EEG routine

- Performed by Biomedical Technologists.
- Interpreted by Physicians.
- Investigation time approximately one hour.

Provocations
- Sleep
- Photic stimulation
- Hyperventilation

Equipment
- Digital Walter Graphtec Machine
- Silver electrodes
- Central server
- 10 Reading stations
Analysis of Digital EEG
- routine recordings

Advantage of digital EEG analysis
• Remontage
• Changing filter and gain.
• Quantitative analysis (FFT, Coherence analysis, Amplitude mapping). This is not usual in our routine.

Transfer of digital EEG-files
• LAN within our department.
• IntraNet from some satellite laboratories.
• MO discs or ZIP discs from some satellite laboratories.

Archiving analysed EEG recordings
• Server station within LAN.
• Server station at satellite laboratories.
• WORM and CD.

Equipment in our department
• Walter Graphtec, Winsor software.
• NT operating system.
• 2 acquisition stations.
• 8 stations with Windows and 2 with DOS for analysis.
Video EEG Monitoring

Diagnostic recordings
• Children and adults.
• Unclear fits and/or episodes of clouded consciousness.
• Scalp electrodes (sometimes with sphenoidal electrodes).
• Recording time 2-7 days.

Preoperative recordings
• Children and adults with intractable partial seizures.
• Extracranial recordings (scalp and sphenoidal electrodes).
• Intracranial recordings (Subdural strip-, grid- or depth electrodes).
• Functional cortical stimulation mapping motor/sensor cortex and speech areas.
• Registration time 1-3 weeks.

Equipment
• 2 mobile Telefactor Beehive stations for acquisition.
• 128 channel digital EEG and analogue SVHS video.
• Automatic seizure detection.
• 1 stationary Telefactor TWIN station for analysis.
• Archiving on CD (EEG files and video transferred to MPEG files).
Neurography

• Routinely performed with surface electrodes by Biomedical technologists.
• All EMGs are preceded by neurography. In many patients only neurography is performed.
• In a few cases needle electrodes are used, by physicians (Morton’s metatarsalgia, Meralgia paraesthetica).
• Motor investigations always include F-wave studies. H-reflex and "centimetering" are often performed.
• Autonomic and sensory tests are performed when indicated.
TMS
magnetic stimulation

• Used to study central motor pathways (ALS, spinal processes...).
Thermal Thresholds

- A thermostimulator is applied to the hand, foot and other locations of interest.
- Temperature either rises or falls linearly starting from an adapted temperature in a neutral region.
- The temperature change is interrupted by the patient when he perceives warmth, cold or pain.
Sympathetic Skin Response

- Electrodes are placed on the hands and feet.
- Sympathetic nervous system is activated by an electrical stimulation on a peripheral nerve, sudden loud sound or deep breath.
Median nerve:
- Stimulation at wrist 3 Hz sufficient to produce twitch, twice perception level.
- Recording at Erb’s point, C7, C2 and C4´-C3´. Reference at Fz.

Tibial nerve:
- Stimulation at ankle 2 Hz sufficient to produce twitch, twice perception level.
- Recording at knee, vertebra L1 - linked iliac crest, Cz - Fz and C3´- C4´.

- SEP are also performed on patient wards.
- Surface electrodes, needles if indicated.
- Recording performed by Biomedical technologist and interpreted by Physician.
Stimulation:
• Pattern shift 2Hz checker board monocular.
• Full field or, if indicated, partial field.
• If co-operation is insufficient, flash stimulation lamp or goggles are used.

Recording:
• Left and right occipital / midoccipital / midparietal (4 channels).
• Reference - Fz.
• VEP are also performed on patient wards.
• Surface electrodes, needles if indicated.
• Recording performed by Biomedical technologist and interpreted by Physician.
BAEP

Stimulation:
• Click stimuli 10Hz rarefaction with masking noise contralateral.

Recording:
• A1 and A2, Reference Cz.
• BAEP are also performed on patient wards.
• Surface electrodes, needles if indicated.
• Recording performed by Biomedical technologist and interpreted by Physician.
EMG

• Performed with concentric needle electrodes, 4-5 patients per session (morning / afternoon).
• Quantitative analysis is performed in almost all patients, but not in all investigated muscles.
• All recordings are stored in a central server.
SFEMG

• To study the microphysiology of the motor unit.
• This lab is used for research (Stålberg) and also for routine.
• All physicians in the department perform SFEMG.
• Indications mainly MG and fatigue syndromes.
• On-line analysis.
Macro EMG

- To study the size of motor units.
- Used routinely in borderline cases of myopathy / neuropathy and in monitoring changes over time.
- Performed at least once in all patients with history of polio.
Muscle Biopsy

- Taken in patients with neuromuscular disorders.
- Muscle chosen with clinical and EMG criteria.
- A semiopen technique (conchotome) is used.
- In infants open biopsy is taken by pediatric surgeons.
- Biopsies are analysed by muscle pathologist.
Investigation of Anal Incontinence

- Terminal motor latency of the pudendal nerve.
- EMG of the external sphincter and puborectal muscle with motorunit analysis.
- Fibre density SFEMG of the external sphincter.
Polygraphic Recording in movement disorders

- Patients referred for torticollis, writers cramp or other movement disorders.
- EMG recording from different muscles performed on 17 channel analog EEG polygraph.
- Surface electrodes preferred.
- Standardised electrode positions and a standardised protocol of movements performed according to disorder.
Motor Functions

- Movement analyses
- Gait analyses
- Force measurements
- Follow up of effect of treatment on motor control.

Patients with
- Parkinson's
- Stroke
- Movement disorders, especially children
- NMD
- Myositis
IOM

Type of operations:
• Acoustic neuromas
• Brachial plexus and peripheral nerve lesions
• Selective dorsal rhizotomy
• Scoliosis surgery
• Spinal stenosis
• Spinal cord tumors
• Tethered cords

Biomedical Technologist places electrodes and does most of the monitoring, physician is present during critical moments.
Pediatric Neurophysiology

NEUROMUSCULAR DISEASES
- EMG quantitative and semiquantitative.
- Percutaneous muscle biopsy.
- Nerve conduction studies.
- VEP, SEP and BAEP studies.

CNS CONDITIONS
- Epilepsy; EEG videomonitoring (4-8 hours), seizure registrations (2-7 days), routine EEG.
- Encephalopathies.
- ADHD/DAMP and other behavioural disorders.
- Neonatal EEG.

For neuromuscular diseases and myelopathies the same methods as applied in adults are in use. For cerebral conditions standard and special EEGs are performed including polygraphic recordings.
Our telemedicine equipment is used for:
• Weekly rounds with satellite hospitals.
• Courses and education for other groups without travel costs.
• Second opinion with colleagues all over the world.

Technical specification:
• ISDN: 3 lines, total 384kB/s
• LAN: 10Mb/s
• WAN: depending on available net (1,5 Mb/s needed)
Facts:
• We have our own domain with 4 servers and about 45 clients (PC’s).
• The rest of the hospital (UUH) consists of 1 domain with about 3000 clients.
Microneurography

• Only for research.
• Microelectrode recordings are made from single nerve fibres in intact nerves in awake human subjects.
• Interest is focused on stimulus-response properties of nociceptive unmyelinated C-fibres signalling pain and itch.