MAHATMA GANDHI UNIVERSITY
of
MEDICAL SCIENCES & TECHNOLOGY
JAIPUR

SYLLABUS

M.Ch. NEURO SURGERY

Edition 2019-20

Notice

1. Amendment made by the Medical Council of India in Rules/Regulations of Post Graduate Medical Courses shall automatically apply to the Rules/Regulations of the Mahatma Gandhi University of Medical Sciences & Technology (MGUMST), Jaipur.

2. The University reserves the right to make changes in the syllabus/books/guidelines, fees-structure or any other information at any time without prior notice. The decision of the University shall be binding on all.

3. The Jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.

Syllabus of DM / M.Ch. Courses
M.Ch. NEURO SURGERY (9350)

Selection of Candidates:
There shall be a uniform entrance examination to all medical educational institutions at the Postgraduate level namely 'National Eligibility-cum-Entrance Test' for admission to postgraduate courses in each academic year and shall be conducted under the overall supervision of the Ministry of Health & Family Welfare, Government of India.

In order to be eligible for admission to Postgraduate Course for an academic year, it shall be necessary for a candidate to obtain minimum of marks at 50th percentile in the 'National Eligibility-Cum-Entrance Test for Postgraduate courses' held for the said academic year. However, in respect of candidates belonging to Scheduled Castes, Scheduled Tribes, and Other Backward Classes, the minimum marks shall be at 40th percentile. In respect of candidates with benchmark disabilities specified under the Rights of Persons with Disabilities Act, 2016, the minimum marks shall be at 45th percentile for General Category and 40th percentile for SC/ST/OBC.

The percentile shall be determined on the basis of highest marks secured in the All India Common merit list in National Eligibility-cum-Entrance Test for Postgraduate courses.

Provided when sufficient number of candidates in the respective categories fail to secure minimum marks as prescribed in National Eligibility-cum-Entrance Test held for any academic year for admission to Postgraduate Courses, the Central Government in consultation with Medical council of India may at its discretion lower the minimum marks required for admission to Post Graduate Course for candidates belonging to respective categories and marks so lowered by the Central Government shall be applicable for the academic year only.

The reservation of seats in Medical Colleges/institutions for respective categories shall be as per applicable laws prevailing in States/Union Territories. An all India merit list as well as State-wise merit list of the eligible candidates shall be prepared on the basis of the marks obtained in National Eligibility-cum-Entrance Test and candidates shall be admitted to Postgraduate Courses from the said merit lists only.

There shall be no admission of students in respect of any academic session beyond 31st August under any circumstances. The Universities shall not register any student admitted beyond the said date.

ELIGIBILITY:

S. No.	Area of Specialisation	Prior Requirement
1	DM Cardiology	MD (Medicine / Paediatrics)
2	DM Medical Gastroenterology	
3	DM Nephrology	
4	DM Neurology	
5	M.Ch. Cardio vascular & Thoracic Surgery	MS (Surgery)
6	M.Ch. Urology	
7	M.Ch. Neuro-Surgery	
8	M.Ch. Plastic Reconstructive Surgery	

Common Counseling:
There shall be a common counseling for admission to all Postgraduate Super specialty Courses (DM/ M.Ch.) in all Medical Educational Institutions on the basis of merit list of the National Eligibility-cum-Entrance Test.

Period of Training:
The period of training for obtaining DM/M.Ch Degrees shall be three completed years including the examination period.

Migration:
Under no circumstance, Migration/transfer of student undergoing any Super Specialty course shall be permitted by any University/Authority.

Staff - Faculty:
Only those teachers who possess 6 years teaching experience out of which at least 2 years teaching experience as Assistant Professor gained after obtaining the higher specialty degree shall be recognized post graduate teacher.

No teacher shall be considered as a postgraduate teacher in any other institution during the period till the postgraduate course at the institute which has been granted permission considering him as a postgraduate teacher is recognized u/s 11(2) of the Indian Medical Council Act, 1956.

Minimum staff required (Super-speciality):
1- Professor
1- Associate Professor
1- Assistant Professor
1- Senior Resident
2- Junior Resident

Training programme:
All the candidates joining the Post Graduate training programme shall work as 'Full Time Residents' during the period of training and shall attend not less than 80% (Eighty percent) of the imparted training during each academic year (Academic Term of 6 months) including assignments, assessed full time responsibilities and participation in all facets of the educational process.

No candidate shall be permitted to run a clinic/work in clinic/laboratory/nursing home while studying postgraduate super specialty course. No candidate shall join any other course or appear for any other examination conducted by this university or any other university in India or abroad during the period of registration.

Every institution undertaking Post Graduate training programme shall set up an Academic cell or a curriculum committee, under the chairmanship of a senior faculty member, which shall work out the details of the training programme in each speciality in consultation with other department faculty staff and also coordinate and monitor the implementation of these training Programmes.

The training programmes shall be updated as and when required. The structured training programme shall be written up and strictly followed, to enable the examiners to determine the training undergone by the candidates and the Medical Council of India inspectors to assess the same at the time of inspection.

Post Graduate students shall maintain a record (log) book of the work carried out by them and the training programme undergone during the period of training including details of surgical operations assisted or done independently by M.Ch. candidates.

The Record (Log) Books shall be checked and assessed periodically by the faculty members imparting the training.

During the training for award of Degree / Superspecialty in clinical disciplines, there shall be proper training in Basic medical sciences related to the disciplines concerned; so also in the applied aspects of the subject; and allied subjects related to the disciplines concerned. In the Post Graduate training programmes including both Clinical and Basic medical sciences, emphasis has to be laid on Preventive and Social aspects. Emergency care, facilities for Autopsies, Biopsies, Cytopsies, Endoscopy and Imaging etc. shall also be made available for training purposes.

The Post Graduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.

Training in Medical Audit, Management, Health Economics, Health Information System, basics of statistics, exposure to human behaviour studies, knowledge of pharmaco – economics and introduction to nonlinear mathematics shall be imparted to the Post Graduate students.

The teaching and training of the students shall include graded responsibility in the management and treatment of patients entrusted to their care; participation in Seminars, Journal Clubs, Group Discussions, Clinical Meetings, Grand Rounds, and Clinico-Pathological Conferences; practical training in Diagnosis and Medical and Surgical treatment; training in the Basic Medical Sciences, as well as in allied clinical specialitites.

The training programme shall be on the same pattern as for M.D. / M.S. in clinical disciplines; with practical training including advanced Diagnostic, Therapeutic and Laboratory techniques, relevant to the subject of specialization. Postgraduate Superspecialty Residents in Surgical Specialties shall participate in Surgical operations as well.

A postgraduate student of a postgraduate degree course in super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

ENROLMENT AND REGISTRATION

Every candidate who is admitted to DM/MCh. course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself enrolled and registered with the Mahatma Gandhi University of Medical Sciences & Technology upto November 30 of the year of admission without late fees upto December 31 of the year of admission with late fees after paying the prescribed eligibility and enrolment fees.

The candidate shall have to submit an application for the enrolment/eligibility along with the following original documents with the prescribed fees –

(a) MD/MS pass Marks sheet/Degree certificate issued by the University.
(b) Migration certificate issued by the concerned University (in case the University is other than the MGUMST).
(c) Date of Birth Certificate
(d) Certificate regarding registration with Rajasthan Medical Council / Medical Council of India / Other State Medical Council.

ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION

1. **Work diary and Logbook**: Every candidate shall maintain a work diary for recording his/her participation in the training program conducted in the department. The work diary and logbook shall be verified and certified by the Department Head and Head of the Institution.
2. Every student would be required to present one poster presentation, to read one paper at a National/State Conference and to have one research paper which should be published/accepted for publication/ sent for publication to an indexed journal during the period of his/her post graduate studies so as to make him/her eligible to appear at the Post Graduate Degree Examination.
3. **Attendance:** Every candidate shall have fulfilled the requirement of 80% attendance during each academic year of the postgraduate course (as per MCI rules).

EXAMINATIONS

The examination shall be held at the end of three academic years (six academic terms). The academic term shall mean six months training period. The examination shall consist of: Theory and Clinical/Practical and Oral.

The examinations shall be organised on the basis of 'Marking system' to evaluate and to certify candidate's level of knowledge, skill and competence.

For passing DM/M.Ch. examination as a whole, a candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory (2) Clinical / Practical and Oral examination.

(1) **Theory:**

There shall be four theory papers of 3 hours duration and 100 marks each. Out of the four theory papers, one Paper-I shall be on 'Basic Sciences', and another Paper-IV on 'Recent Advances'. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

Paper I and II will be set by one external examiner from outside of the state and paper III and IV by another external examiner from outside of the state. The external examiner, who is paper setter for paper I & II shall evaluate the answer books of paper II. The external examiner, who is paper setter for paper III & IV shall evaluate the answer books of paper III. The answer books of paper I & IV shall be evaluated by internal examiners. The answer books of paper IV shall be evaluated by the Head of the Department and the answer books of paper I shall be evaluated by the second Internal Examiner.

Candidates will be required to attempt all the questions in every question paper. In Paper I, Paper II and Paper III there will be 10 questions. Each question shall carry 10 marks. In Paper IV there will be 5 questions of 20 marks each.

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers shall be compulsory to pass the examination.

Nomenclature of Papers

Paper – I : Basic Neurosciences: Principles of Neurosurgery
Paper – II : Clinical Neurosurgery – Cranial
Paper – III: Practice of Neurosurgery of Skull base and spine including peripheral nervous system
Paper – IV : Recent advances

(2) **Clinical / Practical and Oral:**

Clinical/Practical examination shall be conducted to test / aimed at assessing the knowledge and competence of the candidate for undertaking independent work as a specialist / teacher. Practical examination shall consist of carrying out special investigative techniques for Diagnosis and Therapy. M.Ch candidates shall also be examined in surgical procedures. Oral examination may be comprehensive enough to test the candidate's overall knowledge and competence about the subject, investigative procedures, therapeutic technique and other aspects of the specialty, which shall form a part of the examination.

There shall be one long case of 150 marks, two short cases of 75 marks each and oral examination of 100 marks. Obtaining of 50% marks in Clinical / Practical and Oral examination shall be mandatory for passing the Clinical / Practical and Oral examination.

Result:

For passing DM/M.Ch. Examination, a candidate will be required to obtain at least 40% marks in each theory paper, 50% marks in the aggregate of all the four theory papers and 50% marks in the aggregate of Clinical / Practical and Oral examination separately. A candidate failing in any theory paper or in the aggregate of all four theory papers or Clinical / Practical and Oral examination shall have to repeat the whole DM/M.Ch. examination.

Grace Marks

No grace marks will be provided in DM/M.Ch. examinations.

Revaluation / Scrutiny

No Revaluation shall be permitted in the DM/M.Ch. examinations. However, the student can apply for scrutiny of the answer books as per University Rules

Examiners:

As per the Amendment Notification of the MCI dated June 5, 2017, no person shall be appointed as an internal examiner in any subject unless he/she has three years experience as recognized PG teacher in the concerned subject. For external examiners, he/she should have minimum six years of experience as recognized PG teacher in the concerned subject.

For all Post Graduate Super specialties examinations, the minimum number of Examiners shall be four, out of which at least two (50%) shall be External Examiners, who shall be invited from other recognised universities from outside the State.

Number of Candidates:

The maximum number of candidates to be examined in Clinical / practical and Oral on any day shall not exceed three for D.M./M.Ch examinations.

Number of Examinations:
The university shall conduct not more than two examinations in a year, for any subject, with an interval of not less than 4 and not more than 6 months between the two examinations.

M.Ch. – NEUROSURGERY (9350)

AIM OF TRAINING

The end product should have acquired knowledge, skills, aptitude and attitudes to be able to function as an independent clinician/consultant and a teacher acquainted with research methodology.

OBJECTIVES

The End Product:

- Should be well acquainted with the current literature on relevant aspects of the basic, investigative, clinical and operative neurosciences.
- Should have learned indications and performance skills of common neurosurgical operations.
- Should have acquired performance skills and ability to interpret relevant clinical investigations.
- Should be able to diagnose, plan investigations and treat common conditions in the speciality by relevant current therapeutic methods.
- Should be acquainted with allied and general clinical disciplines to ensure appropriate and timely referral.
- Should be capable of imparting basic neurosurgical training.
- Should be able to identify, frame and carry out research proposals in the relevant speciality.

TRAINING SYSTEM

Exclusively on whole time in service basis, on residency pattern.

ELIGIBILITY

For Post MS

M S (Gen. Surgery only) degree of an Indian University recognized by the Medical Council of India or any other examination recognized for the purpose by the MCI.

TRAINING METHODS

- Clinical teaching in the OPD, Emergency and Operation theatres. Clinical teaching rounds in Neurosurgery Ward and bed side presentations.
- Special teaching sessions like Neuroradiology rounds, Neuro-ophthalmalogy round combined Neurology-Neurosurgery case discussions.
- Seminars, journal clubs, mortality, conferences.
- Treatment planning sessions.
- Assisting and performing neurosurgical operations.
- Paper presentations at conferences.
- Preparation of manuscript for publication. 8. Training in an experimental microsurgical laboratory.

COURSE CONTENTS

Paper – I : Basic Neurosciences: Principles of Neurosurgery

- **Landmarks in the history of neurosurgery**, micro neurosurgery, neuroradiology
- Applications of principles of cellular and molecular biology in neurosurgical disorders
- Microsurgical anatomy of brain and spine with blood supply and venous drainage and clinical applications

- Congenital malformation of brain and spine
- Neuropathology - Surgical Neuropathology and the essentials of the Pathology of Neurological disorders likely to present to the Neurosurgeon
- Basic medical sciences relevant to the practice of Neurosurgery
- **Diagnostic tests** – examination of CSF and related procedures, electrodiagnostic tests (NCV, EMG, EEG, Evoked potentials, Trans Cranial Doppler, Pet scan, Spect, Angiography, Brain Biopsy)

Paper – II : Clinical Neurosurgery – Cranial

- **General and peri operative care**-Initial evaluation and treatment of the comatose patient, Seizure disorders and their medical management, Evaluation of the patient with dementia and treatment of normal pressure hydrocephalus, Blood-Brian barrier; cerebral edema, increased intracranial pressure, Brain Herniation, and their control, Pseudotumor cerebri, Neurology, Preoperative evaluation of a neurosurgical patient, Blood coagulation, Neuroanesthesia, Intensive care, Spasticity
- Clinical Neurosurgery including history taking, physical examination, diagnosis, selection and planning of relevant investigations, appropriate treatment and rehabilitation of patients with neurosurgical disorders related to brain and trauma including those presenting as emergencies.
- Essentials of clinical Neurology especially with reference to disorders common in India and those likely to present to the Neurosurgeons.
- **Neuroradiology** - Performance and interpretation of Neuroradiological procedures, such as carotid arteriography and myelography. Familiarity with the technique of selective arteriography and its interpretation
- Principles and interpretation of common Neurophysiological, Neuro-ophthalmological, Neurootological and Neuroendocrinological tests especially with reference to Neurosurgical disorders
- Performance of common neurosurgical operations in the supra and infra-tentorial compartments
- Pharmacology of various drugs used in Neurosurgery
- **Neurosurgical and related techniques**- Principles of neurosurgical operative technique, Principles of Neurosurgical operative technique, Endoscopic neurosurgery, Prophylactic antibiotics, Patient positioning, Intraoperative neurophysiologic Monitoring, High speed drills, Intraoperative use of topical hemostatic agents in neurosurgery, Use of fibrin glue in neurosurgery, Calcium phosphate ceramics as bone substitute, Endovascular therapy of vascular lesions of the central nervous system
- **Neuro Oncology** : Gliomas, Metastatic brain tumor, Meningiomas, Epidermoid and dermoid tumor, Tumors in the region of the pineal gland, Cerebellopontine angle tumor, Posterior fossa tumors, Sellar and Parasellar tumors,
- Vascular Diseases of The Nervous System

Paper–III : Practice of Neurosurgery of Skull base and spine including peripheral nervous system

- Performance of common neurosurgical operations in the spinal canal and on the peripheral nerves and surgeries related to trauma
- Disorders of peripheral and cranial nerves and the autonomic nervous system
- Peripheral nerve injuries like Brachial plexus, carpel tunnel syndrome, cervical rib etc.
- **Spinal tumor** - Spinal Intradural tumors, Paragangliomas of the cauda equine, Spinal epidural tumors, Primary Neoplasms of the spine

- **Intervertebral disc disease and selected spinal disorders**- Cervical disc disease and cervical spondylosis, Cervical ossification of the posterior Longitudinal ligament, lumber disc disease, Postoperative intervertebral disc space infections. Lumber spondylolisthesis, Posterolateral lumber spinal fusion, The failed back surgery syndrome
- **Pain**-Anatomy and physiology of pain, Craniofacial pain syndromes: An overview Trigeminal neuralgia:- Introduction, Trigeminal neuralgia: Problems as to cause and consequent, Trigeminal neuralgia: treatment by glycerol Rhizotomy, Trigeminal neuralgia: Treatment by microvascular decompression, Deep brain stimulation for pain relief

Paper – IV : Recent advances

- Knowledge of recent advances in the field of neurological surgery
- Advance in molecular genetics in relation to neurogenetic diseases
- Stereotactic And Functional Neurosurgery- stereotactic surgery; principles and techniques, image guided stereotactic surgery, radiofrequency lesion- making in the nervous system, surgical therapy of movement disorders, surgical treatment of epilepsy
- Gene therapy, psycho surgery,
- Intraoperative imaging applications in neurosurgery
- Foetal surgery
- Stem cell therapy in neurosurgery

TRANING ON SUB-SPECIALITY OF NEUROSCIENCES

Neuro-Anaesthesiology

There should be a didactic lectures which may be a common programme for the Neurology and Neurosurgery postgraduates. The major thrust in these would be the resuscitation management of coma, life-support systems and monitoring of patients. The Neurosurgery trainees would have additional requirements in which they should know the interaction of anaesthetic drugs with systemic diseases and neurosurgical disease conditions and for this few more didactic lecture would be required. The major thrust would be on continuing training for the Neurosurgery trainees in the operation theatre as a result of the informal discussions which would be taking place during the training period.

Neuroradiology

Combined Neuroradiology rounds or meetings once a month.

Clinical Neurology Neurophysiology

Candidiates should have 1 months training under Neurology department to familiarize themselves regarding common neurological disorders. During this period candidate should also familiarize themselves with the technique and interpretation of EEG/EMG/NCV and evoked potentials.

Neuropathology

It is suggested that there should be a 15 days capsuled training for Neurosurgery trainees or regular once a month Neuropath conference in which they should be familiarized with the techniques of grossing, staining procedures, brain cutting, autopsy methods and tissue processing including frozen sections and should be able to identify histological features of the common neurosurgical disorders. In regard to weightage in the examination it is felt that it should be five percent of the theory and the practical examination.

VISIT TO OTHER INSTITUTIONS

Candidate in 3rd year (Post MS) should visit other neurosurgical centers recognized by MCI for about 4 weeks to be able to observe difference in approaches to various neurosurgical problems.

It is desirable to have training in certain special areas to be arranged outside the institute, when necessary like micro surgical lab training if not available within the department.

I. EVALUATION OF M Ch (NEUROSURGERY)

1. **Internal assessment**
   To be done by all teachers concerned in the training of the candidate both inside and outside the parent department independently and entered into log book on a standard marking system (see infra). The course director will average out and put the final evaluation.

2. **Theory Papers**
   (equally distributed for each paper)
   Minimum pass marks 40% in each paper.

   Timing of Examinations
   At the end of 36 months of training (for post MS).
   Four papers –
   Paper – I : Basic Neurosciences: Principles of Neurosurgery
   Paper – II : Clinical Neurosurgery – Cranial
   Paper – III : Practice of Neurosurgery of Skull base and spine including peripheral nervous system
   Paper – IV : Recent advances

3. **Practical Examinations**

   a) Clinical
   b) Operative demonstration for M Ch
   c) Radiology, Pathology and general viva
   Minimum pass marks - 50%

II. MINIMAL REQUIREMENTS OF TRAINING UNIT FOR M Ch NEUROSURGERY

1. Separate 30 bedded department with an OPD and casualty attendance of at least 1000/year attached with or having access to a well equipped general hospital with casualty services and investigative facilities, with well equipped departments of biochemistry, pathology, microbiology, ophthalmology, otorhinolaryngology, general medicine, paediatrics, behavioural sciences, forensic medicine and neurology.
2. The radiology department would provide required support and should be equipped with skull table, myelography table, image intensifiers and facilities for selective angiography. Facilities for intervention radiology, DSA, CT scan, MRI and Ultrasonography are desirable. The availability of 2 trained neuroradiologists is desirable.
3. The department of anaesthesiology would provide the required support. The availability of at least 2 trained neuroanaesthesiologists is desirable.
4. There should be access to a separate operation theatre(s) and intensive care area of atleast 3 beds. In addition to the usual neurosurgical equipment it should have operating microscope, biopolar cautery, microsurgery instruments, image intensifiers and monitors, etc.

5. Department of Pathology would provide the required support including autopsy facilities, the availability of 2 fully trained Neuropathologists is desirable.
6. There should be a faculty of 3 persons with one of them atleast 10 years teaching experience.
7. For every recognized teacher two candidates may be taken for training per year, subject to a maximum of 1 trainee per 4 beds at any given time.

MODEL PAPER

MCh-9351 **Neurosurg.-I**

M.Ch. Neuro Surgery Month, Year

Paper – I

Basic Neurosciences: Principles of Neurosurgery

Time : Three Hours
Maximum Marks : 100

Attempt all questions
All questions carry equal marks.
Draw diagrams wherever necessary

Q.1 Neurophysiological monitoring during spinal surgery.
Q.2 Microsurgical anatomy of Orbit and various approaches for Orbital Tumours.
Q.3 Pathophysiology of Peripheral Nerve Injury
Q.4 Pathophysiology of Autonomic Disturbances in Cervical Cord Injury
Q.5 Optic Atrophy
Q.6 Various Haemostatic agents used in Neurosurgery
Q.7 Excitatory Neuro Transmitters
Q.8 Supra nuclear regulation of ocular movements
Q.9 Neural regulation of urinary bladder
Q.10 Draw transverse section through brain stem and mark structures involved in decerebrate rigidity

MODEL PAPER

MCh-9352 **Neurosurg.-II**

M.Ch. Neuro Surgery Month, Year

Paper – II

Clinical Neurosurgery – Cranial

Time : Three Hours

Maximum Marks : 100

Attempt all questions
All questions carry equal marks.
Draw diagrams wherever necessary

Q.1 Surgical approaches to foramen magnum tumors.

Q.2 Ventriculitis

Q.3 Vasospasm

Q.4 Tumor markers

Q.5 Pharmacotherapy of prolactinoma

Q.6 Moya moya disease

Q.7 Benign Intracranial Hypertension

Q.8 Intracranial germinomas

Q.9 Brain herniation syndromes

Q.10 Cysticercosis of brain

MODEL PAPER

MCh-9353 **Neurosurg.-III**

M.Ch. Neuro Surgery Month, Year

Paper – III

Practice of Neurosurgery of Skull base and spine including peripheral nervous system

Time : Three Hours

Maximum Marks : 100

Attempt all questions
All questions carry equal marks.
Draw diagrams wherever necessary

Q.1 Spinal shock
Q.2 Surgeries for Brachial plexus injuries
Q.3 Describe about Anterior cervical discectomy and fusion
Q.4 Stretch reflex
Q.5 Differential diagnosis of single vertebral collapse
Q.6 Surgeries for AAD
Q.7 Differential diagnosis of Intramedullary SOL
Q.8 Split cord malformation
Q.9 Management of cervical injury patients in Emergency
Q.10 Gene therapy in spinal cord injury

MODEL PAPER

MCh-9354 **Neurosurg.-IV**

M.Ch. Neuro Surgery Month, Year

Paper – IV

Recent Advances

Time : Three Hours

Maximum Marks : 100

Attempt all questions
All questions carry equal marks.
Draw diagrams wherever necessary

Q.1 Psycho surgery

Q.2 Deep brain stimulation

Q.3 Endovascular treatment of Intracranial

Q.4 Neural plasticity

Q.5 Fluorescence guided resection of gliomas