



EUROPEAN SOCIETY OF NEURORADIOLOGY  
Diagnostic and Interventional  
ESONR – EUROPEAN SCHOOL OF NEURORADIOLOGY

## **ESNR Advanced Courses in Interventional Endovascular Neuroradiology**

Coordinator: Prof. Serge Bracad

### **Educational and training programme**

#### ***Objectives***

The overall objective is to prepare the resident in training to be familiar with the core curriculum and to become a competent and independently practicing interventional neuroradiologist.

A specialist in interventional neuroradiology shall have the skill to independently perform, conduct, consult, interpret and communicate with referring physicians and patients regarding common neuroradiological procedures. A specialist in interventional neuroradiology shall have acquired knowledge in basic and clinical neurosciences, including neuroanatomy, neurobiology, pathophysiology and natural history of neurological disorders. A specialist in interventional neuroradiology advises clinicians and carries the main responsibility for how the diagnostic and therapeutic methods are used within the domain of neuroradiology.

A specialist in interventional neuroradiology shall understand the diagnostic and master the therapeutic methods used within the domain of neuroradiology and shall be aware of their development, strengths, weaknesses and risks.

A specialist in interventional neuroradiology should be able to train new specialists in neuroradiology, and specialists in training within other specialities, in the strengths, weaknesses and risks of therapeutic methods used within the domain of neuroradiology.

Research should be encouraged and time and facilities available during training.

#### ***Knowledge-based objectives***

The level of education and training should be structured along the established levels of knowledge and skill:

A body of knowledge well mastered by the specialist. Diagnostic or therapeutic procedure that is understood, performed, interpreted and communicated independently without assistance.

A body of knowledge well known to the specialist. Diagnostic or therapeutic procedure that can be understood, performed, interpreted and communicated with assistance of a senior colleague.

A body of knowledge familiar to the specialist. Diagnostic or therapeutic procedure that is familiar to the specialist but not to be performed interpreted or communicated independently by the specialist.

##### ***- Embryology, morphological and functional anatomy***

The objective is to have a good knowledge (level B) of the embryology, morphological and functional anatomy and physiology of skull, brain, head & neck, spine, spinal cord, peripheral nervous system and to well master (level A) the cerebrospinal vascular system.



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*- Pathology and pathophysiology*

The objective is to have a good knowledge (level B) of the pathology and pathophysiology of diseases, trauma, development and normal aging and malformations of all structures mentioned above in adults and children.

*- Imaging technology*

The objective is to know (level B) the physiological, technical, mathematical and statistical principles, strengths and weaknesses of common neuroradiological diagnostic and interventional procedures; and to master (level A) to neuroradiology relevant, radio-physics and radiation protection and have knowledge of the laws governing the use of medical radiation.

*- Image interpretation*

The objective is to have a good knowledge (level B) interpretation and evaluation of the common neuroradiological procedures; to have deep understanding (level A) of the importance and value of diagnostic neuroradiology in the clinical care for the patient; to have a deep understanding (level A) of post-therapeutic conditions and be able to evaluate the result of surgical, medical and other interventional procedures; to recognise and have a deep understanding (level A) of complications and side effects, and their consequences, related to diagnostic and therapeutic procedures; to have knowledge about the indications, contraindications, limits of:

- conventional radiology (level B)
- computed tomography (level B)
- magnetic resonance (level B)
- catheter angiography (level A)
- cranial and cervical ultrasonography (level B)
- radio nuclide investigations (level C)
- functional neuroradiology (level C)

to have knowledge in special paediatric applications within neuroradiology:

- foetal neuroradiology (level C)
- neonatal neuroradiology (level B)
- the normal postnatal development of the brain (level B)
- neurometabolic diseases (level C)
- malformations (level B)
- child abuse (level C)

to have knowledge in special head & neck applications within clinical neuroradiology:

- tumours of the head & neck (level A)
- vascular diseases of head & neck (level A)
- malformations of head & neck (level B)
- inflammatory diseases of head & neck (level B)
- the embryology of head & neck (level B)
- trauma of head & neck (level B)



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***Clinical, technical objectives***

The objective is to have good knowledge in patient care (level A) and be able to evaluate the clinical status of the patient prior to, during and after an interventional procedure; to have in depth knowledge (level A) in pathophysiological conditions, indications and contraindications, complications and adverse events in Interventional Neuroradiology; to master (level A) and be able to explain to the patient the benefits and risks of techniques used and obtain informed consent where applicable; to have basic knowledge (level C) of clinical management in neuro-intensive care.

***Decision-making / value judgment skills (level A)***

The objective is to be able to make independent and well founded decisions (level A) in matters of medical-ethical nature within clinical neuroradiology:

- priorities when resources are limited
- management of incidental findings
- risk management and management of adverse events
- medical legal implications pertaining to interventional neuroradiology

to acquire communications skills (level A) necessary for:

- discussion of indications and contraindications for diagnostic and interventional procedures
- appropriate reporting of diagnostic and interventional procedures
- to consult with clinicians
- to consult with residents in training
- to communicate with patients
- to communicate with hospital staff and administration.

**Clinical components**

The clinical and educational experience must include the following clinical components:

- regular clinical rounds and conferences in related disciplines
- sufficient volume of adult and paediatric patients
- adequate volume of invasive and interventional procedures.

**Teaching components**

The clinical and educational experience must include the following teaching components:

- to attend the full cycle of European Course in Neuroradiology (ECNR)
- to attend the European Course in Interventional Neuroradiology (ECINR) organized by the ESNR.

Suggestions to go into the subject in depth:

- To attend at least one of the accredited courses in interventional neuroradiology: Zurich course, Chiang Mai cycle, LINC courses.
- Annual attendance of an accredited scientific meeting or postgraduate course in neuroscience: ESNR, ABC WIN, WFITN, etc.



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- Preparation of clinically or pathologically proven cases for inclusion in the teaching file
- Daily film reading conferences
- Presentation of scientific material
- Ability to teach interventional neuroradiology to peers and residents in other disciplines

### **Research**

The educational environment should encourage trainees to undertake investigative study in relevant clinical or basic sciences subject areas.

- Trainees may participate in research projects conducted by the faculty or other trainees or may undertake a project as principal investigators
- They should learn the fundamentals of the experimental design, performance and interpretation of results
- They should learn how to develop and complete a project
- They should be encouraged to submit their work for presentation at national or international meetings and to publish in scientific journals.

To understand ethical aspects and conflicts of interest (level A).

### **Participant requirements:**

Applicants must have attended a full ECNR cycle and be Certified as Fellow in Neuroradiology, or hold the Portuguese Specialization in Neuroradiology.

Curriculum: basic knowledge on cerebral diagnostic angiography.

Courses are reserved to ESNR Full Members in good standing with ESNR dues.

**Number:** in order to preserve the practical character of these courses, the number of participants is limited to 24.

### **Courses:**

The key idea of these sessions is to complete the European Course in Diagnostic and Interventional Neuroradiology with practical sessions and a part of the programme is included in the ECNR.

Four sessions (each of 21 hours) with workshops, video sessions, cases and simulator or animal sessions are included in the cycle:

- |   |  |
|---|--|
| 1 | Endovascular aneurysm treatment              |
| 2 | Endovascular stroke treatment                |
| 3 | Endovascular AVM and DAVF treatment          |
| 4 | Spine, spinal cord and ENT vascular diseases |

Simulators are needed for sessions 1 and 2 and these sessions may be organized in collaboration with industrials in their institutes. Session 3 should be organized in centres with animal laboratories.



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**Course 1 Endovascular aneurysm treatment**

**Course objective:**

When the courses have been completed the participant should have a basic understanding of the following subjects:

- Clinical aspects of subarachnoid haemorrhage and aneurysms
- Aneurysms: different types, diagnosis.
- Catheter, microcatheter, microguide wires
- Coils and coiling
- Balloon and remodelling
- Intracranial stents and aneurysms
- Parent artery occlusions
- Antiplatelet therapy and anticoagulation in INR
- Complications, risk management
- Endovascular treatment: indications, patient information
- Unruptured aneurysms
- Follow-up and evaluation of treatment results
- Future of treatment, haemodynamics, biology...

**Course 2 Endovascular stroke treatment**

**Course objective:**

When the courses have been completed the participant should have a basic understanding of the following subjects:

- Clinical aspects of acute cerebral ischemia
- Diagnostic neuroradiological acute and subacute stroke workup (CTA, CTP, MRA, DWI, PWI)
- Intra-arterial thrombolysis
- Clot removal systems
- Catheterization of supra-aortic vessels in the elderly patient
- Diagnostic neuroradiological carotid workup US/MRI/CTA/angiography
- Carotid stenting
- Intracranial stenosis
- Intracranial stenting
- Functional vascular anatomy of the intracranial blood circulation
- Anaesthesia and sedation in stroke
- Postoperative care.

**Course 3 Endovascular AVM and DAVF treatment**

**Course objective:**

When the course has been completed the participant should have a basic understanding of the following subjects:

- Clinical aspects of intracranial haemorrhage
- Brain vascular anatomy



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- Microcatheters adapted to AVM treatments
- Brain AVMs
  - Diagnostic neuroradiological AVM work-up
  - Treatments of AVMs : methods : surgery, radiosurgery, endovascular  
Strategy: to treat or not to treat ? How ?
  - Techniques and objectives of embolization
    - Glue
    - Onyx
  - Pitfalls in AVM embolization
  - Complications, management
  - Neuroradiological and clinical follow-up
  - Anaesthesia
  - Postoperative care
- DAVFs:
  - Natural history, diagnosis
  - Vascular anatomy
  - Endovascular treatments
    - Arterial route
    - Venous route
  - Complications, management.

**Course 4 Spine, spinal cord and ENT vascular diseases**

Course objective:

When the courses have been completed the participant should have a basic understanding of the following subjects:

- Vascular anatomy of spine and spinal cord
- Dural spinal AVFistulas
- Spinal AVMs
- Specific diseases: metameric, Rendu Osler
- Spinal haemangioma, tumours
- Embolization: techniques, pitfalls, complications
- Cervicofacial vascular anatomy
- Facial and cervical haemangioma, classification
- Facial and cervical haemangioma, treatments except INR
- Facial and cervical vascular diseases, INR treatments: embolization, sclerotherapy...
- Facial cervical and skull brain vascular tumours
- Endovascular treatment: indications, patient information
- Follow-up and evaluation of treatment results

*In alternative, these Courses will also be proposed without the use of simulators, and based on video-recorded case sessions:*



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Intended for neuroradiologists active in interventional centres with some “hands on experience” not needing to touch the simulators. The programme, the learning objectives and the course scheme are the same as those of the simulator-based courses. The practical sessions are organized on the discussion of video-recorded cases.

Number of participants: to be defined by the local organizer suggested between five and ten, not limited by the number of simulators.

Course duration: 3-4 days.

**Course examination:** at the end of each course there will be a self-assessment test consisting of multiple-choice questionnaires.

After attending the full Course in Interventional Endovascular Neuroradiology, having passed the multiple choice test, having spent two years in a neuroradiology centre with endovascular interventional activity, it will be possible, for the ESNR Full Members, to sit the examination for the following certification:

**Higher Qualification in Interventional Endovascular Neuroradiology**