

Advanced MIS Solutions: The Evolution of MIS Lumbar Spine Surgery

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The Evolution of MIS Lumbar Spine Surgery

Why MIS Lumbar Spine Surgery

1. Less blood loss
2. Less infections
3. Less post-op pain
4. Shorter hospital stay
5. Strong patient demand
6. Intense technology development
7. Cost effectiveness?
8. Long-term benefits?

Spine Deformity

Rates of Infection After Spine Surgery Based on 108,419 Procedures

A Report from the Scoliosis Research Society Morbidity and Mortality Committee

Aims / Principles MIS

- Limit tissue disruption and destabilisation
- Achieve bilat decomp via unilat approach
- Achieve indirect neuronal decompression

Timeline of Spinal Surgery

Key Developments

- 1933 Burns – transperitoneal ALIF for SPL
- 1934 Mixer and Barr – intradural approach disc herniation
- 1938 Love – interlaminar extradural discectomy
- 1963 Smith – first percutaneous intervention chymopapain
- 1967 Yasargil – operative microscope
- 1968 Wiltse
- 1975 Hijikata – percutaneous lateral approach
- 1982 Magerl – percutaneous screws and ext fixator
- 1983 Friedman – direct lateral percutaneous discectomy

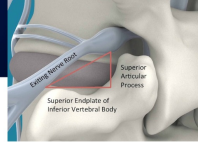
merc **Forst & Hausman – rigid arthroscope**



Key Developments

- 1986 Schrieber - discoscopy
- 1986 Choy – Nd:YAG percutaneous laser nucleolysis
- 1990 Saal & Saal – IDET
- 1990 Kambin - arthroscopic anatomical description of a triangle
- 1991 Faubert & Caspart – tubular access
- 1997 Foley & Smith – endoscope – microendoscopic discectomy
- 1997 Mayer – direct lateral retroperitoneal appr (ATP) and MIS ALIF
- 2001 Foley – removable extenders – 1st perc screw system and MIS PLIF
- 2002 3 groups – unilateral appr bilateral decompression

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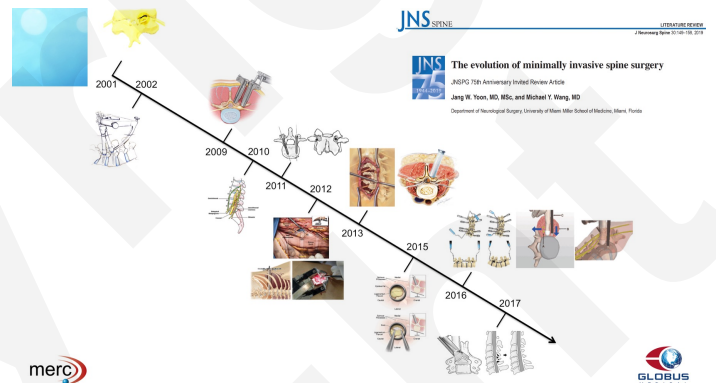
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Key Developments

- 2003 Foley – MIS TLIF
- 2006 Ozgur – XLIF
- 2012 Silvestre – ATP
- 2015 Drazin – Single Position Lateral
- 2017 Hynes – OLIF
- 2019 Lamartina & Berjano – Prone Lateral

Clinical Study
Simultaneous Lateral Interbody Fusion and Posterior Percutaneous Instrumentation: Early Experience and Technical Considerations

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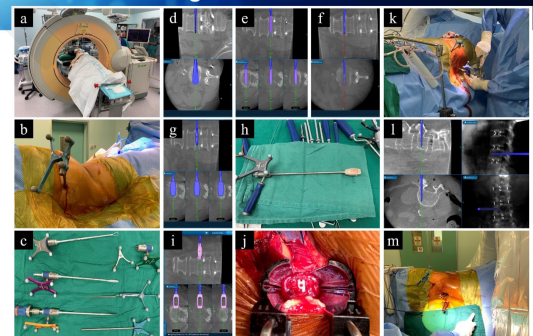


FIG. 2. Prominent figures in MIS spine surgery. A: Parviz Kambin (source: https://upload.wikimedia.org/wikipedia/commons/8/8a/Dr_Parviz_Kambin.jpg). B: Leon L. Wiltse (source: <http://www.burtonreport.com/wp-content/uploads/2010/11/Wiltse200.jpg>). C: Luis Pimenta (source: <https://www.intellicore.com/assets/uploads/2019/02/25-Luis-Pimenta.jpg>). D: Kevin T. Foley (source: <http://www.transcort.com/assets/images/neuro.html>). E: Richard G. Fessler (source: <https://www.mri.org/en/ways-to-qual>). F: Henry J. Martin (source: <https://www.fessler.com/assets/images/hjmartin.jpg>). G: Anthony T. Young (source: <https://www.science.com/doi/fulltext/10.1016/j.jns.2018.08.014>). H: Charles V. Burton (source: http://www.vburton.com/assets/images/aboutting_Dr.jpg). I: Charles V. Burton (source: http://www.vburton.com/assets/images/aboutting_Dr.jpg). J: Charles V. Burton (source: http://www.vburton.com/assets/images/aboutting_Dr.jpg). Copyright 2019 (panel A, license type: CC BY-SA 4.0) (https://creativecommons.org/licenses/by-sa/4.0/); Charles V. Burton (panel B); Society of Lateral Access Surgery (panel C); TrueVision Systems, Inc. 2018 (panel D); Neurosurgery Research & Education Foundation (panel E); Anthony T. Young (panel F); and Woodruff Hospital (panel G). Published with permission. Figure is available in color online only.

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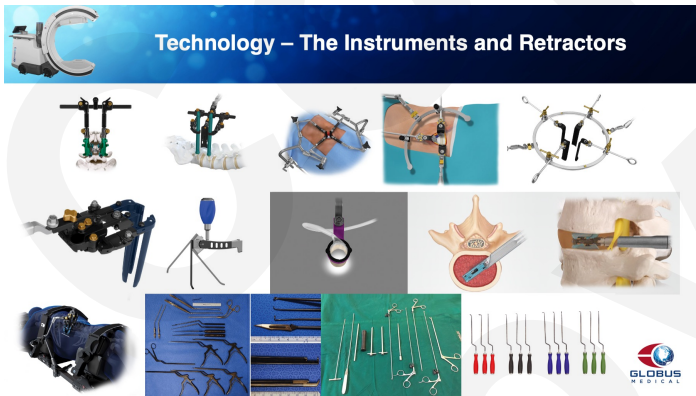
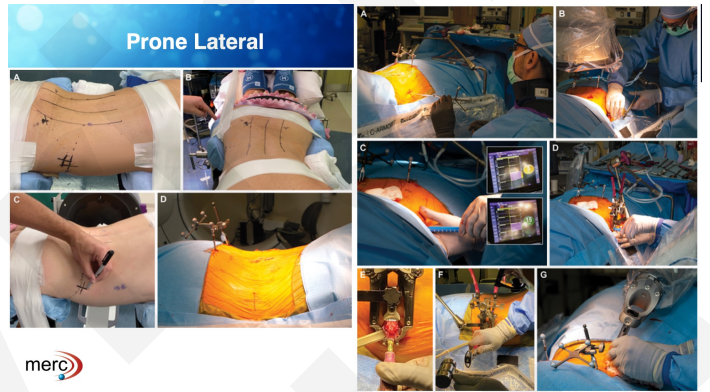
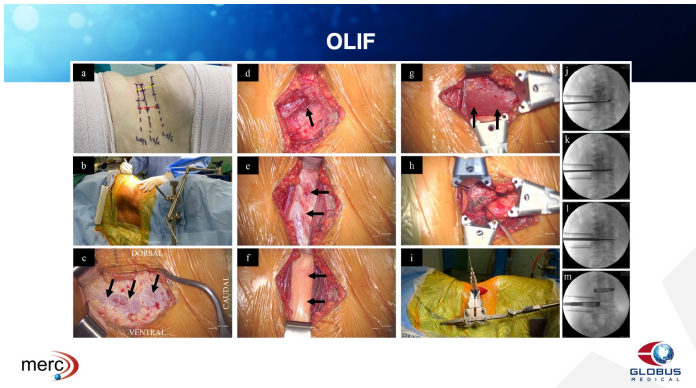
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Single Position Lateral



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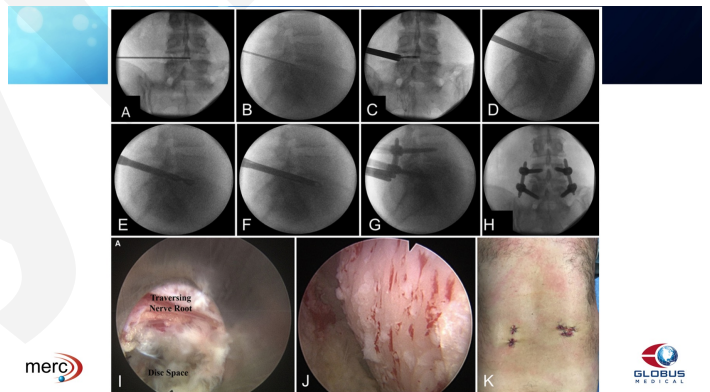
Technology – The Robots

- Mazor Renaissance 2011 Mazor X 2016 Mazor X Stealth 2018
- TiRobot 2016
- Rosa Spine 2016 One 2019
- Excelsius GPS 2017
- Cirq 2019
- eCential 2022
- Velys 2024
- Pyxis 2024
- Mako...

Robot Name	Company	FDA Approval Year	Benefits	Drawbacks
Mazor Renaissance	Mazor	2011	First FDA-approved spine robot	Instability in K-wire placement and shoving can cause inaccurate screw entry trajectory
Mazor X	Mazor	2016	Improved accuracy of vertebral body mapping and intraoperative collision avoidance	Notable risk of screw misplacement secondary to shoving
Rosa Spine	Zimmer Biomet	2016	Improved accuracy of vertebral body mapping and intraoperative collision avoidance	Radiation exposure is still present
Rosa ONE	Zimmer Biomet	2019	Stereoscopic camera allows for optimized pedicle entry point	Robot misinterprets movement of reference array as patient movement, causing inaccurate screw placement
ExcelsiusGPS	Globus Medical	2017	Robot is not connected to the patient or table, allowing for greater flexibility within the operating room	Threshold exposure of radiation during intraoperative imaging compared to traditional surgery
Velys	Globus Medical	2024	Only FDA-approved spine robot that does not require K-wires	Preoperative imaging is still necessary

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Have an Algorithm...

- APPS:**
Anatomy
Pathology
Planning
Surgery



Fusion

-



Fusion

-

Fig. 3 Evolution of anterior lumbar interbody fusion (ALIF) cage design (A) Autograft block; (B) femoral ring allograft; (C) BAK cage; (D) PEEK cage; (E) Swift® (swayback); (F) Ti-PEEK cage



Which Fusion? My opinions...

Which Fusion? My opinions...



Considerations (MIS) TLIF

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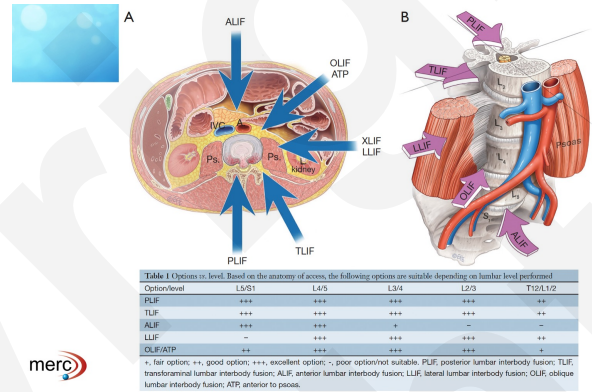
Considerations LLIF / OLIF / ATP

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Considerations (MIS) ALIF

- (L2/3) 3/4/5 5/1 levels
- Restore foraminal height (up / down) ☒
- Improve fusion ☒
- Revision of failed posterolateral fusion ☒
- Restore lordosis / correct deformity ☒
- Biomechanics – shear / large disc height / entire facet removed / long construct involving L5/S1 ☒



Static vs Expandable IB Cages

- Biases and Controversies...
- The ACDF vs IVDR debate...



Static vs Expandable IB Cages



Why do I use Expandable IB Cages*?

- I have done >75 cases
- Minimize tissue trauma during insertion
- Minimize neural retraction
- Minimize endplate trauma during insertion
- Minimize implant subsidence (gradual load sharing)
- Minimize cage back out
- Maintain lordosis with lordotic implant
- Remember - my TLIF / LLIF is not the same as yours
- My endplate prep not the same as yours
- What works in one person's hands does not necessarily work in another's

*Points on slide represent my opinions based on my clinical experience

My Personal Experience

- RISE / Caliber TLIF and Rise L cages
 - Tend to use 12 x 30 x 15 deg RISE in TLIF – whole facet comes off (ie a TLIF!)
 - MIS TLIF – 2 incision – adequate access
- No cage back outs
- No post op subsidence
 - Yes to intra op endplate damage and intra op subsidence
 - Yes to cage insertion nonparallel to endplates
- Yes to post op perineural inflammation
 - Stopped using DBM in the cage / disc space
- No revisions...yet!
 - Adjacent segment surgery - yes of course!



Thank You



Timeline of Spinal Surgery

