynamics of MS
- Describe the pathophysiology of MS and its effect on the heart and circulation
- Describe the symptoms and clinical signs of MS
- Outline the natural history and prognosis of MS
- Describe the values and limitations of diagnostic modalities; in particular echocardiography
- Quantify the severity of MS and its effect on cardiac function
- Plan the follow-up and conservative management of a patient with MS
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of medical, interventional, and surgical therapy
- Discuss the impact of concomitant coronary artery disease and other co-morbidities on the management and outcome of MS

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Assess the benefits and risks of different therapeutic modalities according to patient characteristics
- Identify the appropriate time for interventional or surgical therapy
- Optimize patient condition in preparation for interventional or surgical therapy

Continued

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Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Limit diagnostic modalities to those necessary for a definitive diagnosis or for planning a therapeutic intervention
- Educate the patient on the cause and probable natural history of their MS
- Educate the patient on the necessity for compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on the benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

4.5. Manage a patient with tricuspid regurgitation

Description

Timeframe: from diagnosis of tricuspid regurgitation (TR) until referral for surgical/interventional therapy

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- List the primary and secondary causes of TR
- Describe the haemodynamics of TR
- Describe the pathophysiology of primary and secondary TR and its effect on the heart and circulation
- Describe the symptoms and clinical signs of TR
- Outline the natural history and prognosis of TR
- Describe the values and limitations of diagnostic modalities in particular echocardiography
- Quantify the severity of TR and its effect on cardiac function
- Plan the follow-up and medical management of a patient with TR
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of medical, interventional, and surgical therapy
- Discuss the impact of concomitant coronary artery disease, co-existing disease of other heart valves, and other co-morbidities on the management and outcome of TR

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG

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  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Identify the appropriate time for interventional or surgical therapy
- Optimize patient condition in preparation for interventional or surgical therapy
- Manage HF with optimal medical therapy and devices in a patient with secondary TR
- Assess benefits and risks of different therapeutic modalities according to patient characteristics

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Restrict the use of diagnostic modalities to those required for reaching a definitive diagnosis or for planning a therapeutic intervention
- Educate the patient on the cause, natural history, and consequences of TR
- Educate the patient on importance of compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

4.6. Manage a patient with tricuspid stenosis

Description

Timeframe: from diagnosis of tricuspid stenosis (TS) until referral for surgical/interventional therapy
Setting: outpatient setting, inpatient setting, and emergency department
Including:
initial assessment based on clinical history and physical examination
identification of causes and differential diagnosis
performance and interpretation of basic diagnostic modalities
interpretation of additional diagnostic modalities
medical therapy
Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Continued

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Knowledge

- List the causes of TS
- Describe the haemodynamics of TS
- Describe the pathophysiology of TS and its effect on heart and circulation
- Describe the symptoms and clinical signs of TS to the underlying circulatory changes
- Outline the natural history and prognosis of TS
- Describe the values and limitations of diagnostic modalities in particular echocardiography
- Quantify the severity of TS and its effect on cardiac function
- Plan the follow-up and medical management of a patient with TS
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of conservative, interventional, and surgical therapy
- Discuss the impact of concomitant coronary artery disease, co-existing disease of other heart valves, and other co-morbidities on the management and outcome of TS

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Identify the appropriate time for interventional or surgical therapy
- Optimize patient condition in preparation of interventional or surgical therapy
- Assess benefits and risks of different therapeutic modalities according to patient characteristics

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Only apply the diagnostic modalities required for reaching a definitive diagnosis and for planning a therapeutic intervention
- Educate the patient on individual causes, natural history, and consequences of TS
- Educate the patient on necessity for regular follow-up and optimal compliance
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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4.7. Manage a patient with pulmonary regurgitation

Description

Timeframe: from diagnosis of pulmonary regurgitation (PR) until referral for surgical/interventional therapy or to the adult congenital heart disease team

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Scholar

Knowledge

- List the causes of PR including the commonly associated congenital cardiac malformations
- Describe the haemodynamics of PR
- Describe the pathophysiology of PR and its effect on heart and circulation
- Describe the symptoms and clinical signs of PR to the underlying haemodynamics
- Outline the natural history and prognosis of PR
- Describe the values and limitations of diagnostic modalities in particular echocardiography
- Quantify the severity of PR and its effect on cardiac function
- Consider the impact of associated congenital malformations and previous surgery for congenital heart disease on the clinical presentation and management of PR
- Outline the factors to be taken into account in planning the follow-up under conservative management of a patient with PR
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications for surgical treatment
- Describe the indications, benefits, and risks of conservative, interventional, and surgical therapy

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Co-ordinate follow-up management with the adult congenital heart disease team

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Limit the use of tests to those required for reaching a definitive diagnosis or for planning a therapeutic intervention
- Educate and inform the patient in collaboration with adult congenital heart disease team
- Commit to collaboration with the adult congenital heart disease team

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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4.8. Manage a patient with pulmonary stenosis

Description

Timeframe: from diagnosis of pulmonary stenosis until referral for surgical/interventional therapy or to the adult congenital heart disease team

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Scholar

Knowledge

- List the causes of PS and the commonly associated congenital cardiac malformations
- Describe the haemodynamics of PS
- Describe the pathophysiology of right ventricular outflow tract obstruction and its interaction with other congenital malformations
- Describe the symptoms and clinical signs of PS to the underlying anatomy and pathophysiology
- Outline the natural history and prognosis of isolated valvular PS
- Describe the values and limitations of diagnostic modalities in particular echocardiography
- Quantify the severity of PS and its effect on cardiac function
- Plan the follow-up and conservative management of a patient with isolated valvular PS
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of conservative, interventional, and surgical therapy for isolated valvular PS

Skills

- Take relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Manage follow-up in collaboration with the adult congenital heart disease team
- Refer appropriate patients for interventional or surgical treatment
- Optimize patient condition in preparation of interventional or surgical therapy

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Apply only the diagnostic modalities required for reaching a definitive diagnosis or for planning a therapeutic intervention
- Educate and inform the patient in collaboration with adult congenital heart disease team
- Commit to collaborate with adult congenital heart disease team

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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4.9. Manage a patient with multivalvular disease

Description

Timeframe: from diagnosis of multivalvular disease until referral for surgical/interventional therapy

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

identification of causes and differential diagnosis

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Outline the spectrum of multivalvular disease
- Discuss the interdependence of the haemodynamic disturbances in multivalvular disease
- Analyse the complex and variable pathophysiology of multivalvular disease and its effects on the heart and circulation
- Describe the spectrum of symptoms and clinical signs of multivalvular disease
- Describe the variable natural history and prognosis of multivalvular disease
- Describe the values and limitations of diagnostic modalities in particular echocardiography
- Quantify the severity of the individual components of multivalvular disease
- Identify the critical issues in planning the management and follow-up of patients with multivalvular disease
- Explain the current guidance on endocarditis prophylaxis
- Describe the indications, benefits, and risks of medical, interventional, and surgical therapy
- Discuss the impact of concomitant coronary artery disease and other co-morbidities on the management of multivalvular disease

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select appropriate investigations
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Decide on the strategy and frequency of follow-up
- Identify the appropriate timing for medical, interventional, or surgical therapy
- Optimize patient condition in preparation of interventional or surgical therapy
- Assess benefits and risks of different therapeutic modalities according to patient characteristics

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Only apply the diagnostic modalities required for reaching a definitive diagnosis and for planning a therapeutic intervention
- Educate the patient on the causes, natural history, and consequences of multivalvular disease
- Counsel the patient on the advisability of compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic modalities

Continued

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- Involve the patient in all decisions relating to their care
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses.

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

4.10. Manage a patient with a prosthetic valve

Description

Timeframe: life-long follow-up after hospital discharge for prosthetic valve implantation

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

uncomplicated postoperative follow-up and management of complications

performance and interpretation of basic diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy and endocarditis prophylaxis

Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Describe the haemodynamics associated with normal function of the different types of prosthetic valve
- Discuss the issues to be considered in planning the follow-up of patients with prosthetic valves
- List the complications associated with prosthetic valves
- Explain the haemodynamics associated with the different forms of prosthetic valve dysfunction
- Discuss the aetiology of prosthetic valve dysfunction
- Describe the clinical signs of normal and dysfunctional prosthetic valves
- Summarise the course and prognosis of prosthetic valve diseases
- Describe the values and limitations of diagnostic modalities, in particular echocardiography
- Discuss the quantification of normal and abnormal prosthetic valve function
- Explain the indications, benefits, and risks of medical, interventional, and surgical therapy
- Detail the management of anticoagulant therapy in routine and special situations (e.g. PCI, non-cardiac surgery, pregnancy)
- Explain the current guidance on endocarditis prophylaxis
- Outline the measures required to optimize patient condition in preparation of interventional or surgical therapy

Skills

- Take a relevant history and perform an appropriate clinical examination
- Determine appropriate diagnostic modalities
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography

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  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - Cardiac PET
- Decide on the follow-up strategy
- Determine, in association with the heart team, the indication for and timing of interventional or surgical therapy
- Discuss the benefits and risks of different therapeutic modalities according to patient characteristics

Attitudes

- Evaluate symptoms carefully using patient history and exercise testing
- Only apply the diagnostic modalities required for reaching a definitive diagnosis or for planning a therapeutic intervention
- Educate the patient about the durability of and risks associated with their prosthetic valve
- Iterate the importance of measures to reduce the endocarditis risk at every attendance
- Educate the patient on the natural history of prosthetic valve disease or dysfunction
- Ensure the patient understands the necessity for compliance with regular follow-up
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their management (shared decision-making)
- Commit to work in a Heart Team involving imaging specialists, interventional cardiologists, cardiac surgeons, anaesthetists, and nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion

Level of independence

- 5. Able to teach (no supervision)

4.11. Manage a patient with endocarditis

Description

Timeframe: from diagnosis of endocarditis until completion of effective therapy
Setting: outpatient setting, inpatient setting, and emergency department
Including:
initial assessment based on clinical history and physical examination
identification of causes and differential diagnosis
performance and interpretation of basic diagnostic modalities
interpretation of additional diagnostic modalities
medical therapy and prophylaxis
Excluding: performing interventional or surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader

Knowledge

- Describe the conditions that predispose to the development of endocarditis
- Recall the microbiological causes of endocarditis and the implications for antibiotic therapy, lead extraction, surgical treatment, and prognosis
- Discuss the prevention of superimposed and recurrent infection

Continued

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- Explain the pathophysiology of endocarditis
- Describe the symptoms and clinical signs of endocarditis
- Describe the complications of endocarditis
- Summarise the factors that influence the risk of complications and an adverse outcome from endocarditis
- Explain the importance of blood cultures and timing of appropriate antibiotic treatment
- Describe the use and limitations of diagnostic modalities, in particular echocardiography
- Outline the indications, benefits, and risks of medical therapy, lead extraction, and surgical therapy
- Discuss how to optimize patient condition in preparation for surgery
- Describe the criteria for emergency referral to a specialized centre
- Discuss the follow-up of a patient who has been treated for endocarditis

Skills

- Take a relevant history and perform an appropriate clinical examination
- Determine appropriate diagnostic modalities
- Perform and interpret the following diagnostic modalities:
  – ECG
  – Blood cultures
  – Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  – Chest X-ray
  – Trans-oesophageal echocardiography
  – Cardiac CT
  – Cardiac MR
  – Cardiac PET/CT
  – Cardiac white blood cell SPECT/CT
- Prescribe an appropriate antimicrobial regimen for a patient with endocarditis
- Undertake regular supervision, with appropriate investigations, during the course of treatment
- Recognize the indications for and timing of surgical treatment and/or lead extraction
- Assess benefits and risks of different therapeutic modalities according to patient characteristics
- Plan the follow-up strategy

Attitudes

- Evaluate a patient carefully using patient history and clinical examination
- Perform a comprehensive echocardiographic examination providing complete analysis of cardiac morphology and function
- Apply only the diagnostic modalities required for reaching a definite diagnosis and for following the course of treatment and planning additional intervention
- Educate the patient on individual causes, natural history, and consequences of endocarditis
- Provide balanced, understandable, and appropriate information to the patient on benefits and risks of different therapeutic modalities
- Involve the patient in all decisions relating to their care (shared decision-making)
- Commit to work in an Endocarditis Team
- Educate the patient on necessity for compliance with follow-up, endocarditis prophylaxis, and minimization of the risk of recurrence

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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5. Chapter 5: Rhythm disorders

5.1. Manage a patient with palpitations

Description

Timeframe: from first patient contact until diagnosis or exclusion of a specific rhythm disorder (then continued in specific EPAs), or other cause

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on clinical history and physical examination

using modalities of heart rhythm monitoring

Excluding: performing actual therapy of rhythm disorders (see specific EPAs)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the arrhythmic and non-arrhythmic causes of palpitation
- Describe the electrocardiographic features of the different arrhythmias
- Recall the high-risk features on the resting ECG in a patient with a suspected arrhythmia
- Explain the significance of structural heart diseases in a patient presenting with a suspected arrhythmia
- Discuss the role of the 12-lead ECG and different modalities (invasive and non-invasive) of heart rhythm monitoring in patients with palpitations
- Discuss the limitations of consumer devices for heart rate and rhythm monitoring
- Outline the circumstances in which additional investigation, including echocardiography and blood testing, is appropriate for a patient with palpitation

Skills

- Take a relevant history and perform an appropriate physical examination
- Differentiate the types of arrhythmia from the 12-lead ECG
- Perform and interpret electrocardiographic monitoring including 12-lead electrocardiogram, Holter, patient activated and implantable or wearable devices, and emergency interrogation of pacemakers and implantable cardioverter-defibrillators

Attitudes

- Acknowledge the anxiety associated with palpitation, even when the cause is shown to be benign
- Recognize that palpitation is an insensitive and non-specific symptom of an arrhythmia
- Avoid over-investigation
- Recognize that palpitation can be normal and that some rhythm disturbances are best managed with reassurance
- Explain that self-monitoring devices are prone to over diagnosis and causing inappropriate anxiety

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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5.2. Manage a patient with transient loss of consciousness

Description

Timeframe: from first patient contact until diagnosis of syncope and development of a management plan (then, in cases of arrhythmia or other CVD, continued in specific EPAs)

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on the clinical history, physical examination, ECG

further investigation

risk stratification (incl. driving and high-risk occupations)

Excluding: performing actual therapy of rhythm disorders (see specific EPAs)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Define the terms transient loss of consciousness and syncope
- List the causes of transient loss of consciousness
- Outline the epidemiology and prevalence of syncope
- Describe the clinical features of syncope and how they differ from other causes of transient loss of consciousness
- Outline the diagnostic evaluation of a patient presenting with suspected syncope
- Discuss risk stratification for a patient with syncope
- Describe the management options including education and reassurance, physical countermeasures, drug therapy and device implantation for the different causes of syncope
- Outline the national regulations on driving and high-risk activities

Skills

- Take a relevant history and perform an appropriate physical examination
- Distinguish syncope from other causes of transient loss of consciousness
- Select appropriate investigations for a patient with suspected syncope
- Collaborate, where appropriate, with other specialists
- Identify patients with syncope at high risk of sudden cardiac death (SCD)
- Select an inpatient or outpatient management treatment strategy according to the clinical circumstances
- Advise a patient with syncope on driving and high-risk activities such as working with machinery or at heights
- Teach the patient with syncope how to recognize and avoid triggers and how to perform physical countermeasures

Attitudes

- Involve witnesses in obtaining the history
- Be aware of the lifestyle impact of recurrent syncope
- Recognize that syncope can be a transient symptom, and not necessarily a disease
- Collaborate with neurologists, elderly care specialists and other care providers
- Accept that the diagnosis of syncope is often presumptive
- Recognize that many patients do not need specific treatment
- Help patients to understand that therapies are often ineffective

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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5.3. Manage a patient with atrial fibrillation

Description

Timeframe: from diagnosis until effective therapy of atrial fibrillation (AF)

Setting: outpatient setting, inpatient setting, emergency department

Including:

investigation and assessment of underlying causes

stroke prevention

drug therapy for acute and long-term heart rate or heart rhythm control, cardioversion

integrated care

Excluding: performing ablations [atrial or atrioventricular (AV) node] or 'left atrial appendage occlusions' (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Outline the epidemiology, pathophysiology, and prognosis of AF
- Classify AF according to its causes, severity, and temporal pattern
- Recognize the clinical and electrocardiographic features of AF including pre-excited AF
- Discuss the importance of co-existing structural heart diseases on the prognosis and implications for the management of AF
- Describe how diagnostic procedures should be tailored to the individual circumstances
- List the risk factors for stroke and bleeding
- Describe the indications, contraindications, side effects, and complications of:
  - Anticoagulant therapy
  - Rhythm vs. rate control therapy
  - Pharmacological control of ventricular rate
  - Anti-arrhythmic drug therapy
  - Pharmacological cardioversion
  - Electrical cardioversion
  - Pacemaker therapy
  - Catheter ablation of AF
  - Surgical ablation of AF
  - Surgical or interventional occlusion of the left atrial appendage
  - Catheter ablation of the AV node
- Discuss combined, staged, or hybrid approaches in patients with AF and structural heart disease

Skills

- Take a relevant history and perform an appropriate physical examination
- Assess quality of life using the European Heart Rhythm Association score
- Analyse the ECG and monitoring devices to diagnose AF and differentiate it from other rhythm disorders
- Use validated scores to assess the risks of thromboembolism and bleeding
- Select the best strategy for prevention of ischaemic stroke and systemic embolism
- Treat reversible bleeding risk factors
- Implement appropriate treatment:
  - Anticoagulant therapy and, where necessary for other indications, combination with antiplatelet therapy
  - Switch from one anticoagulant drug to another
  - Rate control vs. rate plus rhythm control
  - Anti-arrhythmic drug therapy
  - Pharmacological cardioversion
  - Pharmacological control of ventricular rate
  - Electrical cardioversion
- Manage predisposing and associated conditions and co-morbidities
- Educate the patient with AF how to reduce the rate of relapse by lifestyle modifications such as exercise and weight loss

Continued

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- Identify patients for referral for interventional procedures: catheter or AV node ablation; left atrial appendage occlusion
- Collaborate with the multi-disciplinary AF team

Attitudes

- Recognize the impact on a patient's quality of life from symptoms and anxiety over anticoagulant therapy and invasive methods of management
- Emphasize the over-riding importance of anticoagulant therapy for most patients
- Explain the limitations and risks of anti-arrhythmic drug therapy
- Help patients to understand the success rate, limitations, and risks of AF ablation
- Acknowledge the importance of information and education to patients and carers
- Promote shared and integrated care: team working with patients, general practitioners, nurses, electrophysiologists, surgeons, haematologists, and other healthcare providers

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

5.4. Manage a patient with atrial flutter

Description

Timeframe: from diagnosis until effective therapy of atrial flutter

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation and assessment of underlying causes

acute and long-term rhythm management

stroke prevention

integrated care

Excluding: performing ablations (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Describe predisposing conditions, and the epidemiology and pathophysiology of atrial flutter
- Classify the types of atrial flutter
- Describe the clinical features and electrocardiographic characteristics of atrial flutter
- Discuss additional diagnostic procedures tailored to the individual need
- Explain how to assess the risk of atrial thrombosis and embolic complications
- Outline the principles of isthmus ablation
- Discuss the indications, contraindications, side effects, and complications of:
  - Anticoagulant therapy and, when necessary, combination with antiplatelet therapy
  - Rhythm vs. rate control therapy
  - Pharmacological control of ventricular rate
  - Anti-arrhythmic drug therapy
  - Pharmacological cardioversion
  - Electrical cardioversion
  - Atrial overdrive pacing
  - Isthmus ablation

Continued

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Skills

- Take a relevant history and perform an appropriate physical examination
- Recognize atrial flutter on the ECG and differentiate it from other rhythm disorders
- Assess the risks of thromboembolism and bleeding
- Determine the best strategy for prevention of ischaemic stroke and systemic embolism
- Implement appropriate treatment:
  - Anticoagulant therapy and, where necessary for other indications, combination with antiplatelet therapy
  - Switch from one anticoagulant drug to another
  - Rate control vs. rate plus rhythm control
  - Anti-arrhythmic drug therapy
  - Pharmacological cardioversion
  - Pharmacological control of ventricular rate
  - Electrical cardioversion
- Identify patients for referral for flutter ablation

Attitudes

- Appreciate the distress from symptoms of atrial flutter and anxiety over anticoagulant therapy and invasive management
- Explain the limitations and potential risks of anti-arrhythmic drug therapy
- Emphasise the importance of anticoagulant therapy
- Communicate the success rate and risks of ablation therapy

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

5.5. Manage a patient with supraventricular tachycardia

Description

Timeframe: from diagnosis until effective therapy of supraventricular tachycardia (SVT)

Setting: outpatient setting, inpatient setting, and emergency department

Including:

atrial tachycardia, atrioventricular node re-entry tachycardia, atrioventricular re-entry tachycardia/Wolff Parkinson White syndrome

anti-arrhythmic drug therapy, cardioversion

Excluding: performing ablations (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Outline the epidemiology and pathophysiology of SVTs
- Explain the implications of co-existing structural heart diseases for management and on the outcomes of SVT
- Discuss the complications associated with the different types of SVT
- Classify the atrial tachycardias
- Describe the pathophysiology of AV bypass tracts and AV re-entry tachycardia
- Explain the pathophysiology of AV nodal re-entry tachycardia
- Discuss the differential diagnosis of wide-complex tachycardias
- Outline the diagnostic procedures tailored to individual need
- Discuss the indications, contraindications, side effects, and complications of:
  - Pharmacological control of ventricular rate
  - Suppression of tachycardia with anti-arrhythmic drug therapy

Continued

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  - Pharmacological cardioversion
  - Electrical cardioversion
  - Ablation of accessory pathways
  - Ablation of AV node duality
  - Ablation of atrial ectopic foci
- Discuss the risk of stroke in association with SVTs

Skills

- Take a relevant history and perform an appropriate physical examination
- Utilize the clinical features and electrocardiogram to diagnose the type and mechanism of SVT
- Perform carotid sinus massage
- Teach patients to perform the Valsalva manoeuvre
- Utilize appropriate electrical or pharmacological cardioversion, anti-arrhythmic prophylaxis and rate control therapy to manage SVT acutely and long-term
- Implement an appropriate anticoagulant regimen for patients undergoing cardioversion
- Identify suitable patients for referral for ablation procedures

Attitudes

- Empathize with patients' anxiety in relation to symptoms and invasive of management
- Recognize the limitations and risks of anti-arrhythmic drug therapy
- Explain the success rates, limitations, and risks of ablation procedures
- Collaborate with specialist electrophysiologists and other physicians

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

5.6. Manage a patient with ventricular arrhythmia

Description

Timeframe: from diagnosis until effective therapy of ventricular arrhythmia, or life-long when appropriate

Setting: outpatient setting, inpatient setting, and emergency department

Including:

diagnosis and characterization; types of ventricular tachycardia (VT)

investigation

anti-arrhythmic drug therapy

Excluding: performing implantable cardioverter-defibrillator (ICD) implantation and ablation (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the different types of ventricular arrhythmia
- Outline the epidemiology, pathophysiology, clinical features, and diagnosis of ventricular arrhythmias in patients with structurally normal and abnormal hearts
- Outline the genetic conditions, including cardiomyopathies and ion channel disorders, associated with ventricular arrhythmias
- Describe the clinical features and electrocardiographic criteria for the differential diagnosis of wide-complex tachycardias
- Discuss how to investigate a patient with a documented ventricular arrhythmia
- Differentiate benign (outflow tract; fascicular) from dangerous forms of VT
- Outline the approach to a patient with ventricular arrhythmias in relation to high-risk occupations and competitive sports
- Describe the pharmacology of anti-arrhythmic drugs and their role in the management of ventricular arrhythmias
- List the major pro-arrhythmic effects of cardiovascular and non-cardiovascular drugs

Continued

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- Outline the indications for electrophysiological studies, ICD implantation, and ablation
- Discuss the complications of invasive electrophysiological and device procedures in patients with ventricular arrhythmias
- Explain national regulations on driving (private and commercial) applying to patients with ventricular arrhythmias (and or a defibrillator)

Skills

- Take a relevant history and perform an appropriate physical examination
- Differentiate between VT and SVT with pre-existing bundle branch block, aberrant conduction, or pre-excitation
- Assess the risk of SCD in a patient with VT
- Manage acute persistent ventricular arrhythmia and VT storm
- Devise a management plan for a patient with ventricular arrhythmias
- Identify and refer appropriate patients for subspecialist assessment, ICD implantation, or ablation
- Interrogate internal cardiac devices
- Advise a patient on participation in high-risk occupations and competitive sports
- Refer for genetic testing of patient and family if a genetic disorder is suspected

Attitudes

- Appreciate the anxiety experienced by patients with ventricular arrhythmias
- Realize the implications to family members of a patient with genetic diseases
- Educate patients on the limitations and potential risks of anti-arrhythmic drug therapy
- Co-operate with electrophysiologists, arrhythmia nurse specialists, and HF specialists

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

5.7. Manage a patient with bradycardia

Description

Timeframe: from diagnosis until effective therapy of bradycardia

Setting: outpatient setting, inpatient setting, and emergency department

Including:

risk assessment

drug therapy and temporary pacing in the acute setting

Excluding: performing pacemaker implantation (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Classify bradycardias and conduction disturbances
- Describe the epidemiology, causes, diagnosis, and clinical features of bradycardia
- Recall the primary, non-cardiac, illnesses associated with bradycardia
- List the common cardiovascular and other medicines that may cause or exacerbate bradycardia
- Discuss the factors influencing the prognosis and risks associated with bradycardia
- Explain the indications for temporary pacing and permanent pacemaker implantation
- Explain the national regulations on driving (private and commercial) applying to patients with pacemakers

Skills

- Take a relevant history and perform an appropriate physical examination
- Analyse the ECG for accurate definition of a bradycardia
- Determine the need for additional investigation of a patient with bradycardia
- Withdraw drugs that cause or exacerbate bradycardia

Continued

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- Manage patients presenting acutely with bradycardia
- Identify patients for referral for permanent pacemaker implantation

Attitudes

- Understand that bradycardia and conduction disturbances may be self-limiting
- Recognize patients' anxiety over the long-term consequences of pacemaker implantation

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

5.8. Manage a patient with a cardiac ion channel dysfunction

Description

Timeframe: from diagnosis until referral for specialist management of a cardiac ion channel dysfunction; life-long follow-up when appropriate

Setting: outpatient setting, inpatient setting, and emergency department

Including:

diagnosis and differential diagnosis

risk assessment

Excluding: performing ICD implantation

CanMEDS roles

- Medical expert
- Communicator
- Collaborator

Knowledge

- Classify the ion channel disorders
- Outline the genetics and pathophysiology of ion channel disorders
- Describe the characteristic presentations and diagnosis of ion channel disorders, specifically of:
  - Brugada syndrome
  - Long and short QT syndromes
  - Early repolarisation syndrome
  - Catecholaminergic VT
- Explain gender-specific risks such as the peri-partum period for pts with long QT
- Discuss the screening of family members of patients with cardiac ion channel dysfunction
- Discuss the prognosis and risk assessment of patients with ion channel disorders including for sport, driving, and high-risk occupations
- Discuss the role of prophylactic drug therapy and ICD implantation in patients with ion channel disorders
- Explain the national regulations on driving and high-risk activities for people at risk of sudden incapacity

Skills

- Take a relevant history, with special reference to family history, and perform an appropriate physical examination
- Interpret the electrocardiographic changes associated with ion channel disorders
- Perform and interpret appropriate testing such as the ajmaline test
- Refer a patient and their family for testing if a genetic disorder is suspected
- Identify a patient for referral for specialist electrophysiology advice and management

Attitudes

- Show consideration and empathy to the patient and family members at risk of sudden death
- Participate in a multi-disciplinary team with arrhythmia specialists, geneticists, paediatric cardiologists, and specialist nurses

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 3. Indirect supervision

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5.9. Manage a patient with a pacemaker

Description

Timeframe: from early post-implantation and including emergency management of a patient with a pacemaker

Setting: outpatient setting, inpatient setting, and emergency department

Including:

complications after implantation

lead displacement; exit block; failure of sensing

infection and endocarditis

Excluding: performing pacemaker implantation (specialist management)

performing generator replacement (specialist management)

performing full pacemaker interrogation and troubleshooting (specialist management)

performing lead extraction (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Outline the principles of pacemaker technology and functions
- Describe the various lead types and configurations
- Classify the different pacing modes, their nomenclature and indications
- Discuss the influence of different forms of physical activity on the response of different activity sensors (e.g. cycling vs. walking)
- List the early and late complications of pacemaker implantation
- Explain the potential effects of exposure to electromagnetic radiation, including electrical cardioversion, surgical diathermy, MR scanning and airport security devices
- List the drugs affecting sensing threshold and pacemaker capture
- Explain the national regulations on driving (private and commercial) applying to patients with pacemakers

Skills

- Take a relevant history and carry out a relevant physical examination
- Recognize surgical complications and arrange prompt re-referral to the implanting cardiologist
- Analyse pacemaker rhythms from the 12-lead ECG
- Interrogate the device:
  - To analyse pacemaker function and settings
  - To detect arrhythmias
  - To anticipate battery depletion
- Use exercise testing to optimize heart rate response
- Use programming to optimize exercise capacity in patients without underlying rhythm sensors
- Diagnose and manage pacing induced HF
- Use echocardiography to decide when to upgrade to cardiac resynchronization therapy (CRT)
- Manage remote monitoring of pacemaker patients
- Activate MR safe mode
- Perform electrical cardioversion on a patient with a pacemaker
- Provide appropriate advice and supervision on pacemaker management for patients scheduled for anaesthesia and surgery
- Collaborate with non-medical cardiac physiologists in dealing with recall situations

Attitudes

- Appreciate the necessity for long-term follow-up
- Understand the difficulty for elderly and disabled patients to attend for regular follow-up
- Collaborate with the implanting cardiologist and cardiac physiologists

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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5.10. Manage a patient with an implantable cardioverter-defibrillator

Description

Timeframe: from early post-implantation and including emergency management of a patient with an ICD

Setting: outpatient setting, inpatient setting, and emergency department

Including:

complications after implantation

lead displacement; exit block; failure of sensing

infection and endocarditis

end-of-life care: device inactivation

Excluding: performing ICD implantation (specialist management)

performing full ICD interrogation and troubleshooting (specialist management)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Outline the algorithms of ICDs
- Explain the basic programmable features of ICDs
- Explain the principles of anti-tachycardia pacing
- Describe the lead types and configurations
- List the complications of ICD implantation
- Discuss the potential effects of exposure to electromagnetic radiation, including surgical diathermy, MR scanning, and airport security devices
- List the drugs with the potential to increase defibrillation threshold
- Explain the national regulations on driving (private and commercial) for a patient with an ICD
- Discuss when to upgrade an ICD to CRT

Skills

- Take a relevant history and carry out an appropriate physical examination
- Recognize surgical complications and arrange prompt re-referral to implanting cardiologist
- Manage a patient after a defibrillation event
- Manage a patient with an electrical storm
- Manage remote monitoring of ICD patients including recognition of lead failure, AF, VT, and others
- Recognize and manage pacing induced HF
- Interrogate the device:
  - To analyse defibrillator shocks and overdrive pacing activity
  - To identify inappropriate discharges
  - To detect arrhythmias
  - To anticipate battery depletion
- Advise on device management for patients scheduled to undergo cardiac or non-cardiac anaesthesia and surgery
- Activate MR safe mode
- Collaborate with non-medical cardiac physiologists in dealing with recall situations
- Contribute to end-of-life decisions with respect to inactivation of an ICD

Attitudes

- Collaborate with electrophysiologists, HF, and palliative care physicians and specialist nurses
- Help patients with ICDs to come to terms with their fears of painful and inappropriate shocks
- Advise patients on the lifestyle implications of having an ICD
- Advise patients on the palliative role of the ICD and on the possibility of device deactivation

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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5.11. Manage a patient with a cardiac resynchronization therapy device

Description

Timeframe: from early post-implantation and including emergency management of a patient with a CRT or cardiac resynchronization therapy defibrillator (CRT-D) device

Setting: outpatient setting, inpatient setting, and emergency department

Including:

complications after implantation

lead displacement; exit block; failure of sensing

infection and endocarditis

Excluding: performing CRT implantation (specialist management)

post-implantation device optimization (specialist management)

performing full CRT interrogation and troubleshooting (specialist management)

Medical therapy for underlying HF (see Chapter 6)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the physiological mechanisms by which CRT improves symptoms and prognosis in a patient with HF
- Describe the lead types and configurations for CRT and CRT-D
- Discuss the influence of different forms of physical activity on the response of different activity sensors
- Explain the programmable functions of the CRT(-D) device
- List the complications of device implantation
- Discuss the potential effects of exposure to electromagnetic radiation, including electrical cardioversion, surgical diathermy, MR scanning, electrical welding, and airport security devices
- List the drugs with the potential to affect pacemaker sensing, capture, and defibrillation threshold
- Outline the national regulations on driving (private and commercial) for patient with CRT(-D) devices

Skills

- Take a relevant history and carry out an appropriate physical examination
- Recognize early and late surgical complications and arrange prompt re-referral to the implanting cardiologist
- Analyse pacemaker rhythms from the 12-lead ECG
- Interrogate the device:
  - To analyse pacemaker settings
  - To detect arrhythmias such as AF
  - To analyse biventricular pacing percentage
  - To anticipate battery depletion
- Manage remote monitoring of patients with CRT devices
- Use programming to optimize exercise capacity in patients without underlying rhythm (sensors)
- Assess NYHA class and if possible 6-min walk regularly to ensure response
- Perform electrical cardioversion in a patient with a CRT/CRT-D device
- Advise and provide appropriate supervision on device management for a patient scheduled for cardiac and non-cardiac anaesthesia and surgery
- Collaborate with non-medical cardiac physiologists in dealing with recall situations
- Contribute to end-of-life decisions with respect to inactivation of the ICD function

Attitudes

- Collaborate with electrophysiologists and HF specialists to optimize medical therapy
- Appreciate patients' anxiety in relation to device implantation, possible complications, and follow-up

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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6. Chapter 6: Heart failure

6.1. Manage a patient with symptoms and signs of heart failure

Description

Timeframe: from first patient contact until diagnosis or exclusion of HF (then continued in specific EPAs), or other cause (such as respiratory causes)

Setting: outpatient setting, inpatient setting, and emergency department

Including:

initial assessment based on the clinical history and physical examination

performance and interpretation of basic diagnostic modalities

formulate an appropriate management plan

Excluding: performing actual therapy of HF (this will be covered by the following specific EPAs)

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Define HF
- Outline the epidemiology of HF
- Classify the causes of HF
- Describe the range and meaning of words used by a patient with HF to describe their symptoms
- Catalogue the symptoms of HF and the features that help to differentiate them from those of non-CVDs
- Explain the pathophysiology of breathlessness
- Classify the cardiac and non-cardiac causes of shortness of breath
- Assess the risk in order to determine the need for hospitalization in a patient with shortness of breath
- Describe a diagnostic evaluation including:
  - History from patient and eyewitness
  - Physical examination
  - Initial investigation including:
    - 12-lead ECG
    - Chest X-Ray
    - Routine blood tests
  - Further investigation when indicated including:
    - Natriuretic peptides
    - Arterial blood gases
    - Echocardiography
    - CT pulmonary angiography
    - Cardiopulmonary exercise testing
    - Basic pulmonary function testing
  - Discuss management according to the underlying cause of the HF
  - Describe the initial medical treatment for HF

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography
  - Arterial blood gases

Continued

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- Interpret the following diagnostic modalities:
  - Chest X-Ray
  - Blood tests including the use of natriuretic peptides
  - CT pulmonary angiography
  - Exercise echocardiography
  - Invasive haemodynamics
- Differentiate HF from other conditions with similar clinical presentations
- Differentiate between heart failure with reduced ejection fraction (HFrEF) and heart failure with preserved ejection fraction (HFpEF)
- Determine the cause of HF
- Prescribe appropriate initial management

Attitudes

- Understand the anxiety and fear associated with and the limitations imposed by symptoms of HF
- Recognize that the symptoms of HF are non-specific and have a wide range of causes
- Focus on appropriate and relevant information
- Commit to participation in integrated care for patients with HF
- Understand the requirements for long-term ongoing care for patients with HF
- Understand that patients often present with other symptoms including fatigue, impaired exercise tolerance, anorexia, and chest pain

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

6.2. Manage a patient with heart failure with reduced ejection fraction

Description

Timeframe: from diagnosis until effective therapy of HF with reduced ejection fraction

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of HF with reduced ejection fraction and differential diagnosis

indications for and interpretation of basic and advanced investigations

indications for and interpretation of results of basic and advanced cardiac imaging

initiation and monitoring of medical or interventional therapy

indication for and managing a patient with ICD or CRT

managing a patient referred/considered for, and after cardiac transplantation in collaboration with the HF specialist team

managing a patient with mechanical circulatory support in collaboration with HF specialist team

Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Health advocate

Knowledge

- List the causes of HFrEF
- Describe the principles of investigation including the critical importance of imaging
  - Echocardiography
  - Other cardiac imaging
- Discuss the role of multimodality imaging
  - List other appropriate investigations for specific aetiologies—e.g. coronary angiography for ischaemic HF

Continued

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- Discuss the range of treatment options for HFrEF:
  - Medical therapy including titration of therapies
  - Device therapy (ICD, CRT)
  - Mechanical devices both as bridge and destination therapy
  - Basic assessment for transplantation
  - Modification of therapy depending on co-morbidities
- List the treatment goals in HF:
  - Improvement of symptoms
  - Improvement in Quality of Life
  - Reduction in hospitalization
  - Reduction in mortality
  - Exercise/Physical activity and rehabilitation
  - Use of combination therapies
  - Compliance
- Discuss the prognostic benefit of HF therapy and according to specific aetiology of HF

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Stress echocardiography
  - Cardiac catheterization
  - Endomyocardial biopsy
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - Nuclear cardiology
- Formulate an appropriate management/treatment plan
  - Know when to use advanced therapies

Attitudes

- Understand the impact of HF on a patient's lifestyle
- Recognize the importance of appropriate information and guidance
- Commit to the central role of integrated care across the multi-professional team and of liaison with primary care
- Communicate the prognostic benefit of HF therapy both to patients and the wider multi-professional team
- Discuss, where appropriate, end-of-life care with patients

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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6.3. Manage a patient with heart failure with preserved ejection fraction

Description

Timeframe: from diagnosis until effective therapy of HF with preserved ejection fraction

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of HF with preserved ejection fraction and differential diagnosis

indications for and interpretation of basic and advanced investigations

indications for and interpretation of results of basic and advanced cardiac imaging

initiation and monitoring of medical and interventional therapy

managing a patient referred/considered for and after cardiac transplantation in collaboration with HF specialist team

managing a patient with mechanical circulatory support in collaboration with HF specialist team

interpret results from endomyocardial biopsy

Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Health advocate

Knowledge

- Outline the causes of HFpEF and the commonly associated conditions
- Describe the principles of investigation including the critical importance of imaging
  - Echocardiography
  - Other cardiac imaging
- Outline the role of multimodality imaging
- List other investigations:
  - For associated conditions and specific causes such as hypertension
- Discuss the treatment approaches for HFpEF
  - Medical therapy
  - Device therapy (ICD)
  - Modification of therapy depending on co-morbidities

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Stress echocardiography
  - Cardiac catheterization (including invasive haemodynamics)
  - Endomyocardial biopsy
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - Nuclear cardiology
- Formulate an appropriate management/treatment plan
  - Discuss the treatment of relevant co-morbidities
  - Discuss specific treatments for specific causes of HFpEF
- Discuss the prognosis of patients with HFpEF

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Attitudes

- Understand of the impact of HF on a patient's lifestyle
- Recognize the importance of appropriate information and guidance
- Commit to the central role of integrated care across the multi-professional team and liaison with primary care
- Communicate the prognostic benefit of HF therapy both to patients and the wider multi-professional team
- Discuss, where appropriate, end-of-life care with patients

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

6.4. Manage a patient with acute heart failure

Description

Timeframe: from diagnosis until effective therapy of acute HF

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of acute HF and differential diagnosis

indications for and interpretation of basic and advanced investigations

indications for and interpretation of results of basic and advanced cardiac imaging

initiation and monitoring of medical therapy

indication for mechanical circulatory support and extracorporeal oxygenation

managing a patient referred/considered for and after cardiac transplantation in collaboration with HF specialist team

Managing a patient with mechanical circulatory support and extracorporal oxygenation in collaboration with HF specialist team

Interpret results from endomyocardial biopsy

Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Health advocate

Knowledge

- Describe the causes of acute HF
- List the symptoms and signs of acute HF
- Describe the principles of investigation including the importance of initial basic investigations
  - Routine investigations such as arterial blood gases, chest X-Ray and blood tests
  - Echocardiography
- Describe the use of other investigations:
  - For specific causes—e.g. coronary angiography for ischaemic HF
- Describe the treatment of acute HF
  - Medical therapy particularly the use of inotropes and vasodilators
  - Modification of therapy depending on co-morbidities
  - Role of mechanical devices as support therapy
  - Appropriate early liaison with HF specialist team and critical care
  - Appropriate early discussion with and transfer to a transplant centre

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Skills

- Take a relevant history and perform an appropriate physical examination
  - Be able to examine a patient in the presence of congestion/hypoperfusion
- Initiate management to stabilize a patient
  - Including appropriate respiratory and circulatory support
  - Continue titration of appropriate therapy including after discharge
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Cardiac catheterization
  - Endomyocardial biopsy
  - Coronary angiography
  - CT pulmonary angiography
  - Cardiac CT
  - Cardiac MR
- Formulate a multidisciplinary management/treatment plan

Attitudes

- Understand the impact of acute HF, particularly at the time of initial presentation
- Recognize the importance of appropriate information and guidance
- Understand the central role of integrated care across the multi-professional team and liaison with regional centres for specific therapies (where indicated)

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

6.5. Manage a patient with cardiomyopathy

Description

Timeframe: from diagnosis until effective therapy of cardiomyopathy
Setting: outpatient setting, inpatient setting, and emergency department
Including:
investigation of the cause of cardiomyopathy and differential diagnosis
indications for and interpretation of basic and advanced investigations
indications for and interpretation of results of basic and advanced cardiac imaging
initiation and monitoring of medical therapy
indication for and managing of a patient with pacemaker, ICD or CRT
counselling for family screening and long-term prognosis
indications for genetic testing and family screening
Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Continued

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Knowledge

- Outline the epidemiology and prevalence of the different causes of cardiomyopathy
- Describe and delineate the classifications of cardiomyopathy
- Correlate the symptoms and signs associated with the different types of cardiomyopathy
- Acknowledge the importance of a detailed family history
- Discuss the principles of investigation including the importance of initial basic investigations: in particular echocardiography and cardiac MRI
- Describe the investigations for specific subgroups of cardiomyopathy
- Discuss the role of genetic investigations
- Understand the aetiology and prognosis of different cardiomyopathies
- Explain the role of the multi-disciplinary approach to cardiomyopathies particularly in managing families with cardiomyopathies
- Discuss the importance, limitations, and role of screening
- Understand the indications for referral to a specialist cardiomyopathy service
- Describe the treatment of cardiomyopathy:
  - Medical therapy
  - Modification of therapy depending on co-morbidities
  - Role of surgical therapy in certain cardiomyopathies
  - Use of other invasive treatments (e.g. septal ablation)
  - Device therapy
- Understand the indications for transplantation or permanent mechanical circulatory support

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Genetic testing
  - Stress echocardiography
  - Cardiac catheterization
  - Endomyocardial biopsy
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - Nuclear cardiology
- Formulate an appropriate management/treatment plan
  - Understand the recommendations for exercise and physical activity
- Make an appropriate referral to an expert cardiomyopathy service

Attitudes

- Understand the anxiety associated with a diagnosis of cardiomyopathy
- Be able to give advice on impact on undertaking physical activity or sports
- Recognize the importance of appropriate information and guidance
- Commit to the central role of integrated care and the multi-professional team including primary care, genetic specialists, and screening

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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6.6. Manage a patient with pericardial disease

Description

Timeframe: from diagnosis until effective therapy of a pericardial disease

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of a pericardial disease and differential diagnosis

indications for and interpretation of basic and advanced investigations

initiation and monitoring of medical therapy

indication and performance of pericardiocentesis

indication for referral

management of tamponade

Excluding: performing surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader

Knowledge

- Describe the symptoms and signs of pericardial disease
- Understand that some pericardial diagnoses are benign
- Describe the principles of investigation including the importance of initial basic investigations
  - Routine investigations (including an ECG)
  - Echocardiography
  - Other cardiac imaging
  - Critical use of multimodality imaging, particularly in constriction vs. restriction
  - Invasive investigations
- Discuss the investigations for specific types of pericardial disease
- Explain the treatment and management of pericardial diseases
  - Observation with periodic monitoring
  - Medical therapy
  - Surgical therapy and its risks in certain pericardial diseases
  - Management of tamponade
- Discuss the use of other invasive treatments

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Cardiac catheterization
  - Cardiac CT
  - Cardiac MR
  - Pericardial fluid analysis
- Manage a patient with acute cardiac tamponade, including performance of pericardiocentesis
- Formulate an appropriate management/treatment plan

Attitudes

- Understand the varying impact of pericardial diseases
- Provide appropriate information and guidance

Continued

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- Commit to the central role of integrated care and including primary care and, pathology dependent, liaison with appropriate surgical teams and other specialist medical teams
- Be alert to the development of tamponade

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

6.7. Manage a patient with right heart dysfunction

Description

Timeframe: from diagnosis until effective therapy of right heart dysfunction

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of right heart dysfunction and differential diagnosis

indication for and interpretation of basic and advanced investigations

indication for and interpretation of results of basic and advanced cardiac imaging

initiation and monitoring of medical therapy

indication for referral

Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader

Knowledge

- Describe the epidemiology and prevalence of different causes of right HF
- Classify the causes of primary right-sided HF vs. those secondary to left HF
- Describe the symptoms and signs of right HF
- Outline the principles of investigation including the importance of initial basic investigations
  - Routine investigations
  - Echocardiography
  - Cardiac catheterization (including right heart catheterization and assessment of pulmonary pressure)
- Discuss the investigation for specific causes of right HF
- Explain the approaches to treatment of right HF
  - Medical therapy
  - Modification of therapy based on co-morbidities
  - The role of surgical therapy
- List the criteria for referral to a specialist pulmonary hypertension service

Skills

- Take a relevant history and perform an appropriate physical examination
- Undertake initial management of a patient
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography

Continued

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- Interpret the following diagnostic modalities:
  - X-ray
  - Blood tests
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - CT pulmonary angiography
  - Ventilation/perfusion lung imaging
- Formulate an appropriate management/treatment plan
  - Understand that the treatment may be predominantly for the underlying cause of right HF

Attitudes

- Understand of the impact of HF on a patient's lifestyle
- Provide appropriate information and guidance
- Understand the central role of integrated care across the multi-professional team and liaison with primary care
- Appreciate that the treatment options for right-sided HF are more limited than for left-sided HF

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

6.8. Manage a patient with a cardiac tumour

Description

Timeframe: from diagnosis until effective treatment (either curative or palliative) of the tumour

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of cardiac tumours and differential diagnosis

indication for and interpretation of basic and advanced investigations

initiation and monitoring of medical therapy

managing a patient referred/considered for and after surgery for a cardiac tumour

managing the complications due to cardiac tumours

Excluding: performing interventional or surgical therapy, specific knowledge of radiotherapy, chemotherapy, or other specific oncological therapies

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader

Knowledge

- List the major types of primary and secondary cardiac tumours
- Describe the principles of investigation including the critical importance of imaging
  - Echocardiography
  - Cardiac MRI
  - Cardiac CT
  - Nuclear imaging
  - Endovascular biopsy
- Discuss the role of multimodality imaging
- List other appropriate investigations for specific tumours
- Outline the medical and surgical treatment of cardiac tumours

Continued

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Skills

- Take a relevant history and perform an appropriate physical examination
- Undertake initial management of a patient
- Perform and interpret the following diagnostic modalities:
  - Blood tests
  - ECG
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
- Formulate an appropriate management/treatment plan
  - Including appropriate palliative care

Attitudes

- Empathize with the fear and anxiety evoked by the diagnosis of a cardiac tumour
- Provide appropriate information sympathetically
- Commit to collaboration and liaison with surgeons, pathologists, and oncologists
- Understand that the treatment options for some cardiac tumours are limited and that cerain tumours are rapidly progressive

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

6.9. Manage cardiac dysfunction in oncology patients

Description

Timeframe: from diagnosis until effective therapy of cardiac dysfunction in oncology patients

Setting: outpatient setting, inpatient setting, and emergency department

Including:

investigation of the cause of cardiac dysfunction due to cancer directly, its sequelae or treatment and differential diagnosis

indication for and interpretation of basic and advanced investigations

indication for and interpretation of results of basic and advanced cardiac imaging

initiation and monitoring of medical therapy

Excluding: performing interventional and surgical therapy

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Describe the symptoms and signs of cardiac dysfunction in an oncology patient
- Classify the causes and types of myocardial, valvular, coronary, and pericardial disease that may result from underlying malignancies or their treatment

Continued

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- Recognize that there may be non-cardiac causes for many of the symptoms of an oncology patient
- Describe the principles of investigation including the importance of initial basic investigations:
  - Biomarkers, in particular the use of serial natriuretic peptides
  - Echocardiography
  - Other cardiac imaging
  - Cardiac pulmonary exercise testing
  - Investigations for specific causes of cardiac dysfunction in an oncology patient
  - Withholding or modifying oncology treatment
- Describe the treatment and management of cardiac dysfunction in an oncology patient:
  - Withholding oncology treatment or amending therapeutic regimens
  - Medical therapy
  - Invasive and surgical treatments
- Discuss the integration of concomitant management of cardiac disease and cancer
- Explain the role of cardiac screening in a patient with cancer

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests
  - Stress echocardiography
  - Cardiac catheterization
  - Coronary angiography
  - Cardiac CT
  - Cardiac MR
  - PET
- Formulate an appropriate management/treatment plan

Attitudes

- Understand the inevitable anxiety experienced by a patient who develops heart disease in association with cancer
- Recognize the importance of appropriate information and guidance
- Participate as an equal member of an integrated multi-professional team including primary care, pathology, radiology, and oncology specialists

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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7. Chapter 7: Acute cardiovascular care

7.1. Manage a patient with haemodynamic instability

Description

Timeframe: first contact with a haemodynamically unstable patient until transition of care

Setting: intensive care unit (ICU); intensive coronary care unit (ICCU); emergency department; inpatient setting; and pre-hospital setting

Including:

evaluate and manage haemodynamic instability and cardiogenic shock

recognize the different underlying causes

integrate the findings from clinical, electrocardiographic, telemetry, imaging, and haemodynamic assessment—to develop a plan for bedside intervention and overall management strategy

manage the interventions aimed at stabilizing the patient

co-ordinate safe and effective transitions of care once the patient is stabilized, and where appropriate, in the event of worsening instability, including referral for acute mechanical circulatory support

Excluding: during interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Describe the pathophysiology, differential diagnosis, and characteristic clinical, haemodynamic, radiographic, and laboratory findings of cardiogenic, hypovolemic, septic, and mixed circulatory shock
- Describe the characteristic clinical, electrocardiographic, echocardiographic, and radiographic findings of pulmonary embolism, aortic dissection, pericardial tamponade, acute decompensated severe HF, acute valvular heart disease
- List the possible causes of HF or shock in a cardiac transplant patient
- Describe the characteristic physical examination, echocardiographic, angiographic, and haemodynamic findings of mechanical complications of myocardial infarction
- Discuss the principles of treatment of hypotension in special populations, including a patient with cardiogenic shock, hypertrophic obstructive cardiomyopathy, right ventricular infarction, massive pulmonary embolism, pericardial tamponade, and distributive shock
- Discuss the indications for, and characteristic findings of, bedside invasive and non-invasive haemodynamic monitoring in a patient with haemodynamic instability
- Describe the indications for revascularization and cardiac surgery in cardiogenic shock
- Discuss the indications for emergency surgery/percutaneous intervention in a patient with pulmonary embolism, aortic dissection, pericardial tamponade, acute decompensated severe HF, severe valvular heart disease, and myocardial infarction
- Consider the indications, contraindications, and clinical pharmacology for vasoactive and inotropic medications used in the treatment of a patient with haemodynamic instability
- Outline the types of, and indications for, acute mechanical circulatory support
- Explain the differential diagnosis and characteristic laboratory findings of oliguria and acute kidney injury in patients with haemodynamic instability
- Describe the indications for oxygen supplementation, endotracheal intubation, and mechanical ventilator support, ultra-filtration, and dialysis techniques

Skills

- Interpret clinical findings, chest X-ray, ECG, laboratory, and echocardiography data to diagnose the underlying causes of haemodynamic instability
- Integrate the findings from clinical, electrocardiographic, telemetry, imaging, and haemodynamic assessment—to develop a plan for bedside intervention for a patient with haemodynamic instability
- Evaluate and manage supraventricular and ventricular arrhythmias and conduction disturbances in an unstable patient
- Manage haemodynamic instability including shock in those with aortic dissection, massive or submassive pulmonary embolism, acute severe valvular regurgitation, and right ventricular dysfunction
- Manage hypertensive emergencies
- Interpret echocardiographic features of tamponade and perform pericardiocentesis or refer patient for surgical drainage as appropriate
- Identify and assess the need for invasive/non-invasive haemodynamic monitoring

Continued

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- Utilize and interpret haemodynamic (invasive and non-invasive) measurements
- Recognize impending organ dysfunction and manage organ dysfunction
- Recognize when renal replacement therapy is indicated
- Use ultrasound guidance to place arterial and central venous catheters
- Place a temporary transvenous pacemaker under fluoroscopy/balloon-tipped wire
- Identify and assess the need for invasive/non-invasive ventilation and CO_2 monitoring
- Incorporate oxygen supplementation and mechanical ventilation in patient management
- Use vasopressor and inotropic therapy appropriately in various types of shock
- Refer for mechanical circulatory support when indicated
- Refer appropriately for extracorporeal support
- Assess the response to treatment
- Select the optimal drug treatment according to changes in patient condition

Attitudes

- Demonstrate collaborative working in treatment decisions along the patient pathway, including the emergency department and the ICU
- Demonstrate collaborative decision-making in bringing specific expertise (i.e. imaging, cardiac catheterization, surgery arrhythmia ablation) to the wider multidisciplinary team
- Provide regular information to the patient and family members of the prognosis and treatment decisions

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

7.2. Manage a patient post-cardiac arrest

Description

Timeframe: from 'return of spontaneous circulation' until transition of care
Setting: ICU; ICCU; emergency department; inpatient setting; and pre-hospital setting
Including:
manage a patient after a resuscitated cardiac arrest including life-threatening arrhythmias
therapeutic hypothermia protocols
neurologic prognostication in conjunction with neurological consultants
respiratory, renal, and haemodynamic support
recognize and manage appropriately the different underlying causes
Excluding: paediatric patients
advanced critical care expertise
extracorporeal life support
extracorporeal cardiopulmonary resuscitation

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Outline the epidemiology, aetiology, pathology, pathophysiology, and clinical presentation of cardiorespiratory arrest, predisposing conditions, and peri-arrest arrhythmias
- Describe the algorithms, methods and guidelines of basic and advanced life support, including airway management, appropriate drug use, defibrillation, pacing, and vascular access
- Describe expected ECG and echocardiography findings

Continued

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- Discuss the indications for not starting resuscitation or ceasing an initiated attempt
- Explain the principles, indications, and application of target thermal control post-cardiac arrest
- Describe the principles of post-resuscitation bundled care
- Discuss the pharmacology: actions, indications, and contraindications of the main drugs used in the management of cardiac arrest
- Describe the methods for assessing neurological function
- Consider the relevance of prior health status in determining risk of critical illness and outcomes
- Discuss the diagnostic work-up and risk stratification of survivors
- List the recommendations for primary and secondary prevention of SCD
- Outline the basics of legal and ethical issues relating to organ donation

Skills

- Participate in timely discussion and regular review of 'do not actively resuscitate' orders and treatment limitation decisions
- Recognize signs and symptoms of impending cardiac arrest
- Undertake resuscitation in accordance with clinical guidelines and the patient status
- Check and assemble resuscitation equipment
- Lead the resuscitation team
- Support relatives witnessing an attempted resuscitation
- Risk-stratify post-arrest and refer appropriately for ongoing intervention/investigation
- Recognize ECG and echocardiography findings in a cardiac arrest patient
- Utilize appropriate hypothermia protocols in survivors of cardiac arrest in conjunction with neurological consultants
- Assess, predict, and manage circulatory shock after cardiac arrest
- Document Glasgow Coma Scale
- Address legal and ethical issues on patient autonomy, appropriateness of resuscitation, and ICU admission
- Consult the views of referring clinicians, family, and team

Attitudes

- Be alert to prodromal symptoms and signs of deterioration and incipient cardiorespiratory arrest
- Recognize the urgency in the management of the deteriorating patient
- Appreciate the importance of timely institution of organ-system support in cardiac arrest
- Empathize with SCD survivor and family anxieties
- Provide clear and timely explanations to a patient, relatives, and staff
- Convey compassionate care to a patient and their relatives
- Exhibit awareness of personal limitations, by requesting and accepting assistance and supervision where appropriate
- Co-operate with the whole multi-disciplinary team, relatives (and where appropriate the patient) where ongoing life-sustaining care appears futile in order to determine the best ongoing management strategy for the patient

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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7.3. Manage a critically ill cardiac patient

Description

Timeframe: from admission of a patient to the I(C)CU until transition of care

Setting: ICU and ICCU

Including:

evaluate and manage the underlying cardiac disease, and its potential contribution to the critical state of the patient and non-cardiac organ failure/dysfunction

interpret clinical findings, cardiac investigations, and monitoring in context

recommend evidence-based cardiac interventions/therapies in context

institute and interpret invasive and non-invasive cardiac monitoring

institute and manage non-invasive ventilation

manage vasoactive agents

Excluding: performing intubation and invasive ventilation

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Health advocate
- Scholar
- Professional

Knowledge

- Discuss the criteria for admission and discharge from ICCU/cardiac intensive care unit (CICU)
- Describe the care bundles/protocolized care commonly used in ICCU/CICU
- Outline the principles of outcome prediction (scoring systems in intensive care), risk/ benefit ratio, and cost effectiveness of interventions
- List the most common complications of intensive care
- Discuss the principles and meaning of quality measures in intensive care
- Discuss common sources of error and factors contributing to critical incidents
- Outline the principles of epidemiology and prevention of hospital-acquired infections
- Discuss the principles of conflict resolution and debriefing

Skills

- Utilize interdisciplinary input and expertise in co-management of a critically ill patient, including transitions of care
- Utilize resources to enhance adherence to guidelines and protocols and obtain new information from trials and relevant professional societies
- Adopt appropriate use criteria, risk/benefit analyses in the use of investigations and treatment
- Apply care bundles/protocolized care where appropriate
- Prescribe drugs and therapies safely
- Monitor, report, and act upon complications

Attitudes

- Focus on safety and apply measures to prevent hospital-acquired infection and other complications
- Communicate effectively with physicians and other professionals on the team in the management of a critically ill patient and their transition to other care environments
- Liaise with experts with specialized skills within and outside cardiology
- Demonstrate sensitivity to patient preferences and values and end-of-life issues
- Evaluate and modify interventions depending upon clinical response
- Participate in hospital quality and safety initiatives in the ICU, including care bundles
- Address the physical and psychosocial consequences of critical illness for a patient and their family including integrating relevant cultural, ethnic, and socioeconomic backgrounds as well as patient preferences and values in order to determine the best ongoing management and communication strategy

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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7.4. Manage a patient after a percutaneous cardiovascular procedure

Description

Timeframe: from immediate post-interventional care after percutaneous cardiovascular procedure until effective transition of care

Setting: emergency department; inpatient setting; ICU; and ICCU

Including:

manage a patient with or at risk of complications, including acute bleeding, pericardial collection/tamponade, recurrent/ongoing cardiac ischaemia, rhythm disturbance, limb ischaemia following transcatheter valve therapy, and other percutaneous coronary or structural cardiovascular procedures

co-ordinate safe and effective transitions of care where specific interventions/escalation is required

Excluding: during interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Explain the indications and contraindications, and clinical pharmacology of anticoagulant, antiplatelet, and fibrinolytic agents used after percutaneous cardiovascular procedures
- Outline the procedural process, risks, and early complications of catheter-based techniques to treat supraventricular and ventricular arrhythmias
- Outline the procedural process, risks, and early complications of catheter-based techniques to treat valvular diseases
- Outline the procedural process, risks, and early complications of coronary interventional techniques
- Discuss the elements of scoring systems for assessment of the risk of major bleeding in patients treated with anti-thrombotic medications after percutaneous cardiovascular procedures
- Describe the targets for initiation and monitoring of anticoagulation and antiplatelet agents after cardiac interventions

Skills

- Evaluate and manage patients with haemodynamic instability following percutaneous cardiovascular procedures
- Manage patients with acute bleeding from a vascular access or other site after percutaneous cardiovascular procedures
- Manage patients with acute limb ischaemia after percutaneous cardiovascular procedures
- Manage patients with stroke after percutaneous cardiovascular procedures
- Manage allergic reaction to contrast
- Manage a patient with worsening renal function post-intervention
- Manage a patient with tamponade post-intervention

Attitudes

- Inform the team, patient, and family members of the procedural outcome in a timely manner
- Inform the patient and family members of the next steps of management and timing of discharge from the ICU/ICCU
- Understand the risks of complication in relation to percutaneous cardiovascular procedures in a critically ill patient

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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7.5. Manage a patient after cardiac surgery

Description

Timeframe: from immediately after cardiac surgery until effective transition of care

Setting: inpatient setting; ICU; and ICCU

Including:

management of routine postoperative care in the recently operated cardiac patient including acute pain

cardiopulmonary resuscitation in the postperative cardiac adult patient

Excluding: VAD and transplant patients

adult congenital heart disease patients

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the indications, contraindications, and clinical pharmacology of anticoagulant, antiplatelet, and antifibrinolytic agents used after cardiac, aortic, and vascular surgical procedures
- Outline the procedural process, risks, and early complications of cardiac, aortic, and vascular surgical procedures
- Describe the elements of scoring systems for assessment of the risk of major bleeding after a cardiac, aortic, or vascular surgical procedure
- Describe expected/possible ECG and echocardiography findings after cardiac surgery
- Describe target treatment levels of anticoagulation/anti-thrombotic agents following cardiac surgery
- Describe strategies to prevent and manage arrhythmia

Skills

- Evaluate and manage a patient with haemodynamic instability following cardiac surgery
- Evaluate and manage a patient with haemorrhage following cardiac surgery
- Manage a patient with stroke after cardiac surgery
- Manage arrhythmia after cardiac surgery
- Prescribe long-term disease modifying agents in the postoperative period
- Interpret echo and ECG findings after cardiac surgery

Attitudes

- Inform the team, patient, and family members of the outcome of the procedure in a timely manner
- Inform the patient and family members of the next steps of management and timing of discharge from the ICCU

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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7.6. Manage end-of-life care in a critically ill cardiac patient

Description

Timeframe: from recognizing a possible end-of-life situation until effective support for patient and family

Setting: I(C)CU and inpatient setting

Including:

using pharmacologic and non-pharmacologic treatments

estimate, communicate, and consider prognosis

delineate goals of care based on patient and/or family values

delineate goals of care discussions leading to the decision to withdraw advanced life support therapy (LST), orchestration of withdrawal of LST, management of symptoms before and after withdrawal of advanced LST, provision of family support for psychosocial, and spiritual distress

identify signs of the dying process

address futility and requests for hastened death

Excluding: end of life in children

lead the interdisciplinary team

palliative care not in an ICCU

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader

Knowledge

- Describe the various settings in which patients and families may access palliative care
- Describe the issues of device management (pacemaker, ICD, CRT) at end of patient's life
- Discuss approaches to screening and basic history taking of spirituality, religion, existential issues, and issues of meaning and purpose
- Describe communication techniques to provide psychosocial support
- Describe the characteristics of normal and complicated grief and bereavement
- Describe issues involving cultural sensitivity and diversity that affect access to and utilization of hospice and palliative care
- Discuss ethical principles and how they apply to end-of-life care
- Describe the national laws that impact the withdrawal of advanced life-sustaining therapies
- Understand the local institutional policies relevant to the process of withdrawal of advanced life-sustaining therapies
- Describe the process and symptom burden of withdrawal of various advanced life-sustaining therapies
- Describe common challenges for symptom management

Skills

- Utilize risk assessment scoring systems when appropriate for patient management and counselling
- Recognize when further medical care is futile
- Review the pharmacological, nonpharmacological and procedural approaches (along with referral services) to manage pain and anxiety
- Explore how patient and family spiritual, religious, and existential beliefs and values affect medical decision-making and the provision of health care to each patient and family
- Engage with palliative care processes
- Facilitate discussions with a patient and/or family regarding goals of care and preparation for withdrawal of advanced LST
- Recognize and manage adverse effects of medications and other therapies
- Attend to psychosocial and spiritual distress including anticipatory grief and bereavement responses from families
- Make the death pronouncement in a sensitive, respectful way in the presence of the family
- Document the patient's death and complete the death certificate appropriately

Attitudes

- Provide compassionate presence and listening
- Value the key roles of collaboration with colleagues and maintenance of professional boundaries in managing end of life
- Recognize the necessity of managing physical suffering to allow a patient to better address other domains of suffering and improve quality of life
- Appreciate the complex interplay between physical and other domains of suffering and the role of the palliative care team
- Be open to working with spiritual providers of diverse backgrounds and belief systems
- Appreciate the importance and time sensitivity in providing care for the imminently dying patient and their family
- Acknowledge the uniqueness of the dying experience for each patient and family

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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8. Chapter 8: Prevention, rehabilitation, and sports

8.1. Manage cardiovascular aspects in an athlete (Sport Cardiology)

Description

Timeframe: from initial patient contact to formulating recommendations until regular follow-up

Setting: inpatient setting, outpatient setting, and sports arena

Including:

assessment of status quo, identification of risk factors, and genetic testing

using basic and advanced tools for investigation

Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Describe the effects of exercise and sports on cardiovascular structure and physiology
- Recognize the characteristics of the athlete's heart and explain how diagnostic criteria are influenced by high-intensity sport
- Discuss the diagnostic criteria and appropriate investigations in professional or recreational athletes with CVD
- Describe the role of pre-participation screening for CVD in competitive and recreational athletes, pros and cons, and choice of investigations
- Discuss contraindications to exercise or competition, and the provision of appropriate medical certification
- Describe the risk factors for and mechanisms of SCD during and after strenuous exercise
- Describe the cause, mechanism, and frequency of SCD in athletes and in the population at large
- Review the mechanisms and side effects of illicit performance-enhancing drugs
- Describe how to make recommendations for professional and recreational sports participation according to patient pathophysiology

Skills

- Perform an individual CVD risk assessment using appropriate information from history, laboratory assessment including full lipid profile, clinical data, and risk scores
- Perform and interpret:
  - ECG
  - Echocardiography
  - Exercise ECG
  - Cardiopulmonary exercise testing
- Recognize pathological cardiovascular changes and differentiate them from the characteristic features of 'athlete's heart'
- Use prevailing recommendations for eligibility for participation in competitive sports

Attitudes

- Recognize the role of exercise and sport in the promotion of health
- Consult athletes with cardiac disease regarding career decisions

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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8.2. Manage a patient with arterial hypertension

Description

Timeframe: from diagnosis until effective treatment of hypertension

Setting: inpatient setting, outpatient setting, and emergency department

Including:

identification of causes and differential diagnosis of hypertension (also malignant hypertension and emergency-related hypertension)

performance and interpretation of diagnostic modalities

interpretation of additional diagnostic modalities

medical therapy

Excluding: performing interventional or surgical procedures

hypertension during pregnancy &cenveo_unknown_entity_wingdings_F0E0; see EPA 9.8.

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Define hypertension.
- Discuss how to diagnose hypertension from:
  - Office measurement
  - Home measurement
  - Ambulatory blood pressure measurement
- Describe the pathophysiology of hypertension
- Describe how to differentiate primary from secondary hypertension (including causes of secondary hypertension)
- Describe the types of hypertension and potential organ damage including heart damage, with the timing of the damage and type of investigations
- Explain the use of investigations to diagnose the cardiac complications of hypertension
- Describe the blood pressure targets for antihypertensive treatment according to age and other risk factors
- Discuss non-pharmacological approaches to lowering blood pressure (e.g. lifestyle modification)
- Explain the pharmacological properties of the drugs used to treat hypertension, their indications, and side effects
- Discuss how to tailor antihypertensive treatment to the patient's age, sex, and co-morbidities
- Define refractory hypertension
- Discuss the management of refractory hypertension
- Outline the indications for interventional and surgical treatment in hypertensive patients
- Define malignant hypertension
- Discuss the management of malignant hypertension
- Describe how to manage hypertensive emergencies

Skills

- Obtain a relevant history and perform an appropriate physical examination
- Measure and interpret BP obtained with manual and automatic office devices, and ambulatory and home BP monitors
- Perform and interpret the following diagnostic modalities:
  - Electrocardiogram
  - Exercise ECG
  - Echocardiography
- Interpret the following diagnostic modalities:
  - Comprehensive blood testing
  - Renal function
  - Proteinuria and microalbuminuria
  - Diabetes screening
  - Cardiac MR
  - Vascular ultrasound

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  - Central BP assessment
  - Ankle brachial index
  - Fundoscopy
- Recognize when a patient should be referred to another speciality
- Select the target BP according to the cardiovascular risk
- Manage hypertension non-pharmacologically and pharmacologically
- Propose a roadmap to reduce global cardiovascular risk in a patient with hypertension

Attitudes

- Collaborate as in a team, with general practitioners and other medical specialists in the management of a patient with hypertension; in particular, the elderly and patients with diabetes, chronic kidney disease (CKD), and cerebrovascular disease
- Appreciate the systemic nature of hypertension and its consequences for various vascular beds
- Identify hypertension as major risk factor for CVD
- Demonstrate attention to detail in ensuring the adequacy of treatment and safeguarding against both under-treatment and over-treatment
- Motivate the patient to maintain long-term compliance with antihypertensive therapy and lifestyle measures and encourage the use of blood pressure home monitoring device
- Participate in hypertension prevention, detection, and treatment programmes in the community

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

8.3. Manage a patient with dyslipidaemia

Description

Timeframe: from diagnosis until effective treatment of dyslipidaemia
Setting: inpatient setting, outpatient setting, and emergency department
Including:
identification of causes and differential diagnosis
performance and interpretation of diagnostic modalities
interpretation of additional diagnostic modalities
non-pharmacological treatment and medical therapy
Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Describe how to diagnose the different forms of dyslipidaemia
- Outline the physiopathology of dyslipidaemia and relation to initiation of atherosclerosis
- Discuss how to assess the cardiac and extracardiac complications of dyslipidaemia
- Discuss the targets for dyslipidaemia treatment
- Explain the role of non-pharmacological approaches (e.g. diet)
- Discuss pharmacological treatment: the indications, side effects, and pharmacological properties of the different lipid-lowering drugs
- Describe how to assess and manage the side effects of treatment
- Explain how to tailor treatment to the individual patient
- Discuss the management options for patients with intolerance to treatment

Continued

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Skills

- Obtain a relevant history (including family history) and perform an appropriate physical examination
- Evaluate the cardiovascular risk of a patient with dyslipidaemia (e.g. Score table)
- Evaluate a patient with dyslipidaemia, including comprehensive blood testing:
  - Cholesterol
  - Triglycerides
  - High-density lipoprotein cholesterol
  - Low-density lipoprotein cholesterol
  - Apolipoprotein A1, Apolipoprotein B, Lp(a)
  - Screening for other associated risk factors such as diabetes
  - Genetic testing and screening of relatives if there is suspicion of familial disease
- Assess cardiac and extracardiac complications of dyslipidaemia
- Perform and interpret the following diagnostic modalities:
  - Electrocardiogram
  - Exercise ECG
- Interpret the following diagnostic modalities:
  - Vascular ultrasound
  - Fundoscopy
- Interpret and apply the lipids target for treatment according to cardiovascular risk
- Assess when the patient should be referred to another speciality
- Propose a roadmap to reduce global cardiovascular risk in a patient with dyslipidaemia

Attitudes

- Communicate to ensure a team working with general practitioners and other medical specialists in the management of a patient with dyslipidaemia; in particular, the elderly and patients with diabetes, CKD, and cerebrovascular disease
- Recognize dyslipidaemia as a major risk factor for CVDs
- Motivate the patient (and their family) to maintain long-term compliance with lipid-lowering therapy and give counsel on nutrition and lifestyle
- Participate in dyslipidaemia, detection, and treatment programmes in the community

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

8.4. Manage cardiovascular aspects in a diabetic patient

Description

Timeframe: from diagnosis until effective treatment of a cardiovascular problem in a diabetic patient

Setting: inpatient setting, outpatient setting, and emergency department

Including:

identification of causes and differential diagnosis

identification of complications

performance and interpretation of diagnostic modalities

interpretation of additional diagnostic modalities

non-pharmacological treatment and medical therapy

Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Continued

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Knowledge

- Explain how to diagnose type 1 and type 2 diabetes, and potential diabetes
- Outline the basic aetiology and pathophysiology of types 1 and 2 diabetes
- Describe how to evaluate a patient with diabetes, including comprehensive blood testing
- Discuss the recognition, diagnosis, and assessment of cardiac complications
- Discuss the recognition, diagnosis, and assessment of extracardiac complications
- Describe the non-pharmacological treatment of diabetes
- Describe the pharmacology of drugs used to treat diabetes: their indications, side effects, and potential for unwanted cardiovascular effects
- Describe the prevention and treatment of hypoglycaemia in a cardiac patient with diabetes
- Outline the continuum from impaired glucose metabolism to overt diabetes that ultimately may become insulin-dependent

Skills

- Obtain a relevant history and perform an appropriate physical examination
- Evaluate the global cardiovascular risk of a patient with diabetes using appropriate risk score
- Evaluate a patient with diabetes, including comprehensive blood testing screening for other associated risk factors
- Assess cardiac and extracardiac complications of diabetes
- Perform and interpret the following diagnostic modalities:
  - Electrocardiogram
  - Exercise ECG
- Interpret the following diagnostic modalities:
  - Stress echocardiography
  - Vascular ultrasound
  - Fundoscopy
- Assess when the patient should be referred to other specialities
- Identify the blood glucose target for treatment according to cardiovascular risk
- Evaluate the benefit of risk factor intervention for the individual patient

Attitudes

- Collaborate to ensure team working with all professionals with a role in diabetes management: general practitioners, other medical specialists, and specialist nurses; with particular focus on the elderly and patients with chronic kidney and cerebrovascular disease
- Recognize diabetes as a major risk factor for CVD
- Motivate the patient and their family to maintain long-term compliance with diabetes treatment and compliance with lifestyle change
- Participate in diabetes detection and treatment programmes in the community

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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8.5. Manage an individual in primary prevention

Description

Timeframe: from initial patient contact until formulating recommendations for primary prevention

Setting: inpatient setting and outpatient setting

Including:

assessment of status quo and identification of risk factors

using basic and advanced tools for investigation

non-pharmacological treatment and medical therapy

Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Discuss the priorities for population screening for cardiovascular risk
- Discuss the importance of lifestyle (smoking, diet, narcotics, alcohol, exercise) in CVD and its prevention
- List the risks associated with smoking
- Describe the treatment options for smoking cessation
- Consider the risks associated with obesity
- Discuss the effect of different types of diet on metabolic profile and clinical outcome
- Identify the protective components of diet
- Consider the risks associated with a sedentary lifestyle and the benefits to be derived from exercise
- Describe the difference between physical activity, exercise, and sports
- Describe how to evaluate physical activity and targets for physical activity
- Describe how to determine targets for body weight and nutrition
- Discuss the emerging risk factors (social, economic, stress, depression, personality type)
- Describe how to evaluate cardiovascular risk for an individual patient and identify patients with potentially high risk (using appropriate tables)
- Describe how to develop recommendations (holistic approach) to prevent CVD in an individual patient, in particular elderly patients and those with diabetes, CKD, and cerebrovascular disease

Skills

- Obtain a relevant history (including family history) and perform an appropriate clinical examination
- Evaluate cardiovascular risk and assess global cardiovascular risk at the individual level (including HeartSCORE or other appropriate tables)
- Evaluate the benefit of prevention at individual levels
- Select the appropriate investigation for refined risk stratification (CT calcium scoring, carotid intima media thickness, others)
- Manage risk factors appropriately, including pharmacological and non-pharmacological therapies
- Communicate the importance of risk factors to patient, family, and wider community
- Communicate the importance of smoking cessation, diet, and exercise
- Communicate the importance of patient compliance and behaviour
- Motivate a patient and their family to change lifestyle and be compliant with prescriptions and recommendations
- Motivate a patient to adopt a less stressful lifestyle
- Monitor patient compliance and behaviour

Attitudes

- Adopt a non-judgemental attitude to a patient regarding their individual lifestyle
- Exemplify appropriate lifestyle in personal behaviour
- Motivate a patient and their family to maintain long-term compliance
- Communicate to ensure a collaborative approach with general practitioners and other medical specialists or paramedical staff (nurses . . .) in the management of a patient with cardiovascular (CV) risk factors

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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8.6. Manage a cardiac patient in secondary prevention

Description

Timeframe: from identifying a patient for secondary prevention to formulating recommendations until regular follow-up

Setting: inpatient setting, outpatient setting, and emergency department

Including:

assessment of status quo and identification of risk factors

identification of target for secondary prevention

using basic and advanced tools for investigation

non-pharmacological treatment and medical therapy

Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Health advocate
- Professional

Knowledge

- Identify patients for secondary prevention
- Describe optimal targets for secondary prevention (blood pressure, lipids, diabetes, physical activity, body weight, nutrition)
- Discuss how to establish a global strategy for reduction of CV risk in secondary prevention
- Understand the pharmacology of drugs used in secondary prevention

Skills

- Obtain a relevant history and perform an appropriate physical examination
- Assess the presence of uncorrected/partially corrected risk factors
- Evaluate a patient for all the risk factors and cardiac or extracardiac complications
- Understand the results of investigations showing cardiac or extracardiac complication
- Identify the incompletely corrected risk factors in a patient requiring secondary prevention
- Evaluate the benefits of risk factor intervention for the individual patient

Attitudes

- Adopt a non-judgemental attitude to a patient regarding their lifestyle
- Motivate the patient (and their family) to maintain long-term compliance with treatment and compliance to lifestyle change (diet, smoking, stress, exercise, others)
- Communicate to ensure effective collaboration with general practitioners and other medical and paramedical specialists (e.g. nurses) in the management of a patient CVD

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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8.7. Prescribe a prevention and rehabilitation programme for a cardiovascular patient

Description

Timeframe: from identifying a patient in need of a cardiovascular rehabilitation programme until prescribing an adapted rehabilitation programme

Setting: inpatient setting and outpatient setting

Including:

assessment of status quo, identification of risk factors and resources (e.g. patient, other healthcare professionals)

determination of exercise capacity

interpretation of reports from basic and advanced diagnostic modalities

motivational conversation with patient

Excluding: performing interventional or surgical procedures

CanMEDS roles

- Medical expert
- Collaborator
- Health advocate
- Professional

Knowledge

- Describe the indications for and benefits of a rehabilitation programme
- Discuss the values and limitations of diagnostic modalities for determining exercise capacity:
  - Exercise ECG
  - Cardiopulmonary exercise testing
- Discuss how to assess lifestyle: physical activity, nutrition, education, and psychological risk factors
- Outline the role of other professionals (e.g. nurses, physiotherapists, dieticians) in a rehabilitation programme
- Describe how to prescribe a patient exercise-based rehabilitation programme adapted to their condition and underlying pathophysiology
- Describe how and when to suggest patient lifestyle interventions according to a patient's condition

Skills

- Obtain a relevant history and perform an appropriate clinical examination including the specific evaluation of an elderly patient
- Discuss the potential advantage of a rehabilitation programme with a patient and obtain their commitment to participate
- Perform and interpret risk stratification using indicated tests
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Differentiate between different causes of exercise limitation
- Prescribe an exercise-based rehabilitation programme (specific patient training) and other lifestyle interventions adapted to the patient's condition, in collaboration with other specialists when necessary
- Motivate a patient to ensure long-term adherence to lifestyle changes and continuing exercise programmes
- Know how to deal with patient information from health apps
- Up-titrate guideline-directed medical therapy (GDMT) and motivate a patient to ensure long-term adherence to GDMT

Attitudes

- Advocate rehabilitation as an essential component of cardiac care, especially in coronary artery disease and congestive HF patients
- Recognize the importance of rehabilitation and secondary prevention for professional, personal and social life among patients with heart disease, the interplay of physical and psychological aspects of heart disease and the positive influence of exercise on cardiovascular risk factors
- Lead the rehabilitation team with other professionals including nurse specialists, physiotherapists, ergophysiologists, psychologists, dieticians, and general practitioners in rehabilitation and secondary prevention
- Recognize the importance of patient and family education, and the role of other professionals in rehabilitation

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

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9. Chapter 9: Cardiac patients in other settings

9.1. Manage a patient with aortic disease

Description

Timeframe: from diagnosis of an aortic disease until establishment of effective treatment

Setting: outpatient setting, inpatient setting, and emergency department

Including:

assessment of a patient with acute and chronic aortic disease

implementing medical therapy

referring for interventional or surgical treatment

Excluding: performing interventional or surgical treatment

Canadian Medical Education Directives for Specialists (CanMEDS) roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the epidemiology, aetiology, genetics, and pathophysiology of aortic diseases, including:
  - Aneurysms of the thoracic aorta
  - Dissection of the thoracic aorta
  - Aortitis
  - Aortic atheromatous disease
  - Aortoiliac occlusive disease
  - Genetic syndromes associated with aortic pathologies
- Classify the types of aortic dissection
- Describe the clinical features of diseases associated with aortic diseases
- Relate the clinical features to the aortic pathology
- Classify the risk conditions for aortic diseases
- Describe the particularities of different imaging modalities in the diagnosis of aortic diseases
- Discuss the medical treatment of aortic diseases
- Describe the indications for interventional and surgical strategies for management of aortic diseases

Skills

- Conduct an appropriate clinical history and physical examination including evaluation of peripheral pulses and blood pressure measurement in both arms and legs
- Obtain a relevant family history and recognize situations that require family screening
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Transthoracic echocardiography
  - Trans-oesophageal echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Coronary angiography and aortography
  - Cardiac CT
  - Cardiac MR
- Manage a patient with diseases of the aorta in a timely fashion, with medical, interventional, or surgical procedures
- Recognize indications for genetic testing and appropriate referral for medical genetics consultation

Attitudes

- Recognize the urgency required in the management of acute aortic diseases
- Work in team with interventional cardiologists, cardiothoracic and vascular surgeons, radiologists, and intensive care physicians

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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9.2. Manage a patient with trauma to the aorta or the heart

Description

Timeframe: from diagnosis of a trauma to the aorta or the heart until establishment of effective treatment

Setting: emergency department

Including:

assessment of a patient with acute trauma to the aorta or the heart

implementing medical therapy

referring for interventional or surgical treatment

Excluding: performing interventional or surgical treatment

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the mechanisms and clinical presentations of trauma to the aorta and heart including:
  - Trauma of the heart including contusion and ACS
  - Trauma of the vessels including acute aortic dissection and aortic rupture
  - Relevance of genetics/aortic root disease
- Understand the strengths and limitations of different imaging modalities
- Describe the appropriate medical, interventional, and surgical management strategies

Skills

- Take a relevant history and perform an appropriate clinical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Ankle brachial index
  - Transthoracic echocardiography
  - Trans-oesophageal echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Coronary angiography and aortography
  - Cardiac CT
  - Cardiac MR
  - IVUS
- Manage different aortic conditions with the appropriate treatment modality in a timely manner

Attitudes

- Work with emergency and intensive care physicians, cardiovascular surgeons, interventional cardiologists, and radiologists
- Recognize the urgency required in managing a patient with diseases of the aorta and cardiac trauma

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 3. Indirect supervision

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9.3. Manage a patient with peripheral artery disease

Description

Timeframe: from diagnosis of peripheral artery disease until establishment of effective treatment

Setting: outpatient setting and inpatient setting

Including:

assessing a patient with peripheral artery disease

identifying and treating associated co-morbidities

implementing medical therapy and lifestyle changes

referring a patient to a specialist (e.g. diabetologist, interventional radiologist, vascular surgeon)

Excluding: performing interventional or surgical treatment; performing vascular ultrasound

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Health advocate
- Scholar

Knowledge

- Describe the epidemiology and pathology of peripheral arterial disease (PAD)
- Discuss the diagnosis and assessment of PAD, including the Ankle Brachial Index (ABI) and various imaging modalities
- Describe the general treatment modalities including smoking cessation, lifestyle modification, supervised exercise training programme, antiplatelet and anti-thrombotic drugs, lipid-lowering drugs, and antihypertensive therapies in a patient with PAD
- Describe the diagnosis and treatment of the cardiovascular aspects of erectile dysfunction
- Recall indications for invasive (interventional and surgical) management and their relative merits in different situations
- Understand prognostic stratification of PAD
- Describe the management of acute and critical limb ischaemia

Skills

- Take a relevant history and perform an appropriate physical examination, especially the examination of peripheral pulses
- Identify the risk factors and select the appropriate management strategy, including antiplatelet and/or anticoagulant therapy
- Perform and interpret the following diagnostic modalities:
  - ECG
  - ABI
  - Vascular ultrasound screening of abdominal aorta, carotid and femoral arteries (depending on national preference)
- Interpret the following diagnostic modalities:
  - Vascular ultrasound screening of abdominal aorta, carotid and femoral arteries (depending on national preference)
  - X-ray
  - Invasive angiography in different vascular beds
  - CT angiography in different vascular beds
  - MR angiography in different vascular beds
- Classify and stage lower extremity artery disease
- Deliver appropriate lifestyle counselling

Attitudes

- Appreciate the systemic nature of atherosclerosis and its implications for a patient in whom disease is manifested within a single territory. In particular, awareness of the association of PAD with disease in the coronary, carotid, and renal arteries.
- Recognize the importance of risk-factor modification in prevention
- Have a positive approach to encouraging a patient to adopt a healthier lifestyle with specific emphasis on risk factors and walking
- Collaborate with specialists including cardiac rehabilitation specialists, interventional cardiologists, radiologists, vascular surgeons, and diabetologists

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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9.4. Manage a patient with thromboembolic venous disease

Description

Timeframe: from diagnosis of thromboembolic venous disease until establishment of effective treatment

Setting: outpatient setting, inpatient setting, and emergency department

Including:

assessing a patient with superficial and deep vein thrombosis

implementing medical therapy

referring for interventional or surgical treatment

implementing secondary prevention

Excluding: Performing interventional or surgical treatment

CanMEDS roles

- Medical epert
- Collaborator
- Professional

Knowledge

- Describe the epidemiology of deep vein thrombosis
- Recall the major risk factors for deep vein thrombosis
- Describe the pathophysiology of pulmonary embolism
- Describe the clinical presentation of superficial and deep vein thrombosis
- Describe the clinical presentation of pulmonary embolism
- Explain the diagnosis of deep vein thrombosis by duplex examination of leg and pelvic veins
- Discuss the value and limitations of investigations for the diagnosis of pulmonary embolism
- Describe the treatment of acute pulmonary embolism by:
  - Anticoagulant therapy
  - Thrombolytic therapy
  - Embolectomy
- Describe the management of chronic thromboembolic pulmonary hypertension, including thrombo endarterectomy
- Recall preventive measures for deep venous thrombosis /pulmonary embolism

Skills

- Take a relevant history and perform an appropriate clinical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Transthoracic echocardiography
  - Trans-oesophageal echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests including the use of D-dimer and troponins
  - Pulmonary angiography
  - CT angiography
  - MR angiography
  - Ventilation-perfusion-scanning
- Implement appropriate therapy for acute pulmonary embolism and chronic thromboembolic pulmonary hypertension
- Diagnose and manage acute and chronic deep vein thrombosis
- Determine the duration of anticoagulant therapy for a patient with thromboembolic venous disease

Attitudes

- Appreciate of the difficulties in diagnosing pulmonary embolism on the basis of symptoms and signs
- Collaborate with other imaging experts including radiologists and nuclear imaging specialists
- Ensure patient understanding of the disease and the importance of compliance with, and the precautions required during long-term anticoagulant therapy

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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9.5. Manage a patient with pulmonary thromboembolism

Description

Timeframe: from diagnosis of a pulmonary thromboembolism until establishment of effective treatment

Setting: outpatient setting, inpatient setting, and emergency department

Including:

assessing a patient with suspected acute pulmonary thromboembolism

implementing diagnosis strategy

implementing medical therapy

referring for interventional or surgical treatment

implementing secondary prevention

Excluding: performing interventional or surgical treatment

for thromboembolic pulmonary hypertension, see EPA 9.6

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Knowledge

- Describe the aetiology and epidemiology of pulmonary thromboembolism
- Recognize the principal risk factors for pulmonary embolism
- Describe the chronic cardiovascular sequelae of pulmonary thromboembolism
- Relate the clinical signs and symptoms to the haemodynamic consequences of pulmonary thromboembolism
- Explain the assessment of clinical pre-test probability (namely D-dimer testing)
- Discuss the use and reliability of diagnostic tools for pulmonary embolism (ECG, arterial blood gas, troponins, echocardiography, CT, MR, ventilation-perfusion scan, and pulmonary angiography)
- Interpret the results of invasive pulmonary catheterization and haemodynamic studies
- Analyse the management options for pulmonary thromboembolism according to the patient's condition and co-morbidities (anticoagulation, thrombolytic therapy, embolectomy)
- Recall the medical and surgical management of chronic thromboembolic pulmonary hypertension
- Detail the preventive measures for thromboembolic venous disease

Skills

- Take a relevant history and perform an appropriate physical examination
- Perform and interpret the following diagnostic modalities:
  - ECG
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests including arterial blood gases and the use of D-dimer and troponins
  - Trans-oesophageal echocardiography
  - Pulmonary angiography
  - CT angiography
  - MR angiography
  - Ventilation-perfusion-scanning
- Select and implement appropriate medical, interventional, or surgical therapy for acute pulmonary embolism and chronic thromboembolic pulmonary hypertension
- Order appropriate tests to identify the underlying aetiology
- Decide upon the duration of anticoagulation therapy

Attitudes

- Be alert to the risk factors for pulmonary thromboembolism and the necessity of prevention in high-risk patients
- Collaborate with radiologists, nuclear imaging specialists, and cardiovascular surgeons
- Recognize venous thromboembolism as a chronic relapsing disease and ensure patient understanding of the importance of compliance with long-term anticoagulation

Continued

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Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

9.6. Manage a patient with pulmonary hypertension

Description

Timeframe: from diagnosis of pulmonary hypertension until establishment of effective treatment

Setting: outpatient setting, inpatient setting, and emergency department

Including:

assessing a patient with pulmonary hypertension

implementing diagnostic and stratification strategies

implementing medical therapy

referring selected patients to expert centres

Excluding: performing interventional or surgical treatment

CanMEDS roles

- Communicator
- Collaborator
- Scholar

Knowledge

- Define pulmonary hypertension and its pathophysiological classification
- Explain the clinical classification and its rationale
- Describe the epidemiology of pulmonary hypertension, in particular pulmonary arterial hypertension
- Outline the pathology and pathophysiology of different types of pulmonary hypertension
- Describe the clinical features of different aetiologies of pulmonary hypertension
- Describe the diagnosis pathway in a patient with suspected pulmonary hypertension
- Describe the co-morbidities associated with pulmonary hypertension
- Describe diagnostic criteria of pulmonary hypertension
- Recall the prognostic markers
- Understand the specificities of different pharmacological treatments in pulmonary hypertension
- Discuss the medical, surgical, and interventional management of pulmonary hypertension
- Summarize the disease targeted therapies and the indications for pulmonary endarterectomy
- Describe the complications of pulmonary hypertension and their management

Skills

- Take a relevant history and perform an appropriate clinical examination
- Recognize clinical signs of pulmonary hypertension and its associated diseases
- Differentiate between pulmonary hypertension and other diseases with similar symptoms
- Perform and interpret the following diagnostic modalities:
  - ECG
  - 6-min walking test
  - Exercise ECG
  - Cardiopulmonary exercise testing
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Blood tests including arterial blood gases and the use of D-dimer and troponins
  - Pulmonary function tests
  - Trans-oesophageal echocardiography
  - Right and left heart catheterization
  - (selective) pulmonary angiography

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  - CT angiography
  - MR angiography
  - Liver ultrasound
  - Ventilation-perfusion-scanning
- Set treatment goals and prescribe appropriate medical or invasive (surgical or interventional) management
- Provide advice on family planning and pregnancy
- Refer families affected by familial PAH for genetic counselling
- Evaluate prognostic markers
- Initiate end-of-life care when appropriate
- Undertake screening for high-risk patients

Attitudes

- Co-operate with a multidisciplinary team in delivering chronic disease management that may include general practitioners, respiratory physicians, internal medicine practitioners, surgeons, nurses, community healthcare workers, rehabilitation teams, and other professionals
- Acknowledge the importance of expert centres (when available) and be prepared to refer appropriate patients
- Collaborate with patient associations

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 3. Indirect supervision

9.7. Manage a patient with adult congenital heart disease

Description

Timeframe: from reaching adult age with a diagnosis of congenital heart disease until establishment of effective treatment or referral to a specialist centre
Setting: outpatient setting, inpatient setting, and emergency department
Including:
assessing and managing an adult with simple congenital heart defects, including those who have undergone cardiac surgery
implementing medical therapy
providing acute care for a patient with congenital heart disease in an emergency setting
identifying complex conditions and referring to a specialist centre
Excluding: managing complex congenital cardiac conditions
performing interventional or surgical treatment

CanMEDS roles

- Communicator
- Collaborator
- Scholar

Knowledge

- Explain the physiology of the foetal and transitional circulations
- Outline the aetiology of congenital heart disease and the developmental anatomy of the heart and vasculature
- List the commonly associated genetic syndromes
- Describe the anatomy of the heart, veins, and great vessels; their major congenital malformations and the principles of nomenclature
- Describe the pathophysiology, natural history, and complications of:
  - Valve and outflow tract lesions
  - Septal defects
  - Patent ductus arteriosus
  - Eisenmenger syndrome
  - Coarctation of the aorta
  - Ebsteins's anomaly
  - Aortic and pulmonary artery malformations
  - Venous anomalies

Continued

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  - Transposition of the great arteries (complete and congenitally corrected)
  - Tetralogy of Fallot
  - Functionally univentricular hearts and the Fontan circulation
  - Congenital malformations of coronary arteries
  - Cyanotic congenital heart disease and secondary erythrocytosi
  - Pulmonary hypertension in congenital heart disease
  - Arrhythmias and conduction disturbances
- Describe the pathophysiology, natural history, and complications of palliative and corrective surgery and interventions
- Recognize expected ECG and echocardiographic findings
- Recognize physical signs of congenital heart disease and its complications
- Discuss diagnostic techniques
- Describe the principles of medical, interventional, and surgical management
- Recognize the indications for device implantation (such as ICD and CRT)
- Understand prevention of infective endocarditis (IE)
- Recall the hazards of pregnancy, contraception, intercurrent illness, and non-cardiac surgery in an adult patient with congenital heart disease
- Consider the circumstances for initiation of end-of-life care when appropriate

Skills

- Take a relevant history and perform an appropriate clinical examination
- Select imaging techniques and, where appropriate, invasive procedures for diagnosis
- Provide monitoring, follow-up, and lifestyle advice in collaboration with an adult congenital heart disease specialist team
- Manage the patient with pulmonary hypertension and with secondary erythrocytosis

Attitudes

- Accept the role of the adult congenital heart disease specialist teams in the management of a patient with complex malformations and complications
- Appreciate the special needs of young adults transitioning from the paediatric congenital heart disease clinic
- Educate a patient on the prophylaxis of IE
- Appreciate the importance of long-term surveillance of a patient with congenital heart defects
- Commit to multidisciplinary management, including genetic counselling
- Understand and empathize in connection with the social and emotional difficulties encountered by an adult patient with congenital heart disease and their relatives

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

9.8. Manage a pregnant patient with cardiac symptoms or disease

Description

Timeframe: from diagnosis of a cardiac disease in a pregnant patient until effective treatment and follow-up

Setting: outpatient setting, inpatient setting, and emergency department

Including:

assessing a pregnant patient with suspected or confirmed cardiac disease in an emergency setting

managing a pregnant patient with cardiac disease or a patient at high risk in an outpatient setting

implementing medical therapy

designing a plan for delivery and follow-up

knowing cardiac conditions contraindicating pregnancy

Excluding: performing interventional or surgical treatment

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Professional

Continued

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Knowledge

- Talk through the physiological, haemodynamic, haemostatic, and metabolic alterations during pregnancy:
  - The normal echocardiogram during pregnancy and puerperium
- Recognize the maternal and foetal complications during pregnancy and puerperium in women with CVD
- Evaluate maternal cardiovascular risk according to the modified World Health Organization classification
- Discuss, for patients with known or suspected CVD who are contemplating pregnancy are pregnant or post-partum:
  - Conditions for which pregnancy is contra-indicated and those which justify early termination
  - Indications for genetic counselling
  - Conditions associated with a high risk of pregnancy-related cardiac complications for which intervention before considering pregnancy is appropriate
  - Appropriate follow-up during pregnancy and post-partum
  - Conditions requiring medical therapy during pregnancy
  - Situations in which cardiac intervention may be required during pregnancy
  - Management of anticoagulant therapy, with special attention to patients with valve prostheses
  - Endocarditis during pregnancy
  - Modalities of delivery and their major indications
- Describe the modalities for foetal assessment and diagnosis of genetic malformations
- Discuss cardiovascular pharmacology during pregnancy and lactation
- Describe the efficacy, risks, and contraindications associated with the various contraceptive methods according to the nature of the underlying heart disease

Skills

- Take a relevant history and perform an appropriate clinical examination
- Recognize the symptoms and signs associated with the haemodynamic changes associated with pregnancy
- Differentiate physiological from pathological dyspnoea during pregnancy
- Assess the cardiac risk of pregnancy on the basis of clinical evaluation and the interpretation of diagnostic procedures
- Recognize the necessity and undertake or refer for preventive cardiac intervention where appropriate
- Diagnose and manage the most frequent or serious cardiovascular complications during pregnancy
- Perform and interpret the following diagnostic modalities when indicated during pregnancy and post-partum:
  - ECG
  - Exercise ECG
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities when indicated during pregnancy and post-partum:
  - Chest X-ray
  - Blood tests including arterial blood gases and the use of D-dimer and troponins
  - Vascular ultrasound
  - Other imaging techniques, considering the hazards of radiation exposure to the foetus
- Prescribe drug therapies that can be used safely during pregnancy and breast feeding
- Manage, in close collaboration with a tertiary expert centre, a pregnant patient who requires ongoing anticoagulation for prophylaxis or treatment of thrombotic complications
- Recognize and manage peri-partum cardiomyopathy
- Evaluate the foetal and maternal risk of different cardiac interventions
- Evaluate the cardiac condition after pregnancy
- Assess the maternal cardiac and foetal risk of subsequent pregnancies
- Identify co-morbidities and refer the patient to the appropriate specialties

Attitudes

- Recognize of the importance of pre-pregnancy counselling and education for a woman with heart disease and her partner
- Co-operate with gynaecologists and obstetricians with regard to recommendations on contraception
- Co-operate during pregnancy, peri-partum, and post-partum with a multidisciplinary team of gynaecologists, obstetricians, anaesthetists, neo-natologists, and midwives
- Recognize the importance of patient education on the symptoms of poor cardiac tolerance
- Be alert to the risk of worsening cardiac status during the early post-partum period and the importance of communication with obstetricians and midwives

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 4. Distant supervision

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9.9. Perform a cardiological consultation

Description

Timeframe: from clinical suspicion of cardiac disease in a patient with non-cardiac conditions or cardiac manifestations of non-cardiac conditions until effective treatment and follow-up, or during pre-operative evaluation of a patient undergoing non-cardiac surgery

Setting: outpatient setting, inpatient setting, and emergency department

Including:

Co-operating with other medical specialties in the prevention, assessment, and management of CVDs in a patient requiring non-cardiac surgery

performing cardiac risk assessment in a patient to be submitted to non-cardiac surgery

optimizing patient's pre-operative conditions before non-cardiac surgery

searching for potential sources of cardiac embolism in a patient with ischaemic neurological symptoms

evaluating other neurological presentations such as syncope, dizziness and neuromuscular diseases with possible cardiac involvement

managing CVD in a patient with diseases of other organs or systems that affect the cardiovascular system

Excluding: Interventional or surgical treatment

CanMEDS roles

- Medical expert
- Communicator
- Collaborator
- Leader
- Professional

Knowledge

- Explain the pathophysiology of systemic and cardiovascular stress responses to surgery
- Understand the pathophysiology of cardiovascular complications during surgery such as perioperative infarction, rhythm disturbances, and HF
- Describe patient-related, cardiac-related, and surgery-specific risk factors that influence cardiac risk for non-cardiac surgical interventions
- Describe the effects of most frequently used anaesthetic and sedative agents on cardiovascular function
- Describe the indications for and limitations of non-invasive testing for cardiac disease before surgery including ECG, echocardiography, stress testing modalities, and X-ray CT
- Describe the indications for pre-operative coronary angiography
- Explain the benefits of and clinical indications for pharmacological risk reduction strategies before and during surgery
- Provide a rationale for the indications for prophylactic myocardial revascularization before surgery
- Talk through the role of monitoring techniques for perioperative cardiac events
- Describe the risk evaluation, timing of the procedure and risk reduction strategies in a patient with specific conditions such as: post-revascularization (PCI or surgery), HF, valve diseases, valve prostheses, rhythm disturbances, and cardiac devices (ICDs and pacemakers)
- Summarize the mechanisms, epidemiology, clinical characteristics, and potential treatment options in a patient with cardiac or aortic sources of embolism
- Consider atherosclerosis as a systemic disease involving (simultaneously) other vascular territories
- Discuss the importance and urgency of stroke prevention (anticoagulation) in a patient with AF
- Describe, in a patient with non-ischaemic neurological manifestations:
  - The various causes of transient loss of consciousness
  - The diagnosis and medical treatment of haemorrhagic stroke
- Outline the indications for neurosurgical interventions
- Explain the rationale for the indications and timing of anticoagulant or antiplatelet therapy for cardiac conditions in a patient with ischaemic or haemorrhagic stroke
- Outline the pathophysiology, epidemiology, recommended cardiac evaluation, and management of a patient with neuromuscular disorders involving the heart
- Describe the pathophysiology, epidemiology, and clinical implications of the complex interplay between the heart, the vasculature, and CKD, as both a risk factor and a consequence of CVD
- Highlight the importance of evaluation of renal function in every patient with cardiac disease
- Describe the pharmacological specificities (indications, contraindications, and dose adjustment) of cardiovascular drugs in a patient with CKD
- Discuss strategies to avoid contrast nephropathy induced by cardiological examinations
- Consider the epidemiology, clinical manifestations, and optimal treatment strategies for CVDs in the elderly and those with pulmonary diseases, erectile dysfunction, rheumatic disorders, and other co-morbidities

Continued

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Skills

- Perform an individualized cardiac risk assessment by applying risk stratification indices according to the patient's underlying CVD and the type and urgency of non-cardiac surgery
- Select, perform, and interpret the non-invasive diagnostic tests before surgery (ECG, echocardiography, and stress testing)
- Perform and interpret the following diagnostic modalities before surgery:
  - ECG
  - Exercise ECG
  - Transthoracic echocardiography
- Interpret the following diagnostic modalities:
  - Chest X-ray
  - Trans-oesophageal echocardiography
  - Vascular ultrasound screening of carotid arteries
  - Cardiac catheterization
- Liaise with the anaesthetist over perioperative management and surveillance appropriate for the type of surgery and the anaesthetic technique
- Implement pharmacological and non-pharmacological interventions that can reduce cardiac risk during surgery
- Decide on the optimal timing and the anti-thrombotic regimen in a patient following a recent myocardial revascularization procedure, in whom non-cardiac surgery cannot be delayed
- Optimize the control of all risk factors for long-term CVD prevention
- Identify the need for cardiac follow-up after non-cardiac surgery
- Use echocardiography, including trans-oesophageal echocardiography, and other techniques to search for potential sources of embolism
- Define the need for further diagnostic work-up to search for other atherosclerotic manifestations, and advise on appropriate therapy
- Implement secondary prevention strategies, including lifestyle and pharmacological therapies
- Prevent, identify, and stratify the risk of CVD with specific reference to the elderly patient

Attitudes

- Stimulate multidisciplinary team discussions on preoperative CVD assessment and perioperative management strategies
- Consider the current cardiovascular prognosis of a patient for whom non-cardiac surgery is planned
- Work closely with neurologists and radiologists to determine the best management strategy for patients with ischaemic and non-ischaemic neurological conditions
- Use the cardiac consultation as an opportunity to identify cardiovascular risk factors and provide recommendations to the patient on lifestyle and medical therapy

Assessment tools

- Direct observation/WBA (e.g. DOPS, Mini-CEX, fieldnotes)
- CbD (case-based discussion)/EbD (entrustment-based discussion)

Level of independence

- 5. Able to teach (no supervision)

Supplementary material

Supplementary material is available at *European Heart Journal* online.

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Corrigendum

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Corrigendum to: ESC Core Curriculum for the Cardiologist [*Eur Heart J* 2020;41:3605–3692]

In the originally published version of this manuscript, several errors relating to the study have been noted. A corrigendum has been published to address the following. This corrigendum addresses the following changes that have subsequently been corrected online:

The Table of Content listing for "Abbreviations" should read: "Abbreviations and acronyms".

Under the "Abbreviations and Acronyms" section, the abbreviation for "UEMS" should read: "Union Européenne des Médecins Spécialistes" instead of "Union EuropOenne des MOdecins SpOcialistes".

The footnote for Table 5. omitted the following: "What should be aimed at and avoided by trainers and trainees in the assessment situation.".

There were ambiguities within the reporting of the levels of independence in Table 2. and the level of independence for each EPA in Table 3.

In Table 5., the heading should read: "Do's and Don'ts for the EPAs of the ESC Core Curriculum" instead of "Do' s and DON'T's for the EPAs of the ESC Core Curriculum".

Under the "Acknowledgements" section, the contributor's name should read "Kevin Domingues" instead of "Kevin Dominques".

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