Cardiothoracic Radiology Fellowship

I. Introduction:

Cardiothoracic diseases are major cause of morbidity and mortality worldwide. Chest diseases such as interstitial lung diseases, chest infections and lung cancer are rising worldwide in the presence of systemic diseases, immune compromise as well as occupational and smoking related hazards. In addition, congenial heart diseases (CHD) are the commonest birth defects with an incidence of 8-10/ 1000 live births. Coronary artery disease and various non-ischemic cardiomyopathies remain a major cause of heart failure and sudden cardiac death.

Highly specialized medical management and surgical procedures have been developed to improve survival and quality of life in patients with various chest diseases. A wide spectrum of diagnostic techniques in chest imaging including; multidetector computed tomography (CT) and high resolution CT (HRCT), as well as image guided chest procedures have also been developed to help physicians optimize patient care.

While Echocardiography and Nuclear Scitigraphy contributed for decades to the diagnosis of acquired and CHD, cardiac CT and magnetic resonance (MR) have developed significantly over the last decade and became detrimental in both diagnosis and management of a wide spectrum of adult and CHD.

The above mentioned facts are calling for highly sub-specialized cardiothoracic radiologists capable of dealing with diverse and

complex clinical settings during the management of patients being treated within these clinical disciplines.

The proposed Cardiothoracic fellowship program aims at preparing graduate radiologists into fulfilling this goal.

II. General objectives:

The ultimate goal of Cardiothoracic radiology fellowship program is for fellow graduates to acquire the knowledge and skills to become independent and safe cardiothoracic radiologists through obtaining high level training, as well as transmitting their knowledge to subsequent generations.

III. Specific objectives:

1. Acquire knowledge of relevant embryological, anatomical, pathophysiological, biochemical and clinical aspects of cardiothoracic diseases.
2. Obtain in-depth understanding of the major imaging techniques relevant to cardiothoracic diseases.
3. Grasp in-depth knowledge of the indications, contra-indications, complications and limitations of surgical, medical and radiological interventions and procedures pertaining to the thorax.
4. Acquire fundamental knowledge of CT chest image acquisition, as well as cardiac CT and cardiovascular MR.
5. Gain sufficient experience in cardiac CT and cardiac MR image acquisition and post processing.
6. Master clinical knowledge relevant to thoracic and cardiac diseases so that the fellow may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician.

7. Obtain a detailed knowledge of current developments in the sub-specialty.
8. Acquire direct practical exposure with appropriate graded supervision in various cardiothoracic imaging procedures including CT and MR.
9. Acquire appropriate competency and accuracy in the selection, performance, supervision and reporting of cardiothoracic radiology investigations and minor imaging-guided interventions.
10. Gain sufficient experience in thoracic interventions to practice independently in performing procedures such as imaging-guided lung biopsies and pleural drainage.
11. Understand and practice appropriate Islamic medical ethics and undertake an attitude of accepted professional conduct that shall be applied throughout the fellow's subsequent medical career.

IV. Admission Requirements:

To be admitted to the Saudi Cardio-thoracic Radiology Subspecialty Program, a candidate must:

1. Possess a Saudi Specialty Certificate in Radiology or its equivalent (which is approved by the Saudi Commission) or have at least successfully completed the written component to the Saudi Specialty Certificate in Radiology.
2. Be licensed to practice medicine in Saudi Arabia.

3. Provide written permission from the sponsoring institution, allowing him/her to participate in full-time training for the entire two-year program.
4. Sign an undertaking to abide by the rules and regulations of the Training Program and the Saudi Commission.
5. Successfully pass the interview for this particular subspecialty.
6. Provide three letters of recommendation from consultants with whom the candidate has recently worked.
7. Register as a trainee at the Saudi Commission for Health Specialties.

V. Structure of the training program:

1. Duration:
   This is a two-year (104 week) fellowship program.

2. Training capacity:
   Two (2) fellows per year.

3. Faculty qualifications:
   Minimum of two (2) certified cardiothoracic radiologists.

   Minimum equipment requirements (Appendix 1)

VI. Program content:

1. Modalities & Procedures:

Fellows must become proficient in the physical principles, indications, setup, logistics and performance of imaging modalities related to cardiothoracic radiology including but not limited to conventional radiography, CT scan and MRI.

They must be knowledgeable in advanced protocols, techniques, artifacts, contraindications and precautions related to the performance of these examinations. They should also become proficient at post processing techniques of 3D data sets utilizing dedicated workstations.

The fellow will gain knowledge and practice of reading chest radiography. The fellow should become proficient in the performance of cardiac CT, cardiac MR and CT chest. The fellow should become proficient in the performance of various thoracic radiology related imaging-guided interventions (drainages, biopsies, etc.).

2. Contrast agents: The fellow will become familiar with the contrast agents available for use in cardiothoracic radiology examinations including iodinated and Gadolinium-based agents. He/she should be familiar with their preparation, indications, methods of administration, precautions, contraindications, limitations and artifacts. The fellow will be trained to handle contrast related reactions and complications.

3. Pathology: The fellow will become familiar with the presentations, imaging findings, differential diagnosis, complications and management of disease processes related to the adult thorax. These processes include but are not restricted to the following:

a. Congenital abnormalities of the chest.
b. Inflammatory disorders and Infectious diseases (acute and chronic)
c. Coronary artery disease and cardiomyopathies
d. Pre and post operated congenital heart diseases (CHD)
e. Neoplastic diseases (benign or malignant) including detection, staging and follow-up

f. Vascular disorders such as aortic aneurysms, pulmonary hypertension and pulmonary embolism
g. Metabolic, endocrine and depositional diseases of the thorax.
h. Traumatic & iatrogenic injuries
i. Functional & mechanical disorders of the chest
j. Smoking related disease of the lungs
k. Emergencies: such as traumatic aortic injuries and diaphragmatic hernia

4. **Collaboration** and interaction with other ***Clinical disciplines*** shall include (though not limited to these areas):

a) Thoracic, vascular and Cardiac Surgery.
b) Internal Medicine.
c) Pulmonary Medicine.
d) Cardiology.
e) Intensive Care.
f) Oncology.
g) Pathology.
h) Emergency & Critical Care Medicine.
i) Family and Primary care Medicine.

The training period will be divided into:

1. Junior fellow level (first year):

a. First 6 months:

The aim of this period is to prepare the fellow to work throughout the rest of the fellowship in a semi-independent

fashion.

The fellow will rotate regularly throughout the week between chest and cardiac radiology on daily bases.

1 day/ week: chest plain films + chest procedures.

1 day/ week: chest CT + chest procedures.

1day/ week: cardiac CT + chest plain films.

1 day/ week: cardiac MR.

1 day float/ week: (2 academic days/ month, 1 cardiac CT/ month, 1 cardiac MR/ month)

b. Second 6 months:

The aim of this period is to apply all practical aspects acquired during the first half of the year.

The fellow will continue to rotate between chest and cardiac radiology. Emphasis in chest procedures will be on planning and performing procedures independently as well as follow up on pathology results. Emphasis on patient preparation and image acquisition in cardiac CT and MR will be replaced with more emphasis on correlating cardiac CT and MR with other cardiac imaging modalities. In addition, the fellow will be allowed 2 months of electives to be taken in an outside institution.

Suggested electives:

1 dedicated chest rotation.

1 dedicated Adult cardiac CT/ MR rotation (special arrangements to be made).

During this period the fellow will receive didactic teaching in

physics of radiology pertinent to cardiac CT and cardiac MR with emphasis on radiation safety and image artifacts.

2. Senior fellow level (second year):

The aim of this period is prepare the fellow to become an independent cardiothoracic radiologist.

The fellow will again rotate in all aspects of cardiothoracic radiology with a higher level of responsibility that will enable him to practice as a qualified cardiothoracic radiologist by the end of the two-year fellowship training period.

There will be emphasis on quality assurance in cardiothoracic radiology. This includes but not limited to: radiation safety and doses, adequacy of chest procedures including complications and adequate sampling, as well as correlation between coronary CT angiograms and conventional coronary angiograms.

The fellows will be encouraged to be involved in and adopt emerging techniques and chest imaging, cardiac CT and cardiac MR.

In addition, the fellow will be allowed 1-2 months of electives to be taken in an outside institution.

Suggested electives:

1 dedicated chest rotation.

1 dedicated Pediatric Cardiac CT/ MR rotation (special arrangements to be made).

VII. Responsibilities of fellows:

1. The fellow will be responsible for interpretation of general chest

radiographs including out-patient, in-patient, ER, ICU, CCU, CSU chest X-rays.

2. The fellow is responsible for the supervision, interpretation, and reporting of routine thoracic radiology CT exams which comprise routine contrast-enhanced or plain chest CT examinations, High resolution CT exams (HRCT), low-dose nodule protocol CT, low-dose screening CT exams, pulmonary CTA to detect pulmonary embolism, Aorta CTA, as well as special protocols to evaluate the tracheobronchial tree such as virtual bronchoscopy.

3. The fellow will also perform interventional thoracic procedures under the supervision of cardiothoracic or interventional radiologist. These interventional procedures include imaging-guided biopsies, radiofrequency ablation, thermal ablation and pleural drainage procedures. Fellows should also learn the indications of thoracic procedures, procedural risks and benefits, and possible alternatives. They should also master how to plan appropriate biopsy approach, recognize anatomic landmarks, appropriately execute the biopsy and obtain specimen as well to recognize and treat procedural complications.

4. The fellow will be responsible image acquisition (protocol) in cardiac CT where he/ she will work closely with technologists under supervision of the staff radiologist. The fellow will learn how to interpret ECG, screen patients for B-blockers and subscribe medications for heart rate control (B- blockers). The fellow will learn how to protocol and perform cardiac CT for various clinical applications including but not limited to Calcium (Ca) score, native coronary CT angiography, CTA of grafts, pulmonary venous mapping

and CHD. The fellow will be also receiving dedicated training on image acquisition in cardiac MR using various techniques and protocols. This will include but not limited to MR protocols for cardiomyopathies, myocardial viability, CHD in adults and children, cardiac masses and thoracic aortic diseases.

5. The fellow will perform post processing of imaging dataset on 3D workstation to analyze all aspects of cardiac pathology such as coronary artery disease, cardiac volumetric analysis and vascular flow.

6. The fellow will be responsible of administration of intravenous contrast, the timing of contrast administration and flow rate as well as all issues pertaining to radiation dose and safety.

7. The fellow will be on-call for cardiothoracic radiology cases, backing up the on-call residents. Fellows will be encouraged to do general radiology calls on weekends where they are responsible for general radiography, body CT and ultrasound. The fellow will not be on-call less than three times a month and no more than eight nights per month. This should include one weekend per month.

8. Fellows will be required to attend weekly joint lecture series in chest and cardiac radiology. Fellows will be required to attend monthly journal club in cardiothoracic radiology or inter-specialty group meetings. Their attendance at these activities should not be less than 75%.

9. In addition, fellows will be expected to prepare:

1 journal clubs every 6 months

1 dedicated talk in chest radiology (once every 12 months)
1 dedicated cardiac radiology talk (once every 12 months).

10. The fellow will be expected to prepare at least one chest and one cardiac scientific paper manuscripts to be submitted to peer reviewed journals. The academic days will be granted conditioned the manuscripts are in progress as documented by the supervising staff.
11. During the entire period, fellows will be expected to demonstrate scholarly activity; such as review of recent literature, teaching of residents and junior staff, as well as involvement in relevant clinical-radiological conferences.

VIII. Evaluation and Promotion:

1. Fellows' clinical performance, professional attitude and assimilation of knowledge will be regularly evaluated by mentoring staff members. Periodic (every three months) written evaluations will be obtained from concerned staff and summarized by the fellowship director into a single form that will be reviewed and signed by the fellow.
2. The evaluations will be reviewed by the fellowship training committee periodically to identify aspects that may require further emphasis or counseling. Attendance at didactic activities will also be monitored.
3. Provided that evaluations and attendance are satisfactory, the fellow will be required to undergo an OSCE examination at the end of the first year in order to be promoted to the second year. At the end of the second year, the fellow must pass both a written and an oral examination. The examination committees will be formed by the

subspecialty committee of the Saudi Commission.

4. Upon satisfactory completion of the above requirements, the Saudi Commission for Health Specialties will confer upon the trainee the official certification of the subspecialty training program.

IX. Completion:

1. Satisfactory completion of all rotations with all scores >60%.
2. Completion of minimum number of procedure reports (Table 1).
3. Attendance at didactic sessions >75%.
4. Completion of a research project.
5. Pass all exam requirements.

Modality	Minimum Requirement
Conventional Radiography	10,000
Chest CT scan	2,000 including 150 HRCT
Cardiac CT	(level 3) 300 cases including: 100 live cases 300 cases reviewed with level 3 staff (≥ 275 other than Ca score)
Cardiac MRI	(level 3) 300 cases including: 100 live cases 100 cases reviewed with level 3 staff -25 CHD cases
Interventions	50 percutaneous lung biopsies 25 pleural drainages

Table 1: Minimum overall procedure report requirements in each area over entire program.

X. Leaves and Holidays:

Fellows will be permitted four weeks of annual leave during the program in addition to *only one* of the two Eid vacations (7-10 days).A maximum of two weeks of vacation may be taken during rotation through any specific service modality. Leave requests must be submitted well in advance. One week of *appropriately justified* emergency leave and one week of *properly confirmed* study leave may be allowed during the program.

Appendix 1:

Minimum equipment requirements for recognition of the training center for subspecialty rotational training in Cardiothoracic Radiology are:

- ***CT scan***: Multi-detector scanner (16 detector rows or more), radiation dose modulation, and power injector are indispensable. Non-ionic IV contrast media must be available. For Cardiac CT rotation, a proper setup such as ECG gating, appropriate Cardiac CT software and trained CT technologists are mandatory.
- ***MRI***: 1.5 T or above scanner. Basic spin-echo, gradient-echo & fat suppression sequences, in addition to 3D angiographic sequences are a must. A power injector and ECG & respiratory-gating facilities are mandatory.
- ***Fluoroscopy***: Standard digital fluoroscopic capabilities.
- ***3D post processing workstation***: capable of all basic techniques for reformations and angiographic rendering is essential.