الهيئة السعودية للتخصصات الصحية
Saudi Commission for Health Specialties

Pediatric Neurosurgery Fellowship Curriculum (2019-2020)

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بسم الله الرحمن الرحيم

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FOREWORD

The Kingdom of Saudi Arabia enjoys unmatched rapid, scientific, and solid development in healthcare systems. This healthcare system is based on many elements such as:

1. Highly qualified manpower; training and producing good quality, competent, and safe physicians and surgeons in different specialties and subspecialties, paramedics, and medical scientists.
2. Building new and modern equipment and distributing health care facilities over every geographical area in the kingdom
3. Good, modern, and efficient administration.

The development of Pediatric Neurosurgery lies well within these health care development plans. The need for the development of modern Pediatric Neurosurgery services and programs is very evident. Therefore, the development of the Pediatric Neurosurgery Fellowship program has become a necessity to provide well-qualified pediatric neurosurgeons who are capable of providing the best possible neurosurgical care for children under 18 years of age, which makes up 36% of the Saudi Arabian population.

In order to promote high quality and safe care of pediatric neurosurgical patients, the curriculum specifies the parameters of knowledge, clinical skills, technical skills, professional behavior, and leadership skills that are considered necessary to ensure patient safety throughout the training process.

This curriculum is structured as a competency-based program in order to achieve the aforementioned goals.

The ultimate goal of this curriculum is to guide trainees to become competent in the chosen specialty, Pediatric Neurosurgery.

This curriculum went through different phases of development and was started by the sending of trainees to Canada in the 1990s to be trained in Pediatric Neurosurgery following Canadian programs. Another group started their training in the kingdom under local programs. Subsequently, the Saudi Commission for Health Specialties (SCFHS) took responsibility and leadership to develop outstanding and applicable Pediatric Neurosurgery Fellowship programs and curricula. A scientific committee for the program was formed, and a committee for developing the curriculum was also formed. The SCFHS aimed to produce excellent training modules to achieve the highest quality of training. Necessary communications have been made between the SCFHS and academic affairs in training centers, and the regional supervisory training committee will have a major role in training supervision and implementation. The Pediatric Neurosurgery Scientific Council will be responsible for ensuring that the content of this curriculum is constantly updated to match the best-known standards of postgraduate education in their specialty.

This goal will require a significant amount of effort and coordination from all stakeholders involved in postgraduate training. As “adult learners”, trainees have to demonstrate full engagement with proactive roles by: careful understanding of learning objectives, self-directed learning, openness to reflective feedback and formative assessment, and self-wellbeing and seeking support when needed. The program director plays a vital role in making the implementation of this curriculum most successful. Training committee members, particularly program administrators and chief residents, have a significant impact on program implementation. Trainees should be able to share responsibility in curriculum implementation.

We are aware that the first implementation of the curriculum may raise some questions and observations that may need to be addressed later. In addition, the rapid development and changes in international postgraduate training programs are significant; therefore, this curriculum is structured to adopt any future needed updates or changes.

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INTRODUCTION

Pediatric neurological surgery is a subspecialty of neurosurgery that deals with infants and children. It includes, but is not limited to, the medical and surgical treatment of congenital, degenerative, vascular, inflammatory, and neoplastic disorders of the central and peripheral nervous system in the named age group.

Context of Practice

The clinical practice of neurosurgery and supporting services rapidly developed after the Second World War. In the early the 1960s, the need for neurosurgical subspecialties evolved. The development of basic sciences showed that pediatric patients have their own identity. There are common neurosurgical problems in pediatric patients. The skills needed to deal with such problems are different from the skills needed to deal with adult patients. Therefore, Pediatric Neurosurgery is one of these badly needed subspecialties that has rapidly developed. The divisions of Pediatric Neurosurgery were formed within the departments of general surgery in some leading universities such as Chicago, New York, Boston, Toronto, Paris, Buenos Aires, and London. At that time, there was no special training program for Pediatric Neurosurgery. Neurosurgeons interested in Pediatric Neurosurgery worked in these divisions. The practice of Pediatric Neurosurgery as a sub-discipline of neurosurgery was set in the 1970s. The International Society for Pediatric Neurosurgery was created in 1972, and shortly thereafter, the American Society of Pediatric Neurosurgeons was formed, followed by both European and Japanese Societies for Pediatric Neurosurgery. Similarly, the American Association of Neurological Surgeons and the Congress of Neurological Surgery established a combined Section of Pediatric Neurosurgery.

The population of the Kingdom of Saudi Arabia is one of the fastest growing in the world. Nearly 31.4% of the population is under the age of 18 years.[1] In addition, with the increase in the quality of medical services, particularly in high-risk pregnancy and neonatology, the need for qualified pediatric neurosurgeons is growing. It became mandatory to develop such services in Saudi Arabia in order to meet the growing demand. Therefore, in 1990s, Pediatric Neurosurgery units were developed in several places.

The major challenge was to develop a good training program to train general neurosurgeons in Pediatric Neurosurgery. The programs were developed in the USA, Canada, and France. However, it is not rare to see pediatric neurosurgeons who are dedicated to Pediatric Neurosurgery having gained their experience and expertise through long practical experience, interest, and enthusiasm for Pediatric Neurosurgery.

It is recommended in some developed countries that a neurosurgeon taking responsibility for a child's structural disease within the nervous system should have additional training and hold special qualifications. North American programs consider a 1-year Fellowship in Pediatric Neurosurgery adequate, and such Fellowship encompasses:

- Necessary experience in an accredited institution
- Pass a written examination
- Receive a certificate of competence in the discipline of Pediatric Neurosurgery.

Alternatively, in some European countries, the qualification in Pediatric Neurosurgery is acquired through formal lecture/seminar programs and receiving a certificate of competence in the discipline of Pediatric Neurosurgery.

Pediatric Neurosurgery itself is rapidly developing, and the need for super specialty in Pediatric Neurosurgery has appeared, such as vascular and radiological intervention, spinal Pediatric Neurosurgery, oncology, and congenital anomalies. These are challenges and demands that must be dealt with by organizing structured courses, rotations, and workshops.

The aim of the Pediatric Neurosurgery Fellowship program is to provide a well-qualified pediatric neurosurgeon who is capable of looking after children with neurosurgical problems. Fellows will gain the required expertise in this field by spending enough time in one or more well-staffed and equipped centers to allow him/her to develop appropriate competence during the period suggested.

In order to promote high quality and safe care of pediatric neurosurgical patients, the curriculum specifies the parameters of knowledge, clinical skills, technical skills, professional behavior, and leadership skills that are considered necessary to ensure patient safety throughout the training process and specifically at the end of training.

Goals and Responsibility of Curriculum Implementation

The ultimate goal of this curriculum is to guide trainees to become *competent* in their specialty. This goal will require a significant amount of effort and coordination from all stakeholders involved in postgraduate training. As an *"adult learner"*, trainees have to demonstrate full engagement with *proactive* roles by: careful understanding of learning objectives, self-directed learning, openness to reflective feedback and formative assessment, and self-wellbeing and seeking support when needed. The program director plays a vital role in making the implementation of this curriculum successful. Training committee members, particularly program administrators and chief residents, have a significant impact on program implementation. Trainees should be able to share responsibility in curriculum implementation. The SCFHS will apply the best models of training governance to achieve the highest quality of training. Academic affairs in training centers and regional supervisory training committees will play a major role in training supervision and implementation. The Pediatric Neurosurgery Scientific Council will be responsible for ensuring that the content of this curriculum is constantly updated to match the best-known standards for postgraduate education in their specialty.

What's new in this edition?

This new version of the curriculum has important additions, such as:

1. Highlighting and emphasizing the philosophy and core of the program.
2. Identification of the program's entry and exit and the structured and non-structured rotations.
3. Statement of competencies needed and methods to achieve each.
4. The assessment of different periods of training is described.

Policies and Procedures

This curriculum represents the means and materials outlining learning objectives with which trainees and trainers will interact for the purpose of achieving the identified educational outcomes. The SCHS has a full set of "General Bylaws" and Executive Policies" and Executive Policies that regulate all processes related to training. General bylaws of training, assessment, and accreditation as well as executive policies on admission, registration, continuous assessment and promotion, examination, trainees' representation and support, duty hours, and leaves and policies that can be accessed online via the official SCFHS websites.

Duties of the Fellow

As a general principle, continuity of care should be emphasized. Ideally, the Fellow should seek to follow patients from the time of the pre-admission evaluation (consultation) or the admission history/physical, through the in-hospital phase of treatment, including surgery and follow-up visits. It is particularly important that the Fellow remains intimately involved with the day-to-day care of neurosurgical patients in the PICU and the NICU, and attends all major pediatric neurosurgical cases.

- The Fellow is highly encouraged to attend outpatient clinics to see as many new patients as possible, and to follow up on all patients who have been treated in hospital or outpatient surgery.
- The Fellow is also encouraged to attend all surgical procedures of interest in other disciplines when relevant to the secondary objectives of training.
- The Fellow is expected to undertake one or more clinical or basic science research projects.

- The Fellow should attend and actively participate in the Neurosurgery Club meetings and be responsible for organizing all academic activities within the department.
- The Fellow must play a major role in the teaching and supervision of junior residents in their daily clinical work.
- The Fellow must be involved in all relevant clinical activities of the unit and run the day-to-day work of the unit.
- The Fellow will be granted 4 weeks of holiday per year, as well as one Eid holiday per year, as determined by the training hospital concerned.

Disciplinary Actions

Dismissal from the program, dispute, and disciplinary actions are taken according to the Rules and Regulations of the Saudi Commission for Health Specialties. The actions will be discussed and approved by the Fellowship supervisory committee of the training program.

https://www.scfhs.org.sa/en/MESPS/Pages/Regulations--.aspx

Abbreviations used in this document

Abbreviation	Description
SCFHS	Saudi Commission for Health Specialties
F(1)	(First) year of Fellowship
F(2)	(Second) year of Fellowship
PT	Progress Test
OSCE	Objective Structured Clinical Examination
OSPE	Objective Structured Practical Examination
Mini-CEX	Mini-Clinical Experience Report
DOPS	Direct Observation of Procedural Skills report
CBD	Case-Based Discussion Report
CBE	Competency-Based Education
ITER	In-Training Evaluation Report
COT	Consultation Observation Tool
FTC	Fellowship Training Committee
CSF	Cerebrospinal Fluid
OR	Operating Room
CNS	Central Nervous System
PICU	Pediatric Intensive Care Unit
NICU	Neonatal Intensive Care Unit

PROGRAM STRUCTURE

Program Entry Requirements

The Fellowship Training Committee will interview the candidates and select the best candidate.

The prospective Fellow must meet the following requirements:

1. Have successfully completed a formal residency training program in neurological surgery and was certified in the specialty by the appropriate board such as the Saudi Board in Neurological Surgery or its equivalent.
2. Must be registered and licensed by the Saudi Commission for Health Specialties (SCFHS).
3. Supply three confidential letters of reference.
4. The candidate must have successfully passed a personal interview by members of the Pediatric Neurosurgery board faculty.
5. Sponsorship for the entire training period.
6. Upon admission the Fellow must sign a statement to abide by the rules and regulations of the SCFHS.

Program Duration

This Fellowship Program consists of 2 years of full-time structured supervised training in Pediatric Neurosurgery. The Fellow is required to rotate at at least two accredited centers.

Program Rotations

Each academic year consists of 13 blocks, each of which is 4 weeks in duration.

Program Master rotations schedule:

Training Year	Mandatory core rotations*		Elective rotations**	
	Rotation name	Duration In blocks	Rotation name	Duration
F1	**Pediatric Neuroscience:** Pediatric Neurology Neuropathology □ Neuroradiology Pediatric Neurosurgery Annual Leave	 1 1 1 9 1	□ □ □	
F2	Advanced Pediatric Neurosurgery Pediatric ICU Annual Leave	9 1 1	□ Spine surgery □ Pediatric neurology (Epilepsy) □ Craniofacial □ Research	2 (in one or more rotation)

INTRODUCTION TO LEARNING OUTCOMES AND COMPETENCY-BASED EDUCATION CanMed ROLES:

Fellows are expected to progress to a mastery level in Pediatric Neurosurgery. SCFHS has endorsed CanMED to articulate professional competencies. The following is the general outline of each competency:

Medical Expert:

1. Perform and practice Pediatric Neurosurgery within the defined scope of practice and expertise.
2. Perform a patient-centered clinical assessment and establish a management plan within the principles of Pediatric Neurosurgery.
3. Plan and perform Pediatric Neurosurgery procedures and rehabilitation in a timely and appropriate manner.

Communicator:

1. Establish a professional therapeutic relationship with the patient and their families.
2. Engage patients and their families in developing treatment and management plans that reflect the health care needs of the patient.
3. Document and share medical information to the treating team to optimize clinical decision-making, patient safety, confidentiality, and safety of the patient.

Collaborator:

1. The Fellow works effectively with physicians and other health care professions to promote understanding, manage differences, and resolve conflicts.
2. The Fellow hands over patient care to other health care team members to facilitate the continuity of safe and effective patient care.

Health Advocate:

1. The Fellow works with other health care teams to contribute his expertise and work with the community to help improve awareness of different Pediatric Neurosurgery problems, management, and treatment.
2. The Fellow responds to the needs of the communities they serve to advocate health care changes in a socially accountable manner.

Leader:

1. The Fellow engages and contributes to the facilitation of the vision of high-quality Pediatric Neurosurgery services in delivering excellent patient care.
2. The Fellow demonstrates leadership in professional practice.
3. Helps in the management of planning, research, finances, and health human resources in the Pediatric Neurosurgery unit.

Scholar:

1. The Fellow demonstrates a lifelong commitment to excellence in the practice of Pediatric Neurosurgery through continuous learning.
2. Engaging in the continuous enhancement of professional knowledge and skills as a pediatric neurosurgeon and imparting it to teach residents, medical interns, and other health care professionals to contribute to the dissemination of knowledge and practices applicable to Pediatric Neurosurgery.

Professional:

1. The Fellow is committed to the health and well-being of its individual patients and its community through application of the best treatment and management adhering to high ethical practices.
2. Demonstrates commitment to the community by recognizing and responding to community expectations in Pediatric Neurosurgery.
3. Demonstrate commitment to physician health and well being to foster optical patient care in Pediatric Neurosurgery.

FELLOWSHIP 1 (F1) LEVEL

Pediatric Neuroscience — Total Duration: 3 blocks

Neurology — Duration: 1 block

Goals and Objectives: by the end of the rotation, the Fellow will:

a. Operate different methods of neurology examinations.
b. Read and interpret electrophysiological investigations.
c. Demonstrate high skills in dealing with epileptic patients.
d. Provide a link between neurological cases and neurosurgery cases.

Learning and Training Settings

a. Inpatient
The Fellow has to participate in all inpatient services such as:

i. Daily rounds.
ii. Share in discussion and making decisions about a patient's admission, management, and discharge.
iii. Taking on call duties.
iv. Participating in the academic activities of that department.

b. Outpatient
The Fellow should attend the outpatient clinic with a neurology consultant in order to:

i. Recognize the short and the long outcome of treated patients.
ii. Recognize when and how it is necessary to admit a patient.
iii. Demonstrate a high skill of adjustment and alteration of medication to control the patient's neurological conditions such as epilepsy and Parkinsonism.

c. Surgical
i. Identify which cases should be referred to neurosurgery at the appropriate time.
ii. Carry out different surgical methods that are appropriate for each case.
iii. Demonstrate good skills in choosing a specific surgical method for a certain patient at the appropriate time.

Neuropathology — Duration: 1 block

Goals and Objectives: by the end of the rotation, the Fellow will:

a. Operate different methods of histopathological investigations, prepare tissues and perform different methods of staining.
b. Illustrate how to diagnose different neuropathological lesions.
c. Demonstrate how to prepare and read frozen sections of different neuropathological lesions.
d. Identify the histopathology of different neurosurgical lesions.

Learning and Training Settings

i. Sharing in different activities such as:
   a. Receiving specimens
   b. Preparation and cutting the specimens
   c. Staining
ii. Participating in discussion to diagnose every case
iii. Writing a pathological report
iv. Participate in different academic and research activities

Neuroradiology — Duration: 1 block

Goals and Objectives: by the end of the rotation, the Fellow will:

a. Recognize the different methods of neuroradiology investigations.
b. Interpret the different radiological findings from different modalities.
c. Identify the correct investigation to use for each case.
d. Recognize the principles of neurointervention.
e. Demonstrate safe skills in taking biopsy under X-Ray or CT-Scan guidance.

Learning and Training Settings

Inpatient and Outpatient:

I. Sharing in different activities such as:
   a. Receiving requests for investigation, and knowing how to filter and schedule these requests according to priorities and emergencies
   b. Preparation of patients according to different investigations
   c. Knowing the different CT-Scan and MRI settings for different investigations
   d. Interpreting the radiological findings correctly
   e. Marking the proper level of the spine to help the neurosurgeon or spine surgeon safely reach the correct level

II. Participating in discussion to diagnose every case
III. Writing a proper radiological report
IV. Participate in different academic and research activities

Surgical (Neurointerventional):

a. Learn the principles of neurointervention.
b. Learn how to prepare the patient and the equipment for neurointerventional methods.
c. Learn the indication and contraindication of each method of neurointervention.
d. Learn to act safely and abort the intervention in a timely manner.

Surgical (biopsy)

a. Perform a biopsy of different lesions from different spinal levels.
b. Take CSF in difficult cases via LP.
c. Mark the proper level of the spine to help the neurosurgeon or spine surgeon to safely reach the correct level

Pediatric Neurosurgery — Duration: 9 blocks

Goals and Objectives: by the end of the rotation, the Fellow will:

1. Gain the knowledge, skills, professional judgment, and attitudes needed to practice Pediatric Neurosurgery.
2. Demonstrate high expertise in examining Pediatric Neurosurgery patients, ordering the proper investigations according to the differential diagnosis, and reaching the proper diagnosis.
3. Illustrate the correct process for preparing patients for surgery.
4. Independently perform some operations such as:
   a. VP-Shunts
   b. EVD
   c. Closure of simple myelomeningocele
   d. Craniotomies for head trauma
   e. Craniotomies for some supra tentorial tumors
   f. Craniotomies to evacuate intracerebral hematoma
   g. Craniotomies to remove empyema and brain abscess

5. Provide efficient assistive skills in major Pediatric Neurosurgery cases.
6. Identify the ethics, skills, and art of prioritizing, admitting, and scheduling cases.
7. Instruct the parents in the necessary steps of home care and postoperative care for their sick children.
8. Keep up with national and international developments and progress in pediatric neurosurgical techniques.
9. Identify the principles of performing clinical research.
10. Demonstration of being a safe, ethical, and professional pediatric neurosurgeon.
11. Participate in different scientific activities, locally, nationally, or internationally.
12. Engage actively in serving the society and country, be a good advocate for the care of Pediatric Neurosurgery patients.

Learning and Training Settings

a. Inpatient - The Fellow should learn and master these clinical skills:
   1. Perform a correct neurological and non-neurological Examination of newly admitted patients and document the findings.
   2. Construct the appropriate investigations according to the patients' needs.
   3. Practice an organized way of writing about and calling for consultation of deferent services.
   4. Analyze the clinical findings to construct a management plan.
   5. Perform a daily round on the admitted patients and document the daily findings.
   6. Prepare patients for operations or special procedures.
   7. Perform a standard method for taking different types of consents (regular consent, high risk consent, consent for certain procedures)
   8. Be on call at least twice a week.
   9. Follow up patients after surgery.
   10. Discharge patients and write discharge summaries.
   11. Learn skills to communicate with the patient and the parents.

b. Out patient - The Fellow should sit in clinics with a consultant in charge to learn the scope and functions of outpatient clinics.
   1. Follow up the operated and discharged patients and learn the short- and long-term management of these cases.
   2. Receive new patients, examine them, and order investigations to reach a diagnosis.
   3. Detect red flags and admit the patients.

c. Surgical - The role of the trainees is divided into two parts:
   1. Perform some surgeries under supervision, such as VP-Shunts, insertion of EVD, repair of small myelomeningocele, removal of EDH, SDH, and ICH.
   2. Perform efficient assistive roles in complex cases such as neuroendoscopic surgery (third ventriculostomy), VA-Shunt, difficult cases of spina bifida and lipomyelomeningocle, different craniotomies, and neurointervention.

FELLOWSHIP 2 (F2) LEVEL

Advanced Pediatric Neurosurgery — Duration: 9 bocks

Goals and Objectives: by the end of the rotation, the Fellow will:

1. Acquire the required knowledge, skills, professional judgment, and attitudes needed to practice and teach Pediatric Neurosurgery, and to participate in the progress of Pediatric Neurosurgery through research and publication. The Fellow at this stage should:
   - 1.1 Familiarize himself/herself thoroughly with the clinical recognition, natural history, and embryology of all conditions relevant to Pediatric Neurosurgery.
   - 1.2 Practice as a safe and ethical pediatric neurosurgeon.
   - 1.3 Produce a decision for the patient at the right time.
   - 1.4 Describe the pathophysiology of these conditions, and the physiological response of the child to trauma and surgery.
   - 1.5 Undertake comprehensive supportive care of pediatric neurosurgical patients, especially newborns.
   - 1.6 Independently perform all surgical procedures in the field of Pediatric Neurosurgery.
   - 1.7 Demonstrate the appropriate attitudes required to deal with specific personal stress involved in the practice of Pediatric Neurosurgery and stress experienced by patients and their families.
   - 1.8 Reinforce the principles of ethical behavior previously acquired, and familiarize himself/herself with ethical issues of particular relevance to Pediatric Neurosurgery.
   - 1.9 Develop the specific communication skills required to deal with children and their parents.
   - 1.10 Develop an awareness of quality Assurance issues specifically related to the specialty.
   - 1.11 Apply the principles of research and publications in the field of Pediatric Neurosurgery.

2. Knowledge
   Upon completion of the training program, the Fellow should be able to:

   - 2.1 Diagnose, manage, and prognosticate on the full spectrum of medical and surgical problems in the field of Pediatric Neurosurgery.
   - 2.2 Possess the technical expertise and intellectual maturity necessary for the practice of Pediatric Neurosurgery.
   - 2.3 Demonstrate teaching abilities.
   - 2.4 Know the principles of research.

3. Clinical Skills:
   By the end of training, the Fellow should have acquired skills appropriate to those of a junior consultant in the following areas:

   - 3.1 Pre-operative care, which includes:
     - 3.1.1 Perform history taking and physical examinations specific to the infant and child, and have the skills necessary to interview parents to explain the diagnosis, proposed treatment, and prognosis, and to obtain informed consent.
     - 3.1.2 Interpret diagnostic aids correctly.
     - 3.1.3 Prepare of the patient for surgery, including assessment of anesthetic risk.

   - 3.2 Operative Care:
     This includes both minor and major surgeries, with an emphasis on index cases. Fellows must demonstrate the ability to exercise judgment and control in unexpected situations, and ingenuity in dealing with “one-of-a-kind” problems. He/she should demonstrate an ability to assist more junior colleagues in the performance of procedures, and should be able to operate independently.

3.3 Postoperative care:
The main emphasis here is on maintenance of homeostasis (fluids and electrolytes, temperature control, monitoring, etc.) and on early recognition of complications, intracranial hypertension, pain control, etc.

Learning and Training Settings

a. Inpatient
by the end of the rotation, the Fellow will:

1. Perform a correct neurological and non-neurological Examination of the newly admitted patients and document the findings.
2. Conduct the appropriate investigations for the patients.
3. Practice an organized way of writing about and calling for consultation of deferent services.
4. Analyze the clinical findings to construct a management plan.
5. Perform a daily round on the admitted patients and document the daily findings.
6. Prepare patients for operations or special procedures.
7. Perform a standard method of taking different types of consents (regular consent, high risk consent, consent for certain procedures)
8. Be on call at least twice a week.
9. Follow up patients after surgery.
10. Discharge patients and write discharge summaries.
11. Learn skills to communicate with the patient and the parents.

b. Outpatient
The Fellow should sit in clinics with a consultant in charge to learn the scope and functions of outpatient clinics.

b.1. Follow up the operated and discharged patients and learn the short- and long-term management of these cases.
b.2. Receive new patients, examine them, and order investigations to reach the diagnosis.
b.3. Detect red flags and admit the patients

c. Surgical
The role of the Fellow is divided into three parts:

c.1 Independently manage the emergencies such as different types of head trauma, shunt obstructions, and cases of increased intracranial pressure due to different reasons.
c.2. Perform some surgeries under supervision, such as VP-Shunts, insertion of EVD, repair different types of meningocele and myelomeningocele, and removal of EDH, SDH, and ICH. Some craniotomies and removal of brain tumors. Should also be able to manage cases of encephalocele.
c.3. Demonstrate the efficient skills to assist in complex cases such as neuroendoscopic surgery (third ventriculostomy),VA-Shunt, difficult cases of spina bifida and lipomyelomeningocle, different craniotomies, and neurointervention.
c.4. Assist and perform reconstructions of the vault and skull and use different techniques to manage craniosynotosis.

Elective Rotation **Duration: 2 blocks**

Elective rotation to a local or international Pediatric Neurosurgery department for the following options: 2 blocks of elective Pediatric Neurosurgery rotation, or 1 block elective and 1 block research.

The Fellow can choose from the following Elective Rotations:

A Pediatric Neurology (Epilepsy)
Goals and Objectives: by the end of the rotation, the Fellow will:

1. Gain the knowledge, skills professional judgment, and attitudes needed to practice Pediatric Neurology (Epilepsy).
2. Demonstrate expert skills in examining Pediatric Neurology (Epilepsy) patients, ordering the proper investigations according to the differential diagnosis, and reaching the proper diagnosis.
3. Illustrate the correct process for preparing patients for procedures.
4. Provide efficient assistive skills in major Pediatric Neurology (Epilepsy) cases.
5. Identify the ethics, skills, and art of prioritizing, admitting, and scheduling cases.
6. Instruct the parents in the necessary steps of home care and post discharge care for their sick children.
7. Apply national and international developments and progress in Pediatric Neurology (Epilepsy).
8. Identify the principles of performing clinical research.
9. Demonstrate being a safe, ethical, and Pediatric Neurology (Epilepsy) professional.
10. Participate in different scientific activities, locally, nationally, or internationally.
11. Engage actively in serving the society and country, be a good advocate for the caring of Pediatric Neurology (Epilepsy) patients.

Learning and Training Settings

a. Inpatient - The Fellow should learn and master these clinical skills:
   1. Perform a correct neurological and non-neurological Examination of newly admitted patients and document the findings.
   2. Perform the proper investigations for the patients.
   3. Practice an organized way of writing about and calling for consultation of deferent services.
   4. Analyze clinical findings to construct a management plan.
   5. Perform a daily round on the admitted patients and document the daily findings.
   6. Prepare patients for operations or special procedures.
   7. Perform a standard method of taking different types of consents (regular consent, high risk consent, consent for certain procedures).
   8. Be on call at least twice a week.
   9. Follow up patients after surgery
   10. Discharge patients and write discharge summaries.
   11. Learn skills to communicate with the patient and the parents.

b. Outpatient - The Fellow should sit in clinics with a consultant in charge to learn the scope and functions of outpatient clinics.
   1. Follow up the operated and discharged patients and learn the short- and long-term management of these cases
   2. Receive new patients, examine them, and order investigations to reach the diagnosis.
   3. Detect red flags and admit the patients.

B Craniofacial

Goals and Objectives: by the end of the rotation, the Fellow will:

1. Gain the knowledge, skills professional judgment and attitudes needed for Craniofacial service.
2. Demonstrate expert skills in examining Craniofacial patients, ordering the proper investigations according to the differential diagnosis, and reaching the proper diagnosis.
3. Illustrate the correct process for preparing patients for surgery.
4. Provide efficient assistive skills in major Craniofacial cases.
5. Identify the ethics, skills, and art of prioritizing, admitting, and scheduling cases.
6. Instruct the parents in the necessary steps of home care and postoperative care for their sick children.
7. Apply national and international developments and progress in Craniofacial services.
8. Identify the principles of performing clinical research.
9. Demonstrate being a safe, ethical, and professional Craniofacial surgeon.

10. Participate in different scientific activities, locally, nationally, or internationally.
11. Engage actively in serving the society and country, being a good advocate for the caring of Craniofacial patients.

Learning and Training Settings

a. Inpatient - The Fellow should learn and master these clinical skills:
   1. Perform a correct neurological and Examination of the newly admitted patients and document the findings.
   2. Perform proper investigation of the patients.
   3. Practice an organized way of writing about and calling for consultation of deferent services.
   4. Analyze the clinical findings to construct a management plan.
   5. Perform a daily round on the admitted patients and document the daily findings.
   6. Prepare patients for operations or special procedures.
   7. Perform standard methods of taking different types of consents (regular consent, high risk consent, consent for certain procedures).
   8. Be on call at least twice a week.
   9. Follow up patients after surgery
   10. Discharge patients and write discharge summaries.
   11. Learn skills to communicate with the patient and the parents.

b. Outpatient - The Fellow should sit in clinics with a consultant in charge to learn the scope and functions of outpatient clinics.
   1. Follow up the operated and discharged patients and learn the short- and long-term management of these cases.
   2. Receive new patients, examine them, and order investigations to reach the diagnosis.
   3. Detect red flags and admit the patients.

c. Surgical - The role of the trainees is divided into two parts:
   1. Perform some surgeries under supervision.
   2. Perform efficient assistive skills in complex cases.

C Spine Surgery
Goals and Objectives: by the end of the rotation, the Fellow will:

1. Gain the knowledge, skills, professional judgment, and attitudes needed to practice Spine Surgery.
2. Demonstrate expert examination skills in Spine Surgery patients, ordering the proper investigations according to the differential diagnosis, and reaching the proper diagnosis.
4. Illustrate the correct process for preparing patients for surgery.
5. Independently perform some operations.
6. Provide efficient assistive skills in major Spine Surgery cases.
7. Identify the ethics, skills, and art of prioritizing, admitting, and scheduling cases.
8. Apply the national and international development and progress in Spine Surgery.
9. Identify the principles of performing clinical research.
10. Demonstrate to be safe, ethical and professional Spine Surgery.
11. Participate in different scientific activities, locally or national or international.
12. Engage actively in serving the society and country, be good advocate for caring of Spine Surgery patients.

Learning and Training Settings

a. Inpatient - The Fellow should learn and master these clinical skills:
   1. Perform a correct neurological and non-neurological Examination of the newly admitted patients and document the findings.
   2. Perform the proper investigation of the patients.

3. Practice an organized way of writing about and calling for consultation of deferent services.
4. Analyze the clinical findings to construct a management plan.
5. Perform a daily round on the admitted patients and document the daily findings.
6. Prepare patients for operations or special procedures.
7. Perform a standard method of taking different types of consents (regular consent, high risk consent, consent for certain procedures).
8. Be on call at least twice a week.
9. Follow up patients after surgery.
10. Discharge patients and write discharge summaries.
11. Learn skills to communicate with the patient and the parents.

b. Outpatient – The Fellow should sit in clinics with a consultant in charge to learn the scope and functions of outpatient clinics.
   1. Follow-up the operated and discharged patients and learn the short- and long-term management of these cases.
   2. Receive new patients, examine them, and order investigation to reach the diagnosis.
   3. Detect red flags and admit the patients.

c. Surgical - The role of the trainees is divided into two parts:
   1. Perform some surgeries under supervision.
   2. Perform efficient assistive skills in complex cases.

Research Rotation

Number of rotation months	First year	Second year	Total
	0	1	1

Medical Expert

Goals:

- To demonstrate an understanding of the basic principles of research design, methodology, data analysis, and clinical epidemiology. In addition, the advantages and disadvantages from the perspective of radiology.
- Familiarization with the ethical requirements of research and demonstrate an understanding of the responsible use of informed consent.
- To understand and practice appropriate methods for writing a research manuscript, data collection, analyzing results, and writing a discussion.
- To demonstrate awareness of the current research topics in radiology using available medical informatics systems.
- To acquire the skills for scientific presentations and public discussions.

Training Methods

- A dedicated 1-month, full-time rotation in research is conducted.
- It is expected that the project will span more than a month. Therefore, completion of the work should be in parallel with the other subsequent rotations.
- The Fellow must choose a supervisor who will help in accessing essential resources that will allow appropriate understanding of research skills and periodically discuss the progress.
- Attendance of dedicated courses or workshops that enhance research skills may be required by the program.
- The Fellow must finish the research proposal by the end of the first 6 months and should be accepted by the Neuroradiology research committee.
- Oral abstract of the study results should be presented at the second year, on the Fellows Neuroradiology Research Day.

- The research paper should be sent at least 2 weeks before the Neuroradiology Research Day.
- It is highly desirable for Fellows to work on presenting the research results at national and/or international meetings and work hard to publish their work in indexed journals.

Evaluation

- Attendance at designated courses/lectures will be monitored and incorporated into the annual evaluation score.
- Panel scoring of the research abstract presentation will be conducted at the end of the 2nd year, on the Neuroradiology Research Day. This will count as the rotation score for that month (Appendix 9).

Communicator

- Demonstrate skills in conveying and discussing scientific research to scientific communities through posters, abstracts, teaching slides, manuscripts, or other scientific communications.
- Communicate and collaborate effectively with the research supervisor to conduct the research.

Collaborator

- Identify, consult and collaborate with appropriate experts to conduct the research.

Leader

- Demonstrate ability to identify an area of research interest and a research supervisor in order to engage in the scholarship of scientific inquiry and dissemination.
- Demonstrate ability to utilize available resources and regularly meet with an identified research mentor.
- Demonstrate ability to set realistic priorities and to use time effectively in order to optimize professional performance.
- Demonstrate an understanding of the cost-effective use of health care resources.

Health Advocate

- Recognize the contributions of scientific research in improving the health of patients and communities.

Scholar

- Demonstrate the ability to pose an appropriate research question, recognize and identify gaps in knowledge and expertise around this question, and formulate an appropriate study to answer it.
- Demonstrate the ability to carry out the research outlined in the proposal.
- Demonstrate the ability for data collection, data analysis, and preparation of an abstract and manuscript.
- Demonstrate the ability to identify areas for further research.

Professional

- Uphold ethical and professional expectations of research consistent with Institutional Review Board guidelines, including maintenance of meticulous data and conducting research ethically.
- Demonstrate personal responsibility for setting research goals and working with the supervisor to set and achieve research timeline objectives.
- Publish accurate and reliable research results, with attention to appropriate authorship attribution criteria.
- Disclose potential financial conflicts of interest (including speaker fees, consultative relationships, etc.) as appropriate when engaging in and disseminating research results.

ACADEMIC ACTIVITIES

Structured Activities:

The program of learning and sitting of all rotations, which were academically designed to achieve the goals and objectives of each rotation, is structured as mentioned previously.

There are groups of structured workshops, seminars, mentor meetings, and conferences that the candidate should be encouraged to attend:

1. Skull base neurosurgery workshops
2. Neuronavigation
3. Neuro-oncology
4. Spine update conferences and workshops
5. Neurovascular course
6. Ethics workshop
7. Neuroendoscopic workshops
8. CSF dynamics and Shunts
9. Pediatric Neurosurgery conferences (local, regional, and international)
10. Research methodology course

Non-structured Activities:

Curriculum-based teaching activities, as approved by the Saudi Council for Health Specialties, should be designed so that each trainee will develop high-quality, practical, and academic expertise. This should include:

a. Daily ward Rounds.
b. Weekly Grand Rounds.
c. Monthly Journal Club.
d. Monthly Combined Neurosurgery-Pathology Meeting.
e. Monthly Combined Pediatric Neurosurgery-Radiology Rounds.
f. Monthly Morbidity and Mortality Round.
g. Research activities that will allow the Fellow sufficient exposure and participation in research.

Universal Topics (referred to the SCFHS website Universal Topics)

Medical and surgical emergencies

Medical and Surgical Emergencies

Medical and Surgical Emergencies

Medical and Surgical Emergencies Assessment Quiz

Acute care

Pre-Operative Assessment

Post-Operative Care

Acute and Chronic Pain Management

Fluid Management in the Hospitalized Patient

Management of Electrolyte Imbalances

Acute Care Assessment Quiz

Ethics and health care

Occupational Hazards of Healthcare Workers

Evidence-based Approach to Smoking Cessation

Patient Advocacy

Organ Transplantation

Autonomy and Treatment Refusal

Death and Dying

Ethics and Healthcare

Ethics and Healthcare Assessment Quiz

Core Specialty Topics

The Fellows are expected to demonstrate mastery of the following areas in Pediatric Neurosurgery:

1. Basic Neuroscience and Neuroradiology
2. Congenital Anomalies
3. Neurovascular
4. Pediatric head injury
5. Hydrocephalus
6. Spinal dysmorphism
7. Neuro-oncology
8. Spine
9. Critical Care
10. Epilepsy and Functional Neurosurgery (spasticity, tremors, and obsessive behavioral disorder)
11. Medical Ethics and Professionalism

The following are illustrative samples of core specialty topics for Pediatric Neurosurgery:

1. Hydrocephalus
   Knowledge:

   The Fellow should learn how to diagnose this problem

   Learn how to make timely decisions for the patient

   Understand CSF dynamics

   Understand the different treatment options

   Understand to follow up these cases

   Skills:

   The Fellow will learn the insertion and revision of ventriculo-peritoneal, ventriculo-atrial, and lumbo-peritoneal shunts; endoscopic third ventriculostomy; image-guided placement of ventricular catheters; and management of neonatal post-hemorrhagic hydrocephalus.

   Attitude:

   - Learn to maintain a high level of ethics and professionalism in practice
   - Learn to be a good communicator with the families
   - Learn to show empathy and provide the best care

1. Pediatric Neuro-oncology
   Knowledge:

   - The Fellow should learn the different types of pediatric brain, spine, and peripheral nerve tumors
   - The Fellow should learn how to screen patients and investigate them for such tumors
   - The Fellow should learn the different methods of management of such serious problems
   - The Fellow should learn how to follow up such lesions

   Skills:

   - The Fellow will learn how to perform stereotactic and image-guided biopsy of pediatric tumors, endoscopic biopsy of third ventricular tumors, and resection of supratentorial and infratentorial intrinsic tumors; approaches to suprasellar, third ventricular, and pineal tumors; and management of spinal cord tumors.

   Attitude:

   - The Fellow should advocate to inform the public and families about such lesions and how to reduce the risk of these lesions
   - Learn to maintain a high level of ethics and professionalism in practice
   - Learn and master the skills to deliver bad news
   - Learn to be good communicator with the families
   - Learn to show empathy and provide the best care

2. Pediatric Head Injury
   Knowledge:

   - The Fellow should learn the types of head trauma and the pathophysiology of each injury
   - Master the Glasgow Coma Scale (GCS) and the different methods of evaluation for each case
   - Able to make timely decisions for the patient
   - Master the different methods of surgery and treatment

   Skills:

   - Master BLS and ATLS
   - Learn the different methods to control raised intracranial pressure
   - Master the skills and techniques of all head trauma surgeries
   - Learn when to intubate the patient

   Attitude:

   - Learn how to provide accurate and scientific information to the families
   - The Fellow should advocate to inform the public and families about such lesions and how to reduce the risk of head trauma, such as safe driving
   - Learn to maintain a high level of ethics and professionalism in practice
   - Learn and master the skills to deliver bad news
   - Learn to be good communicator with the families
   - Learn to show empathy and provide the best care.

3. Spinal Dysraphism
   Knowledge:

   - Learn how to diagnose cases prenatally and after birth
   - Understand the groups with children at risk of such lesions

- Learn the methods of management for each case
- Understand and master the follow up of these sick children for a long duration

Skills:

The Fellow will learn the management of neonatal spina bifida; meningoceles and encephaloceles; and spinal cord tethering syndromes.

Attitude:

- The Fellow should advocate to inform the public and families about such lesions and how to reduce the risk of these lesions, such as taking folic acid 1 month before conception
- Learn to maintain a high level of ethics and professionalism in practice
- Learn to be a good communicator with families
- Learn to show empathy and provide the best care

4. Congenital and Acquired Spinal Deformity
Knowledge:

- Learn how to diagnose cases prenatally and after birth
- Understand the groups with children at risk of such lesions
- Learn the methods of management of each case
- Understand and master the follow up of these sick children for a long duration

Skills:

The Fellow will learn about the management of syndromic spinal deformity and post-operative spinal deformity.

Attitude:

- The Fellow should advocate to inform the public and families about such lesions and how to reduce the risk of these lesions
- Learn to maintain a high level of ethics and professionalism in practice
- Learn and master the skills to deliver bad news
- Learn to be a good communicator with families
- Learn to show empathy and provide best care

5. Craniofacial Disorders
Knowledge:

- Learn the different types of craniosynostosis
- Lear the time of intervention
- Learn the different options of management

Skills:

The Fellow will learn the management of simple craniosynostosis, syndromic craniosynostosis, and post-traumatic deformity.

Attitude:

- The Fellow should advocate to inform the public and families about such lesions and how to reduce the risk of these lesions
- Learn to observe a high level of ethics and professionalism in practice
- Learn to be a good communicator with families
- Learn to show empathy and provide the best care

ASSESSMENT OF LEARNING

Purpose of Assessment

Assessment plays a vital role in the success of postgraduate training. Assessment will guide trainees and trainers to achieve the targeted learning objectives. In addition, reliable and valid assessment will provide excellent means for training improvement as it will inform the following aspects: curriculum development, teaching methods, and quality of the learning environment.

Assessment can serve the following purposes:

a. Assessment for learning: As trainers will use information from trainees' performance to inform their learning for improvement.
b. Assessment as learning: As assessment criteria will drive trainees' learning.
c. Assessment of learning: As assessment outcomes will represent quality metrics that can improve learning experience.

Assessment will be further classified into two main categories: Formative and Summative.

Formative Assessment

Formative assessment (also referred to as continuous assessment) is the component of assessment that is distributed quarterly throughout the academic year aiming primarily to provide trainees with effective feedback. Input from the overall formative assessment tools will be utilized at the end of the year to make the decision to promote each individual trainee from the current to the subsequent training level. The Pediatric Neurosurgery scientific committee recommends the following formative assessment tools cover all three learning domains (knowledge, skills, and attitude). These recommendations (usually updated and announced for each individual program at the start of the academic year; attached in the appendix) are shown in the following table describing the most used formative assessment tools:

Learning Domain	Formative Assessment Tools	Frequency
Knowledge	- Structured Oral Exam (SOE)/ Promotion examination - Case Based Discussion (CBD)	every 6 blocks or at the end of every rotation.
Skills	a. Log): 1. Congenital anomalies 2. Brain tumors 3. Neurovascular 4. Trauma (Head spine/peripheral nerves) 5. Infection b. DOPS: Direct Observation for Procedural Skills	minimum number of 80 cases per year): every 3 blocks
Attitude	ITER: In-Training Evaluation Report	(format in appendix)

Knowledge

– **Structured Oral Exam (SOE)/Promotion examination (blue prints in the appendix)**
The promotion examination in the form of MCQ is held once a year at the end of the F1 level to promote the candidate to move to the F2 level. The purpose of the promotion examination is to prove that the Fellow has studied and understood different subjects of Pediatric Neurosurgery. The examination rules will follow the SCFHS rules and regulations and are subject to changes according to SCFHS recommendations.

Case based discussion at the end of every rotation and every 6 blocks of the Pediatric Neurosurgery rotation to ensure that the Fellow is progressing in training.

Skills

– **A Logbook** should be written by the Fellow to document every operation he assisted in or operated under supervision. Each operation should be countersigned by the attending consultant. The main aim of the logbook is to ensure that the Fellow is exposed to different varieties of Pediatric Neurosurgery cases.

– **DOPS: Direct Observation** for Procedural Skills occurs every 3 blocks. The aim of this direct observation is to monitor the skills of the Fellow and rectify any defects.

Promotion Examination for End of Fellowship 1 Examination:

1. The promotion of the Fellow from F1 to F2 will be determined by:
   a. Passing the in-training assessment at the end of the year (F1)
   b. Passing the continuous assessment during rotations
   c. Passing a written and clinical examination
   d. Approval of the supervisory committee

Summative Assessment

Summative evaluations show the ability of the Fellow to make critical decisions that must be made. This evaluation is conducted at the end of each residency year (for progression to the next year) and at the completion of the program. The psychometric characteristic of summative evaluation provides evidence that the Fellow can make valid and reliable decisions. The program director must provide a summative evaluation that will report the Fellow's development of abilities, competence, and reliability to practice independently without direct supervision. The Fellow should be informed and must be available for discussion of his/her summative assessment at the end of each academic year.

EXAMINATIONS

Final Pediatric Neurosurgery Fellowship Examination at the end of F2

The examination follows the rules and regulations of the SCFHS and is subject to changes according to changes in the SCFHS's regulations. The blueprint for the final examination is shown in the appendix. The blueprint for the final written and oral examinations are attached in the appendix (Appendix 1a, 1b).

1. Who is legible to sit for examination?
   a. Fellows who have successfully finished all the required rotations of F1 and F2.
   b. Fellows who have permission from the program supervisor.

2. The Examination is conducted once a year in two parts:
   a. Written Examination in MCQ form. The examination date will be announced by the SCFHS (reference, in appendix number). If successful, the Fellow will proceed to the second part.
   b. Oral and Clinical examination. Conducted in the format of OSCE and OSE.

3. As per SCFHS rules, the Fellow has three attempts at the final certifying examination, however this rule may be changed, please follow the SCFHS instructions.

Graduation and Certificate

Fellows who successfully pass all the examinations will be entitled to receive the certificate of "Fellowship in Pediatric Neurosurgery".

APPENDICES

Blueprint of Examinations

Blueprint of Written Exam for Promotion and Final Certifying Exam:

No.	Section	Percentage (%)
1	Head trauma and critical care	15%
2	Pediatric spine and peripheral nerves	5%
3	CNS congenital anomalies	15%
4	Hydrocephalus	10%
5	Neuro-oncology	15%
6	Neuro-vascular	10%
7	Epilepsy and function neurosurgery	10%
8	Basic neurosciences (anatomy, physiology, pathology, …)	15%
9	Ethics, Professionalism, and Patient Safety	5%
Total		**100%**

Note:

Blueprint distributions of the examination may differ up to +/- 3% in each category.

Blueprint of Final Clinical Exam:

		DIMENSIONS OF CARE				
		Health Promotion & Illness Prevention 1±1 Station(s)	**Acute** 5±1 Station(s)	**Chronic** 5±1 Station(s)	**Psychosocial Aspects** 1±1 Station(s)	**# Stations**
DOMAINS FOR INTEGRATED CLINICAL ENCOUNTER	**Patient Care** 8±1 Station(s)	1	**2**	2		**5**
	Patient Safety & Procedural Skills 1±1 Station(s)		**1**			**1**
	Communication & Interpersonal Skills 2±1 Station(s)				**1**	**1**
	Professional Behaviors 1±1 Station(s)			**1**		**1**
	Total Stations	**1**	**3**	**3**	**1**	**8**

ITER (In-Training Evaluation Report) – please see attached

Glossary

Blueprint	Description correlating educational objectives with assessment contents. For example, test blueprint defines the proportion of test questions allocated to each learning domain and/or content
Competency	Capability to function within a defined professional role that implies entrustment of a trainee by graduation of the program with the required knowledge, skills, and attitude needed to practice unsupervised.
Specialty Core Content (skills, knowledge, and professional attitude)	Specific knowledge, skill, or professional attitude that is specific and integral to the given specialty.

Recommended Books for Further Reading:

1. Hydrocephalus what we know and what we still don't know by Ahmed Ammar, published by Springer (2018).
2. Neurosurgical ethics in practice- Value Based Medicine. by Ahmed Ammar and Mark Bernstein, published by Springer (2014).
3. Principles and Practice of Pediatric Neurosurgery by A. Leland Albright, Ian F. Pollack, et al. Thieme, 3rd edition (2020).
4. Handbook of Pediatric Neurosurgery 1st Edition by George I. Jallo (Editor), Karl Kothbauer (Editor), Violette Recinos (Editor).
5. Pediatric Neurosurgery: Tricks of the Trade 1st Edition, Kindle Edition by Alan R. Cohen (Author 2016)
6. Rhoton's Cranial Anatomy and Surgical Approaches 1st Edition, Kindle Edition by Albert L. Rhoton, Jr. (Author) Neurosurgery, 2003.
7. Pediatric Neurosurgery (Neurosurgery by Example) 1st Edition, Kindle Edition by Dr Selden, Nathan (Editor), Dr Baird, Lissa (Editor). Oxford University Press (2019).
8. Pediatric Neuroradiology: Clinical Practice Essentials 1st Edition by Asim F. Choudhri (Author) Thieme (2016).
9. Pediatric Neuroimaging 6th Edition, Kindle Edition by A. James Barkovich (Author), Charles Raybaud (Author) 2019 Wolters Kluwer.
10. Diagnostic Imaging: Pediatric Neuroradiology 2nd Edition, Kindle Edition by A. James Barkovich (Author) Elsevier 2010, **vievvie**

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