43eme Congres Annuel de la Societe Francaise de Neuroradiologie

Novotel PARIS Tour Eiffel – 30 Mars – 1 avril 2016

RACHIS INTERVENTIONNEL - SPINE INTERVENTION

Mario Muto Chief Neuroradiology
Cardarelli Hosp. Naples Italy
Chairman Spine committee ESNR
Vice President AINR
What is spine intervention?

- Treatment SPINE PAIN
What is spine intervention?

• Treatment SPINE PAIN
  • VCF due to osteoporosis, metastasis or primary benign spine tumors
  • Percutaneous treatment of herniated disk and facet syndrome
  • Percutaneous treatment of traumatic fracture
    - New materials (osteconductive material)
    - Percutaneous treatment spinal stenosis
    - Percutaneous vertebral and sacral fusion?
Diagnostic algorithm

spine pain

↓

Standard X-Ray (flexion and extension)

↓

MR (STIR or FAT SUPP T2)
(HNP, DDD, Spinal Stenosis)
Diagnostic algorithm

spine pain
↓
Standard X-Ray (flexion and extension)

MR (STIR or FAT SUPP T2)
(HNP, DDD, Spinal Stenosis)

- spongious oedema
- primary tumor
- traumatic frac (CT)

- normal
  - no VP
    - NM CT
      - VP KP

- metastasis
Left or right sciatica or low back pain?
Radicular pain is related to mechanical and inflammatory factors

Ganglium = station of control

Spinal pain.
• DEGENERATIVE SPINE DISEASE

• ESI

• Disk treatment

• Facet infiltration and RF
Percutaneous treatment for herniated disk

- Nucleoplasty (75%)
- Dekompressor (75%)
- Oxygen-ozone therapy (75--80%)
- Gelified Ethanol - discogel (75-80%)
Who we should not treat?

- Hyperalgic-paralyzing sciatica
- Cono-Cauda syndrome
- Patients with progressive foot droop
- Are we sure to do not treat extruded disk?
- Clinical more important than imaging findings
Typical case to treat
Intradiscal L₄ L₅

• Left intraforaminal L₅ S₁
The intradiscal oxygen-ozone in the treatment of low back pain and sciatica
M. Muto et coll
Radiol Med June 2008

Intraforaminal 02 –03 versus periradicular steroidal infiltrations in lower back pain: a randomized study.
Bonetti M. et coll, AJNR may 2005

Sciatica: treatment with intradiscal and intraforaminal injections of steroid and oxygen-ozone vs steroid only.
Gallucci M et al. Radiology march 2007

Meta-analysys of effectiveness and safety of ozone treatment for HNP Steppan J, Murphy K, Muto M and coll J Vasc Interv Radiology 2010

Treatment of Contained Herniated Lumbar Discs With Ozone and Corticosteroid: A Pilot Clinical Study. K. Murphy, M Muto, J Steppan, T. Meaders, C Boxley.
Vertebral compression fracture

- Porotic lesions
- Trauma
- Metastasis
- Multiple myeloma
- Primary tumors

- acute, subacute and chronic clinical symptomatology.

  - VP and KP as PAIN THERAPY to improve life quality.

- Asymptomatic patient with VCF fracture is not an indication to the treatment.
Target of Assisted Technique

1) Vertebral height restoration to reduce kyphotic angle

2) Reduce rates of complications, less disk and venous leakage

Why new cement?

To reduce venous and disk leakage (increase of cement viscosity)

To increase working time
Mix and Wait
Injection Time

-20 -15 -10 -5 0 5 10 15 20 25 30
Time (minutes)

KyphX HV-R
Confidence (HIS)
VertaPlex HV (MIS)
VertaPlex HV (syringes)
VertaPlex
SpinePlex
Vertecem V+
Vertecem
Preventive VP in osteoporosis

Safety, effectiveness and predictors for early reoperation in therapeutic and prophylactic VP: short term results of a prospective case series of patients with porotic fractures.
Diel P and coll Eur Spine J 2012, 21, S792-799

Preventive vertebroplasty for adjacent vertebral bodies: a good solution to reduce adjacent vertebral fracture after VP.
Yen CH and coll AJNR may 2012, 33, 826-832
How many KP and KP like devices?

- Around 20 companies are present on the market
- Spine jack
- Stent
- Kiwa
- etc
Stentoplasty effectiveness and safety for the treatment of osteoporotic vertebral fractures: A systematic review.
Martín-López JE, and coll
Orthop Traumatol Surg Res. 2015 Sep;101(5):627-32

CONCLUSION: The protocols for creating wedge fractures and using the instrumentation under a constant preload of 100 N led to reproducible results and effects. The study showed that height restoration was significantly better in the SpineJack group compared with the balloon kyphoplasty group. The clinical implications include a better restoration of the sagittal balance of the spine and a reduction of the kyphotic deformity, which may relate to clinical outcome and the biological healing process.
• PRIMARY BENIGN SPINE BONE PATHOLOGY

• ABC

• VERTEBRAL HEMANGIOMA

• OSTEOID OSTEOMA
F, 33 y.o. suffering of back pain for several months, resistant to M.T.
Aneurysmal Bone Cyst
Injection
Osteoconductive Material (cerament)
Bilateral approach
8 ml
2 months follow-up

8 months follow-up
8 months follow-up
HEMANGIOMA

Most common vertebral tumor: 12% in adults
Multiple lesions in 25-30% of cases, especially thoracic capillary venous cavernoma.
mature vascular space between bone stroma and fatty tissue
Hypodense at CT, hyperintensity with MR
Posterior elements in 10-15%
Interventional approach

Target: pain reduction, stabilize reduce vascularization (pre-surgical) or as only treatment

1) VP- venous embolization- overfill

2) Endovascular

Radiotherapy of painful vertebral hemangiomas: the single center retrospective analysis of 137 cases. Miszczyk L1, Tukiendorf A.
the gold standard remains 36–40 Gy delivered in 2 Gy fractions.

Table 1. Percentages of patients using different of analgesics before RT and during consecutive control examinations

<table>
<thead>
<tr>
<th>Type of analgesics dispensed</th>
<th>Before RT</th>
<th>1 month after RT</th>
<th>6 months after RT</th>
<th>12 months after RT</th>
<th>18 months after RT</th>
<th>The final control*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No need for analgesics uptake</td>
<td>21.5%</td>
<td>39%</td>
<td>40%</td>
<td>44%</td>
<td>57%</td>
<td>46%</td>
</tr>
<tr>
<td>Nonsteroidal anti-inflammatory drugs</td>
<td>47%</td>
<td>40.5%</td>
<td>43%</td>
<td>32%</td>
<td>31.5%</td>
<td>38%</td>
</tr>
<tr>
<td>Tramadol</td>
<td>31.5%</td>
<td>20.5%</td>
<td>17%</td>
<td>24%</td>
<td>11.5%</td>
<td>14%</td>
</tr>
<tr>
<td>Opioids</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 2. The percent of cases presenting partial reossification or fatty conversion of hemangioma during consecutive control examinations

<table>
<thead>
<tr>
<th>Reossification or fatty conversion</th>
<th>1 month after RT</th>
<th>6 months after RT</th>
<th>12 months after RT</th>
<th>18 months after RT</th>
<th>The final control*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20%</td>
<td>28%</td>
<td>33.3%</td>
<td>28.5%</td>
<td>33%</td>
</tr>
</tbody>
</table>
Percutaneous ethanol embolization and cement augmentation of aggressive vertebral hemangiomas at two adjacent vertebral levels. 
Cianfoni A1, Massari F, Dani G, Lena JR, Rumboldt Z, Vandergrift WA, Bonaldi G.

Aggressive Vertebral Hemangioma Treated with Combination of Vertebroplasty and Sclerotherapy Through Transpedicular and Direct Approach. 
Kelekis A1, Filippiadis DK, Martin JB, Kelekis NL.
OSTEOID OSTEOMA

Osteoblastic benign tumor producing osteoid tissue

Radiological finding: radiolucent nidus <1,5 cm
surrounded by sclerotic rim
10% are vertebral almost all in posterior arch.

Focal painful scoliosis with concavity omolateral to the tumor.
High rate false negative with MR (volume averaging)
MR with contrast media inj more sensitive: nidus >> reactive area
CT >> MR

D.D: Osteoblastoma
stress fracture/ unilateral spondilolysis
sclerotic metastasis
Percutaneous facet stabilization

Introduction of the screw through the screw driver
Procedure

Final result
Procedure

CT check after procedure
**Conclusions.** The stability provided by both transfacet pedicle screw fixation and traditional pedicle screw fixation was not compromised after repetitive cycling. In this model, transfacet pedicle screw fixation appears equivalent biomechanically to traditional pedicle screw fixation.
Biomechanical Comparison of a Novel Percutaneous Transfacet Device and a Traditional Posterior System for Single Level Fusion

Andrew Mahar, MS,* † Choll Kim, MD, PhD,* Richard Oka, BA, † Tim Odell, BS, † Andrew Perry, MD,* Srdjan Mirkovic, MD,* ‡ and Steve Garfin, MD*

attractive surgical option for single-level spinal fusions. A biomechanical evaluation of a novel device for this application demonstrated similar stability to a pedicle screw system. The length adjustability of the device may alleviate concerns for precise device placement and the biomechanical stability may produce similar rates and quality of posterior spinal fusions.
SACROILIAC INSTABILITY
Frequently unknown…

INNERVATION
Anterior from L2 to S2
Posterior from L4 to S4

SIJ INSTABILITY
5-25% of ALL Low Back Pain!!!
Polly, Sembrano Spine 2008
Cohen, SA Anesthesia and analgesia 2005

PIF increases sacroiliac mechanical stress
75% of patients have SI after PIF in 5 years
HA Young, Spine 2008, Ivanov Spine 2009

After Delivery / Post-Partum syndrome

Courtesy L. Manfrè
Symptoms

- Low Back Pain (generally L5 to S2 level)
- Pelvic, Buttom Pain +++ when seated
- Coxofemoral Pain
- Leg Numbness / Dizziness
- Insomnia
- Ipsilateral limb instability

Diagnosis

CT GUIDET LIDOCAINE INFILTRATION: THE BEST
Porotic Titanium
• Thickness: 7mm
• Length: from 30 to 50mm

SI-BONE I-FUSE EU / USA first CT-guided treatments

STABILIZATION
• **Phase 1** 3-6 wks: extra-articular (intraprothesis bone regrowth) 90%
• **Phase 2** 10-12 wks: intra-articular (intraarticular bone regrowth) 10%
PRIMARY OR SECONDARY SPINE PATHOLOGY

Multiple myeloma

Spine mets
MULTIPLE MYELOMA
## Nature of Spine Metastases

<table>
<thead>
<tr>
<th>Type and Extent of Lesion</th>
<th>Number of Cases</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoblastic</td>
<td>45</td>
<td>8,0%</td>
</tr>
<tr>
<td><strong>Osteolytic</strong></td>
<td>399</td>
<td><strong>70,9%</strong></td>
</tr>
<tr>
<td>Mixed</td>
<td>119</td>
<td>21,1%</td>
</tr>
<tr>
<td>Involving 1 Vertebra</td>
<td>77</td>
<td>13,4%</td>
</tr>
<tr>
<td><strong>Involving &gt; 1 Vertebra</strong></td>
<td>486</td>
<td><strong>86,3%</strong></td>
</tr>
<tr>
<td>Lesion of entire Vertebra</td>
<td>81</td>
<td>14,4%</td>
</tr>
<tr>
<td>Lesion of Vertebral Body</td>
<td>252</td>
<td>44,8%</td>
</tr>
<tr>
<td>Lesion of Posterior Arch</td>
<td>228</td>
<td>40,5%</td>
</tr>
</tbody>
</table>

**Metastatic Spinal Metastases are commonly osteolytic and affect multiple vertebrae.**
- 600 cases of spinal metastases were reviewed of which 563 had characteristics of bone lesions
- Examined according to clinical characteristics, type of primary tumor, site of lesion, and survival
- Active treatment occurred in all but 7 of the cases

## What offer these therapies?[^2]

Therapy aims in the treatment of bone metastases

<table>
<thead>
<tr>
<th></th>
<th>Paintherapy</th>
<th>Recovery/Regain of stability</th>
<th>Skeletal related events (SRE)</th>
<th>Tumor control (local)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RF-Ablation</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Radiotherapy</strong></td>
<td>8 - 30 Gy (16 w)</td>
<td>30 Gy</td>
<td></td>
<td>&gt; 50 Gy</td>
</tr>
<tr>
<td><strong>Nuklidtherapy</strong></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemotherapy</strong></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Bis/D-mab</strong></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Surgical Intervention</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Cement</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Spine Instability Neoplastic Score (SINS)

**Location:**
- Junctional (C0-C2, T11-L1, L5-S1): 3
- Mobile segment (C3-C6; L2-L4): 2
- Semirigid (D3-D10): 1
- Rigid (S2-S5): 0

**Type of lesions:**
- Lytic: 2
- Miste: 1
- Blastic: 0

**Pain:**
- Meccanic: 3
- Not meccanic: 1
- Absent: 0

**Alignment with x-ray:**
- Subluxation/translation: 4
- New deformity: 2
- Normal: 0

**Post. Arch inv:**
- Bilateral: 3
- Unilateral: 1
- Absent: 0

**Body involv:**
- >50% collapse: 3
- <50% collapse: 2
- No collapse with >50% of the soma: 1
- None of the previous: 0

0-6 = stable
7-12 = possible instability
13-18 = instability

Location T11 3
Lytic 2
Pain 3
Allignment 0
Posterior arch 1
Body involv 3
Total 12 possible instability
HOW CAN YOU MANAGE THIS LESION?

Surgery?
RT?
CHT?
VP?
RF?

Combined therapy?
RF Kyphoplasty Technology

1. MultiPlex Controller

2. StabiliT® ER² Bone Cement & Saturate Mixing System

3. Disposables
   - Hydraulic Assembly
   - Activation Element
   - AE Cable
   - Hand Switch Cable (10 ft.)
   - Locking Delivery Cannula
   - VertecoR® MidLine Cement
   - Staging Osteotome
   - VertecoR® StraightLine Cement
   - Staging Osteotome
• Minimizes potential for extravasation
• Injection rate 1.3 ml /min, high viscosity
HIGH DENSITY CEMENT
• 52 yo, female, acute cervical pain.
• CT total body show renal Ca and osteolysis of C1 and C2
• Primary renal cell CA
• No other bony or parenchymal lesions
Three major concept dealing with spine metastasis

- Pain treatment
- Stability treatment
- Antineoplastic effect (RF and crioablation)
RF Ablation is well understood
Wide adoption to treat lesions throughout the body
Liver 1
Lung 2, 3
Complete necrosis in nearly 70% of tumors after one treatment
Prostate 4
Predictable tumor necrosis yielding effective follow up in > 80% RFA-treated tumors
➢ 80% success in eliminating tumors in one treatment
Kidney 5 • No residual tumors at 7 month
Osteoid Osteomas 6
Bone Metastases 7
Targeted RF Ablation (t-RFA)

RF Generator
• Active temperature measurements
• Controlled energy delivery
• Displays critical real-time information

Ablation Instrument
• Articulating electrode designed to permit unipediculate access & multiple ablation passes
• Bipolar design requires no grounding pads

• Controlled access
• Controlled energy delivery
• Controlled lesion creation
Active navigation enables site-specific ablation zones throughout vertebral body via unipediculate access.

Real-time temperature monitoring: gauge thermal spread and intra-operative decisions.

- Coil permits edge effect to increase energy delivery.

Insulative Tip
- Enables bipolar properties
- Radiolucent
- Center of Ablation Zone

Articulating Segment
- Navigation within bone

Distal Thermocouple

RF energy stops @ 50º C
Real-time temperature monitoring with CT permits:
• assess thermal spread
• confirm physiologic temp prior to cement delivery
Women 75 y.o.
Treatment of metastatic spinal lesions with a navigational bipolar radiofrequency ablation device: a multicenter retrospective study.
Conclusions:

- Correct Clinical approach and Diagnosis
- Choice of treatment – evaluate the cost
- Team with endocrinologist, oncologist, radiotherapist, neurosurgeons, orthopedics, and pain therapist.

- The Metastatic Spine Disease Multidisciplinary Working Group Algorithms.
- Wallace AN and coll
European Diploma in Spine Interventional Neuroradiology (EDiSINR)

- Diagnostic and Interventional ESNR P. Lasjaunias Diploma
- Attendance to the annual spine meeting
- Minimum amount of procedure as first operator
- Log book
- Final examination
ESNR Spine Course
Diagnostic and Interventional
June 1-4, 2016
Geneva, Switzerland

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Bâtiment de base
2nd floor

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SARDINIA SPINE 2016
...and stroke
30th
June 2
2016

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