EEG videomonitoring equipment for epilepsy diagnosis

Electroencephalographs-recorders "Encephalan-EEGR-19/26" with kits of video equipment and software "Encephalan-Video" are the best tools for continuous EEG videomonitoring in different conditions of a study for a close and subtle analysis of various epilepsy symptoms.

Completely synchronized continuous multichannel record of electroencephalogram and video on a patient's state is a "gold standard" for differential epilepsy diagnosis.
**Stationary complex for continuous EEG videomonitoring**

- **Infrared lamp for night video**
- **Electroencephalograph with a connected patient cable** (6 meters)
- **Electrode system** assures patient’s comfort at a continuous EEG record
- **Electroencephalograph with telemetry** (wireless) EEG record does not limit movement of the patient

**Electroencephalograph-recorder "Encephalan-EEGR-19/26" provides**

- **Preliminary EEG studies with provoking functional tests** (phono-, photo-stimulation, hyperventilation, etc.), followed by the continuous EEG monitoring with the possibility to conduct repeated provoking tests during continuous monitoring;
- **Continuous EEG monitoring with the patient cable** (6 meters) for electrode system attached to the connector EEG-20 with patient transceiver-recorder ABP-26. Six-meter cable allows the patient to move freely in the 30-square-meter ward;
- **Or continuous telemetric EEG monitoring** when patient transceiver-recorder ABP-26 is placed on the waist of the patient. In this case, EEG record is provided both in the patient ward (with EEG videomonitoring) and outside of it with an option of autonomous record on a memory card of ABP-26 (Holter-EEG record without video).

**Set of EEG electrodes ES-EEG-10/20 "Encephalan-ES"**

Low level of EEG electrodes and fixing slots for their attachment, and comfortable elastic net cover caps (15 sizes total – from 34 to 66) ensure comfort of a patient and high quality of EEG record during continuous study.

**Special thin and flexible cable** with a low level of triboelectric noise decreases the number of artifacts during EEG record and provides comfort for a patient.

The complete set contains several types of removable electrode systems, which differ in number of EEG electrodes. Each type of electrode system has 3 variants: for adults, children and babies.
Mobile kits of equipment for continuous EEG videomonitoring include one professional daylight video camera with optical zoom, rotator, and integrated patient microphone, IR receiver of patient's events and portable camera's tripod.

Stationary complex for continuous EEG videomonitoring

Kits of video equipment provide video record synchronized with EEG data for an objective monitoring of movement and paroxysmal activity of the patient as well as audio record of clinical episodes in the patient’s ward.

Stationary

**Professional variant**
- 2 professional Ethernet video cameras:
  - daylight video camera – optical zoom, rotator;
  - day-night video camera – optical zoom, rotator, IR backlight for night mode.

**Professional Advanced variant**
- 2 professional day-night video cameras – optical zoom, rotator, IR backlight for night mode.

Stationary for data recording and processing (in the medical staff room)

- **Real time station (doctor's workplace)** is designed to monitor and analyze data of EEG videomonitoring conducted at the moment.
- **Station for data processing and archiving** is designed to analyze, store and classify EEG videomonitoring data.

Mobile kits of equipment for continuous EEG videomonitoring

Mobile kit for continuous EEG videomonitoring conducted at the patient's home includes the telemetric patient transceiver-recorder, phono-, photostimulator, set of EEG electrodes "Encephalan-ES", portable PC and mobile kit of video equipment (at the customer's option), and can easily fit in a compact carrying case.

Studies provide patient-friendly environment (a functional diagnostic room, hospital ward or at home). The patient can sleep, eat, read, watch TV, play, etc. A doctor or an assistant monitors his/her state, operation of the equipment and recording quality. Mobile kit can be easily placed in the intensive care units and will not hinder resuscitation and seriously ill patients’ care due to its compact size and data transmission to the doctor's PC via the Bluetooth interface.

**Mobile basic variant**
includes one professional daylight video camera with optical zoom, rotator and integrated patient microphone, IR receiver of patient's events and portable camera's tripod.

**Mobile Basic Advanced variant**
includes one professional day-night video camera with optical zoom, rotator and integrated IR backlight for night mode, patient microphone, IR receiver of patient's events and portable camera's tripod.

**Mobile basic low-cost variant**
includes
- portable IP camera of high resolution (HD ready and better) and digital zoom;
- or analog camera with video capture device with USB interface;
- portable camera's tripod.
Type of the video camera and requirements for monitoring determine type of connection: wired (Ethernet/USB) or wireless (Wi-Fi).

Optional video camera

Optional video camera can be included in any of the mobile kit of equipment.
Autonomous kit of equipment (Holter-EEG with videomonitoring)

A unique opportunity of continuous autonomous EEG videomonitoring

An original autonomous video recorder with an option of video record synchronized with EEG data on the internal memory card sets up a new innovative level in ambulatory EEG studies. The autonomous video recorder provides continuous or fragmentary high-resolution video record (for example, 1920x1080 – at least 8 hours, 1024x768 – at least 13 hours) with IR backlight for night mode, audio record of clinical events on integrated microphone and record of patient's events with the button on the video recorder.

Continuous EEG record (Holter-type) is performed on the electroencephalograph-recorder memory card. Application of the original autonomous video recorder allows those present (staff, parents or relatives) to record clinically significant behavioral episodes and paroxysmal events that, in turn, provides accurate differential diagnosis. The feature of the video recorder is synchronization of recorded video with EEG data during their transmission to the computer for processing, analysis and diagnosis.

Autonomous ambulatory EEG record (Holter-EEG) is recommended when the patient's freedom of movement in the natural conditions is of clinical interest.

Indications for continuous video-EEG monitoring

“Video-EEG monitoring in modern diagnosis and monitoring the treatment of epilepsy” Avakyan G., Anisimova A., Ayvazyan S., Generalov V.

- Diagnosis of epilepsy and epilepsy syndromes.
- Idiopathic paroxysmal states, raising suspicion of epilepsy.
- Drug-resistant seizures (in order to identify pseudoepileptic paroxysms or specify the form of epilepsy).
- Monitoring the effectiveness of treatment.
- Pharmacological remission (objective statement of remission).
- Preparation for the abolition of anticonvulsant therapy.
- Pre-surgical assessment.
- Subclinical seizures.
- Progressive cognitive and behavioral disorders in children.
- First convulsive seizure.

Video-EEG monitoring has no contraindications.

Functionality of equipment and software for video-EEG monitoring

- Synchronous view of EEG and video record during monitoring or subsequent analysis can be carried out on 1 or 2 monitors.
- The record can be viewed at normal speed, speeded-up or slowed-down. A still frame mode and quick access to any EEG videomonitoring moment (by set time, markers or marks).
- Camera tilt and zoom (optical and digital) are software-controlled.
- Up to 10 standard settings of camera tilt and zooming are stored in software.
- Timing accuracy of EEG signals and video data during record and playback – 1 frame.

The essence of the method is a continuous EEG record, synchronized with the video recording of the patient. The minimum duration of the study is 4-6 hours, maximum duration is not limited.
An option of both automatic and manual marking of different events during EEG videomonitoring.

Quick access to the video frame corresponding to the selected time on EEG record, and any EEG fragment corresponding to the selected video frame is provided.

Automatic detection and marking of fragments of non-stationarities or epileptiform activity is performed during EEG recording and processing. Detected fragments are highlighted, saved and available for quick search.

Record of ECG, EOG and EMG synchronously with EEG provides automatic suppression of possible artifacts associated with cardio signal, eye movements and muscle activity, and helps to distinguish these artifacts from the manifestations of paroxysmal activity.

Automatic report generation based on the description of the selected background fragment and comparison of its characteristics with the selected EEG fragments. An option of editing the report and forming neurophysiological conclusion using the function of built-in text editor and a glossary containing common phrases used by a doctor.

Specialized application "Encephalan-EEG-Viewer" to view EEG and video data at any off-site computer ensures main functions of visual EEG analysis such as data review, referential montage, zoom, selection of EEG signals and printing out required files. Application and study results are recorded onto any data-storage device – removable hard drive, CD-DVD or USB drive.

All recorded data can be stored on various data-storage devices (internal or external hard disk drives of large capacity) in the database (Cardfile). Cardfile provides various service capabilities for storage (archiving), systematization and search.

For EEG analysis, the most common mathematical treatments are applied: power and amplitude spectrum; cross-spectrum, coherence function, auto- and cross-correlation with the generation of the tables of quantitative parameters and topographic mapping.

Selection of diagnostically significant video data and EEG fragments for creation of a video clip or for printing out

Generation of output documents for printing out

Print manager ensures comfortable and quick generation of the documents for printing out by carried out study. A user can edit available templates and create the new ones.

The following can be printed out:

- fragments of physiological signal record;
- selected video frames or video sets, which display diagnostically significant events in patient's state;
- automatically generated study protocol;
- results of mathematical analysis – spectra, topographic map, 3D, etc.;
- text of doctor's conclusion.
Making up video clip with diagnostically significant study fragments

- The main peculiarity of "Encephalan-Video" software is an option of presenting results of EEG videomonitoring in the form of video clip in the common *.avi format.
- Video clips are used for independent medical consultations, discussion of the diagnosis, presentations and reports preparation, handing over to a patient, etc.
- The video clip can be viewed with standard Windows Media player or any similar one.
- The video clip can contain diagnostically significant EEG fragments, video data of one or two video cameras, audio data from patient’s and doctor's microphones, and a timer.

Optional feature for sleep analysis in EEG videomonitoring

"Neurological" and "maximum" suits of "Encephalan-PSG" software for somnological studies in combination with video-EEG monitoring kit provide wide range of functional capabilities for sleep analysis and detection of epileptiform activity in sleep taking into account recommendations of the AASM and the CSM.

EEG record during sleep is highly recommended: "The intensity of the epileptic activity is increased in sleep stages 1 and 2". (Sweden B., 1996; Autret A, et al., 1999)

- "Neurological" software suit is additionally used for sleep stages determination and comparing them with epilepsy evidences during EEG videomonitoring. Software provides analysis of sleep stages, automatic building and manual editing of hypnogramms, allocation of sleep events, generation of sleep statistic reports and reports of sleep stages distribution.
- Data from additional wireless devices is not analyzed. Analysis of breathing and movement disorders is not available.

"Maximum" software suit expands the functionality of "neurological" software suit with diagnostics of neurological and psychosomatic disorders (restless legs syndrome, etc.), sleep disorders (insomnia, hypersomnia, parasomnia, narcolepsy), breathing disorders (sleep apnea syndrome, alveolar hypventilation, snoring), heart rate disorders and ischemic heart disease if additional wireless modules and sensors are provided.

Marking of brain activity patterns for sleep stages determination (sleep spindles, K-complexes, saw-tooth waves), automatic calculation of sleep statistical indices (sleep scoring) and selected sleep events (indices, number and duration of episodes) are additionally provided.

Generated reports contain such data as indices of snoring, desaturation and respiratory disorders according to body position, data on the change of oxygen saturation and heart rate, and body position in sleep, that conform to common international somnology standards (AASM).