Neuromonitor for use in general and vascular surgery

Identification and functional control of the recurrent laryngeal nerve in thyroid gland surgery

Avoidance of cerebral ischemia in carotid surgery
AVALANCHE® XT Thyroid

Against the risk of paralysis of the vocal cords after thyroid gland surgery

In Germany around 100,000 operations are performed each year for treating diseases of the thyroid gland. Apart from enlarged thyroid glands due to lack of iodine, malignant lesions of the thyroid gland tissue represent the main reason for partial or complete removal of the thyroid gland tissue.

Although thyroid gland operations have been performed routinely for years, there still exists the not to be neglected risk of injuring the vocal cord nerves. Apart from hoarseness and only limited ability to speak, difficulties in swallowing and breathing can considerable restrict the quality of life after thyroid gland surgery if the vocal cords are injured.

Method: Our AVALANCHE® XT neuromonitor developed specially for thyroid gland surgery helps the surgeon in the safe detection of the course of the nerves of the vocal cords and facilitates their functional control in every phase of the operation.

For this purpose tiny current pulses are transmitted to the tissue by hand-held probe and lead to release of a muscular action potential (MUAP) at the target muscle - the vocalis muscle, if the nerve has been found and is intact. The surgeon recognizes the MUAP by its unmistakable acoustic and visual signal.

The MUAP is derived with special electrodes through the tube used for anaesthesia, or by transligamentary insertion of a needle electrode in the corresponding vocalis muscle.
We offer monopolar and bipolar stimulation probes for stimulation. Monopolar probes reach even far distant tissue structures and enable nerves to be localised approximately, whereas because of their comparatively small stimulation field bipolar stimulation probes allow nerve localisation accurate to a millimetre and thus have higher specificity.

Our sterilisable bipolar concentric needle electrodes permit the derivation of the muscular potentials directly from the vocalis muscle. For this purpose the electrode is inserted during the operation transligamentarily between thyroid and cricoid cartilage up to the vocalis muscle of the relevant side. The needle electrodes can be sterilised up to 100 times. In this way the costs per surgical use are unbeatable in comparison with accessories for use once only.

The advantage of surface electrodes in comparison with needle electrodes is that they are used practically non-invasively. However, the signal derivation depends on correct placement and fixation of the tube by the anaesthetists before the operation. Thanks to their special shape our surface electrodes are not only tolerant towards position but deliver signal amplitudes of quality similar to those of needle electrodes. No one else can match this. Our surface electrodes are delivered sterile and can be fastened to tubes of different diameter in a short time. The surface electrode delivers a continuous EMG signal during the entire operation. In this way nerve irritations are detected quickly even without electrical stimulation.
The AVALANCHE® XT monitors are operated by touch screen, menu guidance is simple and intuitive. Should the surface electrode not be placed optimally, the multi-channel display enables the signal of a needle electrode to be displayed simultaneously.

A special sound system has been developed for physiologically authentic signal playback. The Auto-Mute function suppresses irritating noises if there is no stimulation and the needle electrode has just been removed from the vocalis-muscle.

The graphical display of the muscle action potentials simplifies the evaluation of the stimulation results. Since the muscle activity is stored automatically during stimulation, disturbing manipulations during the operation are not required.

The results can be documented at ease at the end of the operation using the built-in thermal printer or as coloured, user-configurable A4 report.

With AVALANCHE® XT the complete functional range of a modern nerve monitor and stimulator is available to you in a compact case. This permits fast changing between several operating theatres and requires only a minimum of space.

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SEP monitoring against the risk of cerebral ischemia in thrombo-endarteriectomy (TEA) of the carotid artery

The not inconsiderable rate of complications - especially the perioperative mortality caused by apoplexy - frequently raises questions about TEA in patients with moderate degrees of stenosis of the carotid artery, although since the first thrombo-endarteriectomy performed successfully by De Bakey in 1953 several studies have shown that the surgical treatment of severe carotid stenosis is superior to solely conservative therapy.

Intraoperative neurological monitoring can help here to detect early on acute ischemia during the interruption of the circulation by clamping the artery in the course of the operation and to avoid postoperative neurological failures by suitable measures such as insertion of a shunt.

Method: For the assessment of changes of the cerebral oxygen supply resulting from clamping of the carotid artery, somatosensory evoked potentials (SEP) are measured continuously and their changes are compared with the normal signal recorded directly after initiating anaesthesia - the so called baseline. The median SEP triggered by electrical stimulation of the median nerve at the wrist and derived at the hemisphere on the operation side shows characteristic changes of amplitude and latency as a consequence of oxygen reduction due to restricted perfusion.

It is especially important to know the influence of anaesthesia and special measures for cerebral protection to avoid misinterpretations. Therefore the anaesthetist is predestined for intraoperative neurological monitoring - in short IOM - in carotid surgery.
Two surface electrodes affixed on the wrist and connected with the stimulator for the stimulation of the median nerve. The median nerve contralateral to the operation side must always be stimulated. In the illustration the right hand is connected for surgery of the left carotid artery.

The signal is derived on the side to be operated, in the case of surgery on the left side at the position C3’ - Fz (illustration) and in surgery on the right side at the position C4’ - Fz. With our system affixing all electrodes lasts only around 3 minutes up to the first signal.

The signals measured by multiple stimulation are subjected to averaging which filters the SEP signal out from the superimposed EEG signal. Clearly displayed signals indicate the course of the SEP during and after the operation. The stimulation parameters are stored for each SEP curve, in this way it is possible to distinguish signal changes caused by changed stimulation parameters from physiologically relevant changes. Signals at different times can be compared with one another. The sudden "disappearance" of the SEP signal after the carotid artery is clamped in the upper illustration indicates acute ischemia and can be rectified by the immediate introduction of a shunt. The signals "recover" again.

For the fast detection of changes, the current signals of the baseline are superimposed during the measuring process (see text).
AVALANCHE® xt Thyroid / EP performance features

Signals:  EMG 2 channels
          EP max. 4 channel (ABR, MEP, SEP)
A/D conversion:  10 kHz per channel, 12 / 16 bit resolution

EP performance features

Amplifier:
- Inputs: 4
- Amplification: 250000
- Measuring range: 100 µV
- Frequency range: 3 Hz... 3000 Hz
- Artefact suppression: Adjustable for each channel separately

SEP stimulator:
- 4 outputs, separately configurable
  - Stimulation frequency: 0,1 Hz ... 1 kHz
  - Stimulation current: 1... 100 mA
  - Pulse shape: positive, negative, alternating

MEP stimulator:
- Additionally trains with up to 9 pulses and adjustable interstimulus interval
  - Voltage <180V
  - Trigger input for transcranial high-voltage stimulators

Trigger input:
- Transcranial high-volt stimulator / magnetic stimulator for MEP

Acoustics (EP):
- Alarm tone on exceeding the set limits of amplitude or latency adjustable

Notch (EP):
- 50 Hz suppression

Thyroid performance features

DNS (Thyroid):
- Stimulation frequency: 3 / 30 Hz
- Stimulation current: 0,1 ... 10 mA
- Stimulation current with fine and coarse adjustment
- Pulse shape: negative

Acoustics:
- Digital sound processor with 5-fold equalizer and bass boost, sound adjustable per channel (sound mixer), 50 Hz suppression

Graphics:
- 15" LCD flat screen with 1024 x 768 pixels, continuous curve display with freely configurable X and Y axis scaling, automatic switching to sweep mode during stimulation, 50 Hz notch filter

Handling:
- Easy handling via touch screen

Documentation:
- Optional bluetooth or network printer for high resolution printouts in A4 format or built-in thermal array printer, optional report function for clearly arranged documentation of all relevant signal events in an individual “hospital layout”, optional PDF export function for central archiving

Data storage:
- Automatic storage of all stimulation responses and curves, optional transmission of the data to a FTP server for archiving and analysis in hospital network

MDD classification: IIa

Applied parts: Type BF

Network:
- 10 BaseT (patient insulated)

Approval:
- (subject to change without notice)

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