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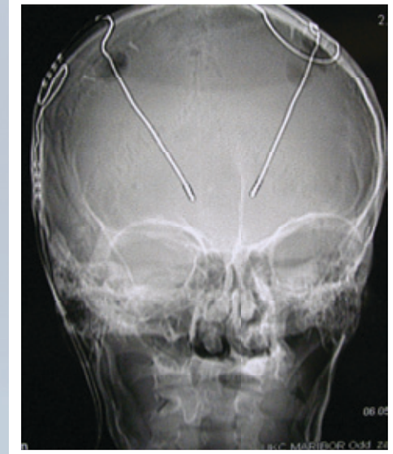

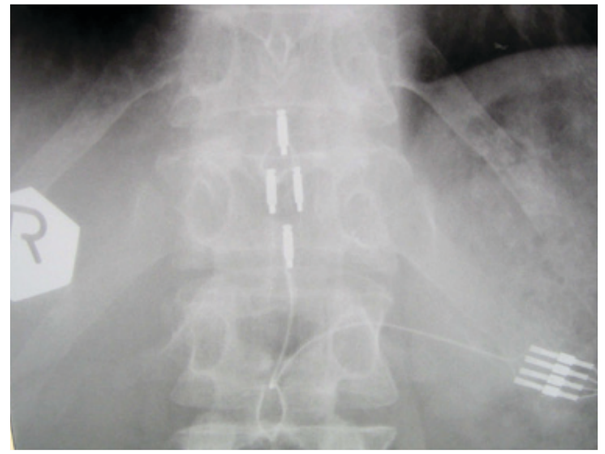

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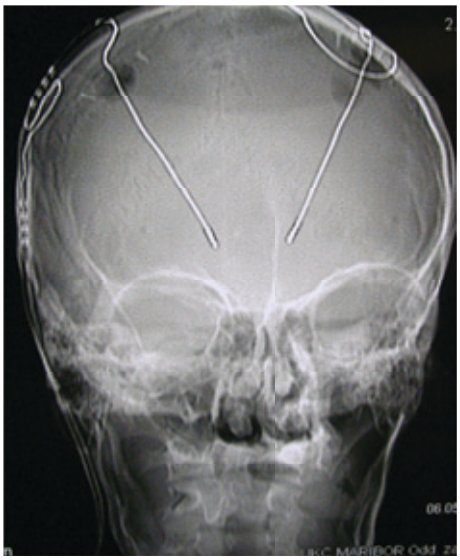

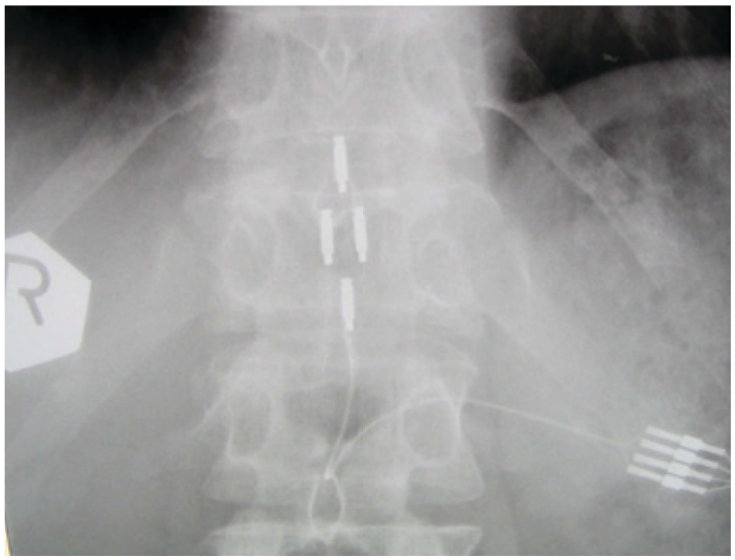

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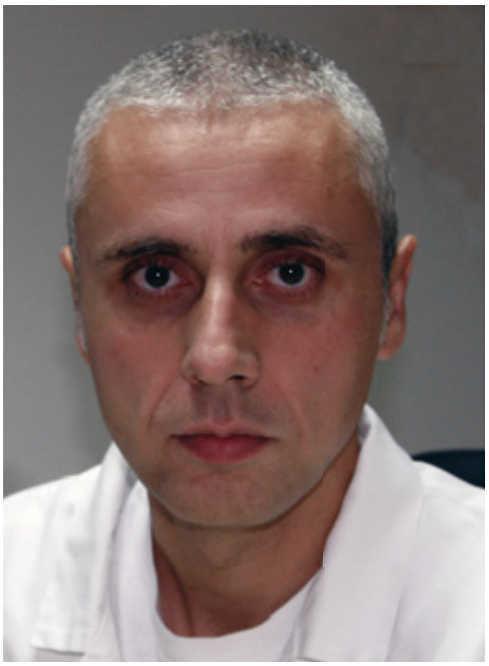
Dear Colleagues,

We are pleased to invite you to attend the 1st international symposium on Neuromodulation in Slovenia. The meeting is devoted to the 10th anniversary of the introduction of neuromodulation procedures in Maribor. It will be held in Maribor Slovenia from October 3rd to October 4th 2013. The topics will cover Deep Brain Stimulation, Spinal Cord Stimulation and Intrathecal Baclofen Therapy. Department of Neurosurgery in Maribor is currently the only center in Slovenia offering all three treatments to the patients. Although neuromodulation is an under-used treatment modality in Slovenia the future of this kind of treatment in Slovenia remains uncertain, due to many unresolved issues. We hope this symposium is a good opportunity to discuss open issues. The participants are cordially invited to present their experiences and to exchange their views with some of the leading experts from Europe.

Tadej Strojnik
Organizing Committee President



Dear Colleagues,

Slovenian Association for Pain Management is active in our surrounding for seventeen years. Pain units have been established in all Slovenian hospitals and management of pain patients is based on the contemporary guidelines. The interventional techniques have been applied almost more than twenty years ago being more frequent in the last decade. The pain management in Slovenia is limited because of lack of personal and lack of devoted means for it. In spite of this limitation the new methods are introduced and we are trying that such treatments are approachable for all patients, which need it.
In the name of Slovenian Association for Pain Management it is my pleasure to invite you to take part in Maribor Symposium.

Nevenka Krčevski Škvarč
Scientific Committee President

INVITED SPEAKERS

Ludvic Zrinzo, London, UK

Rudolf Likar, Klagenfurt, Austria

Darko Chudy, Zagreb, Croatia

Dušan Flisar, Maribor, Slovenia

Zvezdan Pirtošek, Ljubljana, Slovenia

Klemen Grabljevec, Ljubljana, Slovenia

Maja Trošt, Ljubljana, Slovenia

Zoran Rodi, Ljubljana, Slovenia

Roman Bošnjak, Ljubljana, Slovenia

Janez Rebol, Maribor, Slovenia

Barbara Kosmina Štefančič, Izola ,Slovenia

Mateja Lopuh, Jesenice, Slovenia

Igor Drstvenšek, Maribor, Slovenia

Gorazd Požlep, Ljubljana, Slovenia

PROGRAM
Thursday, October 3rd, 2013
20:00 Get-together
Venue: Restaurant Rožmarin

Friday, October 4th, 2013
Venue: Zmago Slokan Lecture Hall University Clinical Centre
08:00 – 08:30 Registration
08:30 - 09:00 Welcome address and cultural programme

Session 1
Deep brain stimulation for movement disorders

Chairmen: Zrinzo, Strojnik

09:00 – 09:30 L. Zrinzo; Improving clinical outcome in DBS surgery for movement disorders
09:30 – 09:50 T. Strojnik; Deep brain stimulation of the subthalamic nucleus in Parkinson's disease – side efects and complications
09:50 – 10:10 D. Flisar; APO, DUO, DBS - last line treatment options for advanced Parkinson's disease
10:10 – 10:30 D. Chudy; Deep brain stimulation for the early treatment of minimal consciousness state and vegetative state
10:30 – 11:00 L. Zrinzo; DBS beyond movement disorders …

11:00 – 11:15 Coffee break

Chairmen: Flisar, Pirtošek

11:15 – 11:35 M. Trošt, M. Kramberger; Pre- and postoperative evaluation & management of patients treated with DBS
11:35 – 11:45 D. Chudy; DBS in PD patient with camptocormia case report and review of literature
11:45 – 12:05 J. Dreo, Z. Pirtošek; Estimating functional connectivity between the subthalamic nucleus and the motor cortex by intraoperative EEG-microelectrode coherence during DBS
12:05 – 12:25 Z. Rodi; Neurophysiological monitoring during movement disorder surgery
12:25 – 12:40 T. Strojnik, D. Flisar; Mania following DBS for Parkinson's disease case report and review of literature
12:40 – 13:00 I. Drstvenšek, T. Strojnik; Neurosurgical instrument's development in terms of ergonomics and technical requirements
13:00 – 13:15 Plenary discussion

13:15 – 14:15 Lunch

Session 2
Spinal cord stimulation for chronic pain, baclofen pumps and cohlear implants

Chairmen: Likar, Strojnik

14:15 – 15:00 P. Likar; New aspects in invasive stimulation therapies
15:00 – 15:20 T. Strojnik; Our experience with spinal cord stimulation for chronic pain
15:20 – 15:40 N. Krčevski Škvarč; The role of SCS in chronic pain management
15:40 – 16:10 K. Grabljevec, M. Gorišek, K. Groleger Sršen, B. Vipavec and R. Bošnjak Treatment of spasticity and neuropathic pain with intrathecal programmable pump - Experiences from the Ljubljana University Rehabilitation Institute

16:00 – 16:15 Coffee break.

Chairmen: Krčevski Škvarč, Požlep
16:15 – 16:35 G. Požlep; Use of radiofrequency ablation for pain relief
16:35 – 16:50 T. Strojnik; Twiddler's syndrome after SCS case report and review of the literature
16:50 – 17:10 B. Kosmina Štefančič; Neuromodulation for complex regional pain syndrome
17:10 – 17:30 J. Rebol, M. Spindler; Hearing preservation with the hybrid cochlear implant (electroacoustic stimulation). Case report
17:30 – 17:45 M. Lopuh; Neuromodulation for cancer pain
17:45 – 18:00 I. Dobovičnik, P. Bastl, S. Kračun; Patient treatment with elastomer pump at home
18:00 – 18:20 Plenary discussion and closing remarks

19:30 Dinner

SPEAKERS' ABSTRACTS

Improving clinical outcome in DBS surgery for movement disorders
Ludvic Zrinzo, National Hospital for Neurology and Neurosurgery, London UK

Reduction in adverse effects and enhancement of therapeutic efficacy will optimize clinical outcome of deep brain stimulation (DBS) for Parkinson's disease.

Patient and target selection are paramount. Subthalamic nucleus (STN) DBS results in less off-period motor symptoms and disability as well as greater reduction in dopaminergic medication and lower battery consumption than pallidal DBS. Nevertheless, pallidal DBS can provide significant symptom relief in patients who are not suitable for STN-DBS. Preoperative factors predicting a good motor outcome after STN-DBS include levodopa responsiveness and younger age. Conversely, hypertension and increasing age carry a higher risk of serious adverse events.[1-4]

Surgical factors associated with good motor outcome include lead location with respect to the MRI-defined STN. Some authors have found a correlation between the length of STN activity on microelectrode recording (MER) and clinical outcome. However, others have found that the best MER activity did not necessarily correlate with the locus that produced the most beneficial clinical response on intraoperative macroelectrode testing. Sulcal or ventricular penetration, using MER and the number of MER penetrations increase the risk of haemorrhage.[4-8]

Dysarthria is a common and disabling problem and may be delayed for many months after STN DBS. Ensuring that DBS leads are well located within the posterolateral portion of the MRI-defined STN, avoiding a too medial location, can significantly reduce the incidence of this side effect of surgery.[9]

Finally, managing patient expectations and provision of expert postoperative care and programming are required if optimal outcome is to be achieved.[8,10]

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DBS of the subthalamic nucleus in PD – side effects and complications

Tadej Strojnik
Department of Neurosurgery, University Clinical Centre Maribor, Ljubljanska 5, 2000 Maribor, Slovenia

Deep brain stimulation (DBS) is a novel and effective surgical intervention for refractory Parkinsons's disease (PD). The subthalamic nucleus (STN) is the best target for correcting motor disability in parkinsonian patients with high-frequency stimulation. However, STN stimulation has also been reported to modify cognitive, emotional, and motivational functions. We review the current literature to evaluate: i) the experimental reports and animal studies, ii) the current clinical implication, iii) the possible side effects and complications associated with STN DBS in PD.

DBS is generally safe from the cognitive standpoint in well selected PD patients. Anyway, there is a clear risk of cognitive decline after STN DBS. It is difficult to demonstrate long-term effects of the surgical procedure or stimulation, and to differentiate these from the natural progression of the disease. Physicians in DBS team should have a comprehensive understanding of the probable complications and how to avoid them. Patients should be informed of the expected risks in association with the procedure. Incorporating also psychiatric symptoms, as important variables should carry out patient selection.
Surgery for PD currently consists of treatment to reduce symptoms. None approaches can be considered curative at present. The desired evolution of surgery for PD should be to change from the treatment of symptoms to a curative approach.

Apomorphine, duodopa or DBS − advanced treatment options for advanced Parkinson's disease

Dušan Flisar
Department of Neurology, University Clinical Centre Maribor, Ljubljanska 5, 2000 Maribor, Slovenia

Levodopa remains the mainstay treatment of Parkinson's disease (PD). Although it is common practice, especially in younger patients, to initiate treatment with a dopamine agonist, this can control motor symptoms only for a limited period of time and after a year or two, levodopa has to be added. Motor fluctuations and dyskinesia are believed to be a consequence of disease progression and pulsatile treatment with oral levodopa. At the beginning they can be controlled by levodopa dose adjustments, as well as the addition of long- acting dopamine agonists. In the terminal phase of PO the therapeutic window for levodopa narrows and achieving an on-state without disabling dyskinesia becomes increasingly difficult. There are unfortunately no efficient anti-dyskinetic drugs. The patients thus spend most of the time either in an off-state or they experience dyskinesia. A stable motor state can be achieved by continuous infusion of dopaminergic drugs such as apomorphine or levodopa-carbidopa using a pump. The third option is stereotactic surgery, most commonly high-frequency deep brain stimulation of tbe subthalamic nucleus (DBS-STN). These three treatment options will be discussed in the presentation with special emphasis on selection of the patients.

Deep brain stimulation for the early treatment of the minimal conscious state and vegetative state

Darko Chudy
Klinička bolnica Dubrava, Avenija Gojka Šuška 6, 10 000 Zagreb

Introduction. An effective treatment of minimal conscious state (MCS) and vegetative state (VS), caused by hypoxic encephalopathy (HE) or traumatic brain injury (TBI), has not been yet achieved. DBS of thalamic reticular nuclei has been attempt mainly in TBI patients.
Methods. Fourteen patients were included (four with TBI and ten with HE, four being in MCS and ten in VS). Entry criteria evaluating status of cerebral cortex and thalamocortial reticular formation comprise of: neurological, including Rappaport Coma/Near coma scale, electrophysiological with multimodal evoked potential and 12/24 hours of EEG, and imaging; positron emission tomography and MRI.
The stimulation target: unilateral centromedian-parafascicular nucleus complex, in 2 patients were bilateral (Fig.1). Patients were stimulated daily for 30 min every three hours (intensity, inducing "arousal reaction", frequency 25 Hz, pulse duration 220 μs). Follow up was from 9 to 26 months.
Results. Two MCS patients regained consciousness, waking, speaking fluently, with impressive speech comprehension. One become completely independent while other needed some assistance in everyday life due to memory deficit. One MCS patient regained consciousness however still wheel chair band. One VS patients improved to MCS after seven months of DBS. Three patients who showed significant clinical improvement had prompt ceasing of previous myoclonus at the beginning of the stimulation. Two died from respiratory infection and sepsis. Other seven patients remain unchanged level of consciousness.
Conclusion. If patients fulfills clinical, neurophysiological, and neuroimaging criteria they should undergo DBS at rather early stage. The spontaneous recovery of MCS/VS is very rare, therefore if entry criteria are fulfilled DBS could be option
Keywords. Vegetative state, minimal consciousness state, DBS

DBS beyond movement disorders …

Ludvic Zrinzo, National Hospital for Neurology and Neurosurgery, London UK

Deep brain stimulation (DBS) has become an established neurosurgical treatment for Parkinson´s disease (PD), dystonia, and tremors. Advancing concepts of brain circuits and their role in both neurological and psychiatric illnesses, coupled with the relative safety of DBS and its exquisite ability to allow ethical study of the human brain, have unlocked new opportunities for this technology, both for future therapies and in research.

Serendipitous discoveries and advances in structural and functional imaging point towards numerous ‘‘new’’ brain targets to manage an ever-increasing number of pathologies. DBS has been used to explore diverse neurological, psychiatric, behavioural, and cognitive conditions.[1]

Trials and “proof of concept” studies of DBS are underway in pain, epilepsy, tinnitus, OCD, depression, Tourette syndrome, as well as in eating disorders, addiction, cognitive decline, consciousness, and autonomic states. [2-7] In parallel, ongoing technological development will provide pulse generators with longer battery longevity, segmental electrode designs allowing a current steering, and the possibility to deliver “on-demand” stimulation based on closed-loop concepts.

While the future of brain stimulation is certainly promising for movement disorders and probably for some psychiatric disorders, brain stimulation as a technique may be at a crossroad between common sense and nonsense. Some reports indicate a disturbing trend with suggestions that future DBS may be proposed for enhancement of memory in healthy people, or even as a tool for "treatment" of "antisocial behaviour" and for improving "morality".[8]

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Pre- and postoperative evaluation and management of patients treated with deep brain stimulation

Maja Trošt, Milica Gregorič Kramberger
University Medical Centre Ljubljana, Department of Neurology, Ljubljana, Slovenia

Introduction. Treatment of various movement disorder syndromes with deep brain stimulation (DBS) tremendously improves quality of life in patients with advanced or medical treatment resistant syndromes. Careful patients' selection, optimal targeting and multidisciplinary pre and postoperative patients' management are key elements for best symptom's control.

Methods. Pre and post-operative evaluation of motor and non-motor signs and symptoms was performed in 15 patients with Parkinson's disease (PD), 11 patients with dystonia (D), two patients with essential tremor (ET) and one Gilles de LaTourette syndrome (GTS) treated with DBS of various targets. Motor and non-motor signs and symptoms were evaluated with neurological, psychiatrical and neuropsychological examination and relevant questionnaires. Pre-operative evaluation was performed 10 days before surgery. Post operative evaluations were performed at 1, 3, 6, 12, months after the implantation and then yearly.

Results. Treatment of PD, D, ET and GTS with DBS of subthalamic nucleus, globus pallidus int. (GPi), ventral intermedius thalamic nucleus and GPi, respectively brings significant improvement of motor and non-motor symptoms as well as disease related quality of life. Additionally, reduction in the drug intake is significant after DBS.

Conclusion. Detailed multidisciplinary pre- and postoperative evaluation and management of movement disorders patients treated with DBS is crucial for good treatment outcome and low rate of complications. It is however time consuming and calls for additional staff with specialized knowledge and experience.

DBS in PD patients with camtocormia case report and review of the literature

Darko Chudy
Klinička bolnica Dubrava, Avenija Gojka Šuška 6, 10 000 Zagreb

Bacground. Camptocormia is characterized by forward flexion of the thoracolumbar spine and may occur in various movement disorders like Parkinson's disease (PD). Camptocormia is a rare symptom in PD patients which occur in late stage of disease. Reports of deep brain stimulation (DBS) with bilateral stimulation of the subthalamic nucleus (STN) or globus pallidus internus (GPI) in PD patients with camptocormia indicate that significant improvement could be expected.
Objective. Two PD patients with camptocormia underwent bilateral STN DBS. The results was objectivized by measuring flexion angle before and after operation
Methods. A 67-year-old female and a 66-year-old male, with disease duration of 15 and 8 years and a follow-up period of 14 and 5 months, respectively. The position of electrode was verified with postoperative magnetic resonance imaging. The flexion angle was measured on preoperative and postoperative lateral view of patients.
Results. The degree of forward flexion of the spine has substantially decreased and the quality of life improved in both patients. There was no postoperative complication and position of active electrodes was within subthalamic nucleus.
Conclusion. Although the reported cases in literature are heterogeneous DBS of STN might be considered for treatment of camptocormia in PD patient.
Keywords. Camptocormia, deep brain stimulation, Parkinson's disease, subthalamic nucleus.

Estimating functional connectivity between the subthalamic nucleus and the motor cortex by intraoperative EEG-microelectrode coherence during DBS

Jurij Dreo, Zvezdan Pirtošek,
Laboratory for cognitive neuroscience, Department of Neurology, University medical center Ljubljana

Deep brain stimulation (DBS) is a functional neurosurgical procedure which involves the implantation of permanent electrodes into specific regions of the brain with the goal of treating various medication-resistant movement (Parkinson's disease, dystonia, tremor) and affective disorders (depression) and chronic pain. While the procedure is clearly effective in reducing symptoms and increasing patients' quality of life, its underlying mechanisms are poorly understood. In Parkinson's disease the implantation target for the stimulation electrodes is the subthalamic nucleus (STN). STN is functionally part of the basal ganglia and involved in the indirect-pathway of movement control. In the normal brain the indirect pathway prevents unwanted movements from competing with voluntary muscle contractions thus preventing hyperkinetic movements. In PD the lack of dopamine causes pathologic over-activity in the STN and in the indirect pathway, which in turn causes reduced excitation of the motor cortex. STN was thus chosen as a target for DBS in PD with the aim of reducing its pathologically increased activity. The DBS implantation procedure also involves intra-operative electrophysiological monitoring during which test electrodes are inserted into the brain with the aim of improved localization of the STN via a characteristic pattern of neuronal activity that is present in brain nuclei but not in white matter tracts. Monitoring the relationship between neuronal activity within the basal ganglia and the motor cortex opens up the possibility of refining our knowledge on the interplay between these two crucial elements of motor control. Standard DBS procedures also permit us to gather data on human subjects which would otherwise be inaccessible to such investigations. To probe the functional

connectivity between the STN and the motor cortex we recorded: A) from micro-electrode tips, which are mostly sensitive to close-by action potentials and are used to localize the previously mentioned nuclei-related neuronal firing pattern; B) intra-brain local field potentials which detect the summed electrical activity of larger cell populations and C) EEG activity above the motor cortex. We present data from two cases of intra-operative EEG and micro-electrode monitoring where we calculated spectral coherence between the local field potentials at the location of the micro electrode and EEG activity above the motor cortex with the aim of detecting possible coherent signals between these two regions of the brain. Discovery of such coherent signals might lead to a better understating of the neuronal mechanisms underlying PD and DBS and also possible improvements in intra-operative localization of the STN leading to improved DBS surgery outcomes for patients.

Neurophysiological monitoring during movement disorder neurosurgery

Zoran Rodi
University Medical Centre Ljubljana, Institute of Clinical Neurophysiology, Zaloška cesta 7, 1525 Ljubljana, Slovenia

During stereotactic procedures for the treatment of medically refractory movement disorders intraoperative neurophysiology is used to guide the surgeon's actions. Due to the small size, poor visualization, and physiological nature of these deep brain targets the surgeon is compelled to rely on physiological confirmation of proper anatomical targeting. In contrast to tumors, which are relatively large, and easily identified on CT or MRI, functional neurosurgical targets typically are small and poorly visualized with imaging modalities. Neurophysiological monitoring methods complement anatomical targeting by providing real-time electrophysiological data concerning probe position and the surgical target. These data are used by the surgeon and physiologist to "fine-tune" their anatomic targeting before completing the therapeutic intervention. The four most commonly employed techniques for physiologic localization during movement disorder surgery are: impedance measurements, macroelectrode recordings and stimulation, semimicroelectrode recording (and/or stimulation) and microelectrode recording (with or without stimulation). Whereas all these methods can accurately demarcate the boundaries of neural structures, they differ in potential to distinguish single-unit firing features characteristic for the given surgical target. Microelectrodes provide the most detailed picture of the neural elements encountered during movement disorder surgery, providing invaluable data concerning electrode position. Studies showed that the microelectrode recorded target was more than 4 mm removed from the site that was originally selected on the basis of stereotactic MRI.

Mania after STN DBS in Parkinson‘s disease: case report

Tadej Strojnik (1)**, Dušan Flisar** (2)
Department of Neurosurgery (1) **and Department of Neurology** (2)**, University Clinical Centre Maribor, Ljubljanska 5, 2000 Maribor, Slovenia**

Deep brain stimulation (DBS) of the subthalamic nucleus (STN) reduces motor symptoms in patients with Parkinson’s disease (PD) and improves their quality of life; however, the effect of DBS on cognitive functions and its psychiatric side-effects are still controversial.
We reported a case history of a 44-year-old man with PD who developed mania after DBS of the bilateral STN. No complications were observed at the time of surgery. After a week the IPG was turned on and although his motor symptoms improved he became restless and manic. During next two days the frontal disinhibition in the patient became disruptive and he was transferred to the department of psychiatry with the stimulation off. Three weeks later we started with the stimulation of the right STN and the results on the left side were good with no symptoms of PD. After few days the mood disorder progress (excitement, agitation, even aggression) and he was re-admitted to the department of the psychiatry. The bipolar disorder was observed and medically treated. Lowering voltage of STN stimulation was associated with depression in the patient, so the voltage intensity was increased back to 3.0 V. The improvement in motor function after DBS was unchanged. Four months later, a neuropsychological assessment revealed psychoorganic syndrome accompanied by disinhibition and infantility.
Recent analysis in published data revealed, that ventromedial electrode placement has been most consistently implicated in the induction of STN DBS-induced mania. Additional clinical correlates may include unipolar stimulation, higher voltage (>3 V), male patients and/or early onset PD.
In order to secure a favorable risk – benefit ratio for individual patients, careful patient selection is necessary.

Neurosurgical instrument's development in terms of ergonomics and technical requirements

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University of Maribor, faculty of Mechanical Engineering, Smetanova 15, SI-2000 Maribor, Slovenia (1)
Department of Neurosurgery, University Clinical Centre Maribor, Ljubljanska 5, 2000 Maribor, Slovenia (2)

The development of new microdrive was triggered by previously used and often malfunctioning microdrive in the University Clinical Centre in Maribor. The instrument consisted of many small parts, which have to be disassembled for sterilization purposes. Practical use of the microdrive has on several occasions revealed some serious engineering errors that caused repeated malfunctions of the microdrive during a neurosurgical procedure.
After analyzing the existing device, a decision was made to design and produce a new microdrive that would address and resolve the detected problems:

- designing a new mechanism for tightening the tubes and eliminating the problem of jamming of the tubes;
- repositioning the rotating knob for better handling;
- eliminating the need of assembling the components by the surgeon right before operation;

- replacing the fixing screws with a more practical solution to avoid the possibility of buckling;
- the design should not require any additional tools to operate the device.

The solution has been compiled out of many well-known principles with some unique approaches and solutions that enabled the authors to file a patent application for the new device.
The unique solution in this device is a collet chuck system, which holds the electrode sleeves securely and allows smooth passage during incremental penetration of the microelectrodes. This significantly shortens the duration of operation and enables us not only to ensure a smoother course of the procedure but also more precise microelectrode placement.

New Aspects in Invasive Stimulation Therapy
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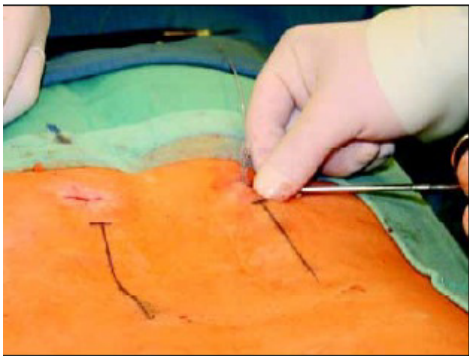
There are numerous examples in which peripheral area stimulation has been applied successfully, for example with chronic back pain.
Minimally invasive procedures are well suited for test stimulation.
Studies show a clear reduction in pain and a reduction in the use of opioids.

In neural stimulation various types need to be differentiated: stimulation directly into the area of the epidural through the spinal cord or directly onto the appropriate nerve root; motor cortex stimulation – the direct stimulation of the peripheral nerves, for example the sciatic nerve, radial nerve radialis; or the so-called peripheral field stimulation, in which patients are given a minimally invasive subcutaneous stimulation.

Subcutaneous peripheral field stimulation

The subcutanous peripheral field stimulation is indicated in any case in which the nerves in the area to be stimulated are not clearly defined or lay in an area that is not supplied by 1 or 2 peripheral nerves. The electrodes are placed centrally in the subcutaneous tissues of the painful region but not placed too deeply as then the patients are not able to feel anything; however if they are placed too near the surface then the patients feel a burning pain. The electrodes can be placed either under general anesthesia or local anesthesia. It is important that the patients feel a paraesthesia sensation in the affected pain area. Placing the electrodes is followed by a test phase of 2 – 3 weeks either in the hospital or at home. If the patient has at least a 50% reduction in pain, then the electrodes can be connected to a puls generator.
In patients with axial neck pain and low back pain, it appears that the subcutaneaous peripheral field stimulation leads to a clear reduction in pain. In patients with a higher body-mass-index, it makes sense to use ultrasound-directed subcutanoues placement. Alexander Yakovlev et al. could show that in patients with post-laminectomy syndrome the implantation not only resulted in a clear reduction in the pain scores but also that, for most of the patients, the use of opioids could be stopped entirely over a certain period of time. Yakovlev concluded from his study that peripheral nerve stimulation represents an alternative method in patients with low back pain that is difficult to treat, and he would like to have more prospective studies.
Mechanism: Peripheral subcutaneous field stimulation seems to work with low-frequency as well as high-frequency impulses. The mechanism is not similar to the transcutaneous electrical nerve stimulation (TENS). The effect hypothesis behind it is that the peripheral

subcutaneous field stimulation seems to have a central modulating effect on the anterograde activation of A- B and A- δ fibers. Besides a local effect of the stimulation on the nerve supply of the dermatome, the electrical stimulation also has a direct local anti-inflammatory and membrane de-polarizing effect and reduces the sensitivity to the circulating catecholamines.



Successful examples

Sator-Katzenschlager, et al. published a retrospective analysis of subcutaneous field stimulation with data from 5 Austrian centers (n=111). Indications for subcutaneous field stimulation were low back pain (n=29), failed back surgery syndrome (n=37), pain in the cervical region (n=15 patients) and post-herpes neuralgia (n=12). It could be clearly shown that in patients whose pain scores were 8.2 before the implantation, after 3 months the pain scores could be reduced to 4. In addition the use of opioids was reduced. Among the complications were dislocation of the electrodes in 14 patients (13%), infection in 7 patients (6%) and electrode breakage in 6 patients (5%).

Our own study data: we conducted an international prospective multicenter study ourselves. (Austria: 11 centers, Switzerland: 2centers). Inclusion period march 2008 to March 2011. Inclusion criteria were patients who were not adequately responding to medicinal therapy and patients with pain for more than 6 months. Patients with the form of pain “low back pain”, post-zoster neuralgia, tension headaches, trigeminal neuropathy, upper-cervical syndrome, occipital neuralgia, cluster headache and migraines could not have had subcutaneous peripheral field stimulation before the study. The end points were pain reduction (VAS), quality of life (SF 12), functional disruption due to back pain (Oswestry score), depression (Beck Depression Inventory) as well as the effects of the medication were also evaluated. 118 patients were treated for chronic back pain; of these, 71 patients were still in treatment at the time of 6 months afterwards. The follow-up examinations were at the intervals of 1, 3, 6 and 12 months after the electrode implantations. The median age of the patients was 56.6 years.

The screening phase averaged 10.3 days (within a period of 7-21 days) and covering the pain area via parathesia was evaluated at 83.1%. After 12 months, the average pain reduction was 43.9%. The use of opioids was reduced on the average of 41%. Even the Oswestry-score improved with the patients by 11.4%. Oswestry score, quality of life and the Beck depression index was clearly improved. This means that a better pain reduction in the beginning brings a better result for pain reduction, functions, quality of life and depression in the long run. The results were very surprising. In the first 6 months, 4 patients had to have the electrodes removed due to infection; in one patient the impulse transmitter caused skin irritation; 2

patients experienced aggravating stimulation; and further, in 3 patients there was a loss of effect.

Summary. Subcutaneous peripheral field stimulation constitutes an enrichment in the treatment of back pain. The method is minimally invasive with minimal side effects. Thus in our opinion, subcutaneous peripheral field stimulation should be implemented before using oral or transdermal opioids. It is important to conduct a test phase to find out whether the patient, at the beginning, is a responder or not.

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Our experience with spinal cord stimulation for chronic pain

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Introduction. The mode of action of spinal cord stimulation (SCS) is complex and certainly includes multiple mechanisms. It probably involves a cascade or sequence of effects, which have not yet been fully mapped. The possible mechanisms of action of SCS are discussed and we analyzed the outcome of pain treatment with the (SCS) at our institution.
Patients and Methods. A retrospective analysis involved 29 patients (12 men and 17 women, median age 51 years) suffering from neuropathic pain. They were treated with the SCS over a 9-year period at the Department of Neurosurgery, University Clinical Centre Maribor. Their pain intensity, clinical alteration in pain relief, functional disability, employment status, analgesics consumption and complications were evaluated.
Results. The median follow-up after the SCS was 48 months. According to Visual Analogue Scale (VAS) measurement, pain intensity before the SCS was scored between 7 and 10, median value 8. After the SCS, the VAS scores ranged between 3 and 7, median value 4 ($p<0.001$). A reduction in postoperative drug consumption was evident. All employed patients returned to work. Results of functional disability measured according to Oswestry Disability Index (ODI) ranged from 18% to 78% with the mean value of 39% (moderate disability).
Conclusions. SCS may be effective in some pain syndromes otherwise resistant to treatment. It is well tolerated for patients, minimally invasive, reversible and with few side effects as compared to chronic pharmacotherapy. We believe that SCS at present is an under-used treatment modality.

The role of SCS in chronic pain management

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Izvleček. Stimulacija zadnjih stebričkov hrbtenjače z vgrajenim sistemom je pomemben del algoritma zdravljenja nevropatske in ishemične bolečine. Metoda je učinkovita in stroškovno utemeljen način zdravljenja, ki se lahko uporablja v obravnavi številnih bolečinskih stanjih kot so radikularne bolečine, ki izvirajo iz ledveno – križne in vratne hrbtenice, bolečine po neuspešni operaciji na hrbtenici, periferne nevropatije, ishemična bolečina in kompleksni regionalni bolečinski sindromi. Uspešnost metode se temelji na predhodni timski obravnavi različnih strokovnjakov, izbiri in pripravi primernega bolnika, predhodnem testiranju stimulacije in primernem vodenju zdravljenja. V nekaterih državah za zdravljenje bolečine z stimulacijo hrbtenjače že imajo smernice, obstajajo pa tudi znanstveno utemeljeni podatki.

The role of SCS in chronic pain management

Summary. Spinal cord stimulation is notable part of the treatment algorithm for patients suffering from neuropathic and ischemic pain. The method is efficacious, cost-effective option that should be used in the treatment continuum in many pain states such as lumbar and cervical radiculopathy, failed back surgery syndrome, peripheral neuropathy, ischemic pain, and complex regional pain syndrome. The success of SCS treatment depends on a robust multidisciplinary approach to patient selection, preparation and management, testing period and appropriate control of treatment. In some countries guidelines for SCS treatment already exist as well as evidence based data.

Uvod

Kronična bolečina prizadene četrtino prebivalstva sveta (1,2). Stanja kronične bolečine so številna in najpogosteje predstavljajo bolezenska stanja. Kronična bolečina je bolezen, ki povzroči bolniku trpljenje in spremeni njegovo življenje v družini in družbi. Kronična bolečina je tudi veliko breme za družbo, ker pomeni manjšo produktivnost družbe in velike direktne in indirektne stroške zdravljenja. Zdravljenje kronične bolečine pa je še prepogosto nezadostno učinkovito in neorganizirano, saj bolniki v iskanju pomoči obhajajo številne medicinske strokovnjake, uporabljajo se številne metode zdravljenja, ki vedno niso strokovno in znanstveno utemeljene (3). Sodobni principi obravnave kronične bolečine se temeljijo na prepoznavanju vzroka in patofiziologije bolečine, ki omogočajo zdravljenje mehanizma bolečine in na osebnostno usmerjenem zdravljenju, ki bolniku izboljša tista področja vsakodnevnega življenja, ki so mu najpomembnejša. V zdravljenju kronične bolečine je zato udeleženo večje število medicinskih strokovnjakov, ki delujejo usklajeno in se med seboj dopolnjujejo. V metodah zdravljenja se če dalj bolj uveljavljajo metode nevromodulacije in intervencijske tehnike. Te metode zdravljenja se lahko izvajajo v specializiranih centrih in so povezane z večjimi finančnimi stroški ter so zato manj dostopne , tudi ko predstavljajo zadnjo izbiro lajšanja bolečine. Ena od metod nevromodulacije je električno draženje zadnjih stebrov hrbtenjače (spinal cord stimulation – SCS), ki obsega okrog 70% od vseh nevromodulacijskih posegov (4,5,6). Za izvajanje invazivnega nevromodulacijskega zdravljenja so že izdelana različna priporočila (7,8,9,10).

V prispevku so opisani mehanizmi lajšanja bolečine z SCS, vodila za izbiro primernih bolnikov, učinkovitost in ekonomski oziri ter zapleti pri zdravljenju bolečine z SCS – podatki, ki opredeljujejo vlogo SCS v zdravljenju kronične bolečine.

Mehanizmi delovanja SCS

SCS deluje na nevrofiziologijo in nevrokemijo bolečinskega prenosa in reverzibilno vpliva na prenos bolečinskega dražljaja po živčnih poteh v hrbtenjači in višjih centrih. SCS izzove električno aktivacijo debelejših aferentnih živčnih vlaken v zadnjih stebrih hrbtenjače ali zadnjih živčnih koreninah, katera lahko zavirajo prenos bolečinskih dražljajev v nociceptivnih vlaknih C in Aδ. Klinične raziskave in praktične izkušnje so pokazale, da SCS ima večjo učinkovitost za lajšanje nevropatske bolečine, kot za lajšanje nociceptivne bolečine. Zato se analgetična učinkovitost ne more razložiti samo na osnovi Meltzakove teorije vrat (11).

Ob direktnem zaviranju prenosa bolečinskega signala po teoriji vrat v hrbtenjači SCS deluje tudi na prenos in sooblikovanje bolečinskega impulza supraspinalno, v podaljšani hrbtenjači, možganskih jedrih in somatosenzoričnem korteksu, kjer stimulacija aktivira endogene zaviralne živčne poti (12,13). Sooblikovanje prenosa bolečinskega impulza traja dlje časa, kar govori da so prisotne tudi spremembe v lokalnem sistemu živčnih prenašalcev. Verjetna živčna prenašalca teh mehanizmih sta GABA in adenozin. Možni živčni prenašalci, ki sodelujejo v učinku SCS so serotonin, noradrenalin in snov P.

Ni še dosti dokazov kako nastane avtonomni učinek. Pri ishemični bolečini SCS ima kurativni učinek ker z vazodilatacijo in izboljša krvni obtok.

Indikacije in dejavniki, ki vplivajo na uspešnost SCS

SCS je invazivna metoda zdravljenja in kot takšna ni primarna. SCS je reverzibilna in minimalno invazivna metoda zdravljenja bolečine, ki ima namen olajšanje trpljenja, izboljšanje funkcije, zmanjšanje uporabe medicinskih storitev, zmanjšanje uporabe zdravil, predvsem opioidov in izboljšanje kakovosti življenja (14). Uspešnost zdravljenja z SCS sloni na pravilno postavljeni indikaciji na osnovi vzroka bolečine, odzivnosti na različne vrste zdravljenja bolečine in dobrega poznavanja bolnikovega zdravstvenega, psihičnega in socialnega stanja. Izbira primernih bolnikov z SCS je najpomembnejši dejavnik za izid zdravljenja.

SCS je učinkovita za lajšanje nevropatske bolečine. Najpogostejše se uporablja za lajšanje bolečine po neuspešni operaciji na hrbtenici in radikularne bolečine in kompleksnega regionalnega bolečinskega sindroma. Takojšnja in dolgotrajna učinkovitost je dokazana v številnih randomiziranih kontrolnih študijah in prikazana v več sistematičnih pregledov in se ocenjuje na 40 -55% (5,6,15). Kompleksni regionalni bolečinski sindrom je druga najpogostejša indikacija za SCS. Okrog 80% bolnikov ima olajšanje bolečine z več kot 50% (16). Učinkovitost opisujejo trudi pri lajšanju periferne nevropatije, fantomske bolečine anginozne bolečine in ishemične bolečine udov.

Izbira bolnikov za SCS

Večina bolnikov s kronično bolečino, ki ni odzivna na konvencionalno zdravljenje ima vrsto dolgotrajnih težav, ki so somatske in psihične. Zato pri ocenjevanju primernosti bolnika za SCS morajo sodelovati različni specialisti, ki ocenijo bolnikovo splošno zdravje, fizično stanje in prisotno stanje bolečine ter njegovo psihološko in socialno funkcioniranje. Razumevanja učinka psihiatrične bolezni je zelo pomembno ker 20% -45% bolnikov s kronično bolečino trpi sočasno psihiatrično bolezen (17). S psihološkim testiranjem se identificirajo bolniki, ki niso primerni za SCS (psihoze, shizofrenija, huda depresija, odvisnost) in bolniki, ki imajo subklinične motnje in jim te predstavljajo relativno tveganje za dober izid SCS terapije. V Študiji Wolterja in sodelavcev niso ugotovili signifikantne razlike na učinkovitost SCS med bolniki z depresijo in strahom in tistimi, ki niso imeli te motnje (18). Taylor in sodelavci enko tako niso ugotovili vpliv mesta bolečine in tehnike stimulacije na izid zdravljenja (19). Med prognostične dejavnike sodi etiologija bolečine, eni ugotavljajo, da je pomembno trajanje bolečine, število operativnih posegov in vrsta stimulacije (20).

Bolnik mora biti dobro seznanjen o načinu in vodenju zdravljenja in mora imeti realna pričakovanja. Pravilnost izbire bolnika za SCS se dodatno ugotovi z obdobjem testiranja učinkovitosti SCS v času katerega bolnik mora navesti vsaj 50% olajšanje bolečine in izboljšanje kakovosti življenja (21).

Učinkovitost in ekonomski aspekti SCS

Učinkovitost SCS je ugotovljena v zdravljenju različnih stanj kronične bolečine, predvsem nevropatske, ishemične in koničnih regionalnih bolečinskih sindromov.

V raziskavah so primerjali učinkovitost SCS v primerjavi z rehabilitacijskimi programi, konvencionalnim zdravljenjem bolečine in operativnim zdravljenjem bolečine. SCS se je izkazala kot dolgotrajno bolj učinkovita in bolnikom izboljša kakovost življenja. Bolniki z učinkovito SCS imajo bistveno manjšo potrebo po drugih zdravilih za lajšanje bolečine in po rehabilitacijskih programih, lahko so delovno aktivni in potrebujejo na sploh manj medicinske oskrbe, kar dolgotrajno pokaže ekonomski prihranek v zdravstvu. V dveh novejših prospektivnih študijah so ugotovili, da zdravstveni stroški in stroški delovne invalidnosti pri bolnikih z SCS niso bistveno drugačni kot pri bolnikih, ki so zdravljeni brez SCS (15, 25).

O primernosti uporabe SCS obstajajo znanstveno utemeljeni podatki: za FBBSS kot 2A, CRPS kot 2B+, za PHN kot 2C+, anginozno bolečino kot 2B+, periferno ishemično bolečino udov kot 2B+ in kronični pankreatitis kot 2C+ (9).

Splošno velja, da vsi bolniki, ki bi imeli od SCS korist, nimajo dostopa do takšnega zdravljenja. Čedalje bolj se tudi ugotavlja, da ne predstavlja zadnjo izbiro in bi se pri primernih bolnikih morala uporabiti prej (26). Situacija bi se lahko bistveno izboljšala z nacionalnimi plani zdravljenja kronične bolečine in smernicami za uporabo SCS v katerih bi opredelili primerne in neprimerne bolnike, način kontrole zdravljenja in izvajanje zdravljenja po principih najboljše klinične prakse.

Zapleti z uporabo SCS

Resni zapleti so redki, manjši pa dokaj pogosti. Redki resni zaleti so nevrološke okvare in infekcija. Med zgodnje zaplete sodijo: krvavitev v epiduralnem prostoru, infekcija rane, infekcija v epiduralnem prostoru. Možni poznejši zapleti so: migracija elektrode, fraktura elektrode, likvorska fistula in meningitis.

Zaključek

SCS ima svoje mesto v zdravljenju kronične nevropatske bolečine zaradi učinkovitosti, stroškovne upravičenosti in znanstvene utemeljenosti. Predvsem iz ekonomskega aspekta jo še vedno uvrščajo med zadnje izbire zdravljenja, medicinsko gledano pa je čas izbire SCS utemeljen tudi prej v kontinuumu zdravljenja kronične bolečine. Dostopnost do te metode zdravljenja je še omejena.

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Treatment of spasticity and neuropathic pain with intrathecal programmable pump - Experiences from the Ljubljana University Rehabilitation Institute

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Background/aims. Complete intrathecal drug delivery programme for treatment of intractable spasticity and pain is available at Institute for Rehabilitation Ljubljana for last eleven years. From the year 1993 to 2000, few patients were transferred abroad (Austria) for pump implantation. Current programme is run by dedicated therapy unit, which is a national referral center and consists of multidisciplinary team that serves for the nation´s population of two million. The aim of the review is to present the experiences with demographic and clinical characteristics of patients, type of treatments and treatment related complications in population of patients with intrathecal pumps at University rehabilitation Institute.

Methods. Review of the documentation of all patients after implantation of intrathecal delivery pump. Demographic data, diagnosis, time since implantation, type of drug, dose, concentration and complications connected to pump or follow up were extracted.

Results. Demographic data: Together 68 patients with baclofen or morphine intrathecal delivery pump were treated for intractable spasticity in Slovenia since 2001.

From current population of 57 patients, there are 52 patients receiving baclofen only, two patients receiving polyanalgetic mixture of morphine, clonidine and baclofen and three patients receiving morphine only with intrathecal delivery pump.

Average age in current population is 41.6 yrs (9-74). The leading pathology in the population is spinal cord injury/vertebral disease (24/57), followed by acquired brain injury (12/57), multiple sclerosis (11/57), cerebral palsy (8/57) and cerebrovascular disease (2/57). Eight patients died since the beginning of the programme and no death was connected with the ITB pump treatment. In three cases definitive pump explantation was decided, due to sepsis (1/3), skin perforation (1/3) and discontinued need for therapy (1/3).

Treatment: Average dose of the daily baclofen is 351 micrograms (70 – 1.500) and average intrathecal dose of daily morphine in five pain patients is 9,0 mg.

Average pump inter-refill period in spastic and pain patients is 135 days, which on average means three refill sessions per patient per year.

Complications: performance period of all pumps implanted is 260 „pump years“ in 56 long term followed up patients (one patient is followed up for one year only).

One drug application related and life threatening complication occurred in patient with analgetic mixture, during refill of a single pump manufactured by another than all other pumps provider.

Thirteen catheter-related revisions in 10 patients were needed due to migration of the tip of the catheter epidurally, three patients had implanted system infected and in one patient the revision of subcutaneous pocket was done due to aseptic cellulitis. In 14 patients we performed CT w/ contrast scan of the system due to suspected catheter problems and we confirmed that in 10 patients. Ten patients needed to be hospitalized in rehabilitation unit after discharge from neurosurgery department.

Four premature pump re-implantations were needed due to pump related technical complications:

- in one pump end-of-battery-life warning was displayed despite only half of the expected battery life time passed.

- in one pump there was a progredient roller failure with concurrent high residual volume in reservoir and evident signs of baclofen withdrawal syndrome despite raising the daily dose, but without complete pump stall and without critical alarm triggered. Technical analysis of the pump confirmed corrosion of metal parts and destruction of tubing system.
- in one pump there was an abrupt pump stall with two self-recoveries and in third pump stall no recovery action occurred. Technical analysis of the pump confirmed corrosion of metal parts and no information is available about the status of a tubing system.
- In one pump there was an abrupt pump stall with critical alarm triggered and without recovery episode. Just after explantation the recovery of the roller action occurred without any clear reason. Pump was sent for analysis and no information is available yet.

Conclusion. Number of patients treated with intrathecal drug delivery device in two centers in Slovenia is 30,5 / million and current needs seems to be 10 - 15 first pump implantations per year in the population of two millions. Majority (42 %) of all patients treated, had spasticity or intractable pain due to spinal cord injury. The number of all complications needed surgical intervention and/or hospitalization in Slovenian population is 22 in 260 pump years, which means ratio of one complication in 11,2 „pump years". Major part of complications happened in early period of intrathecal therapy programme and due to catheter problems. All four pump-related technical complications occurred in last three years and all three pump roller failure occurred in inside last one year.

Use of radiofrequenci ablation for pain treatment

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Introduction. Radiofrequency ablation (RFA) is a procedure using radio waves or electric current to generate sufficient heat to interrupt nerve conduction. The effect of the treatment usually lasts 6 – 12 months. It is most often used for patients with pain along the lumbar or cervical spine which has its origin in the facet joints of the spine. Before performing RFA a diagnostic block has to be positive. (1,2).

Aim of the study. The aim of our retrograde study was to evaluate the effectiveness of diagnostic blocks and RFA for the treatment of cervical and lumbar pain.

Materials and methods

152 patients with chronic back (95%) or neck pain (5%) were enrolled in the study, all of them got a diagnostic medial branch block with 1% lidocain (0.5 to 2 ml). In 32 patients in which the diagnostic block was positive, we performed RFA of the medial branch in the lumbar region.

Results. One week after the diagnostic procedure 103 (67,7%) of the patients had significant less pain, 42 (27,7%) felt no change and 7 (4,6%) patients reported that the pain was stronger. One month after the procedure 63 patients still experienced less pain, 28 felt no change and there were no patients who described their pain as worse. We couldn't get the data from 61 patients after one month. From 32 patients treated with RFA 18 (56%) described the procedure as effective and 14 (44%) patients did not notice any difference after the RFA of the medial branch. There were no major complications.

Conclusion. RF ablation and even diagnostic blocks can be effective for pain treatment in carefully selected patients. At right application RFA is a safe method for treatment of

resistant cervical and lumbar pain. These procedures are an adjunct treatment, which facilitates participation in an active exercise program.

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Twiddler's syndrome in spinal cord stimulation. A case report and review of the literature

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Introduction. Voluntary or involuntary manipulation of an implantable pulse generator (IPG) within its subcutaneous pocket can lead to migration of the transducer wires and permanent malfunction of the device. This so called Twiddler's syndrome has been described in some forms of electrical neuromodulation including for pacemakers, implantable cardioverter-defibrillators and deep brain stimulators. The syndrome may also occur in spinal cord stimulator devices.

Case report. A 37-year-old women presented to the department of neurosurgery for evaluation of her spinal cord stimulator six months from the implantation. Indication for spinal cord stimulation for this patient was failed back surgery syndrome. Two weeks before the admission, she had experienced a failure of spinal cord stimulators during the walk. She denied having the exertion or the trauma. A control X-Ray revealed the twisting of extension wires. The Twiddler's syndrome was confirmed during subsequent revision of the system, when disconnection of the electrodes from the wires have been detected. After the correct model of the extension wires had been delivered, we replaced them and connected to the electrodes and the IPG. After the surgery, the previous result of the spinal cord stimulation was achieved.

Conclusion. Twiddler's syndrome can be expected at any subcutaneously implanted device accessible for patient manipulations. In the literature some authors suggest implanting the IPG in the gluteal region subcutaneously above the iliac crest. This approach has the added advantage of easier access the spine and tunneling in the prone position.

Neuromodulation for complex regional pain sndrome

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Izvleček. Kompleksni regionalni bolečinski sindrom (KRBS) je bolečinski sindrom z nejasno patofiziologijo in nepredvidljivim kliničnim potekom. Za klinično sliko KRBS je značilna huda bolečina, ki jo spremljajo senzorične, motorične in avtonomne motnje, praviloma povezane s trofičnimi spremembami. Zdravljenje je treba začeti čim prej, usmerjeno je v povrnitev funkcije obolelega uda in zmanjšanje bolečine. Začetno zdravljenje vključuje fizikalno terapijo in farmakološko zdravljenje bolečine. Če ne pride do izboljšanja stanja, potrebuje bolnik multidisciplinarni pristop, v sklopu katerega se priporočajo tudi invazivne metode. Med invazivne metode spada tudi nevromodulacija. Od nevromodulacijskih tehnik se priporoča električna stimulacija hrbtenjače, če ostalo zdravljenje ne olajša bolečine in izboljša

funkcije (2B+). Nekaj raziskav je tudi na področju intratekalnega dovajanja zdravil, predvsem pri distoniji v sklopu KRBS.
Ključne besede: kompleksni regionalni bolečinski sindrom, intervencijske metode, nevromodulacija, električna stimulacija hrbtenjače, intratekalno dovajanje zdravil

Abstract. Complex regional pain syndrome (CRPS) is a pain syndrome with an unclear pathophysiology and unpredictable clinical course. Clinical picture is characterized by severe pain and disturbances of sensory, motor and autonomic function that may be associated with trophic changes. Pharmacological pain management and physical rehabilitation of limb function are the main pillars of therapy and should be started as early as possible. If there is no improvement, interventional pain management techniques may be considered, including neuromodulation. Among neuromodulation methods spinal cord stimulation is recommended if other treatments fail to improve pain and dysfunction (2B+). There are also some studies supporting the use of intrathecal drug delivery for CRPS- related dystonia.
Key words: complex regional pain syndrome, interventional treatment, neuromodulation, spinal cord stimulation, intrathecal drug delivery

Uvod

Kompleksni regionalni bolečinski sindrom (KRBS) je bolečinski sindrom z nejasno patofiziologijo in nepredvidljivim kliničnim potekom. Za klinično sliko KRBS je značilna huda bolečina, ki jo spremljajo senzorične, motorične in avtonomne motnje, praviloma povezane s trofičnimi spremembami. KRBS delimo na KRBS tip 1 (refleksna simpatična distrofija), ki ga sproži blaga poškodba tkiva in KRBS tip 2 (kauzalgija), kjer so poškodovani tudi živci. Zdravljenje je treba začeti čim prej, usmerjeno je v povrnitev funkcije obolelega uda in zmanjšanje bolečine. Začetno zdravljenje vključuje fizikalno terapijo in farmakološko zdravljenje bolečine[1]. Če ne pride do izboljšanja, potrebuje bolnik multidisciplinarni pristop, v sklopu katerega se priporočajo tudi intervencijske metode, kamor spada tudi nevromodulacija. Od nevromodulacijskih tehnik je največ raziskav narejenih z električnim draženjem hrbtenjače (spinal cord stimulation-SCS). Nekaj raziskav je tudi na področju intratekalnega dovajanja zdravil.

Nevrostimulacija

Električna stimulacija hrbtenjače (spinal cord stimulation – SCS) je sprejeta in učinkovita metoda za kronično bolečino pri bolnikih s KRBS, ki ne reagirajo na zdravila, fizikalno terapijo in manj invazivne posege ter potrebujejo bolj agresivno zdravljenje bolečine. Pred vstavitvijo trajne elektrode se praviloma uvede začasna testna elektroda. Če je test pozitiven, se nato kirurško vstavi trajna elektroda. Vstavitev testne elektrode in sledeča implantacija trajne elektrode sta invazivna posega z možnimi komplikacijami kot je npr. premik elektrode in bolečina zaradi pulznega generatorja. Komplikacije te metode opisujejo pri 31-38% bolnikov v prvih dveh letih stimulacije.[3]

Izbira ustreznih bolnikov za to metodo je pomemben dejavnik pri uspehu zdravljenja. Van Eijs in sodelavci[4] so raziskovali napovedne dejavnike za uspešno zmanjšanje bolečine pri bolnikih s KRBS in električno stimulacijo hrbtenjače. Ugotovili so, da je prisotnost alodinije pri potegu s čopičem (brush-evoked allodynia), ki govori za centralno senzitizacijo, negativni napovedni dejavnik za uspeh terapije.

Obstaja tudi več opisov primerov, zajetih v sistematskem pregledu,[5] ki kažejo na korist električne stimulacije hrbtenjače pri bolnikih s KRBS. V povprečju 67% bolnikov z električno stimulacijo hrbtenjače navaja vsaj 50 % zmanjšanje bolečine.

V kontrolirani randomizirani raziskavi, ki je vključevala bolnike, ki so jim poleg fizikalne terapije uvedli tudi elektrodo za električno stimulacijo hrbtenjače, je prišlo do večjega

olajšanja bolečine kot pri bolnikih, ki so opravljali samo fizikalno terapijo.[6] Pozitiven učinek na zmanjšanje bolečine je bil prisoten še 2 leti po implantaciji.[7] Prav tako se stroškovna učinkovitost te metode pokaže po dveh letih.[8] Učinek električne stimulacije hrbtenjače na bolečino pa se lahko zmanjšuje s časom. Pet let po začetku zdravljenja so bile razlike med skupinama manjše, še vedno pa je 95% bolnikov z SCS povedalo, da bi se še enkrat odločili za takšno zdravljenje.[9]

Intratekalno dovajanje zdravil

Intratekalno dovajanje zdravil pri KRBS je opisano samo pri manjših skupinah bolnikov, randomiziranih kontroliranih raziskav zaenkrat ni. Intratekalni baklofen se uporablja pri bolnikih s KRBS, pri katerih se je pojavila distonija, povezan pa je z velikim številom zapletov.[10] Intratekalni zikonotid je obetajoča terapija pri bolnikih z refraktarno bolečino pri KRBS, vendar so potrebne še dodatne raziskave.[11]

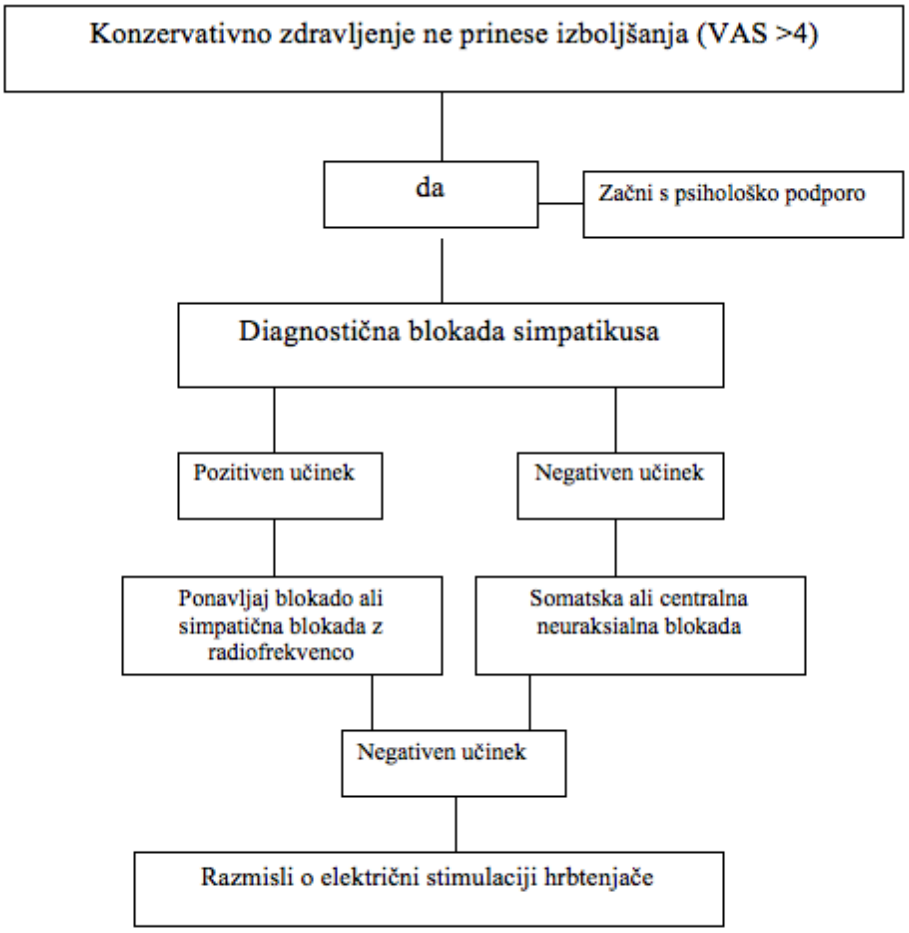

Tabela 1. Klinični algoritem za invazivno zdravljenje KRBS. Povzeto po van Eijs in sod.[2]

Z dokazi podprta priporočila za nevromodulacijske tehnike pri kompleksnem regionalnem bolečinskem sindromu.
Algoritem za klinično uporabo priporočil za invazivne posege pri KRBS prikazuje Tabela 1.[2] Električna stimulacija hrbtenjače se priporoča, če ostalo zdravljenje ne olajša bolečine in izboljša funkcije, stopnja priporočila za to metodo je 2B+[2]. Za ostale nevromodulacijske tehnike je narejenih še premalo raziskav, zato nimamo z dokazi podprtih priporočil za njihovo uporabo in so potrebne še nadaljnje raziskave.[12]

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Hearing preservation with the hybrid cochlear implant (electroacoustic stimulation). Case report

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Introduction. In the last years beside the cochlear implants also hybrid cochlear implants were developed. Typical preoperative hearing loss of candidates for hybrid cochlear implant ranges from mild to moderate hearing loss in the low frequencies (up to 500 Hz) and severe to profound hearing loss in the mid and high frequencies (above 1500 Hz). Usually the patients have limited or no benefit from hearing aids and their word discrimination score is between 10 – 60%. These patients often don't use the hearing aids at all, because they do not hear well in the middle and high frequencies.
Purpose. We present a surgical technique and the patient who was implanted with the hybrid cochlear implant at our institution.

Patient. 8- year old boy presented with the symmetric hearing loss which was profound in middle and high frequencies and moderate in low frequencies. Because of that his speech development was impaired. We inserted a hybrid cochlear implant with a hearing preservation electrode with an atraumatic insertion technique through the round window and succeeded to preserve his residual hearing. He adapted well to the use of hearing aid and cochlear implant and significantly improved understanding of the high frequency words and sentences.
Conclusion. Electroacoustic stimulation can significantly improve the understanding in patients with moderate hearing loss in low frequencies and severe hearing loss in high frequencies.

Neuromodulation for cancer pain
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Napredki sodobnega zdravljenja omogočajo, da bolniki z rakavo bolečino živijo še dolgo po začetni diagnozi, bodisi popolnoma ozdravijo ali pa je rakava bolezen zazdravljena. Bolečina, ki jo lahko kljub temu doživljajo, je posledica osnovne maligne bolezni ali pa njenega zdravljenja. (1)
Obvladovanje rakave bolečine je bilo v večini farmakološko, kar je usmerjalo raziskovalce v proučevanje aktivnosti živčnih prenašalcev kot posrednikov za bolnikovo zaznavanje bolečine. Manjša pozornost je bila namenjena proučevanju električne aktivnosti možganov med zaznavanjem bolečine. Danes so lahko s slikovnimi preiskavami živčne aktivnosti možganov pokazali, da možgani oblikujejo lastno, notranje pogojeno aktivnost nevronov in prilagajajo zaznavanje bolečine glede na dotok podatkov preko senzoričnih živcev iz ostalega dela telesa.
Rakava bolečina je pogojena s spremembami zaznav iz ostalega dela telesa in s spremembami aktivnosti možganske skorje. Tako se je porodila ideja, da bi lahko s spreminjanjem aktivnosti možganske skorje, preko naravne sposobnosti možganov, da sami preoblikujejo aktivnost, vplivali na zaznavanje in dojemanje bolečine. (2)

Obstaja več različnih tehnik invazivnega lajšanja rakave bolečine, ki bi jih lahko v grobem razdelili v nevroaksialne in nevrolitične. V prvi skupini posegamo v subarahnoidni in epiduralni prostor, v drugem primeru pa k posameznim živcem oz. živčnim pletežem. Zdravila, ki jih dovajamo v subarahnoidni prostor, imajo pred sistemskimi zdravili več prednosti v smislu manj izrazitih neželenih učinkov in boljše kvalitete življenja. Dovajomo lahko opioidna zdravila, lokalne anestetike, klonidin, zikonotid. Razvoj pripomočkov za dovajanje zdravil sega že v 80. Leta. Danes so na voljo različne varne in zanesljive črpalke za dovajanje zdravil. V poštev pride tudi neposredno draženje možganov (globoka možganska stimulacija) in hrbtenjače (stimulacija zadnjih stebričkov).
Med nevrolitične uvrščamo nevrolizo simpatičnega živčnega sistema, celiakalnega pleteža, zgornjega hipogastričnega pleteža. (3)

Glede na topografijo delovanja pa nevromodulacijske tehnike razdelimo na cerebralne ali kranialne in ekstrakranialne, ki vključujejo subarahnoidne in periferne tehnike.(4)
Pri cerebralnih nevromodulacijskih tehnikah se naprave vstavlja v stik z

- Možgansko skorjo (stimulacija motorične skorje za bolečine)
- Globokimi možganskimi strukturami (globoka možganska stimulacija)
- Dovajanje narkotikov v možgane

Ekstrakranialne tehnike pa vključujejo:

1. Stimulacijo zadnjih stebričkov hrbtenjače
2. Nevroliza živčnih pletežov in posameznih ganglijev
3. Subarahnoidno dovajanje zdravil

Nezadostno zdravljena bolečina nedvomno vpliva na kakovost življenja. Ob izčrpanju klasičnega zdravljenja z zdravili, ki jih bolnik dobi na neinvaziven način, so nove možnosti za dovajanje zdravil zelo obetavne, sploh ker se kaže, da bo neželelnih sistemskih učinkov zdravil ob takem zdravljenju manj.
Dostopnost metode v Sloveniji pa je omejena s kapaciteto centrov, ki take metode izvajajo in zagotovo tudi s ceno.

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Patient treatment with elastomer pump at home

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Introduction. Pain in various forms is a phenomena by which the nurse is faced every day in Pain Clinic. Urgent and priority medical treatment requires the reception of a patient with carcinoma pain. One of the forms of palliative treatment and care of a patient with cancer pain includes continuous subcutaneous mixed drug infusion by using elastomeric pump at home. Emphasis is placed on the advantages of using such a method for applications to relieve carcinoma pain and other potential weaknesses and successful manage with them. Extremely important in nursing work in Pain Clinic is cooperation with patient social network, including family members, home care nursing service, and volunteers in Hospice care in the Celje region.

The aim of the case-study. The purpose of the case-study is to present specific skills and competences in everyday nurses work with patient, who suffering from cancer pain in a Pain Clinic. The purpose includes the advantages of using subcutaneous drug infusion with elastomeric pump and ways of dealing with potential complications and problems. We also want to emphasize the importance of integration with other health professionals and relatives, which is important for successful pain management and quality, dignified patient end-of-life care.

Research methodology. We will use qualitative case-study methodology to evaluate the case-study of patient in the terminal stages with continuous cancer pain-therapy by elastomer pump. This case-study of patient with cancer paining Pain Clinic required multidisciplinary approach, which includes participation with home care nursing service, patient personal doctor, other doctors specialists, Hospice care and active continuous communication with the patient family members.

Emphasis will be placed on the importance of effective communication between all members of the multidisciplinary team with a common vision of facilitating the patient's suffering.

Keywords. nurse, Pain Clinic, carcinoma pain, elastomeric pump, a visual analog scale (VAS), health education


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