

TC01

Added value of Neuromuscular Ultrasound in clinical neurophysiologic everyday practice

- General indications for neuromuscular ultrasound in 2022, *Erisela Qerama Montvilas*, Denmark
- *Erisela Montvilas*, *Nils Wolfram*, Denmark
- Added value of NMU and diagnostic supplementary role of NMU in the daily neurophysiologic practice.
- *Nils Wolfram*

High-resolution ultrasound of the nerves and muscles has been shown to have a considerable supplementary value to the neurophysiological diagnosis.

With the ultrasound probe at hand, the neurophysiologist is equipped with a powerful tool to supplement his/her functional diagnosis with a structural insight in the nerve pathology. W.

The workshop will focus on latest research on the supplementary role of the neuromuscular ultrasound (NMU) in the daily clinic with emphasis on establishing normal material, acquiring ultrasound practical knowledge and understanding the role of ultrasound in the daily use of the department.

This will be done by presenting evidence, abundance of cases and reviews of NMU praxis in three /more departments of Clinical Neurophysiology in Europe. There will moreover be a hands-on session with demonstration of NMU of upper and lower extremities nerves and plexus brachialis.

Proposal for three topics of talks:

- 1- General Indications for neuromuscular ultrasound in 2021 -
- 2- Added value of NMU and diagnostic supplementary role of NMU in the daily neurophysiologic practice.
- 3- Insights in daily implementation of neuromuscular ultrasound in the neurophysiologic clinical practice- Copenhagen University, Aarhus University.

Recommended audience: Students / Residents / Trainees,

Key words: Ultrasound, Clinical Neurophysiology, MUscle and Nerve

TC02

Paediatric seizures and epilepsies: from EEG and seizure semiology to syndrome diagnosis and etiology in gene related epilepsies.

- [Electroclinical characteristics of genetic epilepsies of neonatal onset](#),
LAURENCE CHATON, France
- *MONIKA EISERMANN*, France
- *LAURE MAZZOLA*, France

The aim of this teaching course is to improve participants' knowledge in EEG features and ictal semiology in gene related epilepsies. In this interactive session, speakers will present Video-EEG cases from the neonatal period to childhood, and discuss distinct electro-clinical patterns allowing to point toward a specific genetic etiology in paediatric epilepsies and epilepsy syndromes (KCNQ2, KCNT1, pyridoxine dependency, SNC1A, ATP1A3, SYNGAP1 etc.). All talks will be highly interactive encouraging audience participation. Discussion will focus on recording protocols, recognition of main interictal and ictal EEG patterns including semiology and seizure type diagnosis as well as differential diagnoses.

Recommended audience: Practitioners,

Key words: pediatric epilepsy, genetic, electroclinical pattern

Electrophysiological tests of neuromuscular junction dysfunction

- Repetitive nerve stimulation, *Hacer Erdem Tilki, Turkey*
- SFEMG during voluntary contraction, *Erik Stalberg, Sweden*
- SFEMG during electrical stimulation *Janez Zidar, Slovenia*

This session will focus on commonly used electrophysiological tests in the work up of myasthenic disorders; RNS and SFEMG.

In RNS of a peripheral nerve, the change in CMAP amplitudes is quantified. Pre- and postsynaptic events are evaluated. Protocol and practical issues will be commented.

In neuromuscular (nm) transmission disorders, an impaired conduction is further depressed with low-frequency stimulation and transiently corrected with high-frequency stimuli, especially in presynaptic disorders.

The course will also include the theoretical background and demonstrations of voluntary SFEMG and stimulated SFEMG. For stimulation, a monopolar needle electrode or a surface electrode is used. The recording electrode is inserted into the twitching part of the muscle. Stimulus strength should be supramaximal for the studied axon and is typically less than 1-15 mA. The optimal stimulation rate is between 5 and 10 Hz. The difference between voluntary and stimulated SFEMG will be discussed.

Over the last years, there has been a need to use concentric needle electrodes to study nm transmission. Smallest possible concentric needle electrode is recommended and filter setting of 1000 Hz to 10 KHz is recommended. Definition of acceptable and non-acceptable components will be discussed and demonstrated. Reference values will be briefly mentioned. Amplitude level and peak detection methods for time analysis will be demonstrated.

The 3 techniques will be demonstrated on healthy subjects.

Recommended audience: Clinical academicians, All of them above mentioned except Non - physician Health Professionals

Key words: neuromuscular transmission, repetitive nerve stimulation, single fiber electromyography

TC04

Infant EDX exam: how to proceed and what to expect?

- [What is specific when performing EDX exam in infants?](#)
Yann Péréon, France
- [How to manage EDX exam in floppy babies,](#) *Cyril Gitiaux, France*
- [Neuromuscular junction testing in infants](#) *Matthew Pitt, UK*

Performing ENMG in young children definitely requires some specific skills from the neurologist or physiologist. In addition to the maturation process of peripheral nerves and muscles which markedly affects the electrophysiological parameters, the clinical field leading to ENMG may be very specific. Moreover, dealing with an infant or a child changes the way EDX should be performed.

A specific approach must be undertaken in order to get maximal useful information from the EDX, while minimizing discomfort for both the child and the parents. In addition, neuromuscular diseases may be quite different from adult ones, with specific presentation (e.g., floppy baby). All these points will be addressed and debated during the workshop

Recommended audience: Students / Residents / Trainees, + practitioners

Key words: Infant, Nerve conduction velocity, Electromyography

Axonal Excitability Studies and MScanFit MUNE

- [Interpretation of axonal excitability studies using modelling](#) *James (Tim) Howells, Australia*
- [Introduction to the TROND protocols](#) *Hugh Bostock, United Kingdom*
- [Clinical applications of axonal excitability](#) *Cindy Lin, Australia*
- [MScanFit MUNE - Methodology and clinical perspectives](#) *Kelvin Jones*

Axonal excitability testing is a non-invasive method of obtaining information about the resting potential and activity of axonal voltage-gated ion channels in vivo, which cannot be achieved by conventional electrophysiological methods. Axonal excitability testing has helped in understanding disease pathophysiology and diagnosis of several neurological disorders, and its value has recently been recognized by the IFCN, with their publication of consensus guidelines (Kiernan et al., *Clinical Neurophysiology* 131:308-323, 2020).

The field has recently been expanded by the addition of a novel method for motor unit number estimation (MUNE), by analysis of a detailed CMAP scan. This method, MScanFit MUNE, is quick and easy to perform. It has been shown to be more reproducible than more traditional MUNE methods, and also more sensitive in detecting motor unit loss in amyotrophic lateral sclerosis, diabetic polyneuropathy and multifocal motor neuropathy.

The aim of this course is to provide basic theoretical and practical knowledge for the participants on axonal excitability testing and MScanFit MUNE. After short lectures on each topic, the experts will demonstrate the methods, and the participants will have the possibility to practice the methods supervised by the experts.

Recommended audience: Clinical academicians, This course is relevant to Clinical academicians, basic scientists and students/residents/trainees.

Key words: Axonal excitability, Mathematical modelling, Cortical excitability

TC06

LET'S ABUSE EMG: WHAT INFORMATION EMG

- EMG is superfluous for this case, *Elif Kocasoy Orhan*, Turkey
- Accessibility of EMG in different countries, *M Baris Baslo*, Turkey
- What can we do to improve the accessibility of EDX, *Ali Emre Oge*, Turkey

For whom?: Students in clinical neurophysiology and those aiming to increase their expertise in EMG.

Aim: To take attention to the overuse of EMG.

Speaker 1: Conditions where EMG does not provide information more than that elicited from clinical and other laboratory examinations (despite the common belief that it is useful- with case presentations)

Speaker 2: Hypo and hyper-accessibility of EMG in different countries (we have 1 year to arrange a multinational survey by sending specific questions to EMG experts in many countries and analyze their answers.)

Speaker 3: Can the EMG'ers do something for improving the situation?

Recommended audience: Students / Residents / Trainees,

Key words: Electromyography, neuromuscular disorders, electrodiagnosis

TC07

Hands-on Teaching Course on Quantitative Electromyography

- [Basic principles of quantitative electromyography \(Christian Krarup\), Ozden Sener, Turkey](#)
- [A novel method for Quantitative MUP analysis- EMGTools \(Steffen Birk\), Christian Krarup, Denmark](#)
- [MUP analysis in myopathic and neurogenic conditions \(Ozden Sener\) Steffen Birk, Denmark](#)
- [MUP analysis in neurogenic disorders \(Clarissa Crone\) Clarissa Crone](#)

Quantitative Electromyography (EMG) may enable more reproducible and evidence based information about motor unit properties compared to qualitative measurements. Quantitative EMG can particularly be useful in borderline cases and may provide comparable results between laboratories and over time.

The aim of this teaching course is to provide basic theoretical and practical knowledge for the participants on quantitative EMG. The participants will also be introduced to the novel quantitative MUP analysis method, EMGTools. After short lectures on each topic, the experts will demonstrate all methods, and participants will have the possibility of practicing on each other supervised by experts.

Recommended audience: Students / Residents / Trainees,

Key words: Quantitative EMG, MUP analysis, Neuropathies and myopathies

EEG in infancy – Boot Camp

- [Early onset developmental and epileptic encephalopathy in infancy](#), *Monika Eisermann*, France
- [Neonatal Seizures and Classification](#), *Ronit Pressler*, United Kingdom
- [Normal Maturation in the first year of life and technical aspects](#)
Alexander Datta, Switzerland
- [Geraldine Boylan](#) *Geraldine Boylan*

The aim of this teaching course is to improve participants' knowledge of EEG in the neonatal period and in infancy. In these interactive teaching sessions, speakers will emphasize key concepts of recording techniques, normal EEG maturation, EEG abnormalities seen in different pathologies (acute brain injury, genetic disorders, structural abnormalities, inborn errors of metabolism) as well as developmental and epileptic encephalopathies in neonates and infants.

The 1st talk will concentrate on technical aspects as well as normal EEG maturation from the preterm and term neonate to infants. The 2nd talk will discuss EEG background changes seen during brain injury in preterm infants (such as intraventricular haemorrhage and periventricular leukomalacia) and in term infants (such as hypoxic ischemic encephalopathy, cerebral infections and stroke).

The 3rd talk will focus on the EEG diagnosis of seizures and their classification, including challenges and pitfalls. The last talk will focus on early-infantile developmental and epileptic encephalopathies with emphasis on distinctive electro-clinical features in genetic and metabolic etiologies.

All talks will be highly interactive encouraging audience participation.

Recommended audience: Practitioners,

Key words: EEG, Neonatal period and infancy, Seizures and epilepsy

How and when to test autonomic nervous system?

- [How to test cardiovascular autonomic function?](#) *Mario Habek, Croatia*
- [How to test sudomotor autonomic function?](#) *Fanciulli Alessandra, Austria*
- [How to test urogenital autonomic function?](#) *Panicker Jalesh, United Kingdom*

As almost every organ system receives regulatory information from the central nervous system (CNS) through the autonomic nervous system (ANS), and vice versa, it is no wonder that the ANS plays a crucial role in homeostasis. Therefore, testing of the ANS is important in various medical specialties, resulting in numerous tests of autonomic function (more ANS tests exist than for any other neurological system). The anatomic location of the ANS renders it inaccessible to simple direct physiological testing, and this is one more reason why only few ANS tests are validated.

In this educational course a special emphasis will be given to fully quantitative and clinically validated protocol for testing of different aspects of autonomic functions.

During the last conference in Budapest in 2017 and in Warsaw 2019, the course was well received and it was sold out a month before the start of the conference. ANS disorders are far more frequent than reported, so with this educational course we aim to raise the recognition of this problem and to learn the participants how to perform and when to order testing of the ANS.

Recommended audience: Practitioners,

Key words: cardiovascular autonomic function, sudomotor autonomic function, urogenital autonomic function

Hands-on Teaching Course on Muscle Excitability Testing

- Muscle excitability testing: methodology and clinical perspectives
Werner Z'Graggen, Switzerland
- Muscle excitability testing in myotonic dystrophy and inclusion body myopathy, *Karl Ng, Australia*
- Muscle excitability testing in other clinical conditions
Alexander Gramm Kristensen, Denmark

Muscle membrane excitability properties have long been of interest, but it has been difficult to study them in patients. In 2009, Z'Graggen and Bostock developed a practical method of studying muscle membranes indirectly, by measuring the changes in velocity of muscle action potentials as a function of time after a preceding impulse.

These muscle velocity recovery cycles (MVRCs) can be recorded quickly and easily by direct stimulation and recording from multi-fibre bundles in vivo. MVRCs have already been found helpful in understanding disease mechanisms in several neuromuscular disorders, and they have been able to demonstrate the differing effects of specific ion channel mutations in patients with channelopathies.

The aim of this course is to provide basic theoretical and practical knowledge for the participants on muscle excitability testing with MVRCs and some more advanced protocols. After short lectures on each topic, the experts will demonstrate the methods, and participants will have the possibility to practice the methods, supervised by experts.

Recommended audience: Clinical academicians,

Key words: Muscle excitability testing, Muscle velocity recovery cycles, Neuromuscular disorders

LARYNGEAL ELECTROMYOGRAPHY (LEMG)

- [Needle injection techniques to reach intrinsic laryngeal muscles](#),
Susana Santiago-Perez, Spain
- [Neurophysiological basis and interpretation of LEMG recordings](#),
Isabel García-López, Spain
- [Decision making based in LEMG results](#) *Almudena Martínez-Pérez, Spain*

Laryngeal electromyography (LEMG) is becoming an increasingly common tool in the diagnosis and management of vocal fold paralysis due to of vagal and laryngeal nerve lesions, and also of laryngeal movement disorders. The main goal of LEMG is the diagnosis of laryngeal movement disorders, the guidance of botulinum toxin injection in laryngeal muscles, and also is as useful tool for investigation in neurolaryngology.

L-EMG should be part of a standard examination of Neurolaryngologic units. The training course will be given by two clinical neurophysiologists and an otolaryngologist, who work daily as a team in clinical practice. In our experience, best results with using LEMG are achieved with the close collaboration between clinical neurophysiologist and otolaryngologist. The otolaryngologist makes the clinical and laryngoscopic examination, and inserts the EMG needle electrodes, especially in hard to reach muscles. The neurophysiologist interprets the LEMG results, giving a diagnosis and a prognosis. Both of them decide the best alternative for treatment.

The objective of this training course is to explain our more-than-ten-year experience with LEMG, including: Patient selection criteria, other examinations employed (voice functional scales, video-laryngoscopy...), needle injection techniques to reach intrinsic laryngeal muscles, neurophysiological basis and interpretation of LEMG recordings, decision making based in LEMG results

Recommended audience: Practitioners,

Key words: Laryngeal Electromyography, laryngeal nerve, neurolaryngology

Updates on the neurophysiological assessment of thermo-nociceptive pathway function

- [Afferent pathway assessment using thermal stimulation](#),
Andrea Truini, Italy
- [Nociceptive pathway assessment using selective electrical stimulation](#),
Lucio Marinelli, Italia
- [Dorsal horn excitability during experimental pain in humans](#)
Caterina Leone, Italy

The assessment of thermo-nociceptive pathways helps diagnose clinical conditions characterized by neuropathic pain and disclose cutaneous small-fibres involvement, which may be compromised in the early stages of neuropathies such as transthyretin amyloid neuropathy. Since new treatments are now available, early diagnosis is increasingly important.

The current gold standard for neurophysiological assessment of small-fibres neuropathy is laser evoked potentials but other techniques are being experimented with. Electrical selective stimulation of cutaneous A δ fibres has been attempted for years, but selectivity has always been an issue. Recently, a new interdigitated micropatterned electrode proved effective for massive synchronous activation of epidermal A δ fibres.

Participants will learn:

1. current approaches for the neurophysiological evaluation of thermo-nociceptive pathways,
2. updates on cold and heat thermal stimulation techniques,
3. use of the new micropatterned interdigitated electrode,
4. recording techniques of nociceptive responses from the spinal cord to the cerebral cortex.

Recommended audience: Clinical academicians,

Key words: nociceptive pain, small-fibres neuropathy, neuropathic pain

TC13

Neurophysiological examinations in childhood and adolescence: application in the clinical setting, current state and future developments

- Application of evoked potentials in the clinical setting in children and adolescents, *Oliver Maier, Schweiz*
- Modern diagnostic options for peripheral neuropathies using nerve conduction studies, EMG, ultrasound and new technologies based on optically pumped magnetometer, *Philip Broser, Germany*

Pediatric neurophysiology is useful in childhood and adolescence if it is applied adequately according to age and developmental status and if the special pediatric indications are considered.

In this symposium we present the method of evoked potentials including visual evoked potentials, somatosensory evoked potentials and brainstem evoked potentials as a useful tool in the clinical setting and as prognostic parameter for multiple neuropediatric diseases.

Nerve conduction studies and electromyography in combination with muscle and nerve ultrasound are important diagnostic methods for peripheral neuropathies in childhood. We first provide an overview of the various application areas on the basis of clinical case studies and then show the latest developments in clinical neurophysiology using optically pumped magnetometers.

Recommended audience: Clinical academicians,

Key words: Neurophysiological investigations in childhood, Evoked potentials, nerve conduction studies

Transcranial brain stimulation in aging and cognitive decline: what works and what fails

- Methodology of TMS and tES, *Andrea Antal*, Germany
- tDCS and tACS to improve cognition in healthy elderly and patients with mild cognitive impairment – how do they it work, *Walter Paulus*, Germany
- rTMS in studies of cognitive impairments *Sasa Filipovic*, Serbia

Non-invasive brain stimulation (NiBS) techniques such as repetitive transcranial magnetic stimulation (rTMS) and transcranial electric stimulation, including direct current and alternating current stimulation (tDCS, tACS), allow to modulate neuronal excitability, oscillatory activity and to boost cortical functions, hereby possibly offering a therapeutic potential to slow down cognitive decline. Cognitive decline reaches medical attention for about 5-25% of the elderly population (over 65 years of age) when suffering from Mild Cognitive Impairment (MCI).

Around half of the people with MCI develop dementia within three years, supporting a medical need for early diagnosis and treatment. The high variability of symptoms renders it both difficult to define the border between healthy and pathological functions and to find reliable methods with which the progression can be monitored. TMS measurements, in particular paired pulse techniques are one of them; they can be used to identify and follow changes in cortical integrity and reactivity of neuronal circuits.

rTMS, tDCS/tACS can be applied as potential therapeutic tools to improve network activity and cognitive functions in the elderly. Several subject-specific and methodological factors, e.g. anatomical and physiological differences, age, brain state during stimulation, can confound the effects of stimulation. During this teaching workshop protocols will be presented with their individual advantages and disadvantages.

Recommended audience: Clinical academicians,

Key words: Brain Stimulation, TMS, tDCS

TC15

Critical Care EEG Monitoring Across the Age Spectrum

- [Pediatric ICU EEG](#), *Nicholas Abend*, United States
- [Neonatal ICU EEG](#), *Ronit Pressler*, UK
- [Adult ICU EEG](#), *Markus Leitinger*, Austria

Recent practice guidelines advocate for increasing EEG monitoring use in critically ill neonates, children, and adults to identify electrographic seizures, and practice surveys indicate EEG monitoring is rapidly increasing across the age spectrum. This session will focus on key topics related to continuous EEG monitoring in critically ill patients for which there are recent and clinically impactful data. Three topics will be addressed for each age group.

First, lectures will summarize data regarding the impact of electrographic seizures on patient outcomes, thereby providing the rationale for seizure detection approaches. Second, lectures will summarize data regarding efficient use of limited EEG monitoring resources by targeting the right patients for the right duration. Third, lectures will provide practice guidance on implementation and optimal approaches to link EEG monitoring data to clinical management.

Recommended audience: Practitioners,

Key words: Critical Care EEG, Status Epilepticus, EEG Monitoring

Follow up of disorder of consciousness from acute to chronic phase in clinical practice

- [Multimodal evaluation of patients in coma for prognostication, Antonello Grippo, Italy](#)
- [Multimodal evaluation of person with prolonged disorders of consciousness for prognostication, Anna Estraneo, Italy](#)
- [Neuromodulation for improving consciousness recovery, Aurore Thibaut, Belgium](#)

Nowadays management of patients with severe acquired brain injury in coma and in prolonged disorders of consciousness are still challenging. Recent guidelines from American and European scientific societies recommended a standardized multimodal assessment, combining easy to record at bedside clinical and neurophysiological evaluations, that could improve prognostication in people with disorders of consciousness.

Additionally, non-invasive neuromodulation have been proposed as innovative therapeutic strategies for improving recovery of consciousness. In this context, the proposed teaching course aims to provide updates related to current evidence on prognosis and treatment of persons in coma and related disorders of consciousness.

Participants will:

1. comprehend the role of neurophysiology in the prognostication in the acute and post-acute phases of acquired severe brain injury;
2. learn the basic protocols for acquiring and classifying clinical and neurophysiological data useful for prognosis;
3. understand how neurophysiological data can help stratify patients with a high probability of being "responders" to therapeutic intervention (personalized medicine);
4. understand the neurophysiological basis for neuromodulation for consciousness recovery;
5. learn the non-invasive neuromodulation protocols (e.g. transcranial direct current stimulation) useful for improving patients' clinical outcome.

Recommended audience: Non - physician Health Professionals, Also directed to non - physician Health Professionals

Key words: Disorders of consciousness, Acquired brain injury, Coma

TC17

The most common entrapment neuropathies of the upper limb – the diagnosis and the neurophysiological evaluation

- [Neurophysiological diagnosis of carpal tunnel syndrome,](#)
Marta Banach, Poland
- [Neurophysiological diagnosis of ulnar nerve lesion,](#)
Justyna Pigonska, Poland
- [How to evaluate the entrapment of the radial nerve,](#)
Magdalena Koszewicz, Poland

Participants will acquire skills to:

1. Identify and distinguish the anatomical and clinical features of upper extremity mononeuropathies.
2. Design and perform EDX studies for assessment of median, ulnar, and radial mononeuropathies.
3. Correctly interpret the EDX findings when studying median, ulnar, and radial neuropathies.
4. Determine the best approaches for diagnosing median neuropathy at the wrist and ulnar nerve lesion in the elbow.
5. Detect the common diagnostic errors.

Recommended audience: Other, Health care professionals (medical doctors, technicians, nurses) who perform nerve conduction studies

Key words: nerve conduction studies, carpal tunnel syndrome, ulnar and radial nerve lesion

Use of 'SFEMG' in paediatric

- [Assessing NMJ using SPACE in paediatric](#), *Jacquie Deeb*, UK
- [SPACE technique in paediatric](#), *Matthew Pitt*, UK
- [SPACE analysis in paediatric](#) *Gerald Cooray*, UK

There is still a need for a neurophysiological demonstration of abnormalities of the neuromuscular junction and a test that is universally applicable in children and possible to use as a screen for abnormalities of the neuromuscular junction. We describe SPACE (single potential analysis using concentric needle electrode) a technique developed in paediatric based on stimulation single fibre EMG using concentric needle electrode and high frequency filter to investigate neuromuscular junction dysfunction.

SPACE is part of the solution to the problem of screening for myasthenia in children and it may need other elements of the electrodiagnostic examination. We will describe the technique in detail, its pitfalls in the paediatric population, normative data in children. We will carry a demonstration of the technique and allow participants to have hands-on practice afterwards.

Recommended audience: Students / Residents / Trainees,

Key words: Paediatric, EMG, SFEMG

TC19

Technical and practical approach to different visual Electrophysiological tests in clinical neurology

- ERG pattern ,flash technical considerations And their updated applications, *ayatallah hussein*, Egypt
- VEP pattern and flash technical considerations and their updated applications, *hala Elhabashy*, Egypt
- Multifocal ERG Technical and practical approach
- Multifocal VEP Technical and practical approach

Electrophysiology of Vision updates and clinical applications in Neurology, is a teaching course discussing the different clinical neurophysiological tests of vision , discussing the basics of VEP flash and pattern types , basics of electroretinogram flash and pattern types ,advanced techniques as multifocal VEP and multifocal ERG and their applications in different neurological disorders , there are few practicing neurologists and neurophysiologists having adequate training in these techniques. There is high demand for neurologists, neurophysiologists with competence in these areas.

Recommended audience: Non - physician Health Professionals,

Key words: neurophysiology, VEP, ERG

TC20 – Pending

How to perform rTMS and tDCS in practice?

MUNIX: dos and dont's

- [MUNIX as a biomarker for neuromuscular disorders](#),
Markus Weber, Switzerland
- [MUNIX: Pitfalls](#), *Christoph Neuwirth*, Switzerland

Objective markers of disease progression for neuromuscular disorders especially in ALS clinical trials are urgently needed. Quantification of motor unit loss by means of MUNIX has the great advantage that this measure directly reflects the loss of motor neurons. This methods has gained a lot of scientific interest over the past few years and is at the forefront of developing into a valuable biomarker.

This course will focus on practical issues. Participants will understand the applicability and limitations of the method. After an introduction highlighting the background and indications (lecture 1) the pitfalls will be discussed (lecture 2). Participants will then apply the methods on each other. MUNIX will be performed on APB, ADM, FDI, Biceps, TA, EDB. After the course attendees will be able to make high quality CMAP and MUNIX recordings

Recommended audience: Clinical academicians,

Key words: MUNIX, motor unit number estimation, biomarker

TC22

Neurodevelopmental prognosis and EEG in in extremely preterm newborns

- [Normal EEG in extremely preterm newborns,](#)
Emilie Bourel-Ponchel, France
- [Pathological patterns of EEG in extremely preterm newborns,](#)
Marie-Dominique LAMBLIN, France
- [Prognostic value of abnormal EEG patterns in extremely preterm newborns](#)
Laura ROUTIER, France

Conventional EEG, a non-invasive and well-established method to assess brain function, is widely used to detect functional brain abnormalities. Its prognostic value has been described in the literature. In this teaching course, we will highlight the characteristics of normal EEG in extremely preterm neonates and describe pathological patterns. Finally, the prognostic value of EEG will be discussed in the light of scientific literature.

Recommended audience: Practitioners,

Key words: EEG, prematurity, neurodevelopment

Polysomnography in Clinical Practice

- [Introduction to Polysomnography: scoring and pitfalls](#),
Laurien Teunissen, Netherlands
- [Polysomnography: how to diagnose sleepdisorders](#),
Viviane van Kasteel, Netherlands
- [Polysomnography in Practice: clinical cases](#)

Polysomnography is a tool to measure the different physiologic parameters during sleep.

The data that can be obtained include EEG (electro-encephalography), EOG (electro-oculography), EMG (electromyography), ECG (electrocardiography), respiratory flow, respiratory effort and oxygen saturation measurement via pulse oximetry. Ventilation can be monitored by CO2 measurements.

Polysomnography interpretation includes the identification of the different sleep stages, analysis of breathing patterns and analysis of movement patterns that can occur during sleep.

So polysomnography can also be a very important tool in the differential diagnose of epilepsy.

In this course we will discuss the different types of sleep studies that can be used in the sleep clinic and ambulatory modalities that can be used at home. Interpretation of the sleep monitoring findings is complex. The American Academy of Sleep medicine has provided since 2007 a manual for scoring sleep and associated events. We will discuss these scoring rules according to the latest release. We will discuss these AASM rules in clinical practice.

Sleepdisorders are world wide a major health problem and therefor polysomnography is an important tool in the diagnosis and treatment of these disorders. In this course we will discuss the polysomnographic findings in several sleep disorders. We will provide an overview of indications for polysomnography and how to use the findings in the different categories of sleep disorders.

Recommended audience: Students / Residents / Trainees,

Key words: Polysomnography, Clinical interpretation, Sleepdisorders

TC24

Tips and pitfalls during needle EMG examination

- [same title](#), Yann Pereon, France

This educational session aims to improve the ability of the attending participants to interpret needle EMG. The analysis of needle EMG remains a real challenge while performing EMG examination. Everyone basically knows how to differentiate a typical neuropathic pattern from a typical myopathic pattern, or how to differentiate myotonic discharges from pseudo-myotonic discharges. But there are some difficult cases where both myopathic and neuropathic characteristics can be mixed, or where one mimics the other, leaving the EMGist puzzled.

The objective of this session is, after having reminded the pathophysiological bases of needle EMG interpretation, and using practical examples with EMG videos picked up among routine examinations, to show that 'pseudo-myopathic' and 'pseudo-neuropathic' patterns do exist and may represent pitfalls that one should avoid; that spontaneous activities may also be confusing. The objective is also to explain how this can occur and to provide to the participants the tools to get the better of the EMG exam

Recommended audience: Students / Residents / Trainees, + practioners

Key words: Needle EMG, Neuromuscular disorders, Myopathy

Intraoperative neurophysiological monitoring (IONM): Technical aspects, optimization, troubleshooting, pitfalls and safety.

- [The technology of IONM machines, and consumables: How do they work?](#)
Dimitrios Kefalas, United Kingdom
- [Improving IONM through signal optimization.](#), *Javier Urriza, Spain*
- [Safety, pitfalls and troubleshooting: A practical approach](#)
Beatriz Arranz Arranz, Spain

The course will start with a brief introduction to electromagnetism, followed by a comprehensive presentation of the main hardware components of modern IONM systems. The presentation will briefly refer to a range of topics, from amplifiers (referential, bipolar, gain, CMRR) to analog-digital converters (ADC, bits, sampling frequency), filters (analog/digital, high-pass, low-pass, band-pass, band-reject), and stimulators (voltage, current, auditory, visual).

The differences among different types of recording and stimulation electrodes, including special purpose electrodes, will be discussed. Emphasis will be given to when and why different types of electrodes are used, considering their strengths, limitations and cost.

The next part of the course will focus on how to optimize the IONM recordings in order to achieve continuous, real-time and dynamic IONM and mapping, choosing optimal protocol parameters. Emphasis will be given to the strategies to obtain noise-free and robust responses. Moreover, tips will be provided regarding how to avoid phenomena such as waveform distortion due to amplifier saturation or inappropriate filtering.

The course will continue with discussion and live or video demonstrations regarding troubleshooting, pitfalls, common mistakes and ways to avoid them, using realistic examples. During this part of the course, emphasis will be given to the safety of the patient during surgery and how to avoid IONM-related injuries, such as tongue bites and burns.

Hands-on Teaching Course on performing single and paired-pulse TMS tests single-handed

- [Introducing automated conventional and threshold-tracking TMS protocols](#), *Hugh Bostock*, United Kingdom
- [Single-pulse TMS tests: motor threshold, stimulus response function, and cortical silent period](#), *Gintaute Samusyte*, Lithuania
- [SICI methods as aids to diagnosis of ALS](#) *Martin Koltzenburg*, United Kingdom
- [Other paired-pulse measurements: SICF, LICI, and SAI](#), *Bulent Cengiz*

Currently, transcranial magnetic stimulation (TMS) provides the most attractive way of examining cortical excitability, and a number of different recording protocols have been developed to test different aspects of cortical function and pathology. We have concentrated on designing a range of efficient automated tests, to enable many of these protocols to be carried out optimally by a single-handed operator. Standardised single- and paired-pulse TMS paradigms are included, with the option to use conventional amplitude measurements or threshold-tracking, and with the ability to control different types of magnetic stimulator.

The most commonly used single-pulse measurements are motor threshold, stimulus response function and cortical silent period, while short interval intracortical inhibition (SICI), short-interval intracortical facilitation (SICF), long interval intracortical inhibition (LICI) and short-latency afferent inhibition (SAI) are the most attractive paired-pulse TMS methods to examine cortical excitability.

The aim of this course is to provide theoretical and practical knowledge for the participants on single and paired-pulse TMS methods. The participants will also learn how TMS methods have been used in disorders such as amyotrophic lateral sclerosis (ALS). After the short lectures, the experts will demonstrate conventional and threshold tracking SICI, SICF, LICI and SAI measurements on volunteers.

High Density EEG and Electrical Source Imaging

- [Recording and Headmodeling](#), *Laurent KOESSLER*, FRANCE
- [Events selection and analysis](#), *Martine GAVARET*, FRANCE
- [Source modeling and choices](#) *Christian BENAR*, FRANCE

It is now well accepted that electrical source imaging (ESI) can precisely localize brain sources from scalp EEG recording. The promising results of this non-invasive method should increase its clinical use. The main obstacles are (1) methodological due to complex multi-modal data and (2) the absence of training at the University. Most of the users learned thanks to scientific collaborations or online tutorials. A training course during the ECCN congress would be relevant in order to give guidelines.

The aim of this teaching course will be to give both fundamental and practical information to the clinicians in order to correctly implement ESI method in their own medical center and to avoid common pitfalls. This teaching course will deal with the acquisition and the materials which are required to perform precise source localizations. Both international recommendations and EEG recording environment will be presented (nb of electrodes, electrode's placement, sampling rate, ...).

We will also discuss about the epileptic event selection and their analysis in the time domain (how many events, averaging or not, time duration, ...). Finally, we will discuss about the head and source modeling using practical approaches (MRI segmentation, which tools, which level of details). Very detailed models are not always required in the clinical practice and can increase the time of analysis. Here, the aim will be to explain the advantages and disadvantages of the different models.

Recommended audience: Clinical academicians,

Key words: Electrical source imaging, High Resolution EEG, Epilepsy

Advanced neurography of rarely tested nerves

- Rarely tested nerves in the foot, *Björn Falck*, Finland
- Rarely tested nerves in the arm, *Satu Laaksonen*, Finland
- Supraclavicular nerve, *Carmen Martínez-Aparicio*, Spain
- Lateral cutaneous nerve of the thigh *Jonathan Chu*

The course will cover the following nerves. Many are tested with surface electrodes. Some nerves tested with near nerve electrodes. Foot nerves • Sural nerve distally in the foot • Deep peroneal nerve in the foot • Lateral plantar nerve • Medial plantar nerve • Saphenus nerve • Lateral cutaneous of the thigh • Anterior cutaneous of the thigh • Plantar digital nerves (Morton's metatarsalgia) Arm nerves • Supraclavicular nerves • Radial nerve branches • Ulnar nerve dorsal branches • Palmar digital nerves • Cutaneus antebrachii posterior • Cutaneus antebrachii lateralis • Cutaneus antebrachii medialis

The target groups are residents and specialists in clinical neurophysiology

Recommended audience: Students / Residents / Trainees,

Key words: Neurography, Special nerve conduction studies, Near nerve neurography

Good practices overview in neurophysiology and userfriendly tools for signal analysis

- [Userfriendly tools for signal analysis](#), *Samuel Medina Villalon*, France
- [Overview on good practices in neurophysiology](#), *Manuel Mercier*, France
- *Bruno Colombet*, France

Nowadays, both research and clinical practice in neurophysiology implies advanced analysis.

However, many hurdles exist, from data acquisition to automatic data analysis. Clinicians or researchers have to deal with time/frequency and/or spatial aspects, invasive and/or non-invasive methods. As signal processing methods are no trivial to tune and use and practices not standardized, analyzing data can be difficult and time consuming. A good understanding of the available tools is a prerequisite to efficient analysis and reproducible results.

In this hands-on course, we will discuss common issues and potential solutions to face all these issues. The class will be divided in two parts. In the first one, we will review good practices as well as answer frequently asked questions covering data acquisition to statistical analysis.

In the second part, we will make a demonstration of tools, with emphasis on interfaces and user friendliness, to help visualizing and analyzing data, covering SEEG electrodes localization, MEG/EEG source separation and localization, spikes or oscillations detection and connectivity.

Recommended audience: Other, All people interested in signal analysis

Key words: neurophysiology, Signal processing, data analysis