NBS and NexSpeech featured in US TV series “Health Heroes”

Nexstim’s NBS System and NexSpeech were featured in the Health Heroes: Exploring Neuroscience series on the Discovery Channel in January this year. Video footage for the program was shot on location in California where the NBS System is installed at UCSF, San Francisco.

When talking about the NBS System in the program, Dr. Mitchel Berger, who is Professor & Chair of the Department of Neurosurgery at UCSF said, “What makes this so special is the ability for it to define very, very small, precise cortical regions on the surface of the brain, and define individual components of function which is something we never could do before. In my opinion it’s a breakthrough for all of us, not just in surgery but to the neurological clinical sciences as well.”

In the USA, pediatric hospitals have shown strong interest in the NBS System. In the episode Dr. Kurtis Auguste, Director, Pediatric Epilepsy Surgery Program, UCSF, explains, “I think it comes back to a very big theme with this technology, that is that it’s very kid-friendly...the way that nTMS benefits children is that it’s something that can be done with them just behaving normally and it’s not very frightening and certainly not painful.”

Dr. Auguste added, “The science behind what Nexstim does is solid and safe, and it’s been tested over and over again.”

NBS presurgical mapping warmly received in Saudi Arabia

In January 2013 the latest version of the NBS System with the NexSpeech module was installed by Nexstim’s distributor Amico Group at the Department of Neurosurgery at The Neuroscience Center, King Fahad Medical City, City of Riadh, Kingdom of Saudi Arabia. The system will be the responsibility of Dr. Lahbib Soualmi, Consultant Image Guided Neurosurgery, Director of Neuronavigation Unit and Intraoperative Surgical Imaging, National Neuroscience Institute (NNI), King Fahad Medical City, and Dr. Ahmed I. Lary, MD, FRCSC, Consultant Neurosurgery and Neuro-Oncology, National Neuroscience Institute (NNI), King Fahad Medical City.

The NNI is one of the largest neuroscience centers in the Middle East and serves to prevent and treat complex and under-served nervous system disorders in the region through well-integrated highly sub-specialized clinical multidisciplinary management programs providing state of the art diagnostic and therapeutic services. The neurosurgeons indicated that they are pleased to have the NBS System available and intend it for presurgical mapping of patients with brain tumors.

In January, Nexstim was present at the Arab Health 2013 in Dubai, where an estimated 80,000 healthcare professionals gathered for the Middle East’s largest healthcare event and during 2-4th April, the Amico Group will be showcasing the NBS System at the 7th SANS (Saudi Association of Neurological Surgeons) meeting in Jeddah, Saudi Arabia.
Record interest in NBS during 2012

With 15 peer-reviewed clinical papers first published, 2012 saw growing acceptance of navigated TMS as the new standard for preoperative cortical mapping for patients with brain tumors or other brain diseases. Clinical researchers in the United States, Germany, Spain, Finland and Italy added to the large body of evidence demonstrating the clinical utility of NBS for motor and speech mapping. The papers included NBS investigations in a total of 260 patients, covering the applications: motor area mapping in tumor and epilepsy, language area mapping and the use of NBS mapping results as seeding points for diffusion tensor imaging. Please see Nexstim web pages/Bibliographies for the complete list of articles published in 2012 and Clinical Spotlight below for summaries of four of the most recent papers published.

2012 also saw record attendance at the 4th International Symposium on NBS in Neurosurgery, jointly organized by the Charité-Universitätsmedizin, Berlin and the Neurosurgical Clinic of Munich Technical University. Held again in November in Berlin, Germany, the weekend event attracted 88 participants to the world’s preeminent meeting on navigated TMS for clinical neurosurgery. The fact that the first institutions using NBS have successfully mapped close to 400 patients, and several other hospitals are mapping a hundred patients per year, proves that the technique is no longer experimental at leading German institutions. The reimbursement code available from the start of 2013 should further solidify nTMS preurgical mapping as the new standard of care in preoperative neurosurgical planning in Germany.

Clinical Spotlight

Safety and effectiveness of NexSpeech for language mapping compared to mapping by direct stimulation during awake surgery

In the paper A Comparison of Language Mapping by Preoperative Navigated Transcranial Magnetic Stimulation and Direct Cortical Stimulation During Awake Surgery, neurosurgeons Picht and Kring et al. reported that language mapping using the NBS System and NexSpeech was highly reliable in obtaining negative response maps within motor speech-related areas of the cortex. Stimulation using the rTMS (repetitive transcranial stimulation) feature of NexSpeech could be completed for all patients and the NexSpeech method was well tolerated with no adverse events during the mapping procedure. The authors found a good overall correlation between the repetitive nTMS technique used by NexSpeech and direct cortical stimulation (DCS), particularly with regard to negatively mapped regions. The authors also wrote that, in practice, negative responses to rTMS pre-surgically can be used to reliably identify cortical regions where DCS responses are unlikely to be obtained in awake surgery. With this information, the neurosurgical team can custom-tailor the location and size of the craniotomy for the individual patient, as well as plan a safe resection trajectory. As an added bonus, the clinicians observed that participating in the language mapping procedure with NexSpeech was found to positively impact the patients’ performance and compliance during intraoperative speech mapping. The data collected in the studies underlying this paper formed the basis of Nexstim’s successful application to the US FDA, when the company applied for marketing clearance for the NexSpeech module during 2012.

NBS shown to be able to locate the motor cortical representation area in patients with epilepsy

In a new paper, Applicability of nTMS in locating the motor cortical representation areas in patients with epilepsy, Vítikainen et al. note that lesions behind intratable epilepsy differ from typical brain tumors, ranging from developmental cortical malformations to injuries early in childhood development. These lesions may influence the functional organization of the cortical areas. Additionally, interictal cortical epileptic activity and antiepileptic medication may affect patients’ motor thresholds. Although NBS has now been widely studied in brain tumor patients, there is less evidence published on the reliability of nTMS techniques in epilepsy. The authors therefore compared the NBS-derived motor cortical representation maps of hand and arm muscles with the results of invasive electrical cortical stimulation (ECS) in 13 patients with tumors and epilepsy. The positions of the subdural electrodes were extracted from postoperative CT-images of the head registered with the preoperative MRI. After projecting the NBS maps to the cortical surface, the 3D distance between the average NBS-determined muscle representation site and the average ECS electrode location was 11 ± 4 mm for the hand and 16 ± 7 mm for the arm. In all patients the muscle representation areas defined with nTMS and ECS were located on the same gyrus, even in patients with abundant interictal epileptic activity on the motor gyrus. The investigators concluded that “NBS can reliably locate the hand motor cortical representation area with the accuracy needed for pre-surgical evaluations in patients with epilepsy.”

NBS used to determine exact representation of the cricothyroid muscle

In a paper entitled Practical assessment of preoperative functional mapping techniques: navigated transcranial magnetic stimulation and functional magnetic resonance imaging, Mangraviti et al. describe a comparative study of fMRI, nTMS and NBS in eight patients with lesions in eloquent motor areas. The reliability of nTMS as a routine examination and its ultimate contribution to patient outcome. We performed a preliminary prospective study on eight patients harboring a cerebral malformation to injuries early in development, and may possibly improving surgical outcome. The authors therefore compared the NBS-derived motor cortical representation maps of hand and arm muscles with the results of invasive electrical cortical stimulation (ECS) in 13 patients with tumors and epilepsy. The positions of the subdural electrodes were extracted from postoperative CT-images of the head registered with the preoperative MRI. After projecting the NBS maps to the cortical surface, the 3D distance between the average NBS-determined muscle representation site and the average ECS electrode location was 11 ± 4 mm for the hand and 16 ± 7 mm for the arm. In all patients the muscle representation areas defined with nTMS and ECS were located on the same gyrus, even in patients with abundant interictal epileptic activity on the motor gyrus. The investigators concluded that “NBS can reliably locate the hand motor cortical representation area with the accuracy needed for pre-surgical evaluations in patients with epilepsy.”

Italian clinicians compare NBS and fMRI with DCS in motor cortex lesions

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Experiences of pediatric applications of NBS at Sahlgrenska University Hospital, Sweden

Magnus Thordstein, Associate Professor of Clinical Neurophysiology at the Sahlgrenska University Hospital, a system of hospitals associated with the Sahlgrenska Academy at the University of Gothenburg in Sweden, had his first introduction to NBS at a Nordic neuroscience meeting back in 2006 and began to use a Nexstim eXimia NBS System in March 2007. His department now has the latest NBS System and the NexSpeech module was added this year.

In Sweden, how many centers offer craniotomy for children and how many craniotomies are performed?
Craniotomies are performed in six centers, but the majority of them are performed in three, one of which is Sahlgrenska. Here we perform approximately 20 craniotomies per year.

How many NBS mappings do you perform annually?
Although not all are mappings, we perform around 50 NBS investigations a year, a number that is increasing. Roughly half of our patients have brain tumors and half present with epilepsy. Many children with brain tumors also present symptoms of epilepsy.

Which are the things that need to be taken into account when mapping children?
It is important to build a good relationship with the parents, as their help during mapping sessions is invaluable. We try to produce a calm environment for the family, while being child-friendly by offering the child patients some of their favorite distractions, like music or videos. Sometimes, one also needs some creative skills to overcome stubbornness (being stubborn oneself helps)! Compared to experiences with other techniques parents attitudes have generally been very positive towards NBS.

What age was the youngest NBS patient, so far?
So far, the youngest subject was just two years and eight months old, although in this case we only performed a limited functional mapping.

How has NBS impacted your clinical work?
NBS certainly has been able to make an impact, and it is one of the new diagnostic techniques that are being introduced into the center’s clinical routine. The case of a 3-year-old girl with epilepsy due to continuous spike wave syndrome (CSWS) is a good example of the kind of child who can benefit from us having the NBS System. A non-invasive technique was required since we needed to precisely evaluate the cortical motor somatotopy before a decision to operate. The NBS findings encouraged the neurosurgeons to perform a craniotomy, where they revealed a non-malignant gliotic area which could be completely resected with an excellent recovery for the young patient. Recently we have found that using the NBS System to deliver nrTMS therapy has been effective not only in patients with severe epilepsy, but also in some with post-stroke pain.

Are you working on some NBS or NexSpeech related clinical research at the moment?
We have an on-going program to collect our experiences of NBS investigations in children. We also have a program researching the use of the NBS system as a basis for the delivery of rTMS therapy as treatment for chronic, mainly post-stroke pain.

Nexstim across the globe

Contact us
Sales Director
Henri Hannula
henri.hannula@nexstim.com
Marketing Director
Mervi Turunen
mervi.turunen@nexstim.com
Sales Manager, Germany
Rolf Kunad
rolf.kunad@nexstim.com
Key Account Manager, Germany
Sonja Wächter
sonja.waechter@nexstim.com

Nexstim Oy | Elimäenkatu 9 B, FI-00510 Helsinki, Finland | Tel. +358 9 2727 1710 | www.nexstim.com