Minimally Invasive Spine Surgery

JOHN M SMALL M.D.
FLO RIDA O RTHO PEDIC INSTITUTE
ASSO CIATE PROFESSOR USF DEPT OF O RTHO PEDIC SURGERY
ORTHOPEDICS FOR THE PRIMARY CARE PRACTITIONER AND REHABILITATION THERAPIST
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Trends In Spine Surgery

- Motion Preservation
- Biologics and Biomaterials
- Less / Minimally Invasive
Primary Goals of Spine Surgery

- Adequate Decompression
  - Direct / Indirect
- Stabilize Spine
- Maintain Spinal Balance
- Improve / Speed Recovery
Traditional Surgical Approaches

PLF  
Back

TLIF  
Front

ALF  
Back

Thoracotomy  
Side
Surgical Treatment/Approach
Spine Surgery Procedures: Decompression
Open Laminectomy
Open Fusion

- Types of fusion:
  - Posterior / Posterior lateral fusion (PLF)
  - Posterior lumbar interbody fusion (PLIF)
  - Transforaminal lumbar interbody fusion (TLIF)
  - Anterior lumbar interbody fusion (ALIF)
Purpose of Fusion

- Stop the motion at a painful vertebral segment
  - Decrease pain
- Protect the spinal cord/nerves
- Interbody Implants
  - Restore Disc Height-
  - Indirect Decompression
An MIS procedure is one that by virtue of the extent and means of surgical technique results in less collateral tissue damage, resulting in measurable decrease in morbidity and more rapid functional recovery than traditional exposures, without differentiation in the intended surgical goal.
Conditions Treated Using MIS Procedures

- Herniated Disc
- Degenerative Disc Disease
- Lumbar spinal stenosis
- Spinal deformities
  - scoliosis
- Spinal infections
- Spinal instability
- Vertebral compression fractures
- Spinal Tumors
MISS

Advantages:

- Smaller incisions
  - Few smaller scars instead of one larger scar
- Less tissue dissection
- Less damage to surrounding muscles
- Potential for less blood loss, quicker healing, shorter hospital stay, and less pain
- Quicker return to daily activities
- Marketing
MISS

Disadvantages:

- Inadequate treatment/decompression
- Potential for prolonged operative time
- Increased radiation exposure
- Not appropriate for every case
- Less surface area of bone exposed for fusion cases “Spot Welding”
- May be difficult to repair a spinal fluid leak if one occurs
- Learning curve for surgeons
“Minimally Invasive Procedures”
Chronology of Spine Surgery

- Modern MISS- started with MED System and Kyphoplasty
MIS Procedures

- Micro Endoscopy tubular retractors
  - Minimal disruption to a patient’s normal anatomy - i.e. Muscles, Ligaments, Bone Structures
Disc Herniation
Tubular Retactors

- 14mm, 16mm or 18mm tubes are used for the working space.
- Lengths range from 3cm to 9cm
MIS discectomy
Minimally Invasive Fusion
MIS TLIF
Percutaneous Fixation
MISS- Pedicle Screws
Muscle Splitting
Lateral Access Surgery (XLIF)
Extreme Lateral Interbody Fusion (XLIF)
Adult Idiopathic Scoliosis - Case
Intra Op Pictures XLIF
Intra Operative X-rays
Increased Disc Height
Guide Wires
Multilevel XLIF
Intra Op Fluoro X-Rays
Post Op Fluoro X-Rays
Image Guided Spine Surgery
Robotic Guidance Applications in Spine Surgery

Posterior Surgical Approaches

- Open
- MIS

C1 to Sacrum

- Spinal fixation
  - Pedicle screws
  - Transfacet, translaminar-facet screws
  - Sacroiliac screws

- Spinal deformities
  - Scoliosis PSF, osteotomies

- Cement augmentations
  - Kyphoplasty and vertebroplasty

- Oncological applications
  - Biopsies, tumor resections

- Revisions
Robotic Guidance

- CT-based 3D planning
- Guided instrumentation
- 1 mm accuracy

CT-based 3D Planning Software

Guidance Unit

Workstation
Spine Surgery with Robotic Guidance

How It Works

Step 1: Preoperative Plan

Step 2: Mount

Step 3: 3D Sync

Step 4: Operate

Preoperative blueprint of the ideal surgery is created in a virtual 3D environment.
Pre Op Planning
Spine Surgery with Robotic Guidance

How It Works

Step 1: Preoperative plan

Step 2: Mount

Rigid attachment to the patient assures maximum surgical accuracy throughout the procedure.
Spine Surgery with Robotic Guidance

How It Works

Step 1: Preoperative plan
Step 2: Mount
Step 3: 3D Sync
Step 4: Operate

Two fluoroscopy images are automatically synchronized with the CT-based surgical blueprint (independent of anatomy).
Spine Surgery with Robotic Guidance

How It Works

Step 1: Preoperative plan

Step 2: Mount

Step 3: 3D Sync

Step 4: Operate

Tools and implants are guided to the planned trajectory with 1 mm accuracy
Other Innovations for MISS
Conclusion

- MISS here to stay
  - future
- Techniques continue to improve
- Image guidance and Robotics appear to improve accuracy
Thank You
Preop Scoliosis Xrays - 75 degrees kyphosis T6-L4
Surgery

- Subtraction Osteotomy L3
- TLIF / SPO L4/5 and L5/S1
- Posterior Fusion with instrumentation T12-S1
- Bilateral screws
Ioflex Foraminotomy
Decompression with iO-Flex® System

3-D CT reconstruction of cadaver before/after L4/5 decompression with iO-Flex® System

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