

International Certification in Neurosonology (ESNCH, NSG/WFN)

-

practical examination

Examiner 1: _____

Candidate (incl. academic degree):

Examiner 2: _____

Start of examination: _____

Results (Part 1): __ out of __ points

End of examination: _____

Results (Part 2): __ out of __ points

Exam passed: 0

Exam NOT passed: 0

Signature of Examiner 1: _____

Signature of Examiner 2: _____

The International Certification in Neurosonology consists of TWO parts, which both must be completed successfully to pass the exam!

Part 1

Part 1 includes the basic parts of neurosonography that should be (1) safely conducted by EVERY candidate and (2) examinable in ALL volunteer subjects.

The whole content must be tested!

Passing-Threshold: 80% (32 of 40 points) Maximum Investigation Time: 20 Minutes

Annotation: Content can be looked up in the Manual of Neurosonology:

Csiba L, Baracchini C. Manual of Neurosonology. Cambridge University Press (2016).

(<https://www.cambridge.org/core/books/manualofneurosonology/57AA270BB8E18BF14599A973D5FD6C31>)

Part 1-A: Extracranial arterial insonation – Carotid (C) protocol

1) Correct positioning of the patient (neck in hyperextension + slightly tilted towards the opposite side; see Manual of Neurosonology [MoN] p. 16)

- 2) Adequate ultrasound probe is used (linear phased array probe, frequency 5-13 MHz; see MoN p. 15)
- 3) Standard positioning of the “nose” of the probe: pointing medial or cranial
- 4) Investigation is started in brightness mode (B-mode, see MoN p. 16)
- 5) Illustration of Common Carotid Artery (CCA) in the cross-sectional insonation plane using B-mode (see MoN p. 16)
- 6) Illustration of Internal Carotid Artery (ICA) and External Carotid Artery (ECA) in the cross-sectional insonation plane using B-mode (see MoN p. 16)
- 7) Illustration of CCA, ICA and ECA in the cross-sectional insonation plane using colormode to avoid that moderate/echolucent plaques are overlooked (see MoN p. 62)
- 8) Show the largest plaque in CCA, ICA or ECA (if no plaque is identified, plaque criteria should be explained: thickness >1.5mm, focal structure encroaching into the lumen by ≥ 0.5 mm or 50% of the surrounding IMT thickness; see MoN p. 58)
- 9) Color mode adjustment in the CCA: Adjustment of pulse repetition frequency (PRF) (see MoN p. 16)
- 10) Illustration of CCA in the longitudinal plane from its origin to the carotid bulb using color mode (see MoN p. 17)
- 11) Doppler waveform obtained at least twice in the CCA using adequate PRF, sample volume placement and angle correction (see MoN p. 15)
- 12) Illustration of proximal ICA and ECA in the longitudinal plane using color mode (see MoN p. 18)
- 13) Doppler waveform obtained in the proximal ICA and ECA using adequate PRF, sample volume placement and angle correction (see MoN p. 15)
- 14) Differentiation between ICA and ECA (1): anatomical position (usually more superficial [ECA] vs. usually more deeply [ICA], see MoN p. 17)
- 15) Differentiation between ICA and ECA (2): branches (branching [ECA] vs. No branches [ICA], see MoN p. 17)
- 16) Differentiation between ICA and ECA (3): pulsatility (high pulsatility [ECA] vs. low pulsatility [ICA], see MoN p. 17)
- 17) Differentiation between ICA and ECA (4): compression maneuver (oscillation when tapping the temporal artery [ECA] vs. NO oscillation when tapping the temporal artery [ICA], see MoN p. 17)
- 18) Doppler waveform obtained in the middle C1-Segment of the ICA using adequate PRF, sample volume placement and angle correction (see MoN p. 15)

Each correct step of the examination gives 1 (one) point. _____ (maximum points Carotid protocol: 18)

Part 1-B: Extracranial arterial insonation – Vertebral (V) protocol

- 1) V2 segment is searched by moving the probe (color mode) slightly laterally when the image of the carotid artery appears (see MoN p. 27)
- 2) To assess V2 segment PRF, depth and gain are optimized (see MoN p. 27)
- 3) Doppler waveform is obtained in V2 segment using adequate PRF, sample volume placement and angle correction (see MoN p. 27)
- 4) B-mode is used to obtain vessel diameter
- 5) Doppler waveform is obtained in V1 segment using adequate PRF, sample volume placement and angle correction (see MoN p. 27)
- 6) Subclavian artery is assessed by Optimization of PRF, depth and gain
- 7) Doppler waveform is obtained in the proximal subclavian artery using adequate PRF, sample volume placement and angle correction

Each correct step of the examination gives 1 (one) point. _____ (maximum points Vertebral protocol: 7)

Part 1-C: Transcranial arterial insonation – Transtemporal protocol

- 1) Correct positioning of the patient (supine position + head in midline; see MoN p. 119)
- 2) Adequate ultrasound probe is used (1.6-3.5 MHz transducer or 2-3 MHz multifrequency transducer, see MoN p. 119)
- 3) Probe is placed over the area of arcus zygomaticus between the lateral edge of the orbit and the ear (MoN p. 142)
- 4) Standard positioning of the “nose” of the probe: pointing to the eyebrow
- 5) Transtemporal investigation is started in B-mode with an imaging depth of 140160mm (see MoN p. 119)
- 6) Axial plane is first visualized: hypoechoic butterfly-shaped cerebral peduncles surrounded by the hyperechoic neighboring cisterns (see MoN p. 119)
- 7) Color mode is now used for vessel detection: How is the transtemporal window? (see MoN p. 142)

Each correct step of the examination gives 1 (one) point. _____ (maximum points Transtemporal protocol: 7)

Part 1-D: Transcranial arterial insonation – Transnuchal protocol

- 1) Correct positioning of the patient (lateral position + head slightly tilted forward; see MoN p. 122)
- 2) Probe is placed suboccipitally in the midline and pointed towards the nasion (see MoN p. 122)
- 3) Transnuchal investigation is started in B-mode by visualizing the great foramen (see MoN p. 122)
- 4) Color mode is now used for vessel detection at a depth of 70-80 mm (see MoN p. 122)
- 5) Doppler waveform is obtained in the ipsilateral vertebral artery – V4 segment using adequate PRF and sample volume placement (see MoN p. 122).
- 6) Doppler waveform is obtained in the contralateral vertebral artery – V4 segment using adequate PRF and sample volume placement (see MoN p. 122).
- 7) Doppler waveform is obtained in the proximal basilar artery using adequate PRF and sample volume placement (see MoN p. 122).
- 8) PSV and mean blood flow velocity is measured in the basilar artery

Each correct step of the examination gives 1 (one) point: _____ (maximum points Transnuchal protocol: 8)

Total points Part 1: _____ (maximum points Part 1: 40)

Passing threshold: 80% (32 points)

Additional Comments (Part 1, if needed):

Part 2

Part 2 offers two investigation protocols of neurosonographic findings that might be more **DIFFICULT to detect (e.g. vessel stenosis/occlusion)**

ONE of the following two protocols should be chosen by the examiner depending on the volunteer subject's vessel status.

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Carotid artery stenosis/occlusion protocol: 10 Points

or

Transcranial Duplex protocol: 10 Points

Passing-Threshold: 70% (7 Points)
Maximum Investigation Time: 10 Minutes

**Part 2-A: Extracranial arterial insonation –
Carotid artery stenosis/occlusion protocol**

- 1) B-mode imaging is used to localize and characterize the stenosis (see MoN p. 82)
- 2) Color flow is used to guide Doppler waveform measurement and/or to differentiate between occlusion and subtotal stenosis (see MoN p. 82)
- 3) Peak systolic velocity (PSV) obtained from the jet of the stenosis using adequate PRF, sample volume placement and angle correction (error margin: ± 30 cm/sec, see MoN p. 82)
- 4) End-diastolic flow velocity obtained from the jet of the stenosis using adequate PRF, sample volume placement and angle correction (error margin: ± 20 cm/sec, see MoN p. 82)
- 5) Poststenotic PSV obtained as far downstream from the stenosis as possible using adequate PRF, sample volume placement and angle correction (error margin: ± 20 cm/sec, see MoN p. 84)
- 6) Observation of poststenotic turbulences downstream from the stenosis (no vs. moderate vs. pronounced, see MoN p. 81)
- 7) Prestenotic blood flow is obtained in the CCA using adequate PRF, sample volume placement and angle correction (error margin: ± 20 cm/sec, see MoN p. 81)
- 8) Calculation of ICA/CCA ratio (see MoN p. 81)
- 9) Observation of collateral flow (peri-/orbital arteries or circle of Willis): one (peri)orbital artery should be correctly observed. *For this the acoustic power in B mode is correctly lowered (mechanical index <0.3), and the time of color mode application is kept short* (see MoN p. 81)
- 10) Degree of stenosis must be defined (error margin: $\pm 10\%$)

Each correct step of the examination gives 1 (one) point. _____ (maximum points Carotid artery stenosis/occlusion protocol: 10)

Total points Part 2: _____ (maximum points Part 2: 10)

Passing threshold: 70% (7 points)

Part 2-B: Transcranial arterial insonation – Transcranial Duplex protocol

- 1) Doppler waveform is obtained in the proximal/middle M1 segment using adequate PRF and sample volume placement (see MoN p. 27).
- 2) Angle correction is only used if an at least 1,5cm straight segment can be visualized (see MoN p. 131)
- 3) PSV and mean blood flow velocity is measured in the proximal M1 segment
- 4) PSV and mean blood flow velocity is measured in the middle M1 segment
- 5) Pulsatility index is measured in the middle M1 segment
- 6) Doppler waveform is obtained in the distal M1 / proximal M2 segment using adequate PRF and sample volume placement (see MoN p. 27).
- 7) Doppler waveform is obtained in the intracranial ICA using adequate PRF and sample volume placement (see MoN p. 27).
- 8) Doppler waveform is obtained in the anterior cerebral artery using adequate PRF and sample volume placement (see MoN p. 27).
- 9) Doppler waveform is obtained in the posterior cerebral artery – P1 segment using adequate PRF and sample volume placement (see MoN p. 27).
- 10) Doppler waveform is obtained in the posterior cerebral artery – P2 segment using adequate PRF and sample volume placement (see MoN p. 27).

Each correct step of the examination gives 1 (one) point. _____ (maximum points Transcranial Duplex protocol: 10)

Total points Part 2: _____ (maximum points Part 2: 10)

Passing threshold: 70% (7 points)

Additional Comments (Part 2, if needed):