Canadian Neuromodulation Society

# Program | *Programme*

## 5th Annual Conference | 5e Conférence annuelle


**Hotel Marriott Vancouver Pinnacle**

**June 10 to 12, 2011 | 10 au 12 juin 2011**

## Conference Venue | *Lieu de la conférence*

This year's Conference will be held in Vancouver, Canada at the Hotel Marriott Vancouver Pinnacle Downtown from June 10 to 12, 2011. | *Cette année, la 5e Conférence annuelle aura lieu à Vancouver, à l'Hôtel Marriott Vancouver Pinnacle, Vancouver, du 10 au 12 juin 2011.*

**Hotel Marriott Vancouver Pinnacle**
1128 West Hastings Street
Vancouver (British Columbia)
V6E 4R5 CANADA

## Fee Structure | *Structure de prix*

| | Before April 29 | *Avant 29 avril* | After April 29 | *Après 29 avril* |
|---|---|---|---|---|
| **Categories | *Catégories*** | **Member | *Membre*** | **Non-member | *Non-membre*** | **Member | *Membre*** | **Non-member | *Non-membre*** |
| Physician | *Médecin* | 325.00 $ | 400.00 $ | 400.00 $ | 475.00 $ |
| Researcher, Resident, Nurse, Program coordinator, Corporate, Technician, Student and other non-physician healthcare professionnal | *Chercheur, résident, infirmière, coordonnateur, entreprise, technicien, étudiant et autre professionnel de la sant* | 175.00 $ | 250.00 $ | 250.00 $ | 325.00 $ |
| Saturday's Banquet | *Banquet samedi* for Accompanying Person | *Accompagnant* | 100.00 $ | 100.00 $ | 100.00 $ | 100.00 $ |

Registration includes: Breakfasts, Breaks, Lunches, Cocktails on Friday, Banquet on Saturday. | *L'inscription inclut : petit-déjeuners, pauses, déjeuners, cocktail du vendredi, banquet du samedi*

# OBJECTIVES | *OBJECTIFS*

The main objective of the 5th Annual Conference of the Canadian Neuromodulation Society is the training of participants in the field of neuromodulation. | *La 5e conférence annuelle de la Société Canadienne de Neuromodulation 2011 a pour objectif principal la formation des participants en ce qui a trait à la neuromodulation.*

## Activity Objectives | *Objectifs de l'activité*

At the end of this year's conference, participants will be able to | *À la fin de cette conférence annuelle, les participants seront en mesure de* :

1. Define the clinical indications of treatment with neuromodulation for various pathologies. | *Définir les indications cliniques du traitement par neuromodulation dans diverses pathologies.*
2. Understand the impact of the use of neuromodulation for the treatment of various diseases and discuss the therapeutic benefits. | *Comprendre les répercussions de l'utilisation de la neuromodulation pour le traitement de diverses pathologies et discuter des avantages thérapeutiques.*
3. Understand the mechanisms of action of neuromodulation for the different stimulation sites. | *Comprendre les mécanismes d'action de la neuromodulation en fonction des différents sites de stimulation.*
4. Become familiar with the latest technological advances in neuromodulation. | *Saisir les avancées technologiques prometteuses pour l'évolution des traitements par neuromodulation.*
5. Discuss the socio-economic impacts of the Neuromodulation treatments. | *Saisir les impacts socio-économiques des traitements par neuromodulation.*

## Teaching methods used | *Méthodes pédagogiques utilisées* :

1. Presentations | *Conférences magistrales*
2. Group Discussion | *Groupes de discussion*
3. Oral and poster presentations | *Présentations orales et par affiche*

## *ACCREDITATION:*

This event is an Accredited Group Learning Activity eligible for up to **12.75** Section 1 credits as defined by the Maintenance of Certification program of the Royal College of Physicians and Surgeons of Canada. This program has been reviewed and approved by UBC Division of Continuing Professional Development.

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**Invited Speakers | *Conférenciers invités***



**Oral Presentations | *Présentations orales***



**Poster Presentations | *Présentations par affiche***

# Friday | *Vendredi*

**June 10, 2011** | *10 juin 2011*

| | | |
|---|---|---|
| 11:30 | Registration | *Inscription* | Foyer |
| 12:30 | Welcome & Introduction | *Mot de bienvenue et introduction*<br>Dr. Ivar Mendez | Pinnacle II |
| | **SESSION 1 – Spinal Cord and Peripheral Neurostimulation**<br>**Review selected clinical applications of neurostimulation.**<br>Chairman | *Président de séance*<br>Dr. Ivar Mendez | |
| 12:45 | Dr. Line Jacques<br>Peripheral Neurostimulation for Pain<br>1. To review patient selection criteria for peripheral nerve stimulation.<br>2. To update on the different techniques available and lead selection.<br>3. To outline the future direction of peripheral nerve stimulation. | | Pinnacle I |
| 13:15 | Dr. Andrew Parrent<br>Craniofacial Pain – Neuromodulation and Surgical Treatment<br>1. To understand the pathophysiology of craniofacial pain.<br>2. To understand the application of neuromodulation for the treatment of cranial facial pain.<br>3. To understand the rational for lead selection and lead placement for cranial facial pain. | | Pinnacle I |
| 13:45 | Dr. Krishna Kumar<br>Spinal Cord Stimulation is Effective in Management of Complex Regional Pain Syndrome (CRPS) I: Fact or Fiction<br>1. To consider the differences in therapeutic outcomes of a 16 electrode surgical lead versus 2X8 percutaneous leads. | | Pinnacle I |
| 14:15 | Break with Exhibitors | *Pause avec les exposants* | Shaughnessy Salon |
| | **SESSION 2 – Neuromodulation in Urology – GI-GU**<br>**An awareness of how neurostimulation can be applied to diseases of the pelvis.**<br>Chairman | *Président de séance*<br>Dr. Madgy M. Hassouna | |
| 14:45 | Dr. Madgy M. Hassouna<br>Neuromodulation in Voiding and Sexual Function<br>1. To familiarize the audience with the concept of Pelvic Neuromodulation.<br>2. To illustrate the scope of Sexual Dysfunction.<br>3. To present the effect of Pelvic Neuromodulation on Sexual Function. | | Pinnacle I |
| 15:15 | Dr. Derek Griffiths<br>Brain Control of the Bladder, Functional Disease Syndromes, and the Effect of Neuromodulation<br>1. To recognize the normal response of the brain to bladder filling.<br>2. To know that the brain responds abnormally in functional syndromes such as overactive bladder and Fowler's syndrome.<br>3. To understand how neuromodulation affects brain responses in Fowler's syndrome. | | Pinnacle I |
| 15:45 | Dr. Ghislain Devroede<br>A Multifactorial Approach to Fecal Incontinence<br>1. To understand that fecal incontinence is multifactorial in nature, that the treatment will vary accordingly, and that sacral neurostimulation is a breakthrough that must be tried before more aggressive approaches are adopted, such as the artificial bowel sphincter, dynamic graciloplasty, or, worst of all, a colostomy. | | Pinnacle I |
| 16:15 | Break with Exhibitors | *Pause avec les exposants* | Shaughnessy Salon |
| 18:00 | Meeting Adjourned | *Fin de la journée* | |
| 18:30 | Welcome Reception | *Soirée de bienvenue* | Hotel Renaissance |
| 19:30 | Dinner on your own | *Dîner libre* | |

# Saturday | *Samedi*

**June 11, 2011** | *11 juin 2011*

| | | |
|---|---|---|
| 7:00 | Registration | *Inscription* | Foyer |
| 7:00 | Breakfast and Exhibits | *Petit-déjeuner et visite des exposants* | Pinnacle II |
| | **SESSION 3 – Intrathecal Pumps and Polyanalgesia**<br>**Understanding the essential components and practice guidelines that are essential to optimize outcomes with ITTD.**<br>Chairman | *Président de séance*<br>Dr. William McDonald | |
| 8:00 | Dr. Dan Doleys<br>Screening for Success<br>1. To be able to list 3 tools to screen appropriate candidates.<br>2. To be able to appraise critical psychological factors which may lead to unsuccessful outcomes.<br>3. To identify 3 potential predictors of success. | | Pinnacle I |
| 8:30 | Dr. K. Dean Willis<br>Intrathecal Drug Delivery - Optimizing Outcomes<br>1. To understand the factors affecting the decision recommend an intrathecal drug trial.<br>2. To learn about several acceptable methods for Intrathecal drug trialing, including advantages and disadvantages of each.<br>3. To present a logical progression of IT drugs as established by the Polyanalgesic Consensus. | | Pinnacle I |
| 9:15 | Dr. William McDonald<br>Intrathecal Catheter Masses and other Complications of Intrathecal Drug Delivery<br>1. To categorize types of complications that can occur.<br>2. To recognize risk factors for intrathecal granuloma.<br>3. To explain current treatment recommendations for intrathecal granulomas. | | Pinnacle I |
| 9:45 | Mr. William Stuart<br>Practical Safety Standards for Compounded Medications: A Review of Current USP 797<br>1. To describe conditions to safely compound sterile preparations per USP 797.<br>2. To describe the responsibilities of compounding personnel related to sterile compounding with emphasis on training and documentation.<br>3. To comprehend environmental monitoring for viable and non-viable particulates. | | Pinnacle I |
| 10:15 | Break with Exhibitors | *Pause avec les exposants* | Shaughnessy Salon |
| 10:30 | Dr. Line Jacques<br>How I Select Drugs for Intrathecal Therapy<br>1. To review different drugs available for intrathecal therapy in Canada.<br>2. To evaluate the transition from oral to intrathecal therapy.<br>3. To learn how to maintain the efficacy of intrathecal therapy through drug transitioning. | | Pinnacle I |
| 11:00 | Dr. Krishna Kumar<br>The role of Polyanalgesia in treatment of Chronic Non-malignant Pain; Indications, Prevalence and Cost Effectiveness<br>1. To describe the role of polyanalgesia in the treatment of chronic non-malignant pain.<br>2. To review the indications, prevalence and cost effectiveness of polyanalgesia in the treatment of chronic non-malignant pain. | | Pinnacle I |

# Saturday | *Samedi*

**June 11, 2011** | *11 juin 2011*

| | | |
|---|---|---|
| **11:30** | **The Kumar Lecture**<br>**Honoured Speaker: Dr. Chris Honey**<br>**The current state of DBS for movement disorders.**<br>1. To understand the origins, current use, and future potential of DBS for movement disorders. | **Pinnacle I** |
| 12:30 | Lunch \| *Déjeuner*<br>Exhibitors \| *Exposants* | Pinnacle II<br>Shaughnessy Salon |
| 13:30 | Annual General Meeting of CNS | Pinnacle I |
| 13:45 | Poster Session \| *Visite des affiches* | Shaughnessy Salon |
| | **SESSION 4 – Future of Neuromodulation**<br>**Learn about new and innovative applications of neuromodulation.**<br>Chairman \| *Président de séance*<br>Dr. Andrew Parrent | |
| 14:45 | Dr. K. Dean Willis<br>Cervical Intrathecal Drug Delivery for Upper and Lower Body Pain<br>1. To understand how cervical catheter placement differs from traditional thoracic catheter placement.<br>2. To understand the differences, risks, and benefits of lipophilic versus hydrophilic medication in CSF.<br>3. To understand selection process, advantages, and disadvantages of cervical catheter placement. | |
| 15:15 | Dr. Michel Prud'homme<br>Neuromodulation for Walking<br>1. To understand the concept of closed loop system in neuromodulation.<br>2. To understand the basics of gait assessment.<br>3. To learn about the application of a novel closed loop system to treat foot drop. | Pinnacle I |
| 15:45 | Dr. Andres M. Lozano<br>The Future in Neuromodulation | Pinnacle I |
| 16:15 | Open Papers (15 minutes) \| *Présentations orales (15 minutes)*<br>1. To explain emerging therapies and research in the field of neuromodulation. | Pinnacle I |
| 18:00 | Meeting Adjourned \| *Fin de la journée* | |
| 18:45 | Bus shuttle departure for the Aquarium \| *Départ de la navette pour l'Aquarium* | Hotel Entrance \| *Entrée de l'hôtel* |
| 19:15 | Cocktail and \| et Banquet<br>Vancouver Aquarium | Hotel Entrance \| *Entrée de l'hôtel* |

# Sunday | *Dimanche*

## June 12, 2011 | *12 juin 2011*

| | | |
|---|---|---|
| 7:30 | Registration | *Inscription* | Foyer |
| 8:00 | Breakfast with the Experts | *Petit-déjeuner avec les experts*<br>1. Participants will have an opportunity to discuss, in a small group setting, issues relevant to their self-identified learning needs. | Pinnacle II |
| | **SESSION 5 - Neuropsychiatry**<br>**Learn how CBT can augment neuromodulation in clinical practice. Learn how neuromodulation can be applied to treat psychiatric diseases.**<br>Chairman \| *Président de séance*<br>Dr. Krishna Kumar | | Pinnacle I |
| 9:00 | Dr. Dan Doleys<br>Cognitive Behaviour Therapy<br>1. To be able to define cognitive behavioral therapy (CBT)<br>2. To identify the potential benefits of CBT<br>3. To be able to list at least two situations when CBT should be considered | | Pinnacle I |
| **9:30** | **The Tasker Lecture**<br>**Honoured Speaker: Dr. Andres M. Lozano**<br>Neuromodulation for Psychiatric Disorders<br>1. To understand brain circuits that underlie psychiatric disease.<br>2. To investigate how deep brain stimulation can modulate brain activity and function. | | **Pinnacle I** |
| 10:30 | Dr. Paul E. Holtzheimer<br>Structural and Functional Neuroimaging for Neuromodulation<br>1. To appreciate the prevalence and cost of treatment-resistant depression (TRD) and the critical need for improved treatment approaches.<br>2. To be familiar with the safety and efficacy data for subcallosal cingulate deep brain stimulation (SCC DBS) for TRD.<br>3. To understand the role of structural and functional neuroimaging studies in both the development and optimization of SCC DBS for TRD.<br>4. To appreciate how structural and functional neuroimaging will be critical in better understanding the mechanism of action of SCC DBS for TRD. | | Pinnacle I |
| 11:00 | Best oral and poster presentations awards \| *Prix pour les meilleures présentations orale et affiche* | | Pinnacle I |
| 11:30 | Concluding Remarks \| *Mot de fermeture* | | Pinnacle I |
| 12:00 | Meeting Adjourned \| *Fin de la conférence* | | |
| | Box Lunch \| *Boîte à lunch* | | Foyer |

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# Dr. Ghislain Devroede

Ghislain Devroede, MD, MSc, is Professor of Surgery at the University of Sherbrooke, in Sherbrooke, Québec, Canada, where he was appointed in 1969. He serves as Scientific Director of the Quebec Institute in Ericksonian Hypnosis. He is an associate member of the Thématique de Physiopathologie Digestive, Centre de Recherche Clinique, Centre Hospitalier Universitaire de Sherbrooke, Québec, Canada. He is also the head of investigation in pharmacological products for functional bowel disorders, and the only Canadian MEDTRONIC investigator of Interstim devices for sacral neurostimulation for fecal incontinence. The results of this multicentric study have been published in the Annals of Surgery and the American Journal of Gastrointestinal Surgery. As of March 2011, he is the sole North American surgeon implanting the device (58 so far) for incontinence and severe highly selected constipation problems. He is also one of the professors involved in the education of medical students in doctor-patient communication.

As author and coauthor, Dr. Devroede has published hundreds of papers and abstracts in such peer-reviewed journals as *Gut*, *Acta Endoscopica*, *Gastroenterology*, *Digestive Diseases and Sciences*, and *International Journal of Colorectal Diseases.* In addition, his work has been presented at many seminars in North America and Europe as lectures (over 400), posters, experiential workshops and audio and video cassettes. He is on the Editorial Boards of several journals, including *Techniques in Coloproctology*, *Journal Français de Psychiatrie*, and *Le Courrier de Coloproctologie.* Dr. Devroede has published widely, particularly in Canada and France, in the lay press on spiritual as well as health-related topics, and he has appeared on numerous radio and television broadcasts.

Dr. Devroede has published four books. He initially published poems, "*Au commencement*" (Editions Saint Germain des Prés, 1987, Paris). Subsequently, he wrote three books for lay people on functional bowel problems and their meaning. "*Ce que les maux de ventre disent de notre passé*" has been published in 2002 and reedited in pocket version in 2003 (circulation circa 20,000), and "*Ces enfants malades de leurs parents*", with Anne Ancelin Schützenberger, on transgenerational somatization, reedited in pocket version in 2005 (circulation circa 35,000), both by PAYOT editors in Paris. The latter has appeared in the United States in 2005, and been reedited in 2007 under the title of "*Suffering in Silence. The Legacy of Unresolved Sexual Abuse*" (Gestalt Institute Press, Metairie, New Orleans, La). He has also published (2009) published "*Chacun peut guérir*", (Payot, Paris), on the healing process, (2009; pocket version in 2011) to illustrate the fact that, given the essence of the biopsychosociospiritual model of medicine, if patients succeed to find a meaning for the disease or disorder they suffered from, they cannot only cure the problem, but become happier thanks to having gone through the ordeal, provided they are not only cared for but taken care of. The book adopts the format of narrative medicine and discusses the meaning of four case and life histories of patients with Crohn's Disease, Colon Cancer, Idiopathic Anal Pain and Irritable Bowel Syndrome.

Dr. Devroede is a member of a number of Societies, including the Society for Surgery of the Alimentary Tract, the Royal College of Surgeons of Canada, as well as the Société Nationale Française de Coloproctologie (membre correspondant étranger), and the Sociedad Argentina de Gastroenterologia (miembro correspondiente estranjero), among others.

Dr. Devroede received his medical degree from the Université Catholique de Louvain, in Belgium, in 1962, and graduated summa cum laude. He completed an internship at the Cliniques Ste-Elizabeth in Brussels, Belgium, and a residency in the Department of General Surgery at St. Vincent Hospital in Erie, Pennsylvania, where he also served as Chief Resident. He completed another residency in colorectal surgery at the Mayo Clinic, Mayo Graduate School of Medicine in Rochester, Minnesota. There, he also served as research assistant in the Gastrointestinal Research Unit, where he was the first fellow of Dr Sidney Phillips, later to be the head of the Unit, and the editor of *Gastroenterology*. He has been appointed professor honoris causa of the Cluj Napoca University, in Romania, in 2003, and of the Brasov University, in the same country, in 2004.

Ghislain Devroede is married to Eve Beausejour, a mezzo soprano, and has three sons, Laurent, Thierry and Matthieu.

# Abstract .....

**A Multifactorial Approach to Fecal Incontinence**

Ghislain Devroede

Fecal incontinence is not a life threatening condition but it impairs dramatically the quality of life of patients, mainly women, who suffer from it. They are numerous since the problem reaches about 2% of the general population, and the problem increases markedly with aging.

It is erroneous to speak about « anal incontinence », since continence results from a delicate balance between two opposing forces. Factors conducing to liquid stools are provoking incontinence. A normal subject can withold a bad bout of turista for only ninety seconds. Conversely, all elements regulating colorectal motility are promoting continence. If food takes five hours to go through the three meters of small bowel, feces take up to five days to go through the one meter of large bowel. Once in the rectum, rectal accomodation properties and anorectal motility further promote continence and allow defecation in a socially acceptable manner.

Not only is fecal incontinence multifactorial in nature, but there are a number of diseases that cause it. Thus, a differential diagnosis must be made in its medical approach, with appropriate problem solving. Vaginal deliveries not only cause perineal tears, particularly in sexually abused women, but they also cause pudendal neuropathy, perineal descent, and hypotonocity of the entire pelvic floor, front, middle, and rear. Also, anismus, a rectosphincteric dyssynergia, where the subject squeezes the anal sphincter in order not to defecate, while straining at the same time in order to defecate, in the long run causes rectoceles, perineal descent and, also, pudendal neuropathy.

Fecal incontinence has long remained a shameful hushed up miserable problem. Medications and biofeedback have been used with relatively little results except in precise pathophysiological conditions. Diapers and pads are commonly used. Some surgeries are effective, in a palliative fashion such as the Malone procedure (appendicostomy) or better, pelvic floor reconstruction. One needs to remember that the irritable bowel syndrome, functional in nature, not responding to any medication beyond a placebo effect, but responding to psychotherapy and hypnotherapy, was found to be the major cause of fecal incontinence in a large population based study around the Mayo Clinic. Moreover, we published data demonstrating that controlling constipation or diarrhea corrects incontinence in ninety five per cent of patients. In despair, colostomy is still offered to some miserable patients. Fortunately, sacral neurostimulation can now be offered in selected subjects, with a forty percent full recovery of continence, and an eighty percent of close to normal restoration. These results hold up to at least three years, in an ongoing five year, 120 patients, prospective study, with major improvement in quality of life as well as restoration of normal continence.

# Dr. Dan Doleys

Dr. Doleys is the director of The Doleys Clinic/Pain and Rehabilitation Institute in Birmingham, Alabama. He has held this position since its inception in November 1979. Prior to starting in private practice, he was a full time faculty member in the Department of Psychology/Psychiatry, School of Medicine at the University of Alabama in Birmingham as an Associate Professor.

Dr. Doleys obtained his Bachelor's degree in Mathematics and Psychology from Central Michigan University and followed with his Master's Degree in Psychology from the same university. He received his Ph.D. in Psychology in 1973 from the University of Miami in Florida, after which he completed a two-year clinical postdoctoral fellowship in Behavioral Therapy and Analysis at the University of Georgia. Additionally, he has been a Diplomat of the American Academy of Pain Management and the American Board of Forensic Examiners.

His clinical and research interests have focused the application of behavioral therapy and behavior medicine procedures to a variety of disorders. He received the *Distinguished Research Psychologist Award* from the Alabama Psychological Association and the *Excellence in Research and Clinical Care Award* and the *Distinguished Service Award* from the Southern Pain Society. His current clinical and research activities involve the application of behavioral approaches to the assessment and treatment of chronic pain, as well as assessment and outcome strategies for implantable technology.

Dr. Doleys' previous appointments include Adjunct Professor in Psychology at Florida International University from 1972-1973 and Barry College in 1973. At the University of Alabama in Birmingham, School of Medicine, he served as Staff Psychologist in the Center for Developmental and Learning Disorders and was an Assistant Professor of Psychology from 1975-1979. He held academic appointments in the Departments of Psychiatry, Psychology with adjunct appointments in the departments of Nursing, Nutrition Sciences and Physical Therapy. Dr. Doleys also acted as the Chief of the Division of Psychology in Psychiatry from 1981-1991 at Brookwood Medical Center.

He has presented multiple lectures at local, regional and national meetings on pain assessment, treatment and outcomes research. He co-authored *Time Calorie Displacement*, and co-edited *Behavioral Medicine: Assessment and Treatment Strategies*. He also presented an invited address on chronic pain personality to the Australian Pain Society. He has authored or co-authored over 100 scientific papers, journals articles and book chapters. He has served on the editorial board of *Behavior Modification* from 1978-1981, *Phobia: Practice and Research Journal* from 1988-1990 and *The Pain Medicine Journal Club Journal* as a Section Editor from 1995-1998. He has also functioned as a guest reviewer for several journals, including *The Clinical Journal of Pain*, *Neuromodulation*, *Pain*, *Pain Medicine*, *Clinical Psychology Review*, and *Behavior Research and Therapy*, *The Journal of Pain.*

Dr. Doleys is a member of several professional associations, including the American Psychological Association, American Pain Society, the International Association for Study of Pain, American Academy of Pain Medicine, and the Southern Pain Society. He has been on the Board of Directors for the International Pelvic Pain Society and the Southern Pain Society, and past President of the Southern Pain Society (2007-2009).

# Abstract .....


**Cognitive Behavioral Therapy**

Dan Doleys

Cognitive behavior therapy (CBT) addresses maladaptive thoughts (cognitions), beliefs, and expectations that can negatively affect pain and functioning. Catastrophizing, over-generalization, and selective attention are but a few of these negative cognitions. Appropriate alternatives are identified and taught to the patient. CBT has been shown to produce changes in the activity of several cortical structures and has been associated with a partial reversal of the cortical atrophy found in some chronic pain disorders. The combination of CBT plus neuromodulation has been shown to be superior to neuromodulation alone.

# Abstract .....


**Screening for Success**

Dan Doleys

The outcomes of neuromodulation for chronic pain approximate 50% relief with the number of patients benefiting deteriorating with time. It has been suggested that psych-social factors known to contribute to the experience of pain may well contribute to this less than ideal outcome. A number of authors have outlined contraindications, but none have been experimentally verified. The research which has been done is not very systematic and no one or combination of psychological variables has been shown to be 'predictive' of the outcome. However, it is generally agreed that such an evaluation should take place and has value. Some of the philosophical issues center around the search for 'predictors versus descriptors'. The use of a clinical interview in combination with validated psychological test/questionnaires interpreted by a mental health practitioner experienced with neuromodulation is recommended. To the extent possible, a functional trial should be undertaken. The treatment algorithm should include periodic psychological consultation and intervention as appropriate.

## Dr. Derek Griffiths

Derek Griffiths is a physicist whose interests have evolved over the past 45 years from the hydrodynamics of superfluid helium, through the physics of urine flow and its clinical applications, to the central control of bladder and urethra. His career has taken him from the UK to Holland and Canada, and since 2000 he has worked in the USA with the geriatric incontinence research unit at the University of Pittsburgh. The focus of the unit is clinical research into the etiology of urge incontinence, and especially the role of brain control of bladder, studied by functional magnetic resonance imaging.

# Abstract .....

**Brain Control of the Bladder, Functional Disease Syndromes, and the Effect of Neuromodulation**

Derek Griffiths, University of Pittsburgh and Institute of Neurology, University College London

During urine storage the brain of a normal continent adult responds in a characteristic way to bladder filling. In functional syndromes such as overactive bladder (OAB, urgency incontinence) or Fowler's syndrome (inability to empty the bladder) brain responses are abnormal. These syndromes can sometimes be treated successfully by sacral neuromodulation (SNM). The mechanism of SNM – like the mechanism of the underlying dysfunction – is unknown, but in principle it might normalize responses or it might strengthen a coping mechanism (by making coping responses more abnormal).

Over the past 10-15 years, methods have been developed to simultaneously monitor bladder and brain responses to bladder filling, using functional brain imaging, either by positron emission tomography (PET) or by functional magnetic resonance imaging (fMRI, on which this talk is based). Both provide a blood-flow signal believed to represent local neural activity. Bladder filling is mimicked by repeatedly infusing and withdrawing liquid into/out of the bladder during brain scanning.

The bladder and urethra are driven by a brainstem (voiding) reflex that ensures alternate urine storage and emptying. The reflex is controlled by higher (limbic and cortical) parts of the brain, which generate bladder sensations and suppress voiding unless it is appropriate. In **normal adults** the prime target of afferent signals ascending from the bladder to the brain is in the visceral sensory cortex, the insula, which registers normal bladder sensations such as first or strong desire to void. It in turn has connections with other parts of the brain where presumably signal processing is carried out and motor output is generated.

In **urge incontinence (OAB)**, bladder afferents are routed also to part of the brain involved in the emotions, the middle part of the cingulate cortex. It is activated by bladder filling when there is urgency to void – an abnormally compelling sensation only reported in such patients. It too has connections to other parts of the brain that appear to tighten the urethral sphincter mechanism, and presumably inhibit bladder contraction.

**Fowler's syndrome** is an unusual condition, afflicting younger women, which represents almost the opposite situation to OAB: bladder sensation is absent and there is inability to void. Overactivity of the striated urethral sphincter may be the cause of the problem, preventing voiding. fMRI indicates that – consistent with absent sensation – there is little or no brain activation in response to bladder filling. Rather there are prominent *deactivations*.

Sacral neuromodulation (SNM) can help both conditions. In **Fowler's syndrome** it improves sensation, restores voiding, and partly reverses the deactivations, partially normalizing brain responses to bladder filling and suggesting a curative effect. In **urge incontinence (OAB)**, PET studies of Blok show an immediate effect of SNM and a longer-term learned response. In the short term, SNM increases neural activity in the insula, suggesting increased normal sensation. In the long term, SNM reduces activity in the dorsal cingulate cortex, suggesting a reduction in the abnormal sensation of urgency – a curative effect. Thus functional brain imaging promises to illuminate the mechanism of SNM in functional syndromes that are otherwise difficult to understand. The little work that has been done suggests that its effect can be curative (although incomplete), but the field is wide open for new, ground-breaking work.

# Dr. Magdy M. Hassouna

**Degrees**

MB.Ch.B University of Alexandria
LMCC
PhD. McGill University
FRCSC
FACS
Diplomate of the American Board of Urology

**Positions**

Professor of Surgery (Urology) University of Toronto
Staff urologist at the University Health Network, Toronto.
Consultant, Baycrest Geriatric Centre, Toronto, Ontario
Consultant, Lyndhurst Rehabilitation Centre, Toronto, Ontario
Consultant, Queen Elizabeth Hospital, Toronto, Ontario
Senior Investigator, The Toronto Western Hospital Research Institute, Toronto.

**Contribution in Clinical and Basic Researches**

Application of different electronic modalities in treating voiding dysfunction and the lower Urinary tract. Research involving application of pharmacological and devices in treating male health problems.

**Major Fields of Expertise**

- Leading clinical expert in sacral neuromodulation treatment for voiding dysfunction since 1987
- Participation in FDA panel approving Pelvic Neuromodulation in 1997
- Proctored > 100 Urologists and Urogynecologists across the USA on implantation technique for sacral neurostimulation from 1997 to 2001
- > 70 peer-reviewed publications and 75 abstracts presented at various Urology symposia in the field of urodynamics and neuro-uorology
- Authored nine chapters in books related to the field of neuro-urology.
- Received the Lapides Award for best research in Neurourology at AUA, 2000
- Past Vice President of the International Society of Pelvic Neuromodulation
- Expert reviewer for the Journal of Urology, Urology, British Journal of Urology and International Journal of Urogynecology on articles related to pelvic neuromodulation and past editor of International Continence Survey
- Current Secretary/Treasurer of the International Society of Pelvic Neuromodulation
- Section Editor for Neuromodulation Journal
- Member of several academic and research committees at the University of Toronto

# Abstract .....

**Neuromodulation in Voiding and Sexual Function**

Magdy M. Hassouna

The presentation will address the following:

1. The concept of bladder and lower urinary tract innervations
2. The importance of Sacral Neuromodulation in the treatment of voiding dysfunction.
3. The preliminary role of SNM in helping patients with female sexual dysfunction.

# Dr. Paul E. Holtzheimer

Paul Holtzheimer, MD, is an Assistant Professor in the Department of Psychiatry and Behavioral Sciences at Emory University School of Medicine in Atlanta, Georgia. Dr. Holtzheimer graduated from Dartmouth Medical School in 1999 and completed his psychiatry residency at the University of Washington School of Medicine in 2003. He then spent one year in a clinical research fellowship at the University of Washington, focusing on the use of transcranial magnetic stimulation as an intervention for treatment-resistant depression. He is Diplomate of the American Board of Psychiatry and Neurology.

Dr. Holtzheimer joined the faculty of Emory University in 2004, where his research has focused on the neurobiology and treatment of mood disorders (primarily treatment-resistant depression, functional and structural imaging analyses and focal neuromodulation therapies). He directs the Emory Psychopharmacology Clinic and provides consultation for patients with treatment-resistant mood disorders. In July, 2011, Dr. Holtzheimer will become the Director of the Mood Disorders Service in the Department of Psychiatry at Dartmouth Medical School and Dartmouth-Hitchcock Medical Center in Hanover, New Hampshire.

Dr. Holtzheimer is an author of over 60 publications in psychiatry, neurosurgery and neuroimaging. He has been an investigator on several clinical trials of novel treatments for mood disorders, including transcranial magnetic stimulation and deep brain stimulation, as well as numerous studies investigating the structural and functional neuroanatomy of mood disorders. He is an Associate Member of the American College of Neuropsychopharmacology where he serves on the Liaison Committee and the Membership Task Force. He is also a member of the Society of Biological Psychiatry where he currently serves on the Program Committee and the Education Task Force, and is a Mentor for the Mentor/Mentee Program. He also belongs to the International Society for Electroconvulsive Therapy and Neurostimulation and the Society for Neuroscience.

# Abstract .....

**Structural and Functional Neuroimaging for Neuromodulation**

Paul E. Holtzheimer, MD

Neuromodulation, especially deep brain stimulation (DBS), is showing increasing promise as a treatment for severe, treatment-resistant psychiatric disorders such as major depressive disorder (MDD) and obsessive-compulsive disorder (OCD). Structural and functional neuroimaging studies have played a role in the initial development of these interventions, the optimization of the techniques, and the elucidation of mechanisms of action. This presentation will focus on the role of structural and functional neuroimaging studies in the development and investigation of DBS of the subcallosal cingulate gyrus (SCC) for severe, treatment-resistant depression (TRD).

At the end of this presentation, participants will:

1. Appreciate the prevalence and cost of treatment-resistant depression (TRD) and the critical need for improved treatment approaches.

2. Be familiar with the safety and efficacy data for subcallosal cingulate deep brain stimulation (SCC DBS) for TRD.

3. Understand the role of structural and functional neuroimaging studies in both the development and optimization of SCC DBS for TRD.

4. Appreciate how structural and functional neuroimaging will be critical in better understanding the mechanism of action of SCC DBS for TRD.

## Dr. Chris Honey

Dr. Honey is Associate Professor of Surgery (Neurosurgery) at the University of British Columbia. He obtained his medical degree at the University of Toronto. He completed a doctoral degree in neurophysiology at Oxford University as a Canadian Rhodes Scholar. He completed his neurosurgical training at the University of British Columbia. His neurosurgical practice is subspecialized in stereotactic and functional neurosurgery. Dr Honey has been the President of the Canadian Section of Stereotactic and Functional Neurosurgery and is serving on the Boards of the American and World Societies of Stereotactic and Functional Neurosurgery.

# Abstract .....

**The current state of DBS for movement disorders**

Chris Honey

This lecture will highlight the current indications for deep brain stimulation for movement disorders. Examples of ideal patients will be presented. The current controversies in the field will also be reviewed and some personal reflections on these issues will be presented.

# Dr. Line Jacques

Associate professor in neurosurgery at Mcgill University.
Neurosurgeon at the Montreal Neurological Hospital (MNH) and Institute McGill University, Montreal, Canada
Director of the training residency program in neurosurgery for 9 years
Head of Spine and Peripheral Nerve division in neurosurgery
Director of the pain clinic at the MNH work in neuromodulation since 1990 -6 with Dr Martinez then 1997-to now at the MNH fellowship in peripheral nerve under Dr David Kline in Louisiana medical center

# ABSTRACT .....

**How I select drugs for Intrathecal Therapy**

Line Jacques
Department of Neurology and Neurosurgery
Montreal Neurological Institute/Hospital, McGill University

This presentation will discuss the various types of conditions which may precipitate the need for intrathecal therapies vs. other treatment modalities for chronic benign pain conditions

The following topics will be reviewed:

1. Drugs available for intrathecal use in Canada
2. Transition between per os to intrathecal therapy
3. Patient selection criteria
4. Assessment protocol
5. Maintaining efficacy through drug transitioning
6. Treatment outcomes

Litterature review will be provided during this presentation to highlight critical point of importance for this procedure, along with precautions to minimize the risk of complications for the patient .

# ABSTRACT .....

**Peripheral Nerve Stimulation for the Treatment of Chronic Neuropathic Pain**

Line Jacques
Department of Neurology and Neurosurgery
Montreal Neurological Institute/Hospital, McGill University

This presentation will discuss the various types of conditions which may precipitate the need for Peripheral Nerve Stimulation (PNS) vs. other treatment modalities which have been found to be ineffective in treating peripheral nerve injuries or other peripheral nerve mediated syndromes.

The following topics will be reviewed:

1. Mechanisms of action
2. Indications
3. Patient selection criteria
4. Assessment protocol
5. Surgical technique
6. Pre and post operative patient care
7. Treatment outcomes

Detailed graphics will be provided throughout this presentation to highlight critical features of this procedure, along with precautions to minimize the risk of patient injury.

# Dr. Krishna Kumar

**EDUCATION**

| | |
|---|---|
| **M.B.B.S.** | Agra University, Agra, India: April 1953 |
| **M.S.** | Mahatma Gandhi Medical College, Indore, India: April, 1958. |
| **Fellow of Royal College of Surgeons of Canada (Neurosurgery)** | December, 1961 |
| **Doctor of Laws (honoris causa)** | University Regina: May, 2001. |

**PRESENT POSITIONS HELD**

Clinical Professor of Neurosurgery: University of Saskatchewan, College of Medicine.

**AWARDS**

1. "Order of Canada": Awarded by Hon. Michaelle Jean, Governor General of Canada on July 1, 2009. This is the highest civilian honour that the Government of Canada bestows.

2. 2011, James H. Graham Award of Merit: Awarded by the Royal College of Physicians and Surgeons of Canada for "Outstanding Achievement", reflect the aims and objectives of the Royal College. This is the highest award that is given out by the Royal College of Physicians and Surgeons of Canada to only one Fellow annually.

3. Physician of the Year Award 2008, presented by the Saskatchewan Medical Association in recognition of the high standards of health care and innovations in the field of treatment of chronic pain and movement disorders.

4. 2005 "Citizen of the Year Award", presented by CTV Network station, CKCK Television, December 31, 2005.

5. Award of Excellence", awarded by Saskatchewan Health Care Association on February 22nd, 2002, for meritorious services to the people of Saskatchewan, and innovations in the treatment of chronic pain and movement disorders.

6. Saskatchewan Award of Merit, presented by Government of Saskatchewan,October, 2000. *This is the highest civilian honor that the Government of Saskatchewan bestows*.

7. The City of Regina has voted to name a street after Dr. Kumar:
   May 24, 2004. The street has been named in the Kensington Greens subdivision of the City of Regina in January, 2006.

**PUBLICATIONS**

Papers published: 59
Book Chapters published: 6
Papers presented at various conventions: 118

**ESTABLISHED LECTURESHIPS IN MY NAME**

**1.** Canadian Neuromodulation Society

**2.** University of Saskatchewan in conjunction with Regina Qu'appelle Health Region

**TELEVISED MEDICAL PROGRAMMES:** 8 programs

# ABSTRACT .....


**Spinal Cord Stimulation is Effective in Management of Complex Regional Pain Syndrome (CRPS) I: Fact or Fiction**

Krishna Kumar, MBBS, FRCS

**Objectives:** Complex regional pain syndrome (CRPS) I is a debilitating neuropathic pain disorder of unknown aetiology associated with burning pain and allodynia. Spinal cord stimulation (SCS) has proven effective in the treatment of CRPS I in the medium-term but its long-term efficacy and ability to improve functional status remains controversial.

**Methods:** We retrospectively analyzed 25 CRPS I patients who had failed conventional medical management and who were subsequently treated with SCS over a mean follow-up period of 87.9 months. The parameters utilized for their evaluation were: visual analogue scale (VAS), Oswestry disability index (ODI), Beck depression inventory (BDI), EuroQoL-5D (EQ-5D) and Short-form 36 (SF-36), and drug consumption. Evaluations were conducted at point of entry, 3 months, 1 year, and last follow-up.

**Data Analysis:** We analyzed the impact of age, sex, disease stage, delay from diagnosis to treatment with SCS, upper versus lower limb pain, changes in medication use, and functional status on patient outcomes. Analysis was undertaken with the aid of SPSS for Windows (version 17, SPSS, Chicago, IL). The change in values of the above mentioned variables from their baseline values to 3 months post SCS, 1 year, and last follow-up were then subjected to statistical evaluation using a paired two-tailed t-test. We utilized a forward stepwise multiple regression analysis (MRA) formula to identify parameters that statistically predicted the severity of CRPS I. A probability level of $p<0.05$ was considered significant.

**Results:** At baseline, mean VAS, ODI, BDI, EQ-5D, and SF-36 scores were 8.4, 70%, 28, 0.31, and 24. Maximum improvement was recorded at 3 months (VAS 4.8, ODI 44%, BDI 14, EQ-5D 0.66, and SF-36 45). At last follow-up scores were 5.6, 51%, 19, 0.57 and 39, respectively. Despite the regression noted at 1 year and last-follow-up benefits were maintained compared to baseline (p-value baseline vs. last follow-up: 0.001 VAS, 0.003 ODI, 0.001 BDI, 0.003 EQ-5D, 0.001 SF-36). The multiple regression analysis showed that best results were achieved in stage I CRPS I, patients under 40 years of age, and those receiving SCS within 1 year of disease onset. Medication usage declined. SCS did not prevent disease spreading to other limbs.

**Conclusions:** SCS improves pain, depression, quality of life, and functional status over the long-term. To achieve this goal SCS should be considered early in the treatment continuum.



**Keywords:** Complex regional pain syndrome type I (CRPS I); Spinal cord stimulation; Improvement in pain and functional status; Regression

# Abstract .....

**The role of Polyanalgesia in treatment of Chronic Non-malignant Pain; Indications, Prevalence and Cost Effectiveness**

Krishna Kumar, MBBS, FRCS

To evaluate the cost-effectiveness of intrathecal drug therapy (IDT) compared with conventional medical management (CMM) for patients with chronic non-malignant pain (CNMP).

**Materials and Methods:** A decision analytic model was developed to compare costs and outcomes over a ten-year span for three strategies 1) successful treatment with IDT 2) failed IDT after initial success and then maintained on CMM 3) CMM. Treatment costs were calculated from our center's database of 150 patients suffering from CNMP for these three strategies. EQ-5D scores were used to calculate quality-adjusted life years (QALYs). Cost-effectiveness was identified by deterministic and probabilistic sensitivity analysis (50,000 Monte-Carlo iterations). Impact analysis determined influence of various factors. Incremental cost effectiveness ratios and net monetary benefits were calculated.

**Results:** One-way sensitivity analysis revealed IDT to be the optimal strategy when the probability of success exceeds 0.25 for single-drug therapy. To achieve the same level of cost-effectiveness, dual and triple-drug intrathecal therapy probabilities of success should exceed 0.75. Failed intrathecal therapy is a more optimal strategy than conventional management. Two way sensitivity analysis determined conditions for each strategy to be cost effective. Intrathecal therapy becomes cost-effective starting at $100,000 over ten years, given the superior QALY that is generated. Impact analysis determined that the most significant factors affecting the model were costs for CMM, intrathecal monotherapy and dual-drug therapy.

All 110 patients started monotherapy. 63 continued on monotherapy with dosage escalation, while 47 required dual-drug therapy and 11 subsequently needed a three drug admixture. VAS scores pre-IDT were >8.3 cm and at last follow-up were ≤4.2 cm. Nociceptive pain responded to monotherapy while mixed-pain syndromes improved with dual-drug admixtures while complex cases required triple drug admixtures. Patients recruited pre-2004 stayed on monotherapy for an average 28.01 months before being switched to dual-drug therapies, while post-2004 the figure was 5.38 months. The latter group achieved better pain control (VAS at 5 years: 4.1 vs 2.9). Patients enrolled with a pain duration >5.64 years were more likely to require polyanalgesia. The ARIMA model demonstrated dual, triple drug admixtures, and CMM to be 19%, 44%, and 65% more costly compared to monotherapy over 10 years. Cost-effectiveness is $2483/QALYfor monotherapy, $5761/QALY for dual-drug therapy, and $7120/QALY for triple-drug therapy.

**Discussion:** The incremental cost-effectiveness ratio for intrathecal therapy is $15,382/QALY and is $25,288/QALY for the strategy of failed intrathecal therapy after initial success. Conversely, CMM is least cost-effective $41,818/QALY. The net monetary benefit graph shows that the benefit of successful intrathecal therapy becomes positive at a willing-to-pay $20,000/QALY and exceeds that of the other two strategies. Incremental net monetary benefit for intrathecal therapy is on average 5.3 times higher than for CMM. Similarly, the acceptability curve shows that the probability of cost-effectiveness for successful intrathecal therapy is 1.0 (range 0-1).

**Conclusion:** Intrathecal therapy over a ten-year period is a robust, cost-effective first-line therapy for treatment of non-malignant chronic pain. Monotherapy was adequate for 57% of patients, while 43% required polyanalgesia. Polyanalgesia recaptures lost pain control and is cost-effective.

**References:**

1. Deer T, Krames ES, Hassenbusch SJ, et al.: Polyanaglesic Consensus Conference 2007: recommendations for the management of pain by intrathecal (intraspinal) drug delivery: report of an interdisciplinary expert panel. Neuromodulation 2007, 10:300-328.

2. Krames, Elliot, P. Hunter. Peckham, and Ali R. Rezai. "The Rational Use of Intrathecal Opioid Analgesics." Neuromodulation. Vol. 2. Amsterdam: Elsevier/Academic, 2009. 441-55. Print.

3. Kumar K, Hunter G, Demeria DD. Treatment of chronic pain by using IDT compared with conventional pain therapies: a cost-effectiveness analysis. J Neurosurg 2002;97:803–810.

# Dr. Andres M. Lozano

Dr. Lozano was born in Sevilla, Spain and moved with his family to Canada at the age of 3. He obtained his MD degree from the University of Ottawa and his PhD in Neurobiology and neurosurgical training from McGill University. He was appointed to the Department of Surgery at the University of Toronto in 1991 and was named full Professor in 1999. He is currently Professor and Dan Family Chairman of Neurosurgery at the University of Toronto, RR Tasker Chair in Functional Neurosurgery and holds a Tier 1 Canada Research Chair in Neuroscience. Dr. Lozano's research is focused on developing novel surgical treatments for neurological and psychiatric disorders such as Parkinson's disease, dystonia, depression and Alzheimer's disease. His work has appeared in over 350 publications and he has been an invited lecturer or visiting professor throughout the world. Dr. Lozano is one of the world's most highly cited scientists ranking first in the field or Deep Brain Stimulation and in citations per paper in the field of Parkinson's disease. He is the editor in chief of the Textbook of Stereotactic and Functional Neurosurgery. He has served on the board and executive of several international organizations including the founding scientific advisory board of the Michael J. Fox Foundation, and has been President of both the American and World Society for Stereotactic and Functional Neurosurgery. He serves on the international editorial board of 12 journals and has received a number of awards including the Gold Medal of the Royal College of Physicians and Surgeons of Canada, the Penfield Award, the Order of Merit of Spain and the Jonas Salk Award, the Donald Calne International Award for Parkinson's disease research, The Winn award, and has been elected a fellow of the Royal Society of Canada. He has had the privilege of training several extremely talented young neurosurgeons in Stereotactic and Functional Neurosurgery who have gone on to become leaders in this field.

# Abstract .....

**Neuromodulation for Psychiatric Disorders**

Andres M. Lozano, MD, PhD, FRCSC, FRS

Despite currently available pharmacological and somatic treatments there continues to be a large number of patients with treatment refractory depression. Previous work has shown that cingulated area 25 is activated during the induction of sadness and that the response to antidepressant drugs is associated with a reduction in the metabolic activity of area 25. Based on these findings we have conducted a pilot trial of deep brain stimulation (DBS) of area 25 in patients with treatment refractory depression.

20 patients who have failed multiple medical treatments including electroconvulsive therapy (ETC) were enrolled in the study. They had DBS electrodes implanted bilaterally in cingulated area 25. Electrical stimulation was delivered through the electrodes, their clinical course and PET scan images were obtained to examine changes in regional cerebral blood flow. We found that 60% patients had a response with a benefit of greater than 50% reduction in their Hamilton 17 scores at 3-14 months of follow up. This has been associated with a reduction in the resting cerebral blood flow of area 25 and a normalization of the previously suppressed activity in cortical frontal areas. The procedure is safe and has been without any serious adverse effects. This may represent a novel treatment for patients with severe treatment refractory depression.

# Abstract .....

**The Future in Neuromodulation**

Andres M. Lozano, MD, PhD, FRCSC, FRS
Professor and Chairman, Dan Family Chair in Neurosurgery
University of Toronto
RR Tasker Chair in Functional Neurosurgery
Canada Research Chair in Neurosciences

There have been approximately 90,000 patients operated with deep brain stimulation implants in the subthalamic nucleus for Parkinson's disease. With this experience there has been appreciation of the remarkable benefits that DBS can provide. However, it is also apparent that there are some symptoms of Parkinson's disease that do not respond to either dopaminergic replacement or to DBS. Chief among these are gait and postural disorders as well as cognitive and psychiatric disorders. There is an interest in understanding the pathophysiology of these disturbances and developing new therapeutic modalities.

Our group has been interested in studying the neuro-anatomical substrates of gait and posture as well as depression and cognitive function in Parkinson's disease as well as patients with severe depression and Alzheimer's disease. We have initiated a study of deep brain stimulation in brainstem locomotor areas with some initial success. Our group has also launched a program of the introduction of DBS electrodes to treat patients with major depression. These initiatives suggest that it is possible to modulate the activity of brainstem structures responsible for locomotion and that it is also possible to influence the activity of limbic circuits and memory to provide benefit for patients suffering from psychiatric and memory disorders.

## Dr. William McDonald

Dr. William McDonald obtained his undergraduate and medical degrees from UBC and is a Fellow of the Royal College of Physicians and Surgeons (Canada) in both Anesthesiology and Internal Medicine. He practices Pain Management at St. Paul's Hospital in Vancouver. He is a Clinical Professor in the Department of Anesthesiology and Pharmacology, UBC. His main practice interest is in interventional therapy for pain conditions.

# Abstract .....

**Intrathecal Catheter Tip Masses and other Complications of Intrathecal Drug Delivery**

William N. McDonald, M.D., FRCPC

Intrathecal drug delivery is a technique that can reduce pain, change function, and improve quality of life in properly selected patients with severe pain. Unfortunately, side effects and complications can not only impair efficacy but also cause serious harm to the patient. Complications can occur from a variety of sources and include surgical, device related, and drug related causes. This presentation will review the spectrum of potential complications, focusing on the complication of intrathecal catheter tip mass ("intrathecal granuloma") and its recognition, prevention, and treatment.

## Dr. Andrew Parrent

Dr Andrew Parrent is an Associate Professor in the Schulich School of Medicine and Dentistry, with appointments in the Departments of Clinical Neurological Sciences and Diagnostic Imaging at the University of Western Ontario. He is also an Associate Scientist at the Robarts Research Institute.

Dr Parrent works as a neurosurgeon at the London Health Sciences Centre with clinical interests in Functional Neurosurgery and cerebral endoscopic surgery. He is actively involved in the surgical management of patients with movement disorders, intractable epilepsy and chronic pain disorders – including neuropathic pain and craniofacial pain conditions. He is co-director of the Epilepsy Surgery Program at the London Health Sciences Centre.

Dr Parrent is involved in collaborative research in the Image Guided Surgery Laboratory at the Robarts Research Institute. This work has been funded by CIHR since 1997 and has resulted in the development of image-guided computational tools for the planning of DBS insertion for the treatment of movement disorders as well as a three dimensional physiologic atlas of subcortical structures relevant to functional neurosurgery. The lab has now extended this work to the functional imaging relevant to epilepsy surgery.

# Abstract .....

**Craniofacial Pain – Neuromodulation and Surgical Treatment**

Andrew Parrent MD, FRCSC
Associate Professor
University of Western Ontario

**Overview**

There are a number of ways to categorize pain:

Nociceptive vs. Neuropathic pain

a. Nociceptive pain is pain arising from the stimulation of nociceptors and generally implies ongoing tissue damage. For example:
    i. chronic TMJ disorders
    ii. chronic myofascial pain
b. Neuropathic pain is characterized as chronic pain in the absence of ongoing tissue damage and associated with injury to the nervous system.

Craniofacial pain is a complex collection of entities that can be subdivided into manageable subgroups. For the purposes of this presentation we will ignore the nociceptive pain problems and discuss the following:

1. Cranial Neuralgias
    a. trigeminal neuralgia
    b. glossopharyngeal neuralgia
    c. rarer: geniculate, vagal neuralgia
2. Facial and Orofacial Neuropathic pain
3. Primary Headache Syndromes
    a. Chronic Migraine ('transformed' migraine)
    b. Trigeminal Autonomic Cephalgias

**Pathophysiology**

1. Cranial Neuralgias
    a. Usually caused by vascular compression of the sensory component of a cranial nerve by an artery (or rarely a vein).
        i. trigeminal neuralgia – usually superior cerebellar artery
        ii. glossopharyngeal neuralgia – usually posterior inferior cerebellar artery
    b. Can be seen in MS, where it is attributed to demyelination.

2. Neuropathic Pain
    a. alteration of peripheral and central receptors
    b. ectopic neuronal discharges
    c. wind-up
    d. central sensitization

3. Primary Headache Syndromes
    a. Trigeminocervical Complex: The spinal nucleus of the trigeminal nerve represents the cranial equivalent of the dorsal horn of the spinal grey matter. The trigeminocervical complex is that area where the cranial and upper cervical (especially C2) sensory neurons converge. In particular, there is convergence of the V1 dural innervation and C2 somatic innervation. Connections between the sensory neurons and parasympathetic outflow neurons in the superior salivatory nucleus account for the autonomic manifestations of the trigeminal autonomic cephalgias.

**Specific Entities:**

Trigeminal Neuralgia

- Characteristics
  - unilateral, lancinating, electrical pain
    - brief in duration (1 sec – 2 minutes)
    - variable frequency
    - attacks are stereotyped in the individual patient
  - in one or more trigeminal divisions
  - trigger areas on the face are common
    - touch, wind, chewing
    - usually outside of the pain area
  - normal neurologic exam
  - no underlying disorder
- Natural history
  - characterized by attacks and remissions
  - with time the attacks become longer and the remissions shorter
  - median active period – 49 Days
  - duration of remissions

| | |
|---|---|
| days | 16% |
| weeks | 16% |
| months | 36% |
| > 1 year | 6% |

  - incessant attacks – 20%
  - progressive and increasing resistance to pharmacological therapy is common
- Management
  - medications
    - carbamazepine, baclofen, gabapentin, pregabalin
  - surgical
    - microvascular decompression (MVD)
    - ablative procedures
      - ganglion
        - radiofrequency, glycerol, balloon compression
      - peripheral branch section, avulsion, injections
      - root
        - gamma knife
        - partial sensory section

Glossopharyngeal Neuralgia

- GN has two variants
  - pharyngeal form
    - pain in posterior tongue, pharynx, tonsil, soft palate
    - radiation to inner ear, angle of mandible
    - +/ to eye, nose, maxilla, tip of tongue
  - tympanic form
    - confine to or predominates in the ear
    - +/- radiation to pharynx
  - unilateral, sharp, stabbing, paroxysmal pain
    - brief in duration (1 sec – 2 minutes)
    - attacks are stereotyped in the individual patient
  - •triggers
    - swallowing, chewing, talking, coughing, yawning
    - touching gingiva or oral mucosa
- Management
  - medications
    - carbamazepine, baclofen, gabapentin, pregabalin
  - surgical
    - microvascular decompression (MVD)
    - ablative procedures
      - gamma knife
      - section of glossopharyngeal and partial vagus n

Neuropathic Pain

- Various ways of classifying; all are due to neurologic injury
    - following denervation procedures for trigeminal neuralgia
    - post traumatic
    - post herpetic neuralgia
    - post stroke pain
    - complex regional pain syndrome (CRPS)
    - neuropathic tooth pain (phantom tooth pain, atypical odontalgia)
- Neuromodulatory approaches
    - sensory, lemniscal stimulation
        - peripheral nerve field stimulation
        - peripheral nerve stimulation
            - supraorbital nerve
            - infraorbital nerve
            - occipital nerve
        - trigeminal ganglion stimulation
        - sensory thalamic stimulation
    - motor cortex stimulation

Chronic Headache Syndromes

- Chronic migraine headache
- trigeminal autonomic cephalgias
    - cluster headache
    - paroxysmal hemicrania
    - SUNCT (short lasting unilateral neuralgiform headache with conjunctival injection and tearing)

- occipital nerve stimulation
    - rationale
        - interactions between C2 and cranial (V1) afferents in trigeminocervical complex
    - Studies
        - ONSTIM (Medtronic)
            - responders (≥50% headache days/month; intensity reduction)
                - adjustable stimulation 39%
                - preset stimulation 6%
                - medical management 0%
        - PRISM (Boston Scientific)
            - no difference between sham and active stimulation
        - importance of controlling for medication overuse headache
- posterior hypothalamic DBS
    - efficacy for chronic cluster headache

# Dr. Michel Prud'homme

**EDUCATION**

**Certificate in neurosurgery specialty (CPSQ)** 2002
Université de Montréal, QC, Canada
**Doctorate degree in general medicine (M.D.)** 1996
Université de Montréal, QC, Canada

**Doctorate in neurological sciences (PhD)** 1996
Université de Montréal, QC, Canada
**Master degree in neurological sciences (M.Sc.)** 1989
Université de Montréal, QC, Canada
**Bachelor degree in biology (B.Sc.)** 1986
Université de Sherbrooke, QC, Canada

**CURRENT POSITIONS**

- Neurosurgeon, Hôpital de l'Enfant-Jésus, Centre hospitalier affilié universitaire de Québec, Québec, Canada
- Researcher, Hôpital de l'Enfant-Jésus, Centre hospitalier affilié universitaire de Québec, Québec, Canada
- Co-director of research in neurosurgery, Department of Neurological sciences, Hôpital de l'Enfant-Jésus, Centre hospitalier affilié universitaire de Québec, Québec, Canada
- Co-director of functional neurosurgery section, Department of Neurological sciences, Hôpital de l'Enfant-Jésus, Centre hospitalier affilié universitaire de Québec, Québec, Canada
- Professor (adjoint), Université Laval, Québec, Canada

# Abstract .....

**Neuromodulation for Walking**

Michel Prud'homme

Problems with walking have a major impact on quality of life following a lesion of the central nervous system either from vascular or degenerative disease, trauma or surgery.

According to the Heart and Stroke Foundation 300,000 Canadians are living with the consequences of stroke and there are 35,000 new patients yearly. Although 50% of stroke patients have no walking function initially, 75-85% will present limited walking ability after a rehabilitation period of over 1 month. Twenty percent will have foot drop among the survivors of a stroke.

Parkinson's is a degenerative pathology that eventually leads to walking problems in its advanced stage. Spasticity related to multiple sclerosis, familial spastic paraparesis and many other degenerative diseases also have a major impact on walking abilities.

Neuromodulation for walking can be divided into deep brain stimulation (DBS), intrathecal pump and peripheral stimulation. The peripheral stimulation can be external, partially internal or completely internalized.

This presentation will trace an overview of neuromodulation used to address walking problems. A study on a fully implanted peripheral stimulation device for foot drop of central origin, Neurostep III system, will be presented.

# Mr. William Stuart

William A. Stuart, RPh is a practicing pharmacist with over 25 years in sterile compounding. He is a graduate of University of Arizona, certified in Aseptic Compounding from American College of Apothecaries and Bacterial Endotoxin Testing from Associates of Cape Code USA. Mr. Stuart is a consultant to Medtronic and faculty member of the Napa Pain Conference 2008-2010.

Membership of the International Academy of Compounding Pharmacists, American Association of Pharmaceutical Scientists, California Pharmacists Associations and Parenteral Drug Association.

Recent publications in Practical Pain Management 2007, International Journal of Pharmaceutical Compounding June 2008, and Drug Topics March 2007.

# Abstract .....

**Practical Safety Standards for Compounded Medications: A Review of Current USP 797**

William Stuart

The review of United States Pharmacopeia (USP) 797 guidelines and practical applications intend to educate health care professionals to comprehension sterile compounding of pharmaceuticals. Topics discussed will include historical review of USP 797, categories of sterile compounding, clean-room physical design, compounding personnel responsibilities, environmental monitoring, quality assurance and beyond use dating related to compounded preparations. Attendees completing this program will understand the principles of USP <797>- related to compounding, physical design, cleaning, monitoring, staff training and facility compliance.

## Dr. K. Dean Willis

Dr. Willis has served as the founder and medical director of the multidisciplinary Alabama Pain Center, in Huntsville, Alabama for the past 24 years. His background includes a degree from the University of Alabama in Birmingham School of Medicine, a general surgery internship, anesthesia residency and fellowship training at the Texas Tech Health Sciences Center in Lubbock, Texas. Since then Dr. Willis has provided care to well over 20,000 patients developing and providing innovative pain therapies for CRPS, cervicogenic headaches, FBSS, interstitial cystitis, fibromyalgia and other complicated pain syndromes. He is a well known international speaker and teacher providing training to hundreds of fellow pain physicians. He is well published with many journal articles, studies and textbook chapters to his credit. Dr. Willis currently serves as a founding member and vice president of the North American Neuromodulation Society (NANS), a member of the Polyanalgesic Consensus Conference Committee (PACC) since 2000 and serves on the editorial board of the journal Neuromodulation – Technology at the Neural Interface.

# Abstract .....

**Cervical Intrathecal Drug Delivery for Upper and Lower Body Pain**

K. Dean Willis

Traditional intrathecal catheter placements have long been limited to the upper lumbar or lower thoracic spine. While this has been successful in treating low back and even lower extremity pain it has met with disappointing results for head, neck, upper back and extremity pain. Traditional intrathecal medications such as morphine, hydromorphone and even bupivicaine and clonidine have failed to provide successful outcomes when delivered through catheters at lower levels. Cervical catheter placement is gaining popularity, but carries higher risk of side effects. Use of the more highly lipophilic drugs now available provides surprisingly effective relief with enhanced measures of safety. This advanced approach to combining cervical catheter placement with highly lipophilic agents for both upper and lower body pain distributions will be presented.

# Abstract .....

**Intrathecal Drug Delivery – Optimizing Outcomes**

K. Dean Willis

Intrathecal Drug Delivery Systems (IDDS) and the therapies they provide have been available for over 25 years now. It has been shown to be beneficial to patients when all other pain therapies have failed. Due to the high initial cost of implantable pump therapy, success rates must be equally high in order to maintain cost efficacy. The goal of this lecture is to provide clinical insight to the many factors to consider and address when providing such therapy for a patient. Patient selection, preparation, practice organization, surgical technique (including specific trialing methods, drug selection and permanent implantation), physical and psychological rehabilitation and long term follow up are all vital to a successful outcome. Many clinical "pearls" including an update of recommendations from the Polyanalgesic Consensus Conference (PACC 2011) will be presented.

**Effect of Sacral Neuromodulation on Female Sexual Function & Quality of life, are they Correlated?**

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INTRODUCTION AND OBJECTIVES: Sacral Neuromodulation (SNM) has become an established option in the treatment of Lower Urinary Tract Symptoms (LUTS). Additional benefits such as improved bowel functions and bladder pain have been reported. Improvement in female sexual functions after SNM treatment has been suggested, however, reports examining the effects of SNM on female sexual functions are scarce. The purpose of this study is to evaluate the effects of SNM on female sexual function and its impact on the patients' quality of life (QoL).

METHODS: From January 2010 to October 2010, female patients underwent SNM InterStim® therapy for voiding dysfunction including symptoms of overactive bladder after failed medical and conservative management, Frequency – Urgency Syndrome & Chronic retention. Patients were screened by percutaneous nerve evaluation (PNE) to assess their response to therapy using a 4-day voiding diary. Patients who experienced 50% or more improvement in their voiding parameters were permanently implanted. Female sexual function index (FSFI), short form of health survey (SF-36), and incontinence questionnaires (UDI-6) were completed in all patients preoperatively and 3-5 months postoperatively.

RESULTS: 19 female patients had SNM InterStim® implanted during that period. 6 patients were excluded from the study because they were not sexually active. The indication (Urge/frequency(6), urge incontinence(5) and urinary retention(2)). SNM treatment significantly improved the total FSFI score ($p=0.028$); the components of arousal and satisfaction showed significant improvement ($p=0.037$) and ($p=0.018$) respectively. Age ($r=0.278$, $p=0.357$); body mass index ($r=-0.037$, $p=0.905$); diagnosis ($r=-0.288 p=0.339$); urinary symptoms ($r=0.22$, $p=0.466$) did not show significant correlation with FSFI score improvement. Quality of life showed significant improvement after SNM treatment in five categories.

CONCLUSIONS: Sacral neuromodulation improves patients' QoL and female sexual function particularly the sexual arousal and satisfaction parameters. Further studies are needed to explain whether the improvement of sexual function is caused by direct sacral neuromodulation or as part of the general improvement in patients' QoL.

**A Prospective Study Evaluating the Efficacy of Spinal Cord Stimulation for treating Refractory Angina Pectoris**

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Our objective was to assess, in patients with refractory angina, the long-term effect of spinal cord stimulation (SCS) on angina symptoms, medication usage, psychological symptoms, quality of life, change in Canadian Cardiovascular Society (CCS) classification and patient satisfaction on patients with refractory angina pectoris.

Since 2004 all patients referred for SCS treatment at St. Paul's hospital were consecutively included in a prospective two year and beyond follow-up study. All SCS implant devices were performed at St. Paul's hospital. The SCS-treated patients were followed regarding angina symptoms, nitroglycerin use, and quality of life assessments with generic questionnaires, disease specific questionnaires (Seattle Angina Questionnaire (SAQ)) and telephone interviews. Moreover, CCS classification and hospitalization or emergency room department visits were observed. Assessment points included prior to implantation at 6, 12, 24 and beyond 24 months.

Twelve patients were included in the study and underwent SCS implantation. Data was available on eight of these patients. Compared to before SCS implantation, patients had fewer angina attacks, reduced consumption of Nitroglycerin and improvements in CCS classification. Moreover, quality of life was improved as shown by dimensions of the SAQ and Short Form (SF-36). Complications occurred in four patients where one developed a battery pocket infection, another had a lead migration and a final had extension wire fractures. Two patients passed away during the study from causes not related to their SCS or cardiac status.

SCS treatment was associated with symptom relief, improved quality of life, a reduction in the use of nitroglycerin, and improvements in CCS classification in patients suffering from refractory angina pectoris.

**Motor Cortex Stimulation for Neuropathic Pain Syndromes: A Prospective Multicentre Randomized Blinded Crossover Trial**

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Background: Motor Cortex Stimulation (MCS) is a treatment option for medically refractory neuropathic pain involving the face and upper extremity. The literature and a retrospective review of our patients treated in an open label fashion revealed that MCS was effective in reducing visual analogue scores (VAS) and improving quality of life. Therefore we investigated this procedure further using a prospective multicentre randomized blinded crossover trial.

Methods: Twelve subjects with three different pain syndromes were studied: a) upper extremity (UE) complex regional pain syndrome (CRPS); b) unilateral UE neuropathic pain resulting from brachial plexus avulsion (BPA)/phantom pain, and c) neuropathic facial pain. All had placement of MCS after which they were randomized to receive subtherapeutic (1 min ON, 12 h OFF) or therapeutic (10 min ON, 2 h OFF) stimulation at 75% of motor threshold for the first 12 weeks, followed by a crossover to the other treatment group for another 12 weeks. The primary outcome measure was the VAS. Secondary outcome measures included McGill Pain Questionnaire (MPQ), Beck Depression Inventory-II, medication log, work status, global impression of change, and SF-36 quality of life scale. The measures were completed pre-operatively, at twelve weeks, and at twenty-four weeks post-operatively. Continuous measures were analyzed with paired t-tests comparing scores in each of the treatment conditions with the pre-intervention scores and comparing the scores between the treatment conditions. Categorical variables were analyzed with Chi Square and Fisher's Exact Test.

Results: The trial was halted early due to lack of efficacy. One subject withdrew early due to protocol violation, and five subjects withdrew early due to transient adverse events. Data for the six remaining subjects were analyzed together. Four of these patients had a diagnosis of BPA pain, and two had CRPS. There was no significant change in subjects' VAS while moving from pre-op to low, pre-op to high, or low to high stimulation. There was a significant worsening in the MPQ miscellaneous scores when subjects moved from pre-op to low ($p=0.039$), and a significant worsening of the MPQ total scores from pre-op to high stimulation ($p=0.045$). SF-36 mental health scores were significantly lower with high compared with low stimulation ($p=0.015$). There were no other significant effects of MCS on the remaining outcome measures.

Conclusion: In six patients with refractory UE CRPS or BPA neuropathic pain, there was no significant change in VAS when comparing pre-op to low or high, or between low and high MCS. Compared to other randomized control trials in the literature, this is the first to show that MCS is not an effective treatment for refractory neuropathic pain. Unlike previously published trials, this study did not include a trial stimulation period. It was also limited by small sample size. Nevertheless, we conclude that, at minimum, a healthy degree of skepticism is warranted when considering this invasive therapy for upper extremity pain syndromes.

**Cost-effectiveness of Spinal-cord Stimulation in the Management of Chronic Pain**

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**Introduction:** To evaluate the cost-effectiveness of spinal cord stimulation (SCS) compared with conventional medical management (CMM) for patients with chronic non-malignant pain (CNMP) secondary to failed back surgery syndrome (FBSS).

**Materials and Methods:** A decision analytic model was developed to compare costs and outcomes over a ten-year span for three strategies 1) Successful treatment with SCS (Success-SCS; 60 patients) 2) Failed SCS after initial success and then maintained on CMM (Failed-SCS; 10 patients) and 3) CMM (44 patients). Treatment costs were calculated from our center's database of 122 patients suffering from CNMP for these three strategies. EQ-5D scores were used to calculate quality-adjusted life years (QALYs). Cost-effectiveness was identified by deterministic and probabilistic sensitivity analysis (100,000 Monte-Carlo iterations). Impact analysis determined influence of various factors. Incremental cost effectiveness ratios (ICERs) and net monetary benefits (NMBs) were calculated. We judged cost-effectiveness on the basis of maximum willingness to pay (WTP) thresholds of $20,000/QALY.

**Results:** 1) Success-SCS is the most cost effective strategy with an ICER of $18,504. 2) The ICER for Failed-SCS is $39,998. 3) CMM is least cost-effective (ICER: $46,180). The ICER for successful SCS therapy is well below the societal WTP thresholds of $20,000.

The cost-effectiveness of Success-SCS was exceptionally resistant to parameter uncertainty, as it remained cost-effective compared with the other two strategies (i.e., ICER < $20,000/QALY) throughout all of the sensitivity analyses. The NMB analysis showed substantial savings. In the case of Success-SCS, the NMB becomes positive at a WTP of $18,501. For Failed-SCS and CMM, the NMB thresholds were much higher at WTP of $40,000 and $48,000, respectively.
Impact analysis determined that the most significant factor affecting the model was IPG costs.
The acceptability curve indicated that Success-SCS strategy had a 50% probability of being cost-effective even under the conservative assumption that there exists no WTP ($0) for a gain of one QALY which subsequently increases to 99% at a WTP of $5,500.

One way sensitivity analysis shows that the rechargeable IPG is relatively less costly than a rechargeable one. However, both strategies are cost-effective with an ICER of $15,672/QALY for the rechargeable system and $16,439/QALY for the non-rechargeable IPG.

**Conclusion:** SCS over a ten-year period is a robust, cost-effective first-line therapy for treatment of CNMP.

**Does Automatic Position-Sensing technology improve the Spinal Cord Stimulation experience?**

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Spinal cord stimulation (SCS) has developed over the last 30 years as a viable and highly effective option for the management of chronic pain. This therapy, however, is not without its drawbacks. One of the most common of these is unpleasant or uncomfortable surges of stimulation (US), especially with body position change from sitting or standing to lying. Approximately 71% of SCS patients report episodes of US and most of these episodes correspond with position change. Sixty six percent of patients treat these surges by manually adjusting the voltage levels while another 26% further adjust their posture to compensate. The newly introduced Restore Sensor (Medtronic, Minneapolis, MN) implantable pulse generator (IPG) offers a solution to this problem through the use of an accelerometer implanted into the IPG. This device senses body position and automatically adjusts stimulation levels to match. The purpose of this presentation is to explore the effectiveness of this device in patients with spinal cord stimulators for chronic benign pain.

We gathered data on 7 patients implanted with the Restore Sensor IPG between November and December 2009. Data was collected using the Testing Restore Sensor Usability & Satisfaction (TRUST) survey of patients seen in our institution. For the first 6 weeks post implant, the device functioned as a standard IPG. Data collected during this period was used to establish a baseline. At the 6 week mark, the automatic position-sensing feature was activated. At the 10 and 18 week point, data was collected again and compared to the baseline.

The baseline data showed that 71% of the subjects reported satisfaction with the SCS at the 6 week mark. All subjects reported experiencing breakthrough pain (BTP) attacks and the majority reported episodes of US. All subjects used their patient programmers to adjust the stimulator with the average being 2-4 times /day. After the position sensor feature was activated, all patients reported that the device was effective at controlling their pain with 60% reporting better pain control than prior to activation. Episodes of BTP and US were reported as "less" or "much less" in 5 out of 7 patients using a 5 point scale with 1 being "much less" and 5 being "much more". Overall, 80% of patients reported a decreased need to use their programmer.

The data has shown that the position-sensor technology has decreased both the episodes of BTP and US. This has allowed patients to reduce the need for manual adjustment of the system leading to a more comfortable and less intrusive SCS experience. One hundred percent of subjects reported satisfaction with SCS, while 80% preferred the position sensing technology over the standard SCS.

In conclusion, the Restore Sensor technology has improved patient satisfaction and pain control over basic SCS in the majority of our subjects.

**Subthalamic Nucleus Upper Border Location: Microelectrode Recording and Supramammillary Commissure-Based Method**

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**Background:** Several internal landmarks to target subthalamic nucleus (STN) have been used including the supramammillary commissure (SMC). This study was conducted to identify the relationship between the SMC upper border and the upper border of the STN.

**Methods:** Five consecutive patients underwent 10 STN deep brain stimulation (DBS) for Parkinson's disease were analyzed. Red nucleus and anterior commissure posterior commissure (AC-PC) distance based targeting methods were used to target STN. The co-ordinates (X, Y and Z) for the STN and SMC upper border were calculated. The X, Y and Z co- ordinates of the upper border of STN identified during microelectrode recording (MER) were recorded. The active DBS electrode contact co-ordinates were calculated based on fusion of postoperative CT with pre operative planning MRI. The relationship between the upper border of STN and SMC upper border was measured.

**Results:** In average, SMC upper border was identified at 3.5 mms (± 0.6) below the mid-commissural point (MCP) whereas the top border of STN was identified at 1.9 mms (± 0.8) below the MCP. The average location of the STN upper border was located 1.5 mms (± 0.7) above the top of SMC. Average X, Y, Z co-ordinates for the location of the center of DBS electrode active contact were 11.8, - 2, and -1.7 from the MCP. One DBS electrode was excluded due to lack of optimal clinical benefit. The average location of active contact center was 2 mms (± 0.6) above the top of SMC.

**Conclusion:** SMC might be used as an internal landmark for indirect identification of the upper STN border location. However, the small number of patients, in addition to other factors like image fusion error, image artifacts and brain shift limit this study.

**Vagus Nerve Stimulation for Epilepsy: Quality of Life and Patients' Satisfaction**

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**Background:** Vagus nerve stimulation (VNS) therapy reduces seizures in certain patients with pharmacoresistant epilepsy who are not candidates for resective surgery. Despite the extensive research in this field there is a variability in the impact of VNS on quality of life (QOL) and patients' satisfaction rate.

**Method:** A group of 24 consecutive patients who underwent VNS therapy for epilepsy managment at our institution were analyzed. The patients were divided into two groups; responders and non responders. The response to VNS was defined as > 50% reduction of seizure frequency. QOL was measured using QOLEI-31 inventory for the adult group and patients' satisfaction was rated based on a scale from 0 to 10. These were correlated with the epileptic syndromes, radiological and neuropsychology findings in addition to procedure related complications.

**Results:** 20 adults and 4 pediatrics with a mean follow-up of 16 months after VNS implantation were identified. Of those, 33% (n=8) were considered responders (> 50% seizure frequency reduction). Only one patient from the adult group reached Engel class-II. 16 % (n=4) had a satisfaction of >50% and 20 % (n=5) had more than 50% improvement in quality of life score. Radiological and neuropsychological abnormalities did not correlate with seizure frequency reduction or QOL scores. The main factor that impact QOL is the significant seizure frequency reduction (>70%). In this group most of the patients with Lennox Gastaut syndrome responded to VNS therapy. Complications include hoaresness in 2 patients and intermittent shortness of breath in one. None of these side effects impact QOL or patients 'satisfaction.

**Conclusion:** Significant seizure frequency reduction was the main factor that impacted quality of life and patients' satisfaction. However, this result needs to be verified in a study with large number of patients.

**The Calgary Approach to Neuromodulation and Chronic Pain Management**

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Although neuromodulation can be a helpful modality to treat ongoing pain, it does not usually eliminate all symptoms. Thus despite its successes there remains the need for ongoing medical management, rehabilitation and self-management. Ideally these aspects of care should be integrated and coordinated. The present work describes The Calgary Neuromodulation Pain Program, the Calgary Chronic Pain Centre and provides one example of how a neuromodulation program can successfully work together with an interdisciplinary pain centre to enhance each program.

The Neuromodulation Pain Program includes deep brain, spinal cord, motor cortex and peripheral nerve stimulation for chronic pain. The Calgary Chronic Pain Centre is the largest pain management centre in Canada. It is a tertiary level interdisciplinary chronic pain treatment facility with over 90 staff members including physicians, physiotherapists, psychologists, occupational therapists, nurses, kinesiologists, a dietician, a pharmacist, and a social worker.

The interplay between the two centres will be highlighted through a description of the processes and flow paths of patients through both programs. We will review the referral process for neuromodulation candidates, criteria for implant, inclusion/exclusion criteria, the ongoing evaluation process, and outcome measures. Additionally, a description of how neuromodulation patients, whenever appropriate, become involved in the multidisciplinary pain program will be provided. This may include individual care and group programming focused on the development of rehabilitation goals and self management skills.

Future projects for the Calgary Neuromodulation Program include development of a selective ITPP program to address the needs of those patients not suitable for stimulation therapies and development of a database to house and manage outcomes.

**Evaluation of Patients Implanted with a Novel 5-Column Paddle Lead**

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Ideally, spinal cord stimulation leads should enable broad coverage while still being selective and providing predictable dermatomal activation. An effective way to achieve this goal is through the use of a multi-column and row paddle lead. A recent case series of 5 patients showed that the newly developed 5-column Penta lead (St. Jude Medical Neuromodulation Division, Plano, TX) may provide structured dermatome activation and that certain programming configurations may be able to isolate paresthesia within a portion of the dermatome itself (Feler et al., 2009). The purpose of this study was to expand this case series to further determine if the Penta lead is capable of predictable dermatomal activation and coverage of complex, multifocal pain.

Up to 20 patients will be evaluated during a single office visit to assess pain relief, patient satisfaction, and stimulation coverage specificity since implantation. To date, 11 patients have completed parts of the study.

Preliminary analysis suggests that while using the entire electrode array of the Penta lead patients had significant pain reduction at follow-up (4.2 ± 3.5 months) with 72.8% seeing at least moderate functional activity improvement. In addition, patients reported certain programming configurations were able to adequately cover the painful areas.

Additional patient data will be analyzed (including quantification of stimulation coverage specificity) and results will be updated to reflect a larger patient population and longer follow-up period.

The Penta lead configuration enables increased patient functional activity due to pain reduction through complete stimulation coverage.

This work was supported by St. Jude Medical Neuromodulation Division through a sponsored clinical research study. Drs. Richter and Garber are paid consultants of St. Jude Medical Neuromodulation Division.

**Canadian Neuromodulation Society Pain Database**

*The Canadian Neuromodulation Society.*

There are patients for whom conventional methods of treatment for their chronic pain have not been successful (e.g., medication, anesthesia blocks, physiotherapy). Since 1967, spinal cord stimulation has steadily become a recognized procedure that offers a nondestructive and reversible method for controlling chronic pain (Shealy, Mortimer & Reswick, 1967). The effectiveness of spinal cord stimulation has improved because of improved patient selection (Kumar, Toth, Nath & Lang, 1998; Long, 1981), improved accuracy in electrode placement (Kumar, Toth, Nath & Lang, 1998; North, Kidd, Zahurak, James, Long, 1993) and technical improvements in the equipment (North et al., 2002). While data from randomized clinical trials support the effectiveness of the procedure, there is still debate about the long-term effectiveness of spinal cord stimulation (Burchiel et al., 1996; Cameron, 2004). Because pain is the product of various factors that vary from patient to patient, the success rate of the SCS is variable. Therefore, collecting outcome data prospectively and longitudinally over a long period of time will provide valuable information on the efficacy and 'real world experience' of this intervention. In order to capture as much outcome data as possible, we proposed in 2006 to establish a collaborative effort from all Canadian centers performing this procedure.

The Canadian Neuromodulation Society created a national database that all Canadian centers implanting spinal cord stimulators could contribute data. This database is to be used by both clinicians and researchers to better understand what chronic pain conditions respond to a SCS and to hopefully improve care and quality of life. To date, only a few centers have participated in this data collection, and the CNS wants to encourage other clinicians involved in spinal cord stimulation for pain, to participate.

Each center submits an ethics application for their patients' participation in this study. The principal investigator and research team have access to a multi-center database system. Each center enters the outcome data in their computer and the information is be sent to a central server. Centers' can only access their data but not the data of other centers. The data is divided into three modules: a) background data, b) follow up data, and c) surgical data (General Data Entry Form; Surgical Data Entry Form; Follow-Up Data Entry Form).

An analysis of the national pooled data (without reference to any specific center) will also be available to the each of the participating centers. Clinical prognostic factors such as etiology of pain (e.g. failed back syndrome, complex regional pain syndrome), age, sex, pre-implant surgeries, and duration of pain before implantation will be examined. Outcomes include pain severity, psychological distress (mood, anxiety), and function (participation in activities of daily life, interference of pain, employment status).

Our goal is to further evaluate the long-term impact of the SCS on pain relief, and the impact on quality of life in a variety of intractable chronic pain conditions. Creating a database compiled of data from across all the Canadian sites that implant SCS offers a unique contribution to our knowledge of the factors that may contribute to successful outcomes following implantation of spinal cord stimulation systems.


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**Spinal Cord Stimulation and Pregnancy**

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Currently, the use of spinal cord stimulation (SCS) therapy is not recommended in pregnancy because the effects of SCS on the pregnancy and developing fetus are unknown. However, many recipients of SCS therapy are women of childbearing age who may later choose to become pregnant. As such, it is imperative to investigate the effects of SCS on pregnancy as well as reproductive health in general.

In the present report, we review and summarize the existing literature on the use of SCS therapy during the prenatal period. We begin with the case of a 38-year-old woman from our centre who was implanted with a SCS and then became pregnant 6 months later. This is followed by a synopsis of seven case reports describing 13 cases that were identified in our literature search. Next, we discuss the key findings from this research as they relate to the course of pregnancy, fetal development, labor and delivery management, fertility, and technical complications. In our conclusion, we underscore the need for rigorous and controlled scientific investigations. In order to help guide this research, we urge researchers to continue reporting their case observations.

Until more is known about the impact of SCS on pregnancy we recommend developing clinical guidelines for women of childbearing age who are candidates for SCS implantation. This would include routine pregnancy testing prior to SCS trial procedure and information about the limited state of our scientific knowledge regarding the impact of this technology on reproductive health. For patients already implanted with SCS, decisions about ongoing use in the event of pregnancy should be made on an individual basis after a careful consideration of potential risks and benefits.

Key Words: spinal cord stimulation; pregnancy

**Efficacy of rechargeable internal neural stimulators**

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Rechargeable internal neural stimulators (rINS) are now available for deep brain stimulation. We prospectively surveyed patient satisfaction and clinical efficacy in patients receiving this new technology.

We performed a prospective observational study on nine patients with rINS. All patients studied had established efficiacy of their deep brain stimulation system for either dystonia or pain with a non rechargeable system. Patient satisfaction and efficacy with their rINS were established by completion of a questionnaire, a quality of life assessment (SF-36) and calculation of the Total Electrical Energy Delivered (TEED) by the rINS.

22% of patients noticed a reduction in efficacy of their rINS. 78% of patients had a problem with recharging their rINS due to poor contact. Two patients (22%) felt that recharging the rINS interfered with their lives and it was a daily reminder that they had a deep brain stimulator system *in situ*. Eight out of nine patients (89%), however, would recommend to other patients to have a rechargeable INS.

Most patients were happy with their rechargeable internal neural stimulator. 22% of patients noticed a reduction in efficacy. Thus, all patients require close monitoring post replacement of rINS, in case possible adjustment of parameters is required.

**Why the Anterior Cingulate Cortex MUST be the Next Experimental Target for Deep Brain Stimulation in Treatment-Refractory Depression**

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Major depression disorder (MDD) is a disabling disease featured by anedonia, sad mood and homeostatic functions (appetite, libido...) and global life disturbances. Lifetime prevalence of MDD is 15% and 20% of treated patients show limited response or do not respond to any antidepressant medication (treatment resistant depression; TRD). Deep brain stimulation (DBS) appears now as a potential alternative somatic treatment. The current research challenge about DBS in TRD is to seek the optimal target, considering the diffuse MDD pathophysiology.

This poster will firstly review neuroanatomical basis (cytoarchitecture, histology and neurotransmission) and structural and functional connectivity of anterior cingulate cortex (ACC). ACC's emotional and cognitive putative functions in controls and in major depressive disorder (MDD) will be presented. Moreover, ACC's impairments in MDD for structural, functional and neurotransmission will be reviewed. Finally, this poster will show some data about effects of lesions and stimulation in ACC.

Overall, this review supports the idea that ACC must be the next experimental target to treat TRD using DBS. ACC DBS would be an efficient treatment for TRD and we propose an exploratory experiment with 10 TRD patients.

**Safety of Using a Newly Developed Delivery Device for Percutaneous Introduction of SCS Paddle Leads**

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Paddle type leads offer several advantages over cylindrical type leads. Despite these advantages, paddle leads require a more invasive surgery. The laminectomy procedure used to place paddle leads involves removal of the spinous process. This is undoubtedly more painful to the patient than cylindrical lead placement, which requires insertion of a needle into the epidural space. Thus, the ideal situation for lead insertion would be percutaneous delivery of a paddle lead. A new delivery device has been developed to accomplish this task. The following study was designed to systematically evaluate the feasibility and safety of percutaneous delivery of S-Series™ paddle leads (St. Jude Medical Neuromodulation Division, Plano, TX) using this delivery device.

This was a prospective, multi-center study approved by the AZ-St Lucas (Ghent) Ethics Committee. Each patient signed informed consent and was screened according to the inclusion/exclusion criteria. After the patient signed the informed consent, they underwent a baseline evaluation followed by surgery to percutaneously implant an S-Series paddle lead.

The following parameters were evaluated during the course of the study, which corresponded with the patient's 30-day trial of the SCS system: patient demographics, procedural aspects of the surgery, including angle of entry and approach method, distance from entry to final lead placement, and any adverse events relating to the device.

Data from a total of 34 patients was collected from two investigational sites. The overall mean of advancement of the delivery device was 2.4 vertebral segments while the lead was advanced 4.2 vertebral segments. The average (+ SD) procedure time was 8.7 + 5.0 minutes. Reported adverse events included infection (3), lead migration (2), and other (2). No adverse events related to locomotor ability and/or sensory function occurred, demonstrating the safety of percutaneous implantation and advancement of the S-Series lead using a newly designed delivery device.

This work was supported by St. Jude Medical Neuromodulation Division through a sponsored clinical research study.

**Accuracy of Electrodes Implantation for Deep Brain Stimulation and Contacts Localization in Relation with the Subthalamic Nucleus**

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Deep brain stimulation (DBS) of the subthalamic nucleus (STN) has become an accepted treatment in advanced Parkinson's disease (PD). The success of this surgery depends on several factors including the precise localization of the four electrode contacts in relation to the STN. This retrospective study aims to evaluate both the precision of surgery and the localization of active contacts in relation to STN borders. At the CHA-HEJ, the objective of the surgery is to place an electrode in the STN, specifically two contacts inside the STN, one above and one below. For twenty-three patients who underwent surgery for bilateral DBS-STN, the theoretical target was calculated from different ways: from the red nuclei, the point between the anterior and posterior commisure (ACPC) and with electrophysiological data obtained during a single trajectory of intraoperative microrecording (IMR). A fusion of the preoperative and postoperative nuclear magnetic resonance (NMR) images was performed.

A first step was to assess the accuracy of surgery by measuring the distance between the theoretical target and the ferromagnetic artifact representing the final electrode position. Using an algorithm based on Pythagorean and trigonometric concepts, a second step was to determine the precise localization of each electrode contacts, with tridimensional reconstruction, and this, in the ACPC referential. Finally, the coordinates of active contacts, which are the most effective contacts, were studied in relation of STN borders determined by IMR. The results showed that the average difference between the theoretical and final target is 0.77 mm (± 0.59) in X and 0.78 mm (± 0.59) in Y ($p < 0.05$). For 22/35 (62.9%) of electrodes, the theoretical target and final target overlap. The order of implantation ($1^{st}$ compared to $2^{nd}$ side) and the gender of patients don't influence the precision of surgery ($p > 0.05$). Moreover, there is no correlation between the width of the 3rd ventricle and the target coordinates. The localization of all contacts in relation to the STN borders has been determined and they are mostly located within the STN. Despite the surgical strategy, this distribution tends upwards and most active contacts are located within the NST and no one is localized below the STN. The mean stimulation point was also determined by reconstruction (AP (x) =- 2.33 ± 0.99, LAT (y) = 11.67 ± 1.81, GREEN (z) =- 2.39 ± 1.76) and is located at the means upper border of the STN. In conclusion, the surgical procedure used at the CHA-HEJ demonstrates a good degree of accuracy and active contacts most frequently used clinically are those are placed in the dorsal region of the STN, a region described by the literature as the most effective for the treatment of PD symptoms.

**Clinical Evaluation of a Rechargeable Implantable Pulse Generator (IPG): Final Analysis of Sustainability of Spinal Cord Stimulation Therapy for Chronic Lower Back Pain**

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We have previously shown that spinal cord stimulation (SCS) results in adequate pain relief, patient satisfaction, and improved quality of life.[1] The final results of a prospective, multicenter study in which a dual or tripolar array of percutaneous leads or surgical leads was used in conjunction with the rechargeable Eon implantable pulse generator (St. Jude Medical Neuromodulation Division, Plano, TX) further supports sustainability of SCS therapy for chronic low back pain.

Institutional Review Board (IRB) approval was obtained prior to patient enrollment. Each patient who complied with the study criteria underwent the informed consent process prior to study activities. The patients returned to the clinic for evaluations at 1, 3, 6, 12, 18, and 24 months post implant.

Preliminary analysis of the 24 month visit revealed that 71.6% of patients reported that their overall pain relief was 50% or greater. Sixty-seven percent (67%) reported 50% or greater reduction in the low back. In addition, 90.5% of patients were satisfied or very satisfied with SCS treatment and 89.7% reported quality of life as being improved or greatly improved. At the 24-month visit, results from validated questionnaires showed significant improvement over baseline on the pain and distress (PAD) scale, pain disability index (PDI), the mental and physical components of the SF-36, and all components of the SF-McGill Pain Questionnaire (paired samples t-test, $p < 0.05$). On the Oswestry Disability Index (ODI), the number of patients at the 24-month visit categorized as "Crippled" or "Bed Bound" (6.9%) was reduced, and the percentage that were categorized as "Minimal Disability" was increased from baseline.

Chronic lower back pain patients completing 24 months of treatment with SCS therapy maintained consistent and successful therapy as evidenced by pain relief, satisfaction, and quality of life scores.

**Mapping of Posture-Dependent Shifts in Paresthesia during Spinal Cord Stimulation (SCS)**

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Note: this abstract was previously presented at the North American Neuromodulation Society Meeting in December 2010.

**Introduction**

SCS has secured a place in the arsenal of many physicians because of the analgesic effects it provides to patients with chronic neuropathic pain of the low back and legs. In order for SCS to be effective, paresthesia elicited by SCS must superimpose the patient's pain topography. Sources of variation in paresthesia location (PL) are poorly understood. The PL may partially depend on the distance between the dorsal column fibers and the epidural electrodes (dCSF), which is directly influenced by changes in patient posture. We prospectively evaluated changes in PL reported by SCS patients in supine vs. upright positions using a fixed, current-controlled stimulation program.

**Methods**

Subjects with low back and/or leg pain were implanted with Precision Plus(TM) IPGs and two Linear(TM) octapolar percutaneous leads positioned between T8-T10. At five periodic visits post-permanent implantation, a fixed 8mm bipole was programmed on the same contacts (PW=500us, rate = 50Hz) on each lead. PL was then collected by verbal reports from each subject in both supine and upright positions.

**Results**

Twelve subjects completed at least 3 follow-up visits over a mean follow-up time of 55±3 weeks post-permanent implantation. Subjects' verbal descriptions of PL were mapped onto an electronic body map consisting of 144 segments, each with a unique three-dimensional position along the rostrocaudal, dorsoventral, and left-right axes. The centroid was calculated by geometric decomposition for each subject's paresthesia distribution in supine and upright positions to identify the mean of all points in the shape of the paresthesia across the body. Changes in paresthesia distribution between positions were then analyzed as a paresthesia centroid shift with directionality along the three axes. We found a statistically significant supine-to-upright centroid shift ($P<0.05$). As the subjects moved from a supine to upright position, the paresthesia distribution shifted rostrally and showed a statistically significant preference for the anterior dermatomes in the lower extremities ($P=0.03$).

**Conclusions**

We report a statistically significant change in PL between supine and upright positions. This suggests that as the patient assumes different postures, the movement of the spinal cord within the thecal sac and the consequent changes in the dCSF play a role in the fiber and spatial selectivity of the nerve fibers near the electrode. Selective activation of a particular fiber type or a discrete group of fibers may disrupt paresthesia concordance. The effects of this phenomenon have been mitigated clinically by creating a therapeutic program dedicated for each position.

# Restaurant recommendations | *Recommandations de restaurants*

| | | |
|---|---|---|
| **Pacific North West/Global** | | |
| Show Case | 1128 W Hastings Street | 604-684-1128 |
| Sequoia Grill at Ferguson Point | 7501 Stanley Park Drive | 604-669-3281 |
| Raincity Grill | 1193 Denman Street | 604-685-7337 |
| **Chinese** | | |
| Shanghai Chinese Bistro | 1128 Alberni Street | 604-683-8222 |
| Kirin Mandarin | 1166 Alberni Street | 604-682-8833 |
| Imperial Chinese Seafood | 355 Burrard Street | 604-688-8191 |
| Hon's | 1339 Robson Street | 604-685-0871 |
| **Japanese** | | |
| Kamei Royale | 211-1030 W.Georgia St | 604-687-8588 |
| Kobe Japanese Steakhouse | 1042 Alberni Street | 604-684-2451 |
| Tojo's | 202-777 W. Broadway | 604-872-8050 |
| Miku | 1055 West Hastings Street | 604-568-3900 |
| **Thai** | | |
| Sala Thai | 888 Burrard Street | 604-683-7999 |
| **Italian** | | |
| Cin Cin Ristorante | 1154 Robson Street | 604-688-7338 |
| Il Giardino | 1382 Hornby Street | 604-669-2422 |
| Zefferelli's | 1136 Robson Steet | 604-687-0665 |
| Italian Kitchen | 1037 Alberni Street | 604-687-2858 |
| Al Porto | 321 Water Street | 604-683-8376 |
| **Steakhouse** | | |
| The Keg | 742 Thurlow Street | 604-685-4688 |
| Hy's Encore | 637 Hornby Street | 604-683-7671 |
| Gotham Steakhouse | 615 Seymour Street | 604-605-8282 |
| **Seafood** | | |
| Joe Fortes | 777 Thurlow Street | 604-669-1940 |
| Cardero's | 1583 Coal Harbour Way | 604-669-7666 |
| The Fish House | 8901 Stanley Park Drive | 604-681-7275 |
| The Boathouse | 1795 Beach Ave | 604-669-2225 |
| Lift | 333 Menchions Mews | 604-669-2225 |
| Coast | 1257 Hamilton Street | 604-685-5010 |
| Blue Water Cafe & Oyster Bar | 1095 Hamilton Street | 604-688-8078 |
| **French** | | |
| Le Crocodile | 100-909 Burrard Street | 604-669-4928 |
| La Gavroche | 1616 Alberni Street | 604-685-3924 |
| **Indian** | | |
| Taste Of India | 1282 Robson Street/Jervis | 604-682-1282 |
| India Gate | 616 Robson Street/Seymour | 604-684-4617 |
| Sitar | 8 Powell Street (Gastown) | 604-687-0049 |
| Maurya | 1643 West Broadway Street/Fir | 604-742-0622 |
| Vij's Indian Cuisine | 1480 W. 11th Ave/Granville | 604-736-6664 |

**Casual Style Restaurants**

| | | |
|---|---|---|
| Earls On Top | 1185 Robson Street | 604-669-0020 |
| Moxies | 808 Bute Street | 604-696-9986 |
| Red Robin | 803 Thurlow Street | 604-662-8288 |
| Milestones | 1145 Robson Street | 604-682-4477 |
| Spaghetti Factory | 33 Water Street | 604-684-1288 |
| Cactus Club | 588 Burrard | 604-682-0933 |
| Joey's Bentall | 505 Burrard | 604-915-5639 |

**Breakfast Restaurants**

| | | |
|---|---|---|
| Marcello's Café | 1078 West Pender | 604-331-0046 |
| Moonpennies | 1103 West Pender | 604-669-6092 |
| Café Artiagiano | 1101 West Pender | 604-685-5333 |
| White Spot | 1616 West Hastings | 604-681-8034 |
| Milestones | 1145 Robson Street | 604 682 4477 |

## Contactez-nous / *Contact us*

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