

NEUROSURGERY RESIDENCY

TRAINING REQUIREMENTS

(A) INTRODUCTION

Definition of the Discipline of Neurosurgery

Neurosurgery is a discipline of medicine and the specialty of surgery that provides operative and non-operative management (i.e. prevention, diagnosis, evaluation, interpretation of imaging, treatment, critical care, and rehabilitation) of disorders of the central, peripheral, and autonomic nervous systems, including their supporting structures and vascular supply; the evaluation and treatment of pathological processes that modify the function or activity of the nervous system, including the hypophysis; and the operative and non-operative management of pain.

As such, Neurological surgery encompasses:

1. the surgical, nonsurgical and stereotactic radiosurgical treatment of adult and paediatric patients with disorders of the nervous system;
2. disorders of the brain, meninges, skull, including skull base, and their blood supply, including the surgical and endovascular treatment of disorders of the intracranial and extracranial vasculature supplying the brain and spinal cord;
3. disorders of the pituitary gland;
4. disorders of the spinal cord, meninges, and vertebral column, including those that may require treatment by fusion, instrumentation, or endovascular techniques; and,
5. disorders of the cranial, peripheral, and spinal nerves throughout their distribution.

Duration and Scope of Education

The required length of a neurosurgery residency is 48 months (R3-6) which are for clinical and didactic education in a curriculum under the control of the neurosurgery program director. The resident must complete all years of education for which the program is accredited. The selected group of Neurosurgery residents who wish to become a clinician scientist will apply for the Clinical Scientist track and be interviewed.

(B) PROGRAMME OVERVIEW

The training programme must give the resident competency in the management of:

1. the surgical, nonsurgical and stereotactic radiosurgical treatment of adult and paediatric patients with disorders of the nervous system;
2. disorders of the brain, meninges, skull, including skull base, and their blood supply, including the surgical and endovascular treatment of disorders of the intracranial and extracranial vasculature supplying the brain and spinal cord;

3. disorders of the pituitary gland;
4. disorders of the spinal cord, meninges, and vertebral column, including those that may require treatment by fusion, instrumentation, or endovascular techniques; and,
5. disorders of the cranial, peripheral, and spinal nerves throughout their distribution.
6. At the completion of their residency training residents are expected to demonstrate a full understanding of operative neurosurgical principles, neurosurgical anatomy and the utility of various neurosurgical operative tools. They should have the technical ability to independently perform all core surgical operations as well as to perform some of the advanced neurosurgical procedures under supervision. The residents should achieve a minimum of 150 core surgical procedures annually. Competency in all core operations must be verified by directly observed surgical procedures (S-DOPs).

Operative Principles:

- Principles of normal cranial surface anatomy and surface localization
- Design of the trauma scalp flap
- Principles of the proper positioning of the surgical patient
- Principles of skull clamp application
- Principles on the use of the operating microscope
- Principles on the use of frame based and frameless stereotaxy/image guidance Principles and proper use of the monopolar and bipolar diathermy
- Principles and proper use of the neurosurgical suction devices
- Proper use of the cranial perforator and craniotomy
- Proper tissue handling and instrument handling
- Principles of basic microneurosurgery
- Principles of awake craniotomy
- Principles of endovascular neurosurgery
- Principles of epilepsy surgery including - Lobectomy, cortical resection, hemispherectomy, corpus callosotomy, placement of subdural grid and depth electrodes, and Vagal nerve stimulator and Deep Brain Stimulator implantation
- Principles of Functional Neurosurgery and Neuromodulation for movement disorders, pain and spasticity (including DBS, SCS and drug pump implantation and management).
- Principles of Complex craniofacial repairs for coronal, lambdoid, and multiple suture synostoses in conjunction with the craniofacial surgeons
- Principles of the Repair of complex congenital malformations such as lipomyelo-meningocele, myelomeningocele, encephalocele, disastematomyelia, and neurenteric cyst
- Principles of Sagittal craniectomy for sagittal synostosis
- Principles of Endoscopic third ventriculostomy and Endoscopy for cyst fenestration and septostomy
- Principles of Posterior fossa decompression for Chiari malformation
- Principles of complex spinal instrumentation and fusion
- Principles of stereotactic Radiosurgery and Radiotherapy

Core Surgical Procedures (Adult neurosurgery)

- Burrholes for drainage of subdural hematomas and empyemas
- Ventriculostomy
- Insertion of ICP monitor
- Application of Halo ring and the use of cervical spinal traction
- Application of the stereotactic frame
- Lumbar puncture and Lumbar drain insertion

- Placement of ventriculo-peritoneal shunt and revisions
- Performance of stereotactic brain biopsy
- Cranioplasty
- Craniotomy for trauma and evacuation of EDH, SDH
- Repair of CSF leak
- Craniotomy for decompression in stroke and ICH clot evacuation
- Craniotomy for infections – osteomyelitis, abscess drainage
- Craniotomy for tumour resection (including posterior fossa craniotomy)
- Craniotomy for aneurysm repair, approach to the aneurysm (splitting of the sylvian fissure)
- Anterior cervical discectomy
- Laminectomy exposure for decompression and fusion of cervical spinal fracture with instrumentation
- Laminectomy exposure for cervical, thoracic, and lumbar degenerative disc disease
- Laminectomy exposure for epidural metastatic disease and other spinal tumours including intra- and extra-medullary spinal cord tumours
- Transphenoidal exposure for resection of pituitary tumours

Core Surgical Procedures (Paediatric Neurosurgery)

- Burr holes for drainage of subdural hematomas and empyemas
- Ventriculostomy
- VP shunt insertion and revision
- Insertion ICP monitor
- Craniotomy for trauma, tumour and stroke, including posterior fossa surgery
- Cranioplasty
- Laminectomy for tethered cord and spinal cord tumours.

7. Before entry into the program, each resident must be notified in writing of the required length of the program. This period may not be changed for a particular resident during his or her program unless there is a significant break in his or her education, or the resident needs remedial education.

8. The program must provide 48 months of clinical neurological surgery at the sponsoring institution or one of its approved participating sites. A minimum of 24 months of neurological surgery education must occur at the sponsoring institution.

9. The program must provide residents with experience in direct and progressively responsible patient management experience as they advance through training.

10. Residents must spend a 24-month period of time as senior resident on the neurological surgery clinical service in the sponsoring institution or its approved participating sites.

- a) The senior resident must have major or primary responsibility for patient management with faculty supervision.
- b) The senior resident should also have administrative responsibility as designated by the program director.
- c) The specific portion of the clinical training that constitutes the 24 months of senior residency must be specifically designated as the senior residency experience and must be identified at the time of program review.

(C) ADMISSION REQUIREMENTS

To be eligible to enter into Neurosurgery Residency training, candidate must complete SIG satisfactorily and pass the MRCS examination.

Neurosurgery residents are required to complete the following SIG rotations during the 2-year SIG Residency programme.

Core Postings

- 6 months General Surgery
- 6 months Neurosurgery
- 3 months Neurology

Three Elective Postings (3 months each) chosen from among:

- Orthopaedics
- Anaesthesia/ICU
- ENT
- Plastic Surgery
- Emergency
- Ophthalmology

(D) TRAINING REQUIREMENTS

Educational Program Components

The curriculum must contain the following educational components:

- 1. Overall educational goals** for the program, which the program must distribute to residents and faculty annually;
- 2. Competency-based goals and objectives** for each assignment at each educational level, which the program must distribute to residents and faculty annually, in either written or electronic form. These should be reviewed by the resident at the start of each rotation;
- 3. Regularly scheduled didactic sessions;**
- 4. Delineation of resident responsibilities** for patient care, progressive responsibility for patient management, and supervision of residents over the continuum of the program; and, contain the following educational components:

5. ACGME Competencies

The program must integrate the following ACGME competencies into the curriculum:

a) Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. Residents are expected to:

- (1) gather and understand essential patient information in a timely manner;
- (2) generate an appropriate differential diagnosis;
- (3) implement an effective plan of management;

- (4) prioritize and stabilize multiple patients simultaneously;
- (5) competently perform neurosurgical operative procedures;
- (6) manage complications;
- (7) analyse outcomes;
- (8) counsel and educate patients and families;
- (9) provide health care services aimed at preventing health problems and maintaining health;
- (10) work with health care professionals to provide patient-focused care;
- (11) must participate in the management (including critical care) and surgical care of adult and paediatric patients and experience should include the full spectrum of neurosurgical disorders; and,
- (12) must have opportunities to evaluate patients referred for elective surgery in an outpatient environment. Under appropriate supervision, this experience should include obtaining a complete history, conducting an examination, ordering (if necessary) and interpreting diagnostic studies, and arriving independently at a diagnosis and plan of management. Consonant with their skills and level of experience, residents should be actively involved in preoperative decision making and subsequent operative procedures under the supervision of the attending physician who has ultimate responsibility for the patient. Residents should similarly be actively involved in postsurgical care and follow-up evaluation of their patients to develop skills in assessing postoperative recovery, recognizing and treating complications, communicating with referring physicians, and developing the physician-patient relationship.
 - (i) Resident participation in and responsibility for operative procedures embracing the entire neurosurgical spectrum should increase progressively throughout the training period.

b) Medical Knowledge

Residents must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioural sciences, as well as the application of this knowledge to patient care. Residents are expected to:

- (1) generate a differential diagnosis and properly sequence critical actions for patient care, including management complications, morbidity and mortality;
- (2) synthesize and properly utilize acquired patient data;
- (3) identify neurosurgical emergencies;
- (4) know how to access current medical information;
- (5) understand how to treat neurosurgical conditions;
- (6) incorporate evidence-based principles;
- (7) must have educational experience in neuroradiology, including endovascular surgical neuroradiology, and neuropathology designed specifically for neurological surgery residents. Such experience should, ideally, be under the direction of qualified neuroradiologists and neuropathologists;
- (8) must have experience and instruction in the basic neurosciences.

c) Practice-based Learning and Improvement

Residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning. Residents are expected to develop skills and habits to be able to meet the following goals:

- (1) identify strengths, deficiencies, and limits in one's knowledge and expertise;
- (2) set learning and improvement goals;
- (3) identify and perform appropriate learning activities;
- (4) systematically analyse practice using quality improvement methods, and implement changes with the goal of practice improvement;
- (5) incorporate formative evaluation feedback into daily practice;
- (6) locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems;
- (7) use information technology to optimize learning; and,
- (8) participate in the education of patients, families, students, residents and other health professionals.
- (9) apply knowledge of study design and statistical methods to critically appraise the medical literature;
- (10) Facilitate the learning of students and other health care professionals
- (11) Resident participation in undergraduate medical education is desirable.

d) Interpersonal and Communication Skills

Residents must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals. Residents are expected to:

- (1) communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds;
- (2) communicate effectively with physicians, other health professionals, and health related agencies;
- (3) work effectively as a member or leader of a health care team or other professional group;
- (4) act in a consultative role to other physicians and health professionals; and,
- (5) maintain comprehensive, timely, and legible medical records, if applicable.
- (6) develop an effective therapeutic relationship with patients and their families, with respect for diversity and cultural, ethnic, spiritual, emotional, and age specific differences;
- (7) develop effective written communication skills;
- (8) involve patients in medical decisions; and,

- (9) strengthen listening and non-verbal communication skills.

e) Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles. Residents are expected to demonstrate:

- (1) compassion, integrity, and respect for others;
- (2) responsiveness to patient needs that supersedes self-interest;
- (3) respect for patient privacy and autonomy;
- (4) accountability to patients, society and the profession; and,
- (5) sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation.
- (6) treat patients/family/staff/ paraprofessional personnel with respect;
- (7) demonstrate sensitivity to patient's pain, emotional state, and gender/ethnicity issues;
- (8) discuss death honestly, sensitively, patiently, and compassionately;
- (9) exemplify integrity;
- (10) accept responsibility/accountability;
- (11) demonstrate reliability;
- (12) maintain calm, even temperament;
- (13) exhibit self-awareness and knowledge of limits;
- (14) respond to the comments of other team members, patients, families, and peers openly and responsibly; and,
 - (i) Graduate training in neurological surgery requires a commitment to continuity of patient care, as practiced by qualified neurological surgeons. This continuity of care must take precedence-without regard to the time of day, day of the week, number of hours already worked, or on-call schedules. At the same time, patients have a right to expect a healthy, alert, responsible, and responsive physician dedicated to delivering effective and appropriate care.

f) Systems-based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care. Residents are expected to:

- (1) work effectively in various health care delivery settings and systems relevant to their clinical specialty;
- (2) coordinate patient care within the health care system relevant to their clinical specialty;
- (3) incorporate considerations of cost awareness and risk-benefit analysis in patient and/or population based care as appropriate;

- (4) advocate for quality patient care and optimal patient care systems;
- (5) work in interprofessional teams to enhance patient safety and improve patient care quality; and,
- (6) participate in identifying system errors and implementing potential systems solutions.
- (7) understand, access, appropriately utilize, and evaluate the effectiveness of the resources, providers, and systems necessary to provide optimal neurosurgical care;
- (8) understand different medical practice models and delivery systems and how to best utilize them to care for the individual patient;
- (9) practice cost-effective health care and resource allocation that does not compromise quality of care;
- (10) advocate, coordinate, and facilitate patient care; and,
- (11) understand principles of and advance practices for patient safety at the institutional and individual level.

g) Faculty development

Residents as Future Teachers is uniquely included in the list of core competencies the residents have to be cultivated in. Residents have to be trained as effective role models, teachers and leaders to junior doctors, other healthcare trainees and medical students. Residents are expected to

- To teach and guide junior residents in clinical skills, procedures, and patient care
- Participate in co-ordinating medical students and junior residents teaching programs

6. Residents' Scholarly Activities

- (1) The curriculum must advance residents' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.
- (2) Residents should participate in scholarly activity.
 - a. Graduate medical education must take place in an environment of inquiry and scholarship in which residents participate in the development of new knowledge, learn to evaluate research findings, and develop habits of inquiry as a continuing professional responsibility.
- (3) The sponsoring institution and program should allocate adequate educational resources to facilitate resident involvement in scholarly activities.

7. Evaluation

A. Resident Evaluation

1. Formative Evaluation

- a) The faculty must evaluate resident performance in a timely manner during each rotation or similar educational assignment, and document this evaluation at completion of the assignment.

b) The program must:

- (1) provide objective assessments of competence in patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice;
- (2) use multiple evaluators (e.g., faculty, peers, patients, self, and other professional staff);
- (3) document progressive resident performance improvement appropriate to educational level; and,
- (4) provide each resident with documented semi-annual evaluation of performance with feedback.

c) The evaluations of resident performance must be accessible for review by the resident, in accordance with institutional policy.

2. Summative Evaluation

The program director must provide a summative evaluation for each resident upon completion of the program. This evaluation must become part of the resident's permanent record maintained by the institution, and must be accessible for review by the resident in accordance with institutional policy.

This evaluation must:

- a) document the resident's performance during the final period of education, and
- b) verify that the resident has demonstrated sufficient competence to enter practice without direct supervision.

B. Faculty Evaluation

1. At least annually, the program must evaluate faculty performance as it relates to the educational program.

2. These evaluations should include a review of the faculty's clinical teaching abilities, commitment to the educational program, clinical knowledge, professionalism, and scholarly activities.

3. This evaluation must include at least annual written confidential evaluations by the residents.

C. Program Evaluation and Improvement

1. The program must document formal, systematic evaluation of the curriculum at least annually. The program must monitor and track each of the following areas:

- a) resident performance;
- b) faculty development;

c) graduate performance, including performance of program graduates on the certification examination; and,

d) program quality. Specifically:

- 1) Residents and faculty must have the opportunity to evaluate the program confidentially and in writing at least annually, and
- 2) The program must use the results of residents' assessments of the program together with other program evaluation results to improve the program.

2. If deficiencies are found, the program should prepare a written plan of action to document initiatives to improve performance in the areas identified. The action plan should be reviewed and approved by the teaching faculty and documented in meeting minutes.

3. The number of residents completing training and taking and passing the certification examinations will be part of the Review Committee's evaluation of the program. All residents must pass the FRCS (Surgical Neurology)(Ed) before completing the program.

(E) SUPERVISION AND WORK HOURS OF RESIDENTS

I. Supervision

All residents will be supervised by a designated supervisor. The ratio of all teaching faculty to residents should be 1:1. The number of core clinical faculty to resident ratio must be no less than 1:6 for surgical subspecialties and no less than 1:2 for internal medicine-related subspecialties. 20% of resident's time must be protected for training.

II. Work Hours

Work hours can be defined as all clinical and academic activities related to residency training. Work hours must be limited to 80 hours per week, averaged over a month, including all on-calls. Residents must be allowed 1 day (i.e. 24 continuous hours) in 7 days free from all clinical administrative and academic responsibilities, averaged over a month. Adequate time for rest and personal activities must be provided. This should consist of a 10-hour time period provided between all daily duty periods and after in-house call.

In-house call must occur no more frequently than every third night, averaged over a four-week period. No new patients may be seen after 24 hours of continuous duty. Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Residents may continue to be on duty for up to six additional hours to participate in didactic activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care.

Work hours must be reported in the designation system (e.g. New Innovations) and tracked by the Programme Director.

(F) ASSESSMENT AND FEEDBACK

I. Log of operative / clinical experience

All residents are expected to keep a log of their operative / clinical experience in the E-logbook and consolidation report (RCSEd website) case log system.

II. Assessment

The supervisor's evaluation of the resident should be performed at the end of every rotation using the designated form and then submitted to the RAC for review.

III. Feedback

Residents should perform a yearly evaluation of teaching faculty and the training programme using the designated forms. These forms must be submitted to the RAC and kept absolutely confidential.

IV. Examinations

All residents must pass the FRCS (Surgical Neurology)(Ed) before completing the program.

(H) CHANGES IN TRAINEESHIP PERIOD AND LEAVE OF ABSENCE

I. Changes in Training Period

Residency should be continuous. If a training programme is interrupted for any reason whatsoever, the RAC may at its discretion, require the trainee to undergo a further period of training in addition to the minimum requirements of the programme or terminate the residency altogether. All trainees are required to conform to the residency training plan as approved by the RAC.

II. Leave Of Absence

All residents are to comply with the prevailing MOH policy on Leave of Absence.

III. Overseas Postings

Overseas attachment during Senior Residency training is not permitted with the exception of Radiation Oncology and Neurosurgery (*refer to JCST Circular 114/14*).