

Minimally Invasive Spinal Surgery

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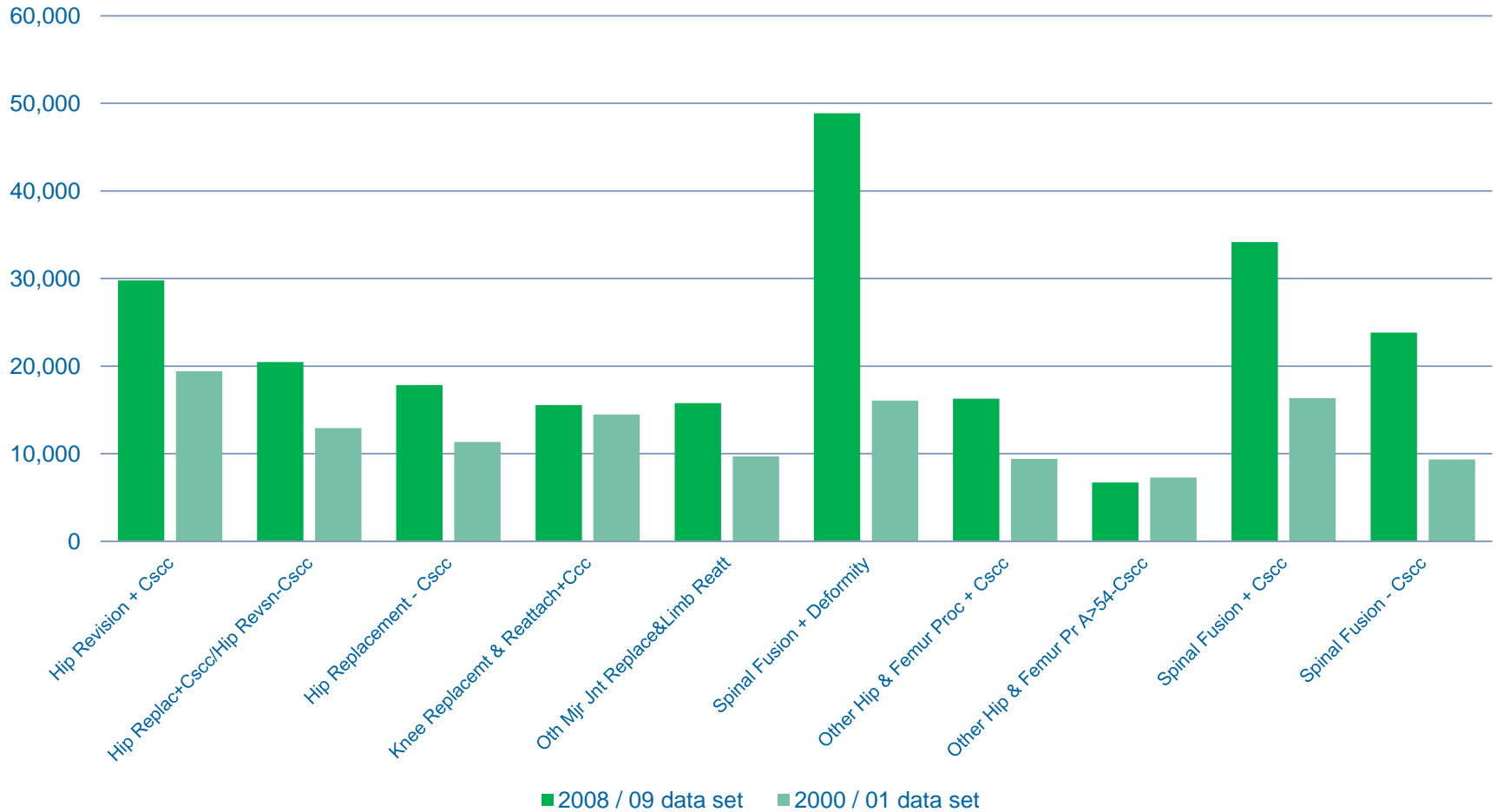
Spinal Pain



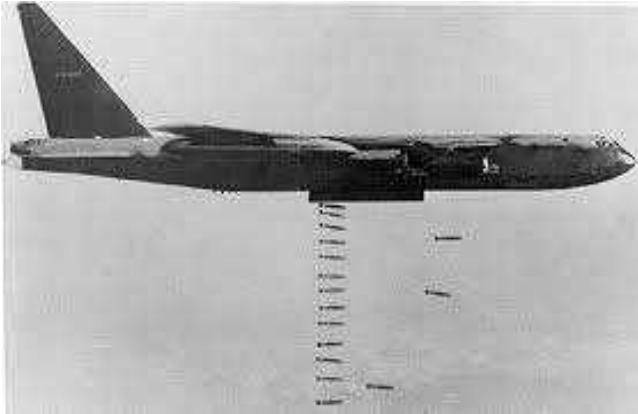
- Most common disability <45 years
- 85% no specific diagnosis
- 80% life time prevalence
- 15% of sick leave
- 1% have nerve root compression
- 2% have disc prolapse

AR-DRG Cost Track Private Hospitals

Avg DRG total cost



Maximally Invasive Surgery

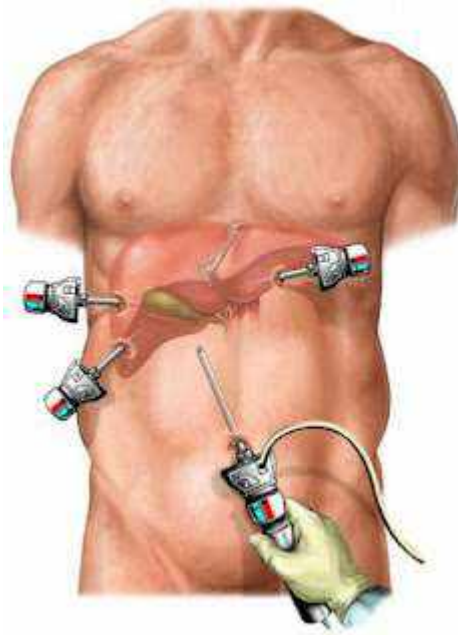


Minimally Invasive Surgery



Minimally Invasive Surgery

Laparoscopic Cholecystectomy

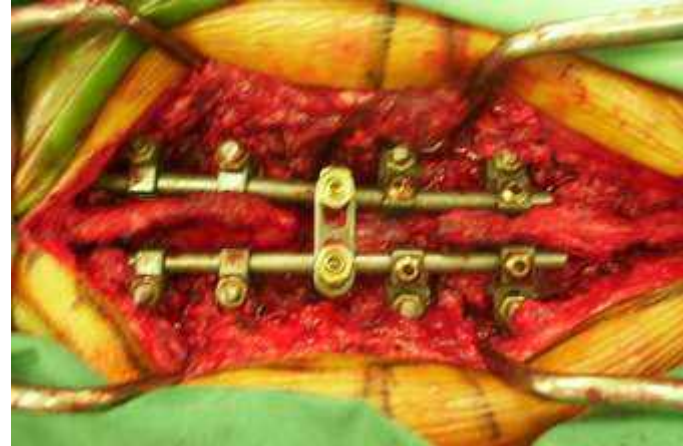


Minimally Invasive Instrumentation

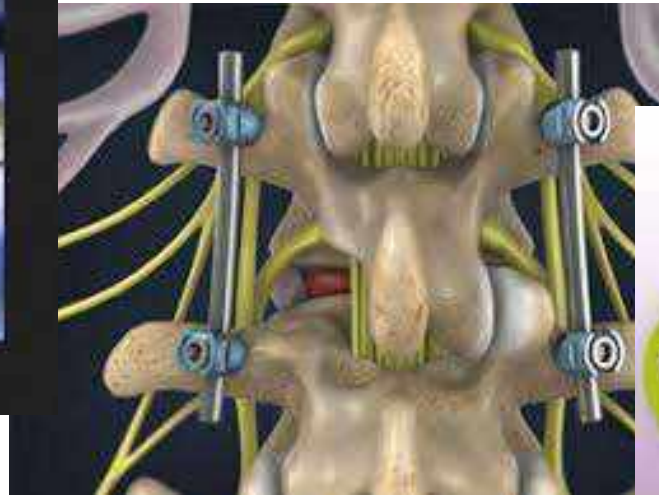
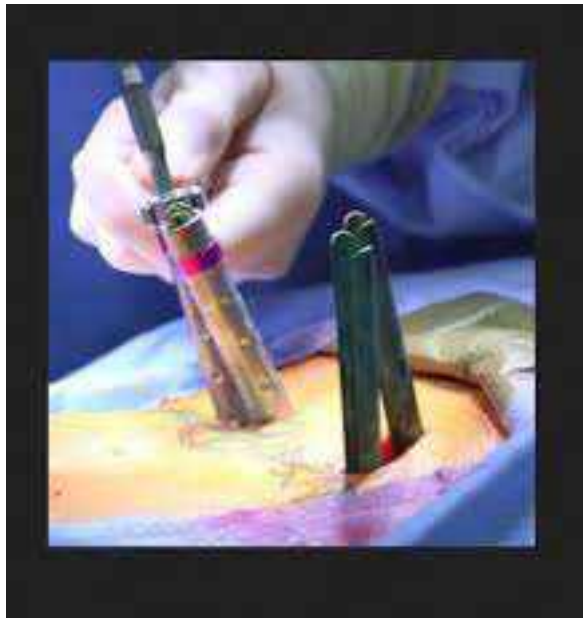


Confluence of Technologies

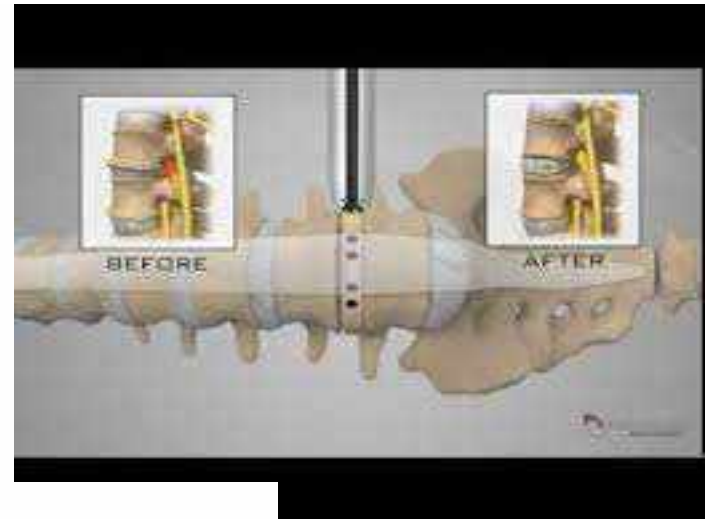
- High resolution CT/MR
- Retractor Systems
- Intra op 2D/3D Imaging
- Neural Monitoring
- Orthobiologics
- Instrumentation
- Biomodelling
- Microscope
- Computer Navigation
- High speed drills



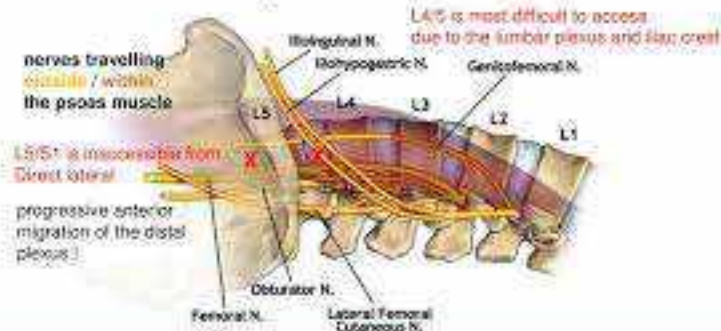
MIS Transforaminal Lumbar Interbody Fusion Procedure (TLIF)



Lateral Interbody Fusion (LLIF)

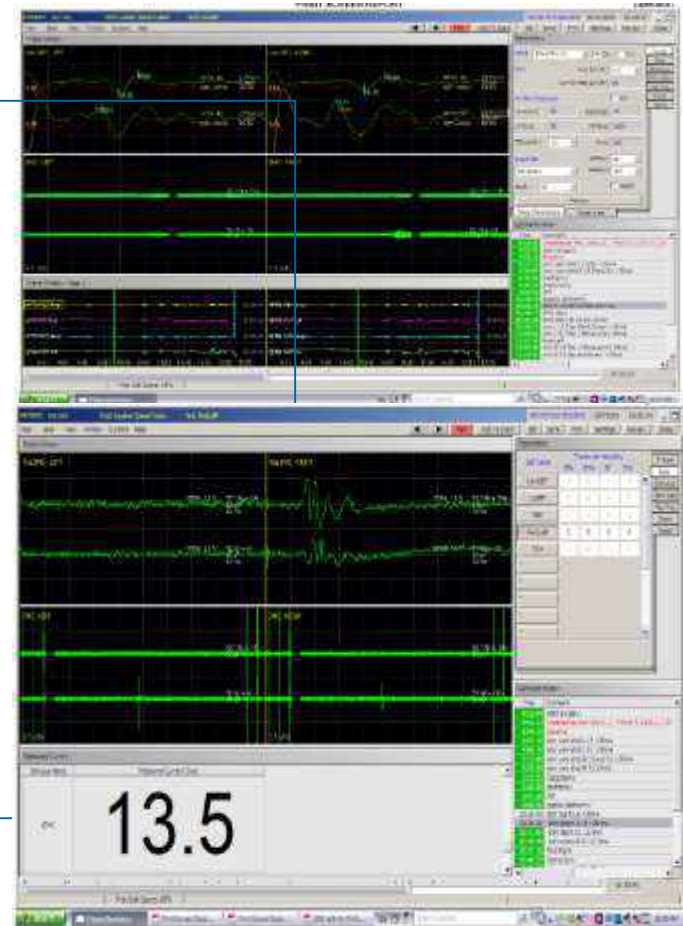


Limitations of Neuroanatomy in lateral decubitus XLIF-Position



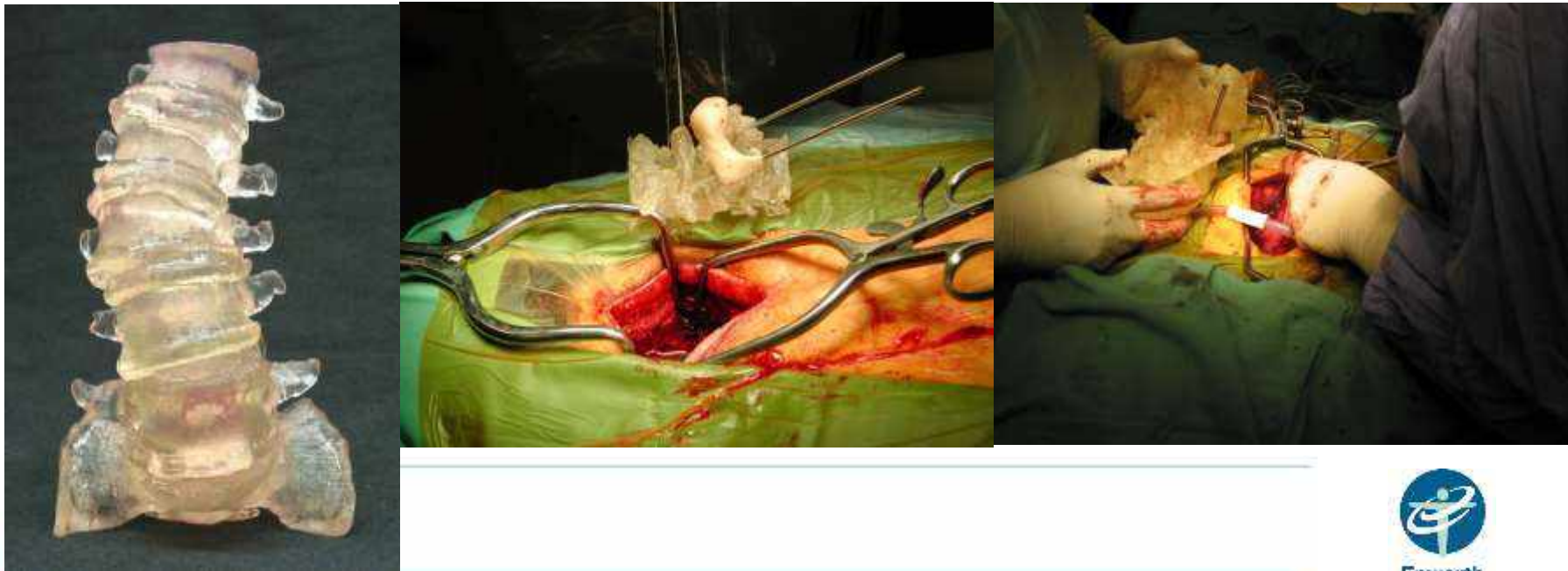
Neural Monitoring

- Motor and Sensory
- Real time
- Accuracy
- Lower patient radiation dose
- Safer decompression
- Safer instrumentation



BioModelling (3D Printing)

- Converts CT images to solid biomodels
- Facilitates diagnosis, communication, simulation
- Navigation aid
- Intuitive and user friendly



3D Image Intensification

- 3D verification of instrumentation
- Data for navigation systems
- Reduces need for post op CT?
- Increased radiation dose



NeuroBiologics

- Bone Morphogenic Protein (BMP)
 - accelerated fusion
 - no need bone harvesting
 - side effects
- Anti Fibrosis Gel
- Bone substitutes (tricalcium phosphate)
- Allograft



Navigation

- 3D positioning of instrumentation
- Trajectory modification
- Anatomy overview
- Less radiation exposure to surgeon



Case Study 1

L45 Degenerative Spondylolithesis

- 68 yr old female
- Anxious about fusion & came for further opinion
- Many years of spinal claudication
- Severe leg paraesthesia when standing/walking
- Can walk/ stand for less than 10 minutes
- Some urge incontinence

L_{HH}
FLEXION



L_{HH}
EXTENSION





+LPH *11/08/1941, F, 67Y
#STUDY 2
2 IMA 6 / 12

+LPH *11/08/1941, F, 67Y
#STUDY 2
2 IMA 7 / 12

+LPH *11/08/1941, F, 67Y
#STUDY 2
2 IMA 8 / 12



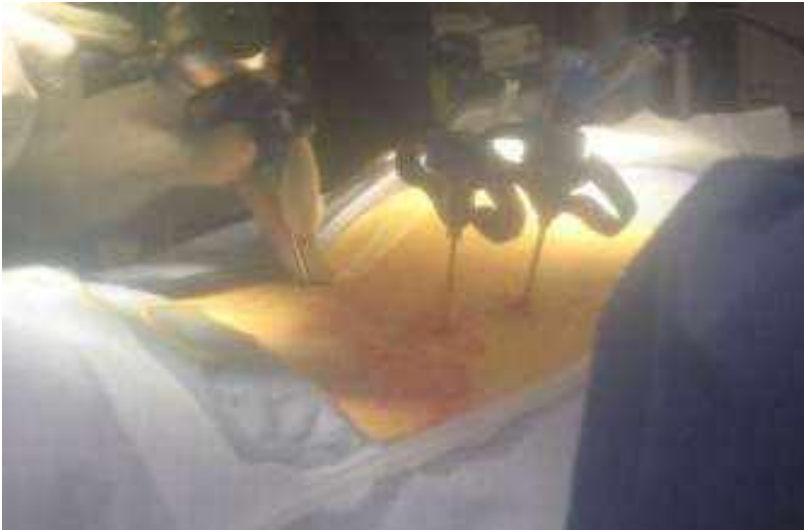
P H18
R17.5
R(1.4)

P H18
R12.3
R(1.4)

P H18
R12.3
R(1.4)

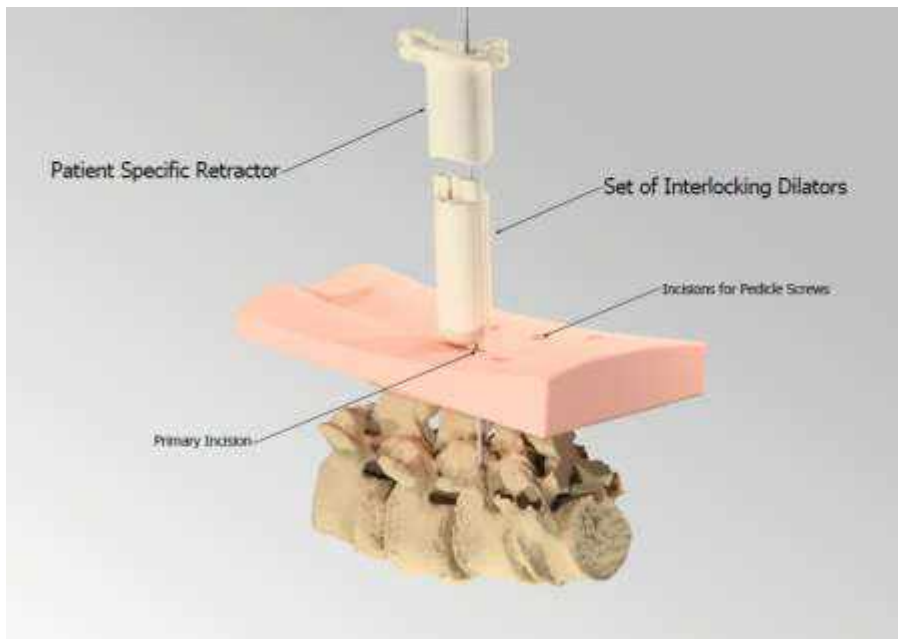
P H18
R7.1
R(1.4)

Minimally Invasive Decompression Instrumented Fusion

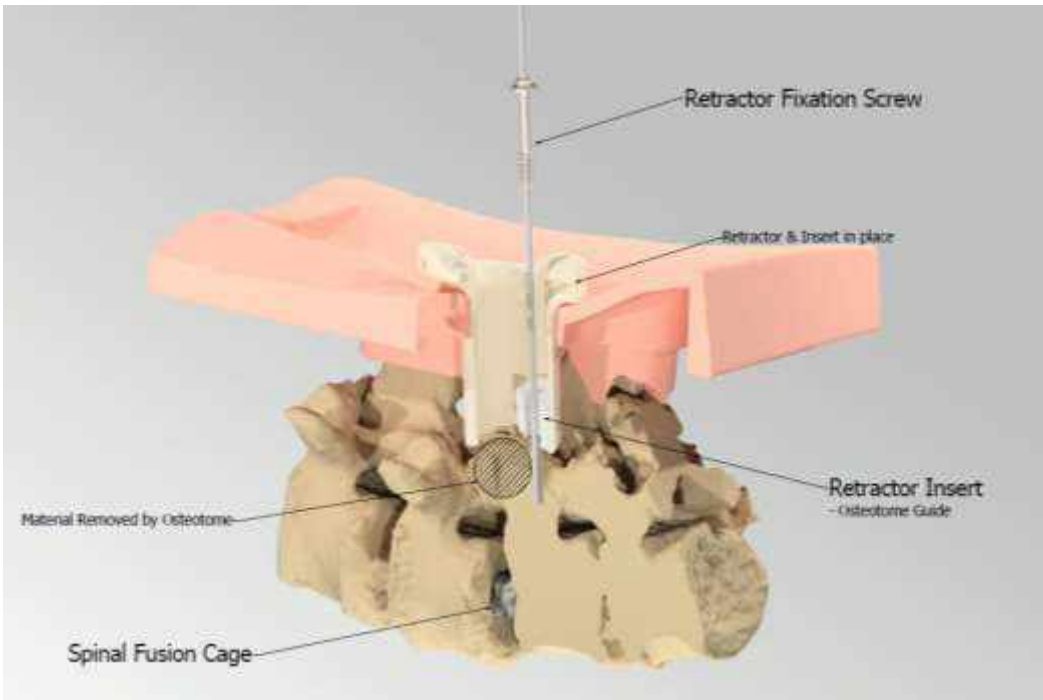




3D Printed Dilators & Retractor Tube

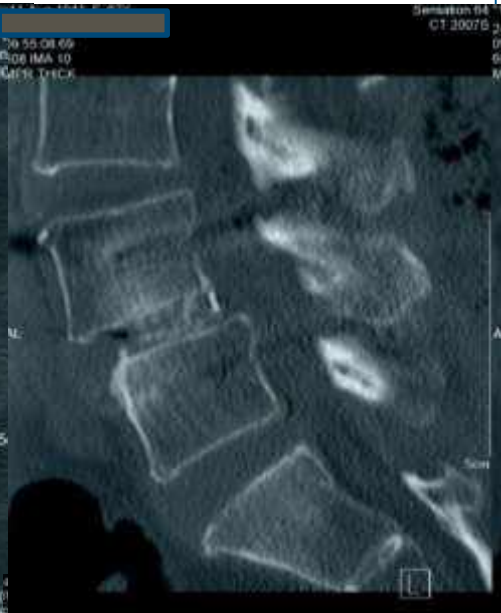


3D Printed Retractor Tube



- Clear visibility
- Docks directly over disc space
- Osteotomy guide





Post Operative Progress

- Day 1 IV out and Mobile
- No IDC!!
- Day 4 Discharge
- Four Week Outpatient Review
 - Minimal Back Pain
 - Mild Residual Left leg parathesia
 - No analgesics required
 - Sitting Comfortably
 - Walking for 20 minutes
 - Driving Car

Research: MIS Lumbar Fusion

- Prospective study
- July 2004 to March 2012
- 155 patients undergoing MIS lumbar fusion
- Single surgeon (PD)
- Independent research assistant
- Chart audit
- Patient questionnaires

Results

- 1 level 129 83.2%
 - 2 level 24 15.5%
 - 3 level 1 0.6%
 - 4 level 1 0.6%
-
- 672 pedicle screws were placed

Results

- Mean procedure time 189 min (range 69-350 min).
- Intravenous narcotic (PCA) 15.7 hrs (range 0-60 hrs).
- Intramuscular narcotics < 35 hrs (range 0-204 hrs).
- Mean time to ambulation was 22 hrs.
- Mean length of acute inpatient stay was 4.38 days.

Results: Complications

- Two screws were misplaced (0.3%) (early revision surgery).
- Wound infections occurred in two (1.3%) patients.
- There were no nerve root injuries or CSF leaks.
- Two patients (1.3%) required a post-op blood transfusion.
- No ICU stays

Results: Radiation Exposure

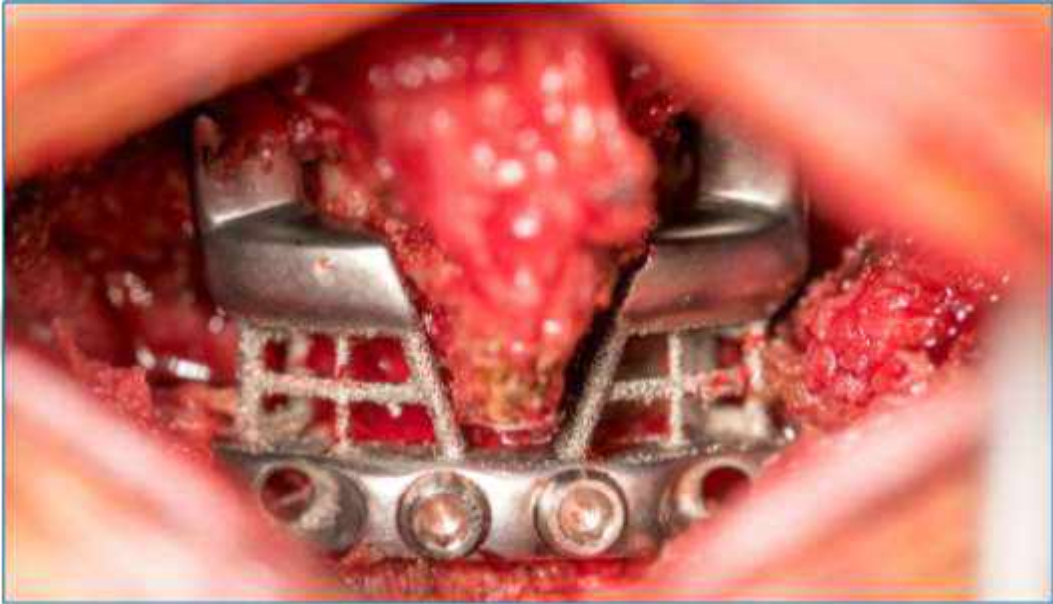
Fluoroscopy time 60 seconds (n=28).

Radiation exposure	105mRem
CT Abdomen/Pelvis	1000mRem
NCRP Maximal Annual Exposure	5000 mRem body 50000 mRem extremity
Surgeon Annual Torso Limit	313 cases
Surgeon Annual Hand Limit	1136 cases

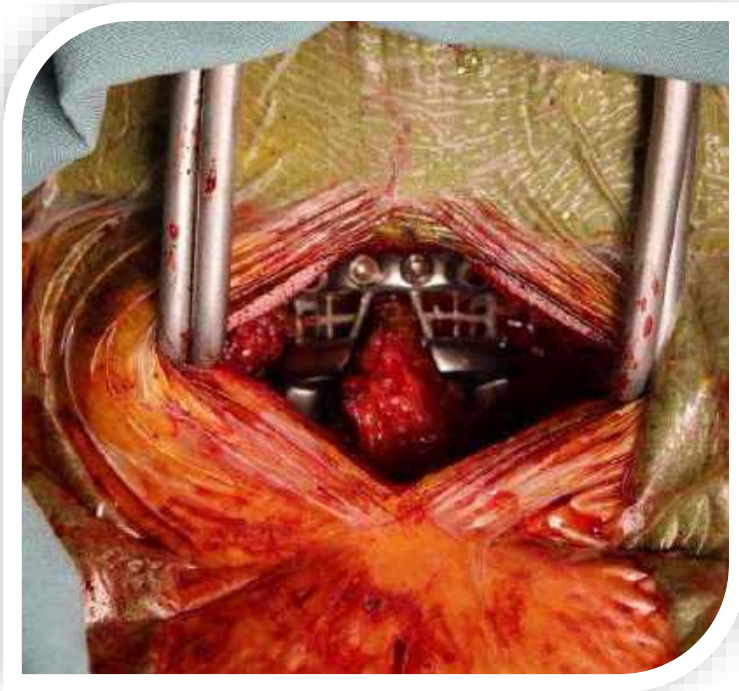
C1/C2 Fusion with Drill Guide



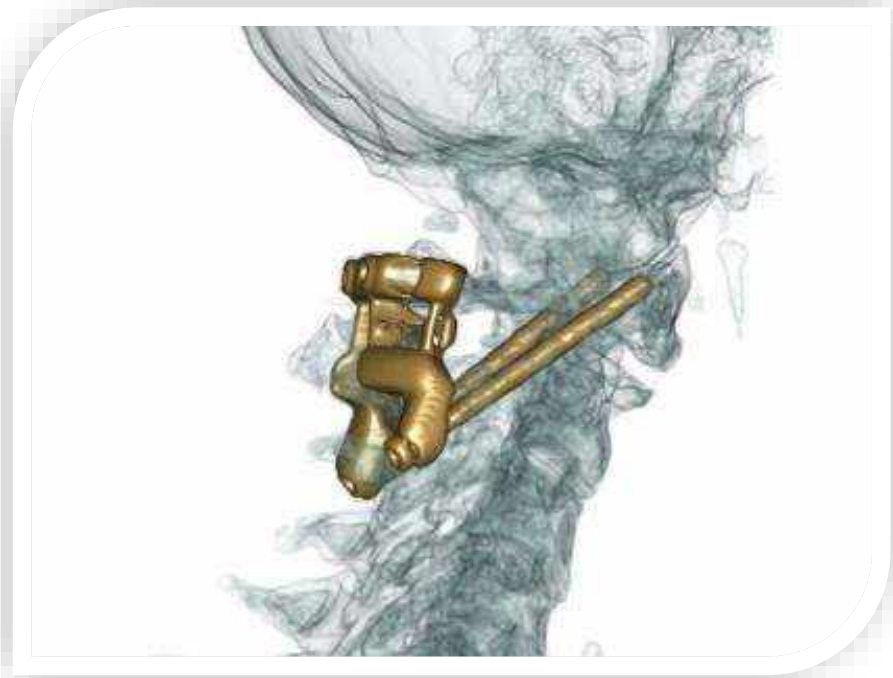
C1/C2 Fusion with Drill Guide



C1/C2 Fusion with Drill Guide



Intra Op Fluro and Post Op CT



Conclusions

- MIS spinal fusion is a safe procedure
- Less post operative pain
- Earlier ambulation
- Low complication rate
- Short bed stay
- Excellent immediate outcomes
- Likely substantial cost benefits