البرنامج التدريبي للاختصاص
أشعة الجملة العصبية والرأس والعنق
المجلس العلمي للاختصاص الأشعة والتصوير الطبي
المجلس العربي للاختصاصات الصحية

Arab Board Fellowship Curriculum of
Neuroradiology and Head & Neck Imaging
Scientific Council of Radiology and Medical Imaging
The Arab Board of Health Specializations

October 2015

Introduction:

The overall intent of the programme is to provide trainees with specific knowledge& skills of clinicalutility, interpretation, and standards of performance of neuroimaging studies..

The goals of the Neuroimaging Fellowship are to provide the trainee with the opportunity to developdiagnostic, procedural, and technical skills essential to the performance of neuroimaging, including:
1. To gain knowledge in the technical aspects of imaging
2. To gain clinical experience in interpretation of images
3. To achieve competence allowing independent performance of the specialty of neuroradiology & head & neck imaging

Requirements of Institute of Training&Required Personnel:
The training centre/s must be approved for training by the ArabBoard
A " Fellowship Director" must be identified/appointed by the training institution. S/he must be a consultant radiologist with appropriate expertise in neuroimaging and with appropriate academic background

Facilities:

- The major imaging modalities include computed tomography (CT), magnetic resonance imaging (MRI), single photon emission computed tomography (SPECT), positron emission tomography (PET), ultrasound, conventional X-ray and contrast studies and selected angiographic & neurointerventional procedures. CTA, MRA, functional imaging & spectroscopy are required
- PACS.
- Appropriate number of supervisors relative to trainees. Ideally at least two consultants should be available in the training unit. Ratio: One consultant: One trainee

Volume needed for training:

- To obtain the appropriate breadth of exposure to the full spectrum of diseases in a specific subspecialty,in both inpatient and outpatient settings.
- Facilities should have asufficient volume and variety of patient material to provide training. To obtain practical experience, the suggested minimum number of studies performed and interpreted under supervision in fellowship settings will be set .
- A teaching file of representative cases in each modality, with case histories and images, should be available to the trainee, either from the training institution itself or on electronic media. Training should include daily interpretation sessions and clinical case discussions.

Eligibility Criteria for training:
The applicant

- Must have successfully completed The Arab Board of Radiology & Medical Imaging (eligibility of graduates of other schemes will be re-evaluated in two years after the start of the subspecialty programme)
- Is licensed to practice medicine in the country/ies of training
- Must have completed one year of radiology practice
- Provide written permission from the sponsoring body allowing him/her to undertake full time training for the full one/two year programme
- Provides two letters of recommendation from the institute where he last worked
- Registers as a trainee with the Arab Board for Health Specialties

Application for Certification in Neuroradiology & Head & Neck Imaging Programme in Radiology& Medical Imaging:

- All applications must be completed online, and all supporting documentation must be uploaded through the online application system where requested.
- Fees paid.

Timetable for Training:

- The programme is offered over two years
- Training guidelines and the curriculum are specified below

Examination Process:

- The examination is held once a year in October
- Examination format : One hour oral examination by a panel of experts.
- The candidate has three chances of passing the exam

Setup for the Training:

Formal rotations are highly desirable where the trainee spendsdefined periods dedicated to a specific modality & which should be arranged by the fellowship director.

Methods of Training:

- Lectures
- Individual interpretation session of representative cases (a teaching file).
- Daily self-studies of course materials and reference textbooks or papers (acquiring knowledge of basic principles, applied anatomy, pathophysiology, diagnostic criteria, and clinical applications).
- Daily interpretation sessions
- Weekly conferences with faculty (discussion of current cases, Q&A, differential diagnosis).
- Individual skill assessment (performing a procedure under direct supervision).

Methods of Evaluation of Trainees:

1. On-going evaluation: (under the supervision of the fellowship director)
   - Performance and interpretation skills assessment by the training personnel (daily or weekly).
   - Interpretation skills assessment using case reviews (weekly or monthly).
   - The trainee's professionalism, attitude to work, team work, responsibility and adherence to ethical principles in medical practice will be included in the assessment

2. Final evaluation of proficiency in interpretation (Arab Board certification examination):
   - Individual consultants should provide written evaluation of trainees who have completed formal rotations in musculoskeletal imaging .The evaluations will be collected and endorsed by the fellowship director
   - After finishing training, the trainee should pass the exit examination
   - Evaluation forms required for a CME activity filled out by the trainee upon course completion.

Methods of Upgrading Knowledge/CME:

- During the training course, trainees are required to perform self- studies of selected textbooks and papers, and participate in weekly discussions with faculty of current cases.
- Trainees are expected to participate in research and audit.
- The trainee is expected to present 10 full case conferences/lectures during each year of training. S/he is required to demonstrate ability to instruct and teach junior colleagues and medical students
- The trainee is expected to be cognizant of radiation protection guidelines and practice

- Upon completion of the coursetrainees are expected to prepare for the Arab Board certification examination.

Leave/ Vacation:

- The trainee is entitled to three weeks of annual leave per year
- One week of educational leave is available per year to attend courses/scientific meetings

Core curriculum:

1. MRI/CT:

A. Technical aspects of MRI/CT:

· X-ray production
· Collimation
· Interaction of X-ray in tissue
· Electricity and nuclear magnetism
· Radiofrequency pulse sequences
· MRI signals and parameters
· Fourier transforms
· MRI and CT hardware and safety
· Conventional spin-echo technique
· Gradient-echo technique
· Fast spin-echo and fast imaging
· Echo planar imaging
· MRA
· MRI and CT Contrast agents
· MRI and CT artifacts
· CTA
· CT perfusion
· MR spectroscopy
· Diffusion and perfusion MRI

B. Clinical aspects of MRI/CT neuroimaging:

I: Brain Imaging

1. Primary Tumors/Masses/Cysts

· Astro-Glial (Glioma)
  - Astrocytoma
  - Choroid plexus papilloma
  - Ependymoma/Subependymoma
  - Glioblastoma multiforme
  - Gliomatosiscerebri
  - Oligodendroglioma
· Germ Cell
  - Germinoma
  - Teratoma
· Maldevelopmental
  - Craniopharyngioma
  - Lipoma
· Meningeal
  - Meningioma
· Mesenchymal and Lymphoreticular

    - Hemangioblastoma
    - Hemangiopericytoma
    - Lymphoma
- Neuronal Origin
    - Ganglioglioma
    - Hamartoma
    - Neurocytoma
- PNET
    - Esthesioneuroblastoma
    - Medulloblastoma
- Peripheral Nervous System
    - Neurofibroma
    - Schwannoma (neuroma)
- Regional Neoplasms
    - Pineoblastoma
    - Pineocytoma
    - Pituitary adenoma
- Non-neoplastic Cysts
    - Arachnoid (leptomeningeal) cyst
    - Colloid cyst
    - Dermoid
    - Epidermoid
    - Neuroepithelial (neuroglial) cyst
    - Pineal cyst
    - Rathke's cleft
- Spinal tumors
    - Intramedullary
    - Extramedullary/intradural
    - Extramedullary/extradural

2. Cerebrovascular Diseases
- Infarction
    - Thromboembolism
    - Watershed Infarction
    - Lacunar syndromes
    - Venous thrombosis
    - Arterial Dissection
- MR Angiography
- Advanced MRI Techniques
- Paraventricular and Subcortical White Matter Disease

3. Vascular Lesions/Malformations
- Aneurysms
    - Saccular, Giant
    - Dolichoectasia
- Vascular malformations
    - Arterioveno us malformation
    - Cavernous Angioma
    - Capillary Telangiectasia
    - Venous Angioma

4. Infectious/Granulomatous Diseases
- Pyogenic/Bacterial

· Viral
· Fungal
· Parasitic
· Sarcoidosis
· Prion-associated
· Myelitis

5. Hemorrhage/Trauma
· Intraparenchymal Hemorrhage
· Subdural Hemorrhage
· Subarachnoid Hemorrhage
· Intratumoral and Secondary Hemorrhage
· Cerebral contusions/Traumatic Brain injury
· Spinal Hemorrhage/Spinal Trauma

6. Toxic/Metabolic Diseases
· Chemotherapeutic/Immunosuppressive agents
· Ethanol-related:
    Degeneration/atrophy
    Wernicke's encephalopathy
· Hallervorden-Spatz disease
· Hepatic failure
· Mitochondrial disorders
· Radiation injury
· Toxin exposure
· Wilson's disease

7. Degenerative Diseases
· Aging
· Alzheimer's disease
· Amyotrophic lateral sclerosis
· Friedreich's ataxia
· Huntington's disease
· Parkinsonian states
· Pick's disease
· Wallerian degeneration
· Spinal degenerative diseases
    Disc herniation
    Spinal stenosis

8. Seizures/Epilepsy
· Mesial Temporal Lobe Sclerosis

9. Hydrocephalus/CSF Disorders
· Benign Intracranial Hypertension
· Hydrocephalus
    Noncommunicating
    Communicating
· Intracranial Hypotension

10. Neurocutaneous Syndromes
· Neurofibromatosis
· Sturge-Weber Syndrome

· Tuberous sclerosis
· VonHippel-Lindau and Hemangioblastomas

11. Demyelinating/Inflammatory Diseases
· Multiple Sclerosis
· Acute Disseminated Encephalomyelitis
· Central Pontine Myelinolysis
· Myelitis

12. Metastatic Diseases
· Brain/spinal parenchymal metastases.
· Calvarial and meningeal metastases
· Extra-axial spinal metastases

13. Congenital Anomalies/Developmental Disorders
· Brain malformations
· Spinal cord and spinal canal malformations

14. Miscellaneous
· Normal tomographic imaging anatomy of head and spine
· Imaging of head and neck diseases relevant to neurology
· Brain death

II. HEAD AND NECK RADIOLOGY

A) Paranasal Sinuses

1)Anatomy of paranasal sinuses

2)Congenital disease

Dermal sinus tract Encephalocele Choanal atresia Dacrocystocele

Nasal glioma (dehiscence of anterior skull base) 3) Inflammation/Infection

Acute sinusitis

Chronic sinusitis - (Allergic, Fungal, Granulomatous) Polyposis

Mucocele

4) Benign Sinus Tumors Osteoma Antrochoanal polyp Juvenile angiofibromaInverted Papilloma Schwannoma

HemangiomaMeningioma 5) Malignant Sinus Tumors

Squamous cell carcinoma Esthesioneuroblastoma Adenocarcinoma Lymphoma

Metastases

Minor Salivary gland tumors Rhbdomyosarcoma

Lethal midline granuloma

B. Oral Cavity, Oropharynx, Hypopharynx

1)Anatomy, contents

2)Masses

Squamous cell carcinoma

Dermoid/Epidermoid

Lingual thyroid

Thyroglossal duct cyst

Ranula
Hemangioma
3)Infection
Cellulitis, tonsillitis, abscess (Ludwig's angina)
Ranula

C. Paraphayngeal Space
1)Location, contents, anatomy and importance in relation to other spaces
2)Pharyngeal Mucosal Space (Anatomy, contents)
Infection (tonsilar abscess, adenitis)
Pleomorphic adenoma (minor salivary glands)
Squamous cell CA
Non-Hodgkin's lymphoma
Thornwaldt cyst
Hemangioma
3)Masticator Space (Anatomy, contents) Tumors (mesenchymal)
Infection
4)Parotid Space (Anatomy, contents)
1st Brachial cleft cyst Infection
Sialadenitis
Sialodochitis, ductal stricture, stone Lymphoepithelial lesions
Sjogren's Pleomorphic adenoma Warthin's tumors
Mucoepidermoid carcinoma Adenoid cystic carcinoma Metastases
Lymphoma
5) Carotid Space (Anatomy, contents) Aneurysm
Paragangliomas (Glomus tumors) Schwannoma
Neurofibroma Nodal Metastases
2) Retropharyngeal Space (Anatomy, contents) Neoplastic and reactive lymph nodes Infection ("Danger space")
6) Perineural spread

D. Larynx
1) Squamous cell carcinomas Staging
Supraglottic, glottic, subglottic Treatment effects (surgery and radiation) Airway obstruction
2)Trauma (laryngeal fractures)

E. Thyroid
1) Masses
Multinodular goiter
Adenoma
Cyst
Carcinoma

F. Cystic Neck Masses

1)Second brachial cleft cyst
2)Thyroglossal duct cyst
3)Cystic hygroma
4)Laryngocele, internal, external
3)Abscess
4)Ranula
5)Dermoid/Epidermoid

G. Lymphadenopathy

1)Graded by level and/or anatomic space.
2)Size criteria for pathologic nodes
3)Etiology
HIV Lymphoma
Metastases (aerodigestive carcinoma) Cat scratch fever
Atypical mycobacterium Mononucleosis Castleman's disease

H. Temporal bones

1)Imaging Techniques (Multi-planar CT/MR)
2)Anatomy/Embryology
3)Trauma
Transverse and longitudinal fractures CSF leaks, brain herniation
4) Tumors Schwannoma
Vestibular (8th) (common) Facial (7th) and trigeminal (5th)
Meningioma Lipoma
Dermoid/Epidermoid
Metastases
5) Pulsatile Tinnitus Glomus tympanicum
High riding/dehiscent jugular bulb
Ectopic carotid, persistent stapedial artery AVM, AV fistula
Venous tinnitus Atherosclerotic disease Dissection
FMD
6) Inflammatory Diseases Otitis media
Mastoiditis
Cholesteatoma (acquired or congenital) Malignant external otitis
Cholesterol granuloma
Hemorrhage or inflammation cochlea, vestibule (labrynthitis)
7)Congenital anomalies
Cochlear hypoplasia/aplasia, Mondini
External ear atresia/hypoplasia (ossicular anomalies)

Enlarged vestibular/cochlea aqueducts
Cochlear/vestibular aplasias-hypoplasias
Internal Auditory Canal anomalies

I.Mandible
1)infection
2)Trauma
3)Cystic lesions
4)Benigntumours
5)Malignanttumours

III. Orbits
1)Imaging Techniques
2)Anatomy/Embryology
Lesion localization based on relationship to muscle cone 3) Lacrimal Gland Tumors
Epithelial
Pleomorphic adenomas Carcinomas Lymphoma
Dermoid Metastases
4)Extra-conal Masses
Orbital wall or sinus neoplasms with extension
Subperiosteal abscess/orbital cellulitis from sinusitis/osteomyelitis Metastases
Lymphoma/Leukemia/Myeloma
Lymphangioma/Hemangioma Rhabdomyosarcoma Histiocytosis
Pseudotumor and granulomatous disease Hematoma
5) Extra-ocular Muscles (Conal)
Grave's Disease
Orbital myositis (Pseudotumor) Granulomatous disease Lymphoma/Leukemia Metastases
Carotid cavernous fistula
6) Intra-conal lesions
Related to optic nerve Glioma Meningioma Optic neuritis
Increased intracranial pressure
Pseudotumor Grave's disease
Meningeal carcinomatosis Leukemia
Separate from optic nerve (well defined) Cavernous angioma, capillary angioma Varix
Neurofibroma/Schwannoma Meningioma
Pseudotumor Lymphoma
Separate from optic nerve (ill defined –infiltrative) Infection
Metastases
Pseudotumor
7) Intra-ocular

Adult
Melanoma
Metastases Drusen
Child
Retinoblastoma Retrolental fibroplasia Coat's disease
Primary Hypertrophic Persistent Vitreous (PHPV) Any age
Metastases Retinal detachment
Infection and inflammation (endopthalmitis), AIDS Phthsis bulbi
8)Trauma
Fractures of the orbital wall Extra-ocular muscle entrapment Orbital emphysema Intra-orbital hematoma
Penetrating soft tissue injuries
Laceration of the optic nerve or muscles
Ocular - Ruptured globe, intra-ocular hemorrhage, dislocated lens Foreign Body

IV. Spinal Imaging

A. Anatomy and Biomechanics
1.Vertebral bodies
2.Facet joints and transverse processes
3.Lamina and spinous processes
4.Support ligaments
5.Specific characteristics of cervical, thoracic, and lumbar segments
6.Cranio-vertebral and lumbo-sacral junctions
7.Normal stability and motion

B. Imaging Modalities
1) Role and relative merit of non-invasive imaging studies.
Plain radiography, CT, MR, nuclear medicine, PET imaging
1)Role of invasive procedures
Myelography (including CT) angiography, biopsies, facet injections, nerve root blocks, discography

C. Trauma
1) Mechanism of injury Flexion Extension
Axial loading Compression Distraction Rotation
2) Stable fractures and ligamentous injuries Compression fracture
Isolated anterior column Isolated posterior column Unilateral locked facet Hyperextension, teardrop
Clay Shoveler's (Spinous process C7)
3) Unstable injuries (Involvement of the middle column and ligaments) Hyperflexionteardrop
Facet joint disruption and dislocation (bilateral locked facets) Hyperflexionligamentous injury without fracture
Odontoid fracture
Distraction fracture (Hangman's) (C2/C3) Chance
Burst

4)Traumatic disc herniation
5)Extrinsic cord compression
6)Cord contusion
7)Intra-spinal hemorrhage
Epidural hematoma (EDH) Subdural hematoma (SDH)
SAH Subarachnoid hemorrhage (SAH) Cord hematoma (hematomyelia)
8) Post-traumatic abnormalities Instability with spondylolithesis Syringomyelia
Arachnoiditis
Pseudomeningocele and root avulsion

D. Degenerative disease
1)Epidemiology
2)Disc degeneration
3)End plate degeneration
4)Disc herniation distributionimaging findings
5) Spinal stenosisdistribution Imaging findings
6) Post-operative changes Epidural scar Arachnoiditis
Recurrent herniation or stenosis

E. Inflammatory and Demyelinating Disease
1)Discitis/osteomyelitis
Acute (Spontaneous and Post-operative) Epidural and paravertebral abscess Chronic low grade discitis
2)Vertebral body Tuberculosis (Potts Disease)
3)Meningitis (Arachnoiditis)
TB, Sarcoid, CMV, AIDS 4) Spinal cord lesions
Abscess, granuloma Transverse myelitis Multiple Sclerosis ADEM

F. Neoplastic Disease
1)Osseous
Primary tumors - Benign Hemangioma
Osteoid Osteoma/Osteoblastoma Chondroid tumors
Giant Cell
Aneurysmal Bone Cyst (ABC) Chordoma
Primary tumors – Malignant Osteoid
Chondroid Metastases Lymphoma
Myeloma
Leukemia
2) Extradural
Neurofibroma Lymphoma Metastases
3) Intradural extramedullary Meningioma Schwannoma Neurofibroma Dermoid
Lipoma Epidermoid

Epidermal inclusion Cyst
Metastases (Carcinomatous Meningitis) Lymphoma
4) Intramedullary Ependymoma Astrocytoma Hemangioblastoma Metastases Lymphoma

G. Cystic lesions
1) Extradural Meningocele
Pseudo-meningocele (post-operative and post-traumatic) Root sleeve cysts (Tarlov) and terminal Meningocele
2)Intradural extramedullary Arachnoid cyst
Post inflammatory and post hemorrhagic arachnoiditis
3)Intramedullary
Syringomyelia/Hydromyelia
Chiari malformation, post traumatic, post infectious, neoplastic

H. Vascular lesions
1)Dural venous fistula
2)AVM
3)Cavernous Angioma
4)Spinal cord infarct

I. Developmental Spine Disease
1)Normal embryological development of spine
2)Open dysraphisms
3)Myelomeningocele
4)Lipomyelomeningocele (tethered cord)
5)Myelocele
6)Diastemometamyelia
7)Occult spinal dysraphisms
8)Tight filum, thick filum
9)Intradural lipoma
10)Dorsal dermal sinus

2. NUCLEAR NEUROLOGY (SPECT/PET):
A. Technical aspects of nuclear neurology:
· Physics and instrumentation
· Radiation Biology
· Radiation Dosimetry
· Radiation Safety
· Mathematics and Statistics
· Radionuclide Chemistry and Radiopharmacy
· Image Generation and Display
· SPECT Principles
· PET Principles

B. Clinical aspects of nuclear neurology:

1. Tumors/Masses/Cysts
· Grading of primary and metastatic neoplasms
· Differentiation of radiation injury from tumor recurrence

2. Cerebrovascular Diseases
· Assessment of cerebrovascular reserve
· Diagnosis of ischemia and infarction
· Determination of stroke subtypes
· Vasospasm following SAH
· Prognosis/recovery from stroke

3. Infectious/Granulomatous Diseases
· Differentiation of abscess versus neoplasm
· Diagnosis of viral encephalitis

4. Hemorrhage/Trauma
· Altered brain metabolism or blood flow in posttraumatic encephalopathy

5. Toxic/Metabolic Diseases
· Cerebral radiation injury versus recurrent neoplasm

6. Degenerative Diseases/Aging
· Aging
· Alzheimer's disease
· Huntington's disease
· Parkinsonian states
· Pick's disease

7. Seizures/Epilepsy
· Ictal localization
· Interictal localization
· Mesial temporal sclerosis

8. Hydrocephalus/CSF Disorders
· Brain metabolism/perfusion pattern in hydrocephalic states including NPH
· Use of cisternography to diagnose hydrocephalus and CSF leakage

9. Psychiatric Disorders
· Mood disorders
· Schizophrenia
· Obsessive-compulsive disorders

10. Miscellaneous
· Normal anatomy and physiology
· Ligand tracer studies
· Brain death

3. NEUROSONOLOGY (CAROTID DOPPLER/TCD):
1. Basic principles of Doppler physics
2. Continuous wave (CW) Doppler principles
3. Pulsed wave (PW) Doppler principles
4. Physical principles of brightness-modulated (B-mode) real time ultrasound imaging
5. Principles of color Doppler imaging

6. Principles of color velocity imaging
7. Basic principles of emboli detection
8. Ultrasound artifacts
9. Ultrasound equipment/hardware
10. Ultrasound bioeffects and safety
11. Cerebrovascular hemodynamics and anatomy
12. Pulsed Doppler techniques
13. Spectral analysis
14. Pulsed Doppler interpretation principles
15. Clinical applications of duplex sonography
16. Plaque morphology
17. Duplex sonography interpretation/criteria
18. Color flow imaging techniques
19. Color flow clinical applications
20. Interpretation extracranial and transcranial color flow studies
21. Power Doppler techniques
22. Power Doppler applications
23. Techniques of adult transcranial Doppler
24. Techniques of transcranial Doppler in children with sickle cell disease
25. Interpretation of transcranial Doppler
26. Applications of transcranial Doppler

4. ANGIOGRAPHY: Clinical Aspects:
1. General Aspects of Angiography
a. Principles of Angiography Interpretation
b. Normal Arterial Anatomy
c. Normal Venous Anatomy
d. Congenital Anatomic Variants
e. Congenital Anomalies
2. Cerebrovascular Disorders
a. Occlusive Pathology
b. Defining Degree of Stenosis
c. Emergency Angiography of Ischemic Stroke
d. Atherosclerotic vs. Non-Atherosclerotic Pathology
e. Traumatic Injuries and Dissection
f. Fibromuscular Dysplasia
g. Moya-Moya
h. Cerebral Aneurysms
i. Cerebral Vasospasm
j. Arteriovenous Malformations
k. Venous Angiomas
3. Neoplastic Conditions
a. Typical Angiographic Findings in Brain Tumors
b. Vascularity of Brain Tumors
4. Inflammatory Conditions
a. Cerebral Vasculitis
b. Meningeal Infections

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