



The 16th Annual Meeting of the Israel Spine Society

29th April - 1st May 2015
Wednesday-Friday
The Royal Beach Hotel, Eilat



**Degenerative
Therapies****Fracture
Therapies****Deformity
Therapies**

ENABLING TECHNOLOGIES

**MICHELSON
TECHNOLOGY
AT WORK**

SERVICES & SUPPORT



General Information

The 16th annual meeting of the Israel Spine Society will be held on Wednesday-Saturday, 29th April - 1st May, 2015 "Royal Beach" Hotel in Eilat.

■ Acting Committee

Nachshon Knoller M.D - Chairman

Yoram Anekshtein M.D - Secretary

Eyal Itshayek M.D - Treasurer

Israel Caspi M.D - Educational Committee

Gad J. Velan M.D - Committee Member

■ International Guests

J. Chapman , M.D - Director, spine service, Swedish Neuroscience Institute, Seattle Washington, USA

I. Lieberman , M.D - Director Scoliosis and Tumor Program Texas Back Institute Texas Health Plano Hospital

Jc Le Huec, M.D - Chairman Ortho-Spine department, Dir. Surgical Research Lab Bordeaux University Hospital, France

F. Smith, M.D - Clinical professor of Radiology, University of Aberdeen Scotland, Clinical Director Medserena (UK), London England

■ Local Guests

R. Atzmon - Resident of Orthopedic

Y. Garbuz - Artist and Author

■ Conference secretary

Mrs. Shanit Twito

■ Official language

The official language will be English

Certificate of attendance will be provided upon request. Throughout the duration of the meeting, exhibits stands will display spine surgery systems, pharmaceutical and medical products

■ Dress code

Casual

Dear friends and distinguished guest speakers,

We meet again in our yearly meeting in that has a solid scientific and social tradition.

I would like to welcome our keynote speakers and guests – Prof. Luek from France, Drs. Lieberman and Chapman from the USA and Dr. Smith from Scotland. Our sincere thanks go to our guest speakers, for devoting their precious time to attend our meeting and enrich us with their knowledge and clinical experience.

In the last year, we were confronted with the results and conclusions of the “German Committee” as well as a hostile media environment to our professional and moral reputation. I am calling the leaders of our professional organizations to act against those trends in first priority.

I am happy to inform you that there are few doctors that started spinal fellowships in some hospitals in Israel. It is a good opportunity to remind all our members that there is a formal two years fellowship program that was approved and confirmed by the Scientific Council of the Israel Medical Association. We will be able to keep our high level of practice if we will adhere to this program.

I wish us all a fruitful meeting and a pleasant stay in Eilat among friends and colleagues.

Nachshon Knoller MD
President, Israel Spine Society

חברי האגוד ואורחים נכבדים ברוכים הבאים,

עברה שנה ושוב אנחנו נפגשים באילת, לכנס השנתי שלנו. כנס עם מסורת מדעית וחברתית מוצקה.

ברצוני לכרך את המרצים האורחים – פרופ' לואק מצרפת, ד"ר ליברמן וד"ר צ'פמן מארה"ב וד"ר סמית מסקוטלנד. תודתנו נתונה על כך שהקדישו מזמנם להשתתף בכנס השנתי שלנו ולהעשיר אותנו בניסיונם וכידע הקליני שלהם.

השנה שחלפה עמדה בצל מסקנות "ועדת גרמן", אשר איימו על הרפואה הפרטית יותר מאשר הבטיחו מזור לרפואה הציבורית. זאת, בליווי שלל מאמרים וכתבות שהביאו לפגיעה במוניטין המקצועי והמוסרי שלנו כרופאים. אני פונה בשם חברי האיגוד לראשי הארגונים המקצועיים שלנו לטפל בנושא זה בעדיפות ראשונה.

אני שמח לכשר שביצוע השתלמות עמיתים בניתוחי עמוד שדרה בישראל מתקיים במספר בתי חולים בישראל. זו הזדמנות טובה להפעיל את מסלול השתלמות העמיתים בת שנתיים שאושרה לאיגוד על ידי המועצה המדעית של הר"י, ובכך לשמור גם על רמה נאותה ללא התפשרויות.

אני מאחל לכולנו כנס פורה ושהייה נעימה באילת בין חברים ועמיתים.

נחשון קנולר
נשיא האיגוד הישראלי לעמוד שדרה

Pre-Meeting Workshops

Wednesday, April 29, 2015

15.45	Coffee break
16.00	Topic: Neurostimulation therapy for chronic pain. Moderator: Dr. Itay Goor-Arye

Sponsored by: Medtronic Ltd.

חברי האיגוד ואורחים נכבדים ברוכים הבאים,

בשם הוועדה המארגנת הנני לברך אתכם על השתתפותכם בכינוס ה-16 של החברה הישראלית לעמוד השדרה.

גם השנה זוכים אנו להשתתפותם המכובדת של אורחים מחו"ל, אשר ישתפו אותנו בהשגיהם וידונו עמנו בנושאים בעלי ענין.

השתדלנו השנה לכלול בתכנית הכנס את כל מגוון הפעילות בתחום ניתוחי עמוד השדרה ולתת במה לחידושים בתחום זה.

אני מודה לכל אלה אשר סייעו בידינו להרים פרויקט זה.

אני מאחל לחברים, בני משפחותיהם ולאורחינו מהעולם, סוף שבוע נפלא באילת המקסימה כרגיל.

דו. ישראל כספי
הוועדה המדעית

Scientific Program

Scientific Program

Wednesday, April 29, 2015

15.45 - 16.30 Pre-Meeting Workshop
19.30 - 21.30 Opening reception

Thursday, April 30, 2015

07.30 - 08.10 Registration
08.10 - 08.15 Opening remarks
N. Knoller, ISS Chairman

■ Session 1: Trauma

■ Chairmen: J.F. Soustiel, I. Engel

08.15 - 08.35 **Keynote lecture:** An ongoing problem: what about pediatric spine trauma
J. Chapman

08.36 - 08.44 **Open vertebroplasty as anterior column support for unstable three column thoraco-lumbar burst fractures augmented with short posterior segmental fixation**
S. Mandler, S. Sagiv, P. Ben-Galim

08.45 - 08.53 **Difficulties in the operative management of ankylosing spondylitis patients undergoing fracture fixation**
G. Ron, S. Sagiv, P. Ben-Galim

08.54 - 09.02 **Penetrating stab wounds to the spine- believe it or not?**
L. Merom, A. Keren, E. Hadad, A. Hanani

09.02 - 09.13 Discussion

09.13 - 09.33 **Keynote lecture:** Improved MRI imaging for whiplash injury
F. Smith

09.34 - 10.54 **Keynote lecture:** Sign of pending silver tsunami - geriatric odontoid fractures
J. Chapman

09.54 - 10.04 Discussion

10.04 - 10.35 Coffee break

■ Session 2: Minimally invasive surgery

■ Chairmen: I. Lieberman, L. Merom

10.35 - 10.43 **Inside-out foraminal decompression - a bone-sparing procedure that may save the need for fusion**
N. Rand, E. Ashkenazi

10.44 - 10.52	Minimally invasive spinal decompression surgery in the geriatric population M. Khashan, G.J. Regev, K. Salame, O. Keynan, Z. Lidar
10.53 - 11.01	Full endoscopic lumbar interlaminar discectomy J.F. Soustiel, M. Elron
11.02 - 11.10	Resection of benign osseous tumors of the spine by M.I.S techniques G.J. Regev, K. Salame, A. Keynon, Z. Lidar
11.11 - 11.19	Spine radiosurgery: safety and efficacy R. Harel, L. Zach
11.19 - 11.30	Discussion

■ **Session 3: Surgical complications Registry and Pain**

■ **Chairmen:** Y. Floman, J.E. Schroeder

11.30 - 11.38	Narcotic use amongst spine patients – trends and beliefs J.E. Schroeder, J. Shue, L. Kaplan, N. Joseph, F. Girardi
11.39 - 11.47	Spinal cord stimulation for the treatment of “failed back” syndrome Z. Zibly, R. Gur, R. Spiegelmann, H.M. Adahan, N. Knoller
11.48 - 11.56	Introducing the neurologist in the spine clinic – a new team player? G.Givati, R.Harel
11.56 - 12.02	Discussion
12.02 - 12.10	The establishment of a prospective spine surgery registry: the spine database L. Mangel, G. Regev, S. Sipis, K. Salame, Z. Lidar
12.11 - 12.19	The mutual influence of spine surgery outcomes and functional health, pain, quality of life and psychological profile of patients L. Shoshan-Amir, I. Engel, S. Shabat, M. Yanko, R. David, Y. Leitner
12.20 - 12.28	Comparison between metallic skin staples and nylon sutures for closure of open spine surgical incisions H. Mulla, A. Shani, V. Poliansky, S. Freiman, N. Rahamimov
12.29 - 12.37	Post operative lumbar CSF persistent leak in elective patients - Dilemma of treatment L. Merom, A. Weissman, A. Keren, E. Hadad, A. Hanani
12.37 - 12.47	Discussion
12.47 - 13.50	Lunch break

■ **Session 4: Navigation, robotics and imaging**

■ **Chairmen:** F. Smith, Y. Mirovsky

13.50 - 14.10	Debate: Cutting edge technology: Robots VS. Navigators Pro-navigation - R. Harel Pro-robotic - Y. Barzilay
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14.11 - 14.19	Computer assisted robotic surgery in the octogenarians J. E. Schroeder, Y. Barzilay, A. Hasharoni, M. Liebergall, E. Itshayek, L. Kaplan
14.20 - 14.28	O-ARM based spine navigation for pedicle screw fixation J.F. Soustiel, A. Sharon, M. Elron
14.29 - 14.49	Keynote lecture: Learning curve and case examples for robotic assisted spinal surgery I. Lieberman
14.50 - 14.58	The craniocervical junction in ankylosing spondylitis: a computed tomography based study A. Shpigelman, G. Slobodin, S. Croitoru, I. Rosner
14.59 - 15.07	Intraoperative radiation exposure in robot guided and fluoroscopy guided percutaneous fixation of vertebral fractures K. Abu-Dalu, H.Arzi, A. Hamad, A.Popov, Y.Barzilay
15.08 - 15.28	Keynote lecture: MRI Imaging - Magnetic field strength is not always important F. Smith
15.28 - 15.38	Discussion
15.38 - 16.10	Coffee break

■ **Session 5: Deformity**

■ **Chairmen:** Jc Le Huec, Y. Anekstein

16.10 - 16.30	Keynote lecture: The pursuit of sagittal balance I. Lieberman
16.31 - 16.41	Discussion: by Jc Le Huec
16.42 - 16.50	A less invasive short peri-apical fixation for correction of AIS :our experience with the ApiFix system R. Blecher, Y.Anekstein, Y. Smorgick, Y. Mirovsky, Y. Floman
16.51 - 16.59	Evaluation of structural and morphological features of thoracic and lumbar pedicles in adolescent idiopathic scoliosis patients, based on reconstructed CT images I. Ophir, I. Engel, Y. Leitner
17.00 - 17.08	Kyphectomy in patients with myelomeningocele (MMC) with spino-pelvic fixation. A long term outcome study H. Shear-Yaskuv, J.E. Schroeder, A. Hasharoni, L. Kaplan
17.09 - 17.17	S-2 alar iliac pelvic fixation O. Rabau, Y. Smorgick, E. Shalmon, Y. Anekstein, Y. Mirovsky
17.18 - 17.38	Debate: Screening for scoliosis Pro - H. Arzi Con - D.E. Lebel

17.39 - 17.59 **Keynote lecture: Adult degenerative scoliosis - are the complications worth the outcome**
J. Chapman

17.59 - 18.10 **Discussion**

Friday, May 1, 2015

■ **Session 6: The degenerative spine**

■ **Chairmen: J. Chapman, A. Friedlander**

08.15 - 08.35 **Keynote lecture: Is iliac fixation needed for long fusion constructs?**
I. Lieberman

08.36 - 08.56 **Keynote lecture: pedicle screw anchorage: a biomechanical challenge where the moment of forces is as important as pull out**
Jc Le Huec

08.57 - 09.03 **Discussion**

09.04 - 09.12 **Lumbar spine surgery in Parkinson Disease patients**
J.E. Schroeder, L. Kaplan, A. Sama, F. Cammisa, F. Girardi

09.13 - 09.21 **Nitinol rod dynamic fixation of the lumbosacral spine for degenerative disc diseases. A two and a half year follow-up prospective randomized study**
S. Kolesov, V. Shvets, D. Kolbovskiy, A. Kazmin, N. Morozova

09.22 - 09.30 **The relationship between the location of cervical cord compression and the location of myelomalacia**
A. Yassin, Y. Smorgick, S. Tal, E. Tamir, Y. Mirovsky, Y. Anekstein

09.31 - 09.39 **Incidental durotomy in primary and revision interbody arthrodesis using the modified Wiltse approach**
D. Sheinis, A. Amitay, N. Ohana

09.40 - 10.00 **Keynote lecture: Spl with lysis: New analysis and treatment algorithm**
Jc Le Huec

10.21 - 10.41 **Keynote lecture: Marketing hype or care advancement - the XLIF story**
J. Chapman

10.41 - 10.50 **Discussion**

10.50 - 11.20 **Coffee break**

11.20 - 12.05 **Guest lecture: Kidnapping in Colombia**
R. Atzmon

12.05 - 13.00 **Guest lecture: "The House in the Galil" – a journal of reading and seeing**
Y. Garbuz

13.00 - 14.00 **Business meeting - ISS members only**
Meeting adjourns

Open vertebroplasty as anterior column support for unstable three column thoraco-lumbar burst fractures augmented with short posterior segmental fixation

S. Mandler, S. Sagiv, P. Ben-Galim

Department of Orthopaedic Surgery, Kaplan Medical Center, Rehovot, Israel

Scientific background: Unstable thoracolumbar burst fractures treated with short-segment posterior spinal instrumentation without anterior column reconstruction are associated with a high rate of screw breakage and progressive loss of reduction. The purpose of this study is to evaluate the functional, neurologic, and radiographic results of three column unstable T-L fractures, following transpedicular pedicle screw assisted open fracture reduction with anterior column reconstruction via open vertebroplasty combined with short-segment posterior instrumentation.

Methods: A consecutive series of twenty five patients with an unstable thoracolumbar burst fracture with or without neurologic deficit were managed with transpedicular, pedicle screw fracture reduction with anterior column reconstruction via open vertebroplasty and short-segment posterior spinal instrumentation from 2011 to 2014. Demographic data, neurologic function, segmental kyphosis, canal compromise, VAS scores, and treatment-related complications were evaluated prospectively.

Results: All neurologically intact patients demonstrated significant clinical improvement and were ambulating at time of discharge. All three patients with incomplete neurologic deficits exhibited neurologic improvement of 1 to 2 Frankel grades. The mean kyphotic angulation improved from 15.41 degrees preoperatively to 5.92 degrees at the time of the latest follow-up, and the loss of vertebral body height improved from a mean of 49.23% preoperatively to 8.94% at the time of the latest follow-up. There were no treatment-related complications, no instrumentation failure or loss of correction. All patients returned to ADL function.

Discussion: This study emphasizes the safety and efficacy of an all posterior approach that achieves both anterior column reconstruction, and posterior fixation for unstable three column Burst fractures utilizing open vertebroplasty. This procedure allows preserving adjacent segmentary motion while achieving fracture reduction, sagittal balance and a stable construct.

Conclusion: Initial results demonstrate that excellent reduction of unstable thoracolumbar burst fractures can be achieved and maintained with use of short-segment instrumentation and pedicle screw assisted open fracture reduction augmented with anterior column vertebroplasty reconstruction performed through a single posterior approach. The resultant circumferential stabilization combined with a decompressive laminectomy in selected cases is safe and efficiently achieved and maintained sagittal alignment with satisfactory clinical results. Long term follow up studies are recommended.

Key words: Vertebroplasty, Short Posterior Fixation, Burst Fractures, Kyphosis Correction

Difficulties in the operative management of ankylosing spondylitis patients undergoing fracture fixation

G. Ron, S. Sagiv, P. Ben-Galim

Department of Orthopaedic Surgery, Kaplan Medical Center, Rehovot, Israel

Scientific background: Ankylosing Spondylitis (AS) is the most prevalent subtype of an interrelated group of seronegative rheumatic spondyloarthritides that primarily affects the axial skeleton. The natural history of this condition is one of slow progression over decades until the full clinical manifestations such as spinal fractures occur. Spinal fractures in patients with AS are notoriously unstable and associated with a high incidence of secondary development of spinal cord injuries. These fractures typically occur at late stages of this disease when multiple systems are involved and in particular respiratory. Objectives: The goals of this study are to present the difficulties associated with the treatment of AS patients with unstable spinal fractures and to describe the complexity that necessitates a multidisciplinary approach to this difficult problem.

Methods: A retrospective chart review of all AS patients treated for unstable spinal column fractures at our medical center during the years 2011-2013. Primary Outcome measures included survival vs. mortality. Secondary outcome measures included: perioperative complications, respiratory complications, infection rates, etc.

Results: Fourteen AS patients were admitted due to suspected vertebral fractures, nine of them were found to have bio-mechanically unstable vertebral column fractures that required surgical fixation. Eight were operated and one patient succumbed due to the multiple complications of this disease prior to surgical stabilization. Six of these developed severe respiratory complications in the peri-operative period, they all required ICU treatment and 3 died due to the respiratory dysfunction. Four patients presented with or gradually developed spinal cord injury, two patients had neurological improvement after surgical treatment.

Discussion: This study emphasizes the treatment challenge in the perioperative management of AS patients with spinal fractures. Peri-operative complications as difficult air way, stiff neck and respiratory dysfunction must be anticipated and addressed in all cases. The most prevalent peri-operative difficulty was respiratory compromise and pneumonia.

Conclusion: Employment of a multidisciplinary approach and a high index of suspicion for the spinal and non-spinal devastating complications is to be expected in the treatment of AS patients with unstable vertebral column fractures. Preoperative pulmonology and anesthesiology consultation is recommended and post-surgery Intensive care unit (ICU) setting monitoring is warranted for optimal outcome.

Keywords: Ankylosing Spondylitis, Diffuse Idiopathic Skeletal Hyperostosis, Unstable Spinal Column Fractures.

Penetrating stab wounds to the spine- believe it or not?

L. Merom⁽¹⁾, A. Keren⁽²⁾, E. Hadad⁽¹⁾, A. Hanani⁽¹⁾

(1) Spine Surgery unit, Rambam Health Care Campus.

(2) Orthopedic Division. Rambam Health Care Campus

Objective: case reports and a literature review of penetrating stab wound into the spine. Summary of background data: We report on 2 patients who were admitted to the emergency department of our institute.

Patient 1: admitted in 18-4-14. A stab wound with a kitchen knife into the cervical spine.

Patient 2: admitted in 29-6-14. A stab wound with a screwdriver into the thoracic spine.

Methods: Rapid ATLS evaluation was done at admission to rule out any life threatening conditions.

The neurological assessment revealed no neurological deficit at all. CT scan with reconstructions of the injured area was done shortly after admission to the emergency department. In awake patient, without anesthesia, the insult weapon was taken out with free hands

Results: Neither neurological deterioration, nor acute bleeding noted after removal of the weapons.

Conclusion: A stab wound is a specific form of penetrating trauma to the skin that results from a knife or a similar pointed object that is "deeper than it is wide". Most stabbings occur because of intentional violence or through self infliction. The treatment is dependent on many different variables such as the anatomical location and the severity of the injury.

Management: Stab wounds can cause various internal and external injuries. They are generally caused by low-velocity weapons, meaning the injuries inflicted on a person are typically confined to the path it took internally, instead of causing damage to surrounding tissue, which is common of gunshot wounds. The abdomen is the most commonly injured area from a stab wound. Interventions that may be needed depending on severity of the injury include airway, intravenous access, and control of hemorrhage. The length and size of the knife blade, as well as the trajectory it followed, may be important in planning management as it can be a predictor of what structures were damaged. Special precautions should also be used to prevent further injury from a perpetrator to the victim in a hospital setting. Similarly to treating shock, it is important to keep the systolic pressure above 90mmHg, maintain the person's core body temperature, and for prompt transport to a trauma center in severe cases.

To determine if internal bleeding is present a focused assessment with sonography (FAST) or diagnostic peritoneal lavage (DPL) can be used. Other diagnostic tests such as a computed tomography scan or various contrast studies can be used to more definitively classify the injury in both severity and location. Observation can be used in place of surgery as it can substitute an unnecessary surgery, which makes it the preferred treatment of penetrating trauma secondary to a stab wound when hypovolemia or shock is not present.

Surgical intervention may be required but it depends on what organ systems are affected by the wound and the extent of the damage. It is important for care providers to thoroughly check the wound site inasmuch as a laceration of an artery often results in delayed complications sometimes leading to death. Typically a surgeon will track the path of the weapon to determine the anatomical structures that were damaged. In severe cases when homeostasis cannot be maintained the use of damage control surgery may be utilized.

Epidemiology: Stabbings are a relatively common cause of homicide in Canada and the USA. Typically deaths caused by stabbings are due to organ failure or blood loss. They are the mechanism of approximately 2% of suicides. Most stab wounds are caused by intentional violence, as the weapons used to inflict such wounds are readily available compared to guns.

In Canada homicides by stabbing and gunshot occur relatively equally (1,008 to 980 for the years 2005 to 2009). In the United States guns are a more common method of homicide (9,484 verses 1,897 for stabbing or cutting in 2008).

Stab wounds occur four times more than gunshot wounds in the United Kingdom, but the mortality rate associated with stabbing has ranged from 0-4% as 85% of injuries sustained from stab wounds only affect subcutaneous tissue. Most assaults resulting in a stab wound occur to men and persons of ethnic minorities.

History: Some of the first principles of wound care come from Hippocrates who promoted keeping wounds dry except for irrigation. Guy de Chauliac would promote removal of foreign bodies, rejoining of severed tissues, maintenance of tissue continuity, preservation of organ substance, and prevention of complications. The first successful operation on a person who was stabbed in the heart was performed in 1896 by Ludwig Rehn, in what is now considered the first case of heart surgery. In the late 1800s it was hard to treat stab wounds because of poor transportation of victims to health facilities, and the low ability for surgeons to effectively repair organs, however; the use of laparotomys which has been developed a few years earlier had provided better patient outcomes. During the Korean war a greater emphasis was put on the use of pressure dressings and tourniquets for initially controlling bleeding.

Inside-out foraminal decompression - a bone-sparing procedure that may save the need for fusion.

A. Rand, E. Ashkenazi

Israel Spine Center, Assuta Hospital

Abstract: A new surgical technique is presented for decompressing lumbar nerve root; the foramen is approached from the within the canal and excess bone can be removed without compromising the facet joint stability.

Background and method: Foraminal stenosis is usually decompressed via a posterior open approach. Removing excess bone or facet joint may cause instability and require fusion. We present a surgical technique for lumbar foraminotomy using a novel - the DReal™ Spinal Decompression Device (Carevature Medical Ltd. Rehovot, Israel). It is a high-speed, drill-like bone cutter with a curved shielded 3mm-diameter tip directed towards the bone to be removed while keeping the nerve root protected.

Cases: 1. A 40 year-old male suffering of sciatica due to L5-S1 foraminal osteophyte. "Traditional" surgery would require removal of part of the facet. Using the DReal™, the osteophyte was removed without compromising the facet. The procedure lasted less than an hour with no significant blood loss. The patient was discharged 24 hours post surgery with no leg pain. 2. A 73 year-old female suffered of sciatica with severe lumbar degeneration & stenosis. Wide decompression would necessitate addressing the whole lumbar spine (L1-S1 decompression & fusion). Selective nerve root block located the source of pain to the left S1 root. A limited L5-S1 decompression was performed through a partial S1 laminectomy and foraminal widening by removal of a bony spur using the DReal™. The operation was completed in less than one hour, blood loss was less than 100cc. The patient was discharged 48 hours post op. Left leg VAS pre-operative was 10 and post-operative was 3.

Conclusion: Treatment choice for foraminal stenosis depends on the pathoanatomy. Lumbar spondylosis leads to loss of intervertebral disc height with anterior and superior migration of the superior facet, decreasing the antero-posterior dimension. Ligamentum flavum hypertrophy and osteophyte formation exacerbate the craniocaudal stenosis, vertebral endplate osteophytes, bulging annulus fibrosus, or a herniated disc may contribute to the narrowing. The combined effect of all or part of these processes may lead to circumferential narrowing of the space available for the nerve root and consequently to radicular symptoms. Decompressing the foramen and restoring the required space for the nerve root remains a challenge if the spinal stability is not to be compromised. We present a new surgical technique for performing effective foraminotomy while preserving the stability of the spine, eliminating the need for fusion or instrumentation in the lack of preoperative instability or deformity. Operative time and estimated blood loss were significantly less than in fusion surgery using the new instrument. Inside-out foraminal decompression using the DReal appears to be a safe and effective surgical technique employing the standard approach without causing secondary spinal instability.

Minimally invasive spinal decompression surgery in the geriatric population

M. Khashan, G.J. Regev, K. Salame, O. Keynan, Z. Lidar

Background context: In the last decades the population has been aging steadily along with continuous increase in life expectancy. One consequence of these changes is an increased incidence of spinal stenosis in the geriatric population. Although lumbar laminectomy has been shown to result in excellent long-term results there is still a concern about the risk of performing this surgery in geriatric patients who usually present with multiple and systemic comorbidities. Lumbar decompression surgery using minimal invasive techniques causes less soft tissue injury, blood loss and postoperative pain. We therefore hypothesize that this technique will be associated with a decreased risk of complication and improved outcomes in the geriatric population.

Purpose: The purpose of this study was to compare the rate of surgery complications, clinical outcomes and length of hospital stay between patients older than 75 years and patients younger than 45 years.

Methods: We retrospectively analyzed the records of patients who underwent single level microscopically assisted lumbar decompression surgery, using a unilateral tubular retractor system. Indications for surgery were: spinal stenosis, foraminal stenosis and herniated nucleus pulposus. In total, 100 consecutive patients were included within two groups, A and B, based on patients' age. Patients in group A are older than 75 years and in group B, younger than 45 years. We evaluated perioperative mortality, perioperative complications, postoperative length of hospital stay and clinical outcome.

Results: The average age in group A was 77 years (range 75-92) and 34 years (range 17-45) in group B. The average follow-up period was 34 months (range 17-60) in group A, and 41 months (range 13-60) in group B. In group A, 32% of the patient suffered from three or more systemic diseases compared to only 2% in group B ($P < 0.05$). As a result, The prediction of operative risk according to the American Society of Anesthesiologists (ASA) physical status classification system was 2.66 ± 0.85 in group A compared to 1.08 ± 0.34 in group B ($P < 0.05$). Despite the increased surgical risk of the geriatric patients group there was no case of perioperative mortality or surgical wound infection in this cohort. The incidence of surgical revisions and intraoperative iatrogenic durotomy rates were found similar for both groups. In addition, no statistically significant differences were found in average length of hospital stay as well as in clinical improvement between the groups.

Conclusions: Minimally invasive lumbar spinal decompression is a safe and successful procedure for geriatric patients even with multiple systemic comorbidities. In terms of mortality and post-operative complication, the outcomes in the elderly group were comparable to the ones of the younger group undergoing similar surgeries.

Full endoscopic lumbar interlaminar discectomy

J.F. Soustiel, M. Elron

Department of Neurosurgery, Galilee Medical Center, Naharia, Israel

Background: Percutaneous endoscopic lumbar discectomy has been used for more than two decades. Most studies, however, have been focusing on a posterior lateral approach directed towards the most lateral aspect of the intervertebral disc outside the spinal canal. Interlaminar discectomy allows a direct visualization and resection of the herniated part of the disc.

Material and methods: The results of 15 endoscopic lumbar discectomies performed during the past 18 months were compared to that of 45 microsurgical single-level lumbar discectomies.

Results: Endoscopic surgery proved to be significantly lengthier than open disc surgery (91 min vs 69 min). Out of 15 endoscopic procedures, 3 were unsuccessful and were converted into an open surgical approach. Of these, two instances were related to a failure of the approach and one to inappropriate patient selection in term of anatomical window. Of the remaining 12 patients, one has persistent leg pain that could be related to insufficient disc removal and was successfully re-operated within 3 months. There was no endoscopic related complications. Patients of the endoscopic group compared positively with patients of the open surgery group with reduced post-operative pain, shorter hospitalization and earlier return to previous activity. Three months outcome, however, did not prove to be significantly different between the two groups.

Conclusions: Full endoscopic lumbar interlaminar discectomy implies the acquisition of dedicated skills which can be initially occasionally frustrating for the experienced spine surgeon. Yet, Familiar surgical scenery provided by the interlaminar approach associated with improving technology may shortly result in a significant improvement of the post-operative comfort and healing of selected patients.

Resection of benign osseous tumors of the spine by M.I.S techniques

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Background Context: Benign tumors of the spine are generally an uncommon cause for surgery. Complete removal of these tumors commonly requires extensive surgical technique that usually consists of generous surgical exposure followed by laminectomy, facetectomy and sometimes even an instrumented fusion.

Purpose: To describe our experience performing intra-lesional resection of intraosseous benign tumors from various locations of the vertebral column, utilizing a minimally invasive tubular retractor system through a variety of surgical approaches. The surgical technique, as well as the patient outcomes, are presented and discussed.

Study Design: Retrospective case series.

Methods: Records of patients who underwent minimally invasive resection of vertebral tumor were reviewed. Patients had been evaluated preoperatively and postoperatively at 1, 3, and 6 months intervals. Outcome measures included a complete neurological examination, and pain, as measured by the visual analog scale (VAS). Secondary outcomes included post-operative spinal instability, and surgical margins. These were assessed clinically and radiographically using plain radiographs and 3-month postoperative CT scans. Final pathological report, operative time, blood loss, complications, and hospital length of stay were also recorded.

Results: Between May 2009 and December 2013, 14 patients underwent minimally invasive, resection of benign bony spinal tumors at our institution. There were 8 men and 6 women with a mean age of 27 years (range 16-68 years). In the six cases with tumors located in the posterior elements- a direct posterior approach was used. Tumors located at the pedicle of the vertebra were excised using a trans-pedicular approach. In two cases where the tumor was protruding into the foramen, the trans-foraminal approach was used. The trans-canal approach was used in two cases when decompression of the thecal sac or nerve root was required, and the retroperitoneal trans-psoas approach was used in the remaining case. Satisfactory removal of the tumor was achieved in all cases, and was verified by a follow-up CT scan. Pathology revealed Osteoid Osteoma in 5 patients, Osteoblastoma in 3 patients and Eosinophilic Granuloma, Fibrous dysplasia and Fibroid adenoma in the rest. Average improvement of the Visual Analog Score was from an initial 7.7 (7-9) to 2.8 (0-7) following surgery.

Conclusions: Our early results suggested that minimally invasive techniques are a valuable choice for the treatment of benign osseous tumors of the spine. A larger, long-term study is in progress. In the meantime, we suggest that this technique be considered by surgeons experienced both with open and minimally invasive spine surgery.

Spine radiosurgery: safety and efficacy

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Introduction: Spine Radiosurgery (SRS) is a relatively new modality for the treatment of spine tumors. Multiple studies demonstrated the safety and efficiency of this modality, however the efficacy of SRS is still to be determined.

Methods: Patients suffering from spine tumors indicated for spine radiosurgery were treated by a single fraction of 16Gy or 18Gy dose in an ambulatory set-up by the author in Sheba Medical center or Assuta medical Center. A retrospective review of the cases was performed, examining the indications, method of treatment, side effects and response to treatment.

Results: Seventy-seven lesions were treated in 63 sessions. Overall local control rate was 95%. Only minor side effects were observed. None of the patients developed radiation induced myelopathy. Selected cases will be presented and discussed regarding the indication for treatment, treatment method and dose, and possible complications.

Conclusions: SRS is non-invasive treatment of spine tumors. The local control rate is high with low complication rate. SRS is beneficial as a primary treatment for patients with radioresistant pathologies, oligometastatic disease, after conventional radiation failure, as an adjunct to surgical treatment and for selected benign tumors.

Narcotic use amongst spine patients – trends and beliefs

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Introduction: There is a growing body of evidence regarding the dangers involved with the use of narcotics. With increasing numbers of patients taking narcotics on a regular basis, complications from narcotics may be greater than complications from other groups of medications. In the current study, we assessed variation in the use of narcotics amongst spine surgeons. In addition we assessed their beliefs regarding the impact of narcotics on spine surgery outcomes.

Methods: An internet-based survey was distributed to AOSpine members in North America and Europe, and spine surgeons in South America. Spine surgeons and practitioners were asked to answer the following questions: years in practice, geographic location, practice setting, percentage of practice that is spine-related, who is the first caretaker of the patients with spine-related conditions, duration of symptoms prior to presenting to spine practice, and proportion of patients using narcotics prior to presenting to practice. In addition, surgeons were asked regarding specific conditions and when narcotics should be introduced for cervical radiculopathy (CR), lumbar disc herniation (LDH), spinal stenosis, spondylolisthesis, and osteoporotic compression fracture. Finally, surgeons were asked if patients treated with narcotics have an inferior outcome.

Results: 204 surgeons from around the world completed the survey. 190 of them were spine surgeons, with 120 of them caring for spine-related conditions in over 75% of their practices. 125 of respondents were from Europe and 57 from North America. 54% of surgeons were more than 10 years in practice and 46% were in the first 10 years of practice. 53% of the surgeons practiced in a university hospital, 22.5% in a community hospital, 22% in private practice and the rest in HMOs. Narcotic use was higher in the USA than Europe with surgeons in practices with approximately one to two thirds of patients on narcotics. USA surgeons tend to give narcotics for the care of acute problems (i.e. LDH and CR), and tend to keep patients for longer periods of time on narcotics after surgery. Significantly more surgeons thought that narcotics should never be started in chronic conditions (i.e. spinal stenosis and spondylolisthesis) versus acute pain conditions ($p < 0.05$), with less surgeons thinking that narcotics are a good bridge to surgery in these patients. When assessing if surgeons think that narcotics hinder surgical outcome, 37% responded that it hinders outcome, 20% answered that they do not know, and 43% thought it does not affect the surgical outcome. However, the surgeons that do not give narcotics in chronic conditions feel that narcotics hinder the outcome of spine surgery.

Conclusions: Narcotic use is a universal phenomenon with 40% of spine surgeons claiming that over one third of the patients they see are on narcotics after family doctors and primary care physicians treat them. The surgeons feel that narcotics should be used as a bridge to surgery when needed in patients with acute conditions. Even so, this use is believed to be safe by only 43% of surgeons. Guidelines and education on the narcotics are necessary to increase patient safety.

Spinal cord stimulation for the treatment of “failed back” syndrome

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Spinal cord stimulator (SCS) and stimulation of the posterior column was first introduced and described in 1965 by Melzack for the treatment of pain and currently is an established treatment for neurogenic pain. SCS is composed of an electrode which is introduced into the epidural space and exerts electrical signals. The epidural electrode is attached to a pulse generator which is implanted subcutaneously. The mechanism of action is based on the gate control theory. The implanted hardware had evolved during the last decade for a single monopolar column electrode to multiple columns with complex programming options and miniature small size generators. The use of a hybrid system which involves both SCS and peripheral field stimulation has become popular and effective for the treatment of complex failed back syndrome pain.

SCS has notable analgesic properties and, at the present, is used mostly in the treatment of failed back surgery syndrome, complex regional pain syndrome and refractory pain due to ischemia.

Between 2013-2015 we have performed a large cohort of patients with failed back syndrome with SCS and hybrid systems. All patients were screened prior to surgery, and no further surgical intervention could be offered. All patients had a VAS score prior to surgery obtained together with all pain medications. Following the SCS implantation all patients were followed up in the comprehensive neurosurgical- pain clinic and their VAS score, quality of life was significantly improved together with reduction of drugs utilization.



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Introducing the neurologist in the spine clinic – a new team player?

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Introduction: The traditional spine clinic is part of the orthopedic- neurosurgery field, but for many patients the symptoms does not correlate with a structural lesion. We evaluated the input of adding a neurologist to the clinic in order to better evaluate the underlying conditions and eventually consider different therapeutical approaches.

Methods: The Neurology spine clinic was established at Sheba Medical Center in 2013. Between 2013-2015, forty patients were referred to the Neurology-Spine clinic by spine orthopedics and neurosurgeons. Patients eligible for a neurological consult were those with unclear diagnosis or a mismatch between the clinical symptoms and the imaging findings. All patients were clinically evaluated and undergone MRI scan of the spine.

Result: Six patients (15%) were diagnosed with various neurological conditions without clear structural lesions. Different entities were diagnosed such as inflammatory diseases (primary and secondary myelitis, Chronic Inflammatory Demyelinated Polyneuropathy), nutritional deficiencies and additional peripheral neuropathies.

Conclusions: Neurologist in the spine clinic is an important asset for the evaluation of the complicated patients in order to expand the differential diagnosis of spine diseases and avoid unnecessary surgeries.

The establishment of a prospective spine surgery registry: the spine database

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Background: Benefits of spine registries are many. Its primary goal remains the documentation of spinal pathologies and surgical procedures. New innovations and technologies are continuously delivered onto the market along with promising therapeutic achievements and outcomes. There is therefore an increasing need for documentation to assess the efficiency, safety and cost effectiveness of these new techniques. In addition, the ageing of the population will result in a constant increased number of patients referred to spine surgery, these patients having numerous medical comorbidities. A year ago we embarked in a project of creating a prospective database, containing comprehensive patient data, that will serve as a platform for future clinical researches in addressing these new challenges.

Aim of the study: The aim of our Spine Database (SDB) is to record and collect demographic data about patients, pathologies, surgical interventions and surgical complications as well as pre and post-surgery validated questionnaires that measure condition-specific outcomes.

Methods: We designed a database based on the FileMaker platform. We started to recruit patients planned for elective surgeries. At admission, after written consent, patients will fill out condition-specific outcome questionnaires that aim at quantifying disability for low back pain (ODI) and neck pain (NDI), the overall health and life quality (SF-12) and the level of pain (VAS), before and up to 2 years post-surgery. Demographic data as well as clinical data are collected.

Results: In the first year, we have recruited consecutive elective patients. Hitherto, 243 patient data have been documented. Eventually we will recruit all patients planned for surgery, elective and emergency. The largest part of performed surgeries are at the lumbar level (n=158) and mostly following a minimal invasive approach (n=106). Discectomy is preferentially done via minimal invasive intervention (n=52 versus 11). In addition, we can create reports and filters for any demographic or clinical data in order to assess the impact of these cofounders onto surgery outcomes. As an example, within the diabetic population, the percentage of bleeding as complication is higher (29%, 13/45) compared with non-diabetic patients (21%, 38/184).

Conclusions: Continual increasing cohort number will grant evaluation results with more power and statistical significance. Furthermore, follow ups are prospectively recorded in our SDB improving the "Quality of Evidence" for all questionnaire forms.

The establishment of the prospective registry that captures patient-centered data from real-world practice may guide evidence-based approaches and reforms.

The mutual influence of spine surgery outcomes and functional health, pain, quality of life and psychological profile of patients

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Background: Many studies have concluded that patient's satisfaction from spine surgery outcomes is considered low when there is emotional distress involved. This study was designed to evoke an important discussion on the Bio-Psycho-Social model of spine surgery patients.

At the Spine Surgery Unit in Meir Medical Center, we conduct pre-operation committees for all candidates for spine surgery. The purpose of these committees is to make a comprehensive decision, considering the necessity and compatibility of each patient for spine surgery. The committees consist of spine surgeon orthopedist, medical psychologist and head of nursing staff.

Only half of the candidates for spine surgery are recommended by the committee for surgery. The main purpose of the committee is evaluating the possibility that spine surgery will reduce the pain and disability and improve the level of function and quality of life.

Following the committee, the patients undergo a psychological evaluation.

In patients that are considered at risk for emotional state which might influence their medical condition, we recommend psychological therapy and/or pharmaceutical treatment as pre-operative preparation procedure.

This study is aimed at examining the linkage between the level of pain and disability, functional difficulties, quality of life and emotional state of the patients' pre-operation and post spine operation. The study further considers the hypothesis that surgery outcomes are influenced by the aforementioned factors.

Methods: 71 patients met inclusion criteria: 43 male subjects and 28 female subjects participated in the study. Mean age 60, age range 23-80. The patients were operated between 12.2012 and 8.2014.

The patients answered the following self-report questionnaires:

1. Oswestry Low Back Pain Scale (ODI) - Quantify the disability for low back pain;
2. The MOS 36 item short form survey (SF36) - Includes functional, physical and mental health scales and general quality of life index in medical conditions;
3. Brief Symptom Inventory (BSI) - Psychological profile that measures psychological distress and psychiatric disorders;
4. Visual Analogue Scale (VAS) - Measures the level of pain;

The patients answered the questionnaires both pre and post operation:

- Pre spine surgery- after the committee approved the operation.
- Post spine surgery- several months after the operation.

Results: The following findings were obtained in the statistical analysis:

1. Oswestry Low Back Pain Scale (ODI) - We found decrease in the level of post-operative pain and disability in comparison to pre operation levels.
2. The MOS 36 item short form survey (SF36) - We found statistically significant improvement in half of the scales that were measured (physical function, bodily pain, general health and role emotional) post-operative in comparison to pre-operative measures.
3. Brief Symptom Inventory (BSI) - We did not find a statistically significant change in the emotional state of patients' pre and post-operation.
4. Visual Analogue Scale (VAS) - We found a statistically significant decrease in post-operative pain in comparison to pre-operative levels.

Discussion: This study findings' showed general improvement in most of the variables we tested: the level of pain, quality of life, functional and general health improved after spine surgery.

The measured emotional state in the Brief Symptom Inventory (BSI), showed no significant change in pre and post-operative measures. It can indicate a stable personality profile that was not affected by the spine surgery. These findings strengthen the value of psychological evaluations pre spine surgery, which can help obtain a better understanding of the patient's needs and difficulties.

Conclusions: This study strengthens the need for the proper protocol that evaluates the patient's medical, psychological and social condition. A decision based on all aspects of the patient's life results in increased satisfaction of the surgery outcomes, and improvement in general health and quality of life.

Comparison between metallic skin staples and nylon sutures for closure of open spine surgical incisions

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There is an ongoing debate in the literature whether closure of skin incisions with sutures is advantageous to staples. While there is evidence regarding total knee replacement and other non-orthopedic procedures, no advantage to either method has been demonstrated so far in spine surgery.

Materials and methods: Up to 2006, all spine surgery incisions at the Galilee medical center spine unit were closed with metallic staples, and from 2006 onwards with nylon sutures. We reviewed retrospectively the charts of all spine patients operated before and after the transition date, aiming to compare 150 matched consecutive patients from each closure technique group who had undergone an open posterior spine operation. Excluded were anterior approaches, microdiscectomies and percutaneous or minimally invasive procedures. Infection rate was evaluated according to the CDC criteria.

Results: After exclusion, 275 patients remained: 130 in the staple group and 145 in the suture group. Both groups did not demonstrate any statistically significant difference regarding age, gender, co-morbidities, type of operation, use of instrumentation, and number of levels operated. There were 19 (6.9%) culture-positive deep wound infections overall, six in the suture group and 13 in the staple group ($P < 0.045$). Patients that had their suction drains removed before 48 hours from surgery had a higher infection rate (72 vs 28%) than when the drains were removed more than 48 hrs post surgery, but this did not reach statistical significance due to the low patient numbers.

Conclusions: Skin closure with nylon sutures results in a statistically significant reduction of post operative infection rates in patients undergoing open posterior spine surgery.

Post operative lumbar CSF persistent leak in elective patients - Dilemma of treatment

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Introduction: Cerebrospinal fluid (CSF) leaks involving the lumbosacral spine can occur as a result of surgery or trauma; rarely, these leaks can also occur after diagnostic or therapeutic lumbar puncture.

These leaks represent serious problems because of persistent headaches and the possibility of meningitis.

Diagnosis is often straightforward as in the case of the patient with a penetrating trauma and cutaneous CSF leak or the patient with a spinal headache following lumbar puncture/surgery. Symptoms of intracranial hypotension (severe postural headache) and or visible leak should suggest the diagnosis. Contrast-enhanced MR images demonstrate diffuse, intense dural enhancement that can be mistaken for meningitis or for metastatic or inflammatory disease. [8,12,18] Subdural fluid collections consistent with hygromas are reported in 60 to 70% of patients.[70]

Methods: There are known methods for treating this problem, including Surgical management which may require repeat surgery with meticulous direct closure of the dura or closure by means of a fascial graft or any artificial closure methods.

Six consecutive patients (age range:32 to 74 years, 3 male, 3 female) after lumbar spinal surgery for degenerative disease with CSF leaks diagnosed from 10 days to 2 weeks after surgery. All patients had magnetic resonance (MR) on admission.

We choose to treat our patients with Proximal Persistent Spinal Drainage (PPSD)

Discussion: The CSF leak has stopped ("dry dressing") after 6 days (Mean) of treatment, without any sequels after 3 month of follow up.

Conclusions: The PPSD method to treat CSF leak after an elective lumbar spine surgery is effective, safe and relatively quick.

No adverse reactions were observed after this treatment.

Computer assisted robotic surgery in the octogenarians

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Introduction: The proportion of population over the age of 80 is growing undergoing spinal surgery is growing. The use of computer assisted surgery in these patients is challenging due to poor bone quality and at times complex anatomy. We here present a consecutive series of octogenarian patients who underwent robot guided spine surgery robotic (planning of entry point and trajectories, drilling and cannulation of the pedicles).

Methods: Prospective data in a spine referral center for robot guided spine surgery was retrospectively analyzed. All patients who were 80 years old or older at the time of surgery were identified. These patients were matched to patients under the age of 80 in according to procedure. Patients' age, sex and indication for surgery were documented. Procedure time, accuracy, fluoroscopy usage time, and any instrumentation related complication were documented

Results: Between 2007 and 2013, 192 trajectories were executed in forty octogenarian patients who underwent robot guided spine surgery. The average age was 83.9 years (range 80-93), twelve patients were males and 28 females. Indication for surgery included fractures in 22 patients, degenerative conditions in 16 and tumors in 2. The highest instrumented vertebra was T5 and the lowest was S1. MIS was performed in 25 patients. Average robotic usage time was 6 min and 40 seconds compared to 5 min and 5 seconds in patients under the age of 80 ($P < 0.05$); Total fluoroscopy exposure time was 27.3 seconds in the octogenarian's vs 21 seconds in the younger patients ($P < 0.05$). 182 of the 192 (94.5%) executed trajectories were accurate vs 95.6% accuracy in patients under the age of 80 (NS). No intraoperative complications related to robot usage occurred.

Discussion: Spine surgery in the octogenarians is challenging. The combination of osteoporotic bone and multiple spine pathologies in robot guided procedures results in longer procedures and in higher fluoroscopy usage compared to younger patients. However, procedure accuracy and safety is identical to younger patients, allowing optimal instrumentation in these frail patients.

O-ARM based spine navigation for pedicle screw fixation

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Background: Pedicle screw fixation has been extensively implemented for spine instability and proved to be both safe and efficient. Yet, despite the use of fluoroscopic guidance, the number of misplaced screws seems to be underestimated and has been described as high as 15% whenever CT scan is used instead of plain X rays for anatomical assessment.

Material and methods: During the past 24 months, 50 spine fixation surgeries have been performed at the Galilee Medical Center using an O-arm based spine navigation system (Medtronic). These procedures included 7 cervical corpectomies and anterior fixation, 12 scoliosis reduction and stabilization and 23 lumbar laminectomies and posterior fixations. Of these, the lumbar procedures only were retrospectively evaluated. Accuracy of screws placement was assessed by CT scan in all patients.

Results: A total of 138 screws were placed during 23 procedures. The number of levels involved ranged from 1 to 4 with a mean of 2.3 levels. The average operating time per level was significantly longer using the O-arm navigation system (73 min) in comparison with the use of fluoroscopic guidance. Systematic CT scan review of screw positioning disclosed 4 instances of a pedicle breach (2.9%) and 1 misplaced screw outside the pedicle (0.7%). All 5 instances were observed with the use of the first generation of faulty navigated screwdrivers that have been replaced since then as they were allowing some range of movement between the screw and the driving instrument.

Conclusions: The O-arm system proved to be an efficient navigation tool leading to improved accuracy of screw positioning. Although the implementation of the system result in some increase operation time and may be therefore cumbersome in simple short fixation procedures, the improved accuracy in instances of marked spine deformity may dramatically improve the surgical results.

The craniocervical junction in ankylosing spondylitis: a computed tomography based study

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Objectives: Available studies of craniocervical junction (CCJ) involvement in ankylosing spondylitis (AS) are based on conventional radiography, which has limited ability in the definition of many elements of the CCJ. The goal of the present study was to describe the spectrum of computed tomography (CT) findings in the CCJ in a cohort of patients with AS.

Methods: CT scans of the cervical spine of 11 patients with AS were reviewed and imaging findings related to the CCJ assessed. The standard anatomic intervals describing the CCJ were measured and compared to accepted normal standards. Findings, representing pathology were described, categorized by localization and relation to joints or ligaments of the CCJ.

Results: All patients were males with median age of 48 years and median disease duration of 20 years. The calculated median modified Stoke Ankylosing Spondylitis Spinal Score (mSASSS) for the cervical spine was 8.5, ranging from 0 to 27. Disease-related changes in one or more elements of the CCJ were detected in all patients. Patients with AS had a strong tendency to the narrowing of the atlanto-occipital joints and atlanto-dental interval, with some patients demonstrating complete fusion of these articulations. Atlanto-occipital joints were involved in 8 patients, while 3 patients had disease of the atlanto-dental articulation. Enthesopathy of the CCJ was observed in 7 patients.

Conclusions: The CCJ is frequently involved in AS patients with advanced disease and may be independent on the mSASSS. Both articulations and ligaments of CCJ may be affected in AS patients.

Intraoperative radiation exposure in robot guided and fluoroscopy guided percutaneous fixation of vertebral fractures.

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Introduction: Percutaneous fixation has become a viable option in vertebral fractures where no decompression is needed and early mobilization of the patient is advised. There is some evidence pointing at less bleeding and shorter ICU stay, however the biggest drawback of fluoroscopy guided percutaneous fixation is a very high exposure to radiation. The aim of this study was to assess whether robotic guided percutaneous fixation offers added value when compared to fluoroscopy guidance.

Study design: Retrospective analysis of prospectively collected data.

Methods: Between April 2014 and December 2014, nine patients, 6 males and 3 females, with a mean age of 45 sustaining unstable or very painful vertebral fractures requiring surgical stabilization underwent fluoroscopy guided (2) or robot guided (7) percutaneous fixation. A trauma series CT converted to bone filter and 1mm cuts was used for robotic guidance.

Data included: operation time (mean + range), radiation time (mean + range), number of vertebra fused (range) and number of screws used to for fixation (mean + range) in robotic assisted vs. fluoroscopy guided respectively. For comparison, radiation times were calculated per level fused and per screw.

Results: In the robotic guided group mean operation time was 170 minutes (105 –340) and mean radiation time was 26 seconds (11-49). In the fluoroscopy guided group mean operation time was 94 minutes (70-119). Four vertebrae were fixed in the fluoroscopy guided cases, while 3 to 9 vertebrae were fixed in the robot guided cases. Six to 14 screws were used in the robotic guided group versus 6 to 8 in the fluoroscopy guided group. Mean radiation time per screw was 2.9 sec. (1.8-5.3) in the robotic guided group versus 12.15 sec. (10.5-13.8) in the fluoroscopy guided group. Mean radiation time per level was 6.4 sec. (3.1-10.75) in the robot guided group versus 27.8 sec. (27.6-28) in the fluoroscopy guided group.

Conclusion: Robotic assisted percutaneous fixation resulted in much less radiation to the patient and the OR team. Moreover, in robot guided procedures, most fluoroscopy shots were taken while standing behind leaded walls. A prospective comparative study is warranted.

A less invasive short peri-apical fixation for correction of AIS: our experience with the ApiFix system

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Background: Surgical correction of Adolescent idiopathic scoliosis (AIS) often necessitates extensive and prolonged procedures. As a result, the interest in applying less-invasive techniques for the correction of AIS is growing. Lately, a system that enables the correction of a subset of AIS curves has been introduced. The ApiFix™ system consists of a construct which is implanted in the concave side of the major curve and is able to lengthen post-operatively. The construct includes two pedicle screws inserted at the ipsi-lateral peri-apical concave side of the curve and a connecting ratchet-mediated growing rod.

Aim: To test the efficacy of the ApiFix system in the correction of AIS.

Methods: We used the ApiFix™ system in 6 cases of AIS. Inclusion criteria included AIS with Lenke type curves of 1 or 5 measuring from 35 to 55 degrees, flexible minor curves, prior failure of conservative treatment and a riser sign of 2-4. Operative technique consisted of the standard posterior approach but was limited to exposing the selected segments of the major curve. Intra and post-operative care and radiographic follow-up were performed as usual. Specific post-operative regimen of designated physiotherapy was given to each patient in order to allow for further correction.

Results: Overall, 6 female patient, aged 13-15 underwent surgical correction of AIS using the ApiFix™ system. All were diagnosed as having Lenke type 1 curves (average of Cobb-44.5, range 35-55) with a varying degree of correction on bending films. Post-operative measured Cobb angles of the major curves had decreased to an average of 33.6, range 24-49 degrees. No hardware failure or other intra-operative complications were noticed. Post-operative course was intact in all but one patient who complained of postural headaches and was diagnosed with an epidural hematoma adjacent to the operated segments. Follow up (3 months- 1 year) which included radiographic evaluation demonstrated that the correction obtained was maintained in all but one patient. Further post-operative correction was noticed in one patient.

Conclusion: Surgical treatment of AIS with the ApiFix™ system may be considered in a subset of patients diagnosed with a Lenke type 1 or 5 curves and in whom the major curve is flexible. The system's advantages include a less extensive approach and the post-operative ability to maintain and further-correct the deformity.

Evaluation of structural and morphological features of thoracic and lumbar pedicles in adolescent idiopathic scoliosis patients, based on reconstructed CT images

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Background: Several studies have provided data on the vertebral morphology of normal spines, but there is only limited information on vertebral morphology in Adolescent Idiopathic Scoliosis (AIS) patients.

Materials and methods: Fifteen adolescent idiopathic scoliosis (AIS) patients who had undergone posterior corrective surgery were included in this study. Reconstructed CT axial images at each vertebra were used to measure: (1) the shortest distance from an entry point to the ventral cortex of the lamina (critical distance), and (2) the distance from the entry point to the tangent of the spinal canal at the medial wall of the pedicle (safe distance). The critical length was defined as the distance between the critical distance and the safe distance.

Results: The average pedicle width length is smaller than in the normal spine, more over, the pedicle width length on the convex side of vertebrae located cephalic to the thoracic curve (T1-T5) was found to be significantly smaller than at the same vertebrae on the concave side. On the convex side of the curve there is a consistent increase of pedicle width length from T4 to T12 and from L1 to L5, while on the concave side there is a decrease in the pedicle width length from T3 to the curve's apex. Around the apex of the structural curve there is an intra vertebral asymmetry, consisting of significantly narrower pedicles on the concave side (2.49-2.78 mm) compared to the convex side (3.17-3.46 mm). Another finding concerning the curve's apex region is that there is an inverted ratio between Cobb's angle and the pedicle width length on the concave side, particularly above 52 degrees, where the pedicle width length is equal or smaller than 2.6 mm, further decreasing to below 2 mm as Cobb's angle becomes greater than 60 degrees. Concerning the secondary curve, which is not structural by nature, no differences were found in vertebral structure between the convex and concave sides. The chord length increased through the thoracic and lumbar vertebrae until L2-3 in an almost constant fashion.

Conclusions: Idiopathic scoliosis is associated with an inter and intra vertebral structural deformity, reflected by narrower pedicles on the concave side of the structural curve, with correlation between the pedicle's width length and the Cobb angle.

Significance: With smaller pedicles on the concave side and a shift of the dural sac toward the concavity, Caution and care is advised when using pedicle screws. Cobb's angle measurement can be used as a reference point to the pedicle's width at that region.

Kyphectomy in patients with myelomeningocele (MMC) with spino-pelvic fixation. A long term outcome study

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Study design: A retrospective case series of patients with myelomeningocele (MMC) who underwent kyphectomy and posterior fixation using Luque rode and 16-gauge wires.

Objective: To assess clinical and radiologic outcomes after posterior kyphectomy and segmental fixation for kyphosis in a series of 18 patients with MMC treated over a 14-year period in our institution.

Summary of background: Kyphotic deformity present in up to 10% of infants with MMC and is rapidly progressive in childhood. Decubitus ulceration over the bony prominence is difficult to reverse. Loss of sitting balance and independent use of hands severely handicap the child. restoration of sagittal alignment in MMS patients with severe kyphosis to improved sitting balance is well accepted.

Methods: Eighteen consecutive patients who underwent posterior kyphectomy for transforaminal fixation contiguous to “everted lamina” between the years 2000-2014. Fusion rates, time to fusion, change in Cobb angle, complications, and improvement in activities of daily living using the Katz score were measured.

Results: Average age at time of surgery was 8.3 (range, 4.5–17) years. Average time to follow-up was 100 (range, 3–171) months. Mean time to fusion was 12 months. The mean postoperative kyphotic curve was 20° with an average correction of 90°. Six patients (34%) experienced a postoperative complication. The mean improvement in activities of daily living score was 1.5 points and all patients achieved independent sitting balance.

Conclusions: Segmental spino-pelvic fixation is a solid alternative mode of fixation in patients with MMC with congenital kyphosis. Patient selection, proper perioperative multidisciplinary assessment, and surgeons’ expertise are significant in the success of this complex surgery.

S-2 alar iliac pelvic fixation

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Background: Fixation of the lumbosacral junction continues to be a challenge in spine surgery. The complex local anatomy and unique biomechanical forces are some of reasons why fixation of the lumbosacral spine is so demanding. Pelvic fixation using the S2 alar iliac technique may address some of the issues with spinopelvic fixation.

Objective: Single institute experience with S2 Alar Screws fixation.

Methods: We reviewed the charts of 20 patients who underwent spine surgery between January 2012 till December 2014. All patients had sagittal/coronal disbalance and underwent sacro-pelvic fixation with S2 alar screws in our institute. We reviewed their charts, X-ray before and after surgery and their follow up exams.

Results: Out of 20 patients who underwent S2 alar 16 where female and 4 male. Our indications for operative treatment were: 1) Adult kyphoscoliosis- 10 Patients, 2) Neuromuscular scoliosis- 5 Patients, 3) Adolescent idiopathic scoliosis- 1 Patient, 4) Scoliosis due to trauma- 2 Patient, 5) Post surgical kyphoscoliosis- 2 Patient. Two Patients had weakness in their legs which resolve completely, 3 Patients had pseudoarthrosis that needed revision operation, 1 Patient needed a revision due to breakage of rod. In one of the revision the S2 alar screws were malspositioned, in another revision a change in 1 of the S2AI was needed due to harvesting of iliac crest bone graft from the same side.

Conclusion: Fixation of the spinopelvic junction with S2 alar screw is safe procedure. The solid pelvic anchor provided by the S2 alar technique allows performing corrective procedures at the lumbosacral junction.

Lumbar spine surgery in Parkinson Disease patients

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Introduction: Parkinson's disease (PD) is the second most common neurodegenerative condition. The literature on PD patients and spine surgery is limited, but increased complications been shown.

Material and methods: All PD patients undergoing lumbar spine surgery between the years 2002-2012 were collected. Patients' charts, radiographs and outcome questioners were reviewed. PD severity was assessed using the modified Hoehn and Yahar score. Complications and subsequent surgeries were analyzed. Risk for resurgery was assessed.

Results: 96 patients underwent lumbar spine surgery. Age was 62.95. Follow up was 30.08 months. The PD severity was under 2 in 11 patients, 2 in 30 patients, 2.5 in 23 patients, 3 or more in 30 patients. Primary indication for surgery was spinal stenosis in 72 patients, spondylolisthesis in 17 and coronal and/or sagittal deformity in 7 patients. 63 cases were instrumented fusions.] There were 15 (15.6%) early complications including 6 patients suffering from post operative infections needing a surgical irrigation and debridement and long term antibiotic care.

Back VAS improved from 7.44 to 1.78 (P<0.001). Leg VAS improved from 7.71 to 2.3 (P<0.001). ODI score dropped from 54.1 to 17.72 (P<0.001). SF-12 physical component improved from 26.6 to 30.5 (P=0.05). SF12 MCS did not change at 47. Fusion was achieved in 78% of fusion cases. 16 patients' required revision surgery. Risks for further surgery included a PD severity score of over 3 (P<0.05), a history of DM, treatment for osteoporosis, a combined anterior posterior approach and the use of an interbody.

Conclusion: In conclusion, despite a higher rate of complications than the general population, the overall outcome of spine surgery in PD patients with a mild to intermediate disease is good, with improvement of the spine related pain. A larger prospective study is warranted.

Nitinol rod dynamic fixation of the lumbosacral spine for degenerative disc diseases. A two and a half year follow-up prospective randomized study

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Introduction: Nitinol - a unique alloy of nickel (55%) and titanium (45%), having the properties of shape memory and superelasticity. Effective elastic modulus of 15-20 GPa is nitinol, which is equal to the elastic modulus of cortical bone (18GPa). Nitinol is used in the superelastic state at body temperature (36-37 S), providing mechanical compatibility pedicle clamp mechanical behavior of the spine.

Method: The study included 120 patients aged 45 to 82 years. Patients were divided into two equal groups. Group I -As the retainer rod used a rod of nitinol; Group II - implanted titanium rods standard.

All patients before and after surgery completed questionnaires VAS, Oswestry, SF36.

During the control examinations were performed in all patients:

- standard radiography in two projections;
- functional radiographs;
- MRT Lumbosacral spine;
- CT of the lumbosacral spine.

Group I - 60 patients. In the first group to perform standard rear median access. Carried out the installation of two nitinol rods. Fusion and bone grafting were not met. Fixation was performed in 24 L5-S1, in 26 L4-L5-S1 and 10-L3-L4-L5-S1.

Group II - 60 patients in this group also performs a standard posterior approach. Sets the pedicle screws. If the zone fixing stints segment L5-S1 was performed interbody fusion at L5-S1 PLIF or TLIF technique using age. Additionally performed using bone autografts. At 20 carried fixation L5-S1, in 29 L4-L5-S1 and 11 L3-L4-L5-S1.

Results: In both groups was restored lumbar lordosis. However, in the study of functional radiographs in 2.5 years after surgery in patients of the first group is marked mobility stabilized segments ($7^\circ \pm 2.4^\circ$). In Group II, the mobility in the fixed levels have been detected.

VAS back and lower extremities decreased significantly in both groups, and remained at a comparable level in 2.5 years. ODI - (64.6 before surgery and after surgery, 17.8 against 65.2 and 25.6 in the second group, respectively, p <0.05). According SF 36 - in the first group to the PH - 37.2 after - 66,5, MH to - 41.5, then - 74.3. In this case, in the second group were several worst performance of physical health: PH to - 36.2, after - 55.2, MH to - 42.5, after - 73.7, p <0,05.

In the first group patients after 2.5 years revealed no instability implant according to CT

detected in 3 patients resorption of bone tissue around the screw, without any clinical manifestation. In 2 patients had infectious complications. In the second group 1 patient had infectious complications. Pseud arthrosis was detected in 7 patients. Adjacent segment disease detected in 6 cases, 4 cases since severe pain required revision operations.

In the I group results in 2.5 years were better on the basic parameters.

Conclusion: The use of nitinol rods at the lumbar spine fixation combined with pedicle screws without fusion showed good results after 2, 5 years after surgery compared with traditional rigid fixation. Nitinol rods allow you to keep mobility in the vertebral - motor segment 2, 5 years after surgery.

The relationship between the location of cervical cord compression and the location of myelomalacia

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Objective: The purpose of this study was to examine the relations between the location of the cervical cord compression and the T2W increased signal intensity within the cervical cord in patients with cervical myelopathy and myelomalacia.

Methods: We reviewed 1,615 MRI reports, which were performed between January 2011 and May 2013, at a single institution. Of the 1,615 reports reviewed, 168 patients were diagnosed with T2W increased signal intensity within the cervical spine, after using the exclusion criteria 82 patients were included in the study. These 82 patients MRI scans were then reviewed and the location of the T2W increased signal intensity in relation to the location of the pressure on the spinal cord was recorded.

Results: In more than 50% of the cases the T2W increased signal intensity lesions were located either distal to the pressure on the spinal cord or started at the level of the pressure and extended to an area distal to the pressure. In 26 out of the 92 T2W increased signal intensity lesions, the lesion started proximal to the pressure on the spinal cord and extended distal to it. In only 3 out of the 92 lesion the T2W increased signal intensity lesion was solely located proximal to the pressure on the spinal cord, in 5 other cases the T2W increased signal intensity lesion started proximal to the level of pressure on the spinal cord and extend into the level of pressure on the spinal cord ($p < 0.001$). (Table 1).

Conclusion: Cervical myelomalacia may appear proximal, distal or at the level of the compressed cord, it rarely appears solely proximal to the pressure area on the cord.

Incidental durotomy in primary and revision interbody arthrodesis using the modified Wiltse approach

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Background and objectives: incidental durotomy (Id) is a well-known complication in lumbar spine surgery that was reported to be around 5% in primary cases and nearly 10% in revisions. We present our clinical experience with Id during TLIF procedure that was done, using the modified Wiltse approach, for primary and revision disc disease.

Material and methods: a retrospective study consists of patients, who had lumbar interbody fusion, using the modified Wiltse approach. All patients who matched these criteria, during the last 9 years, were enrolled into the study. Demographic and clinical data were collected from the patient's charts and medical files.

Results: there were 267 patients in the study group. 210 patients were primary cases and 57 revisions. Indications for surgery were: degenerative disc disease, recurrent disc herniation, spinal stenosis, spondylolisthesis and trauma. Most of surgeries were done at L4-5 level. Id occurred in 8/210 (3.8%) primary cases and only in 2/57 (3.5%) revision cases. All durotomies were sutured primarily; none of the patients had to be revised later. Other general complications were: infectious, screws malposition and pseudoarthrosis.

Conclusion: while our data for primary cases shows no difference with the known literature, the rate of incidental durotomy in revision disc excision, is significantly lower with our preferable technique. There can be some explanations to the difference; however we attribute this to the wide lateral access we are taken during the discectomy stage. Our feeling is that it helps us to perform a more careful dissection during that venerable stage.

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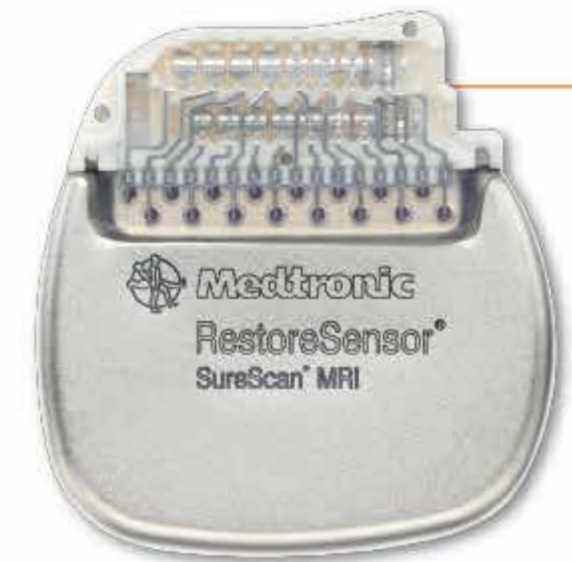
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