

MIS TLIF: Tubes

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Disclosures

- Consultant: Bioventus
Medtronic



Outline

- History
- Technique
- Literature



TLIF

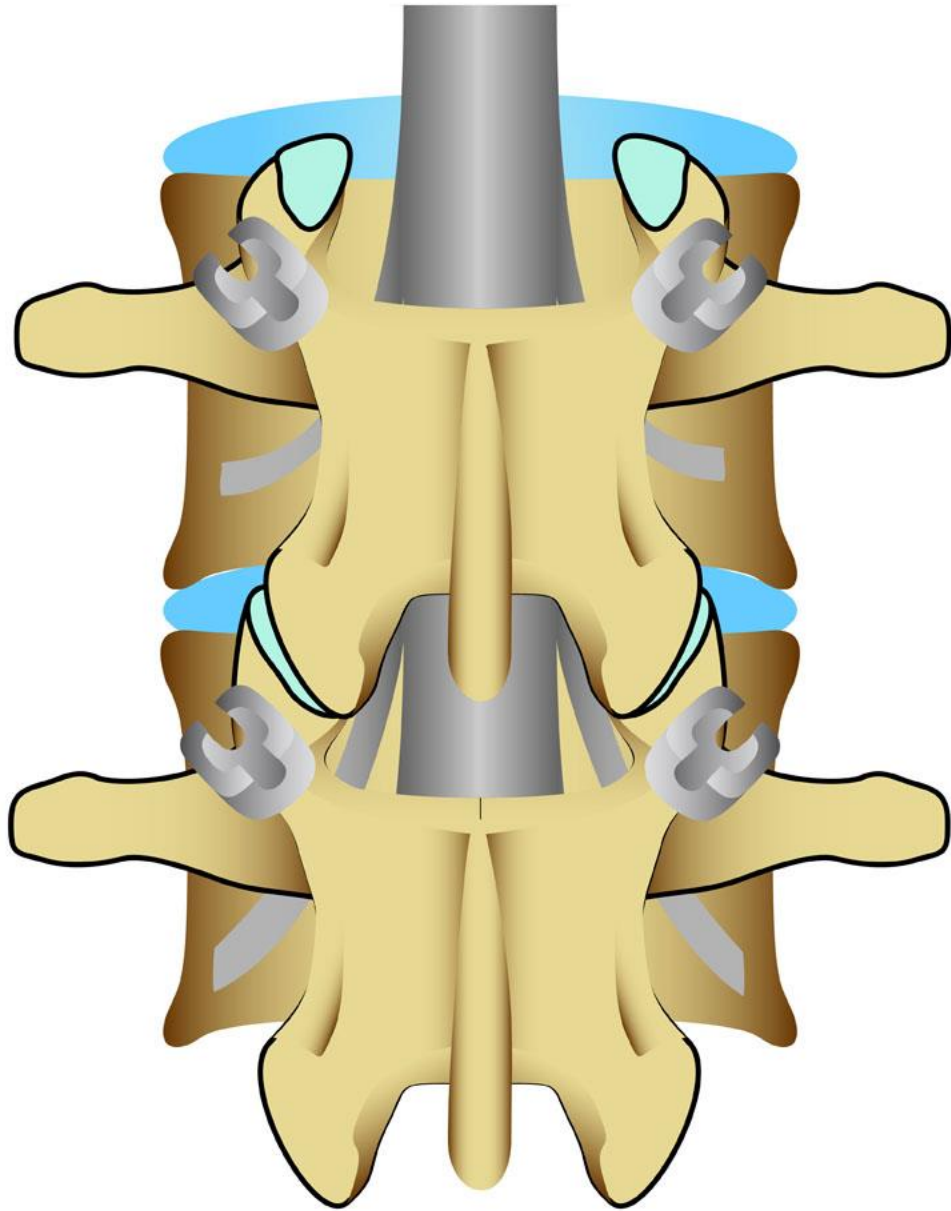
- History

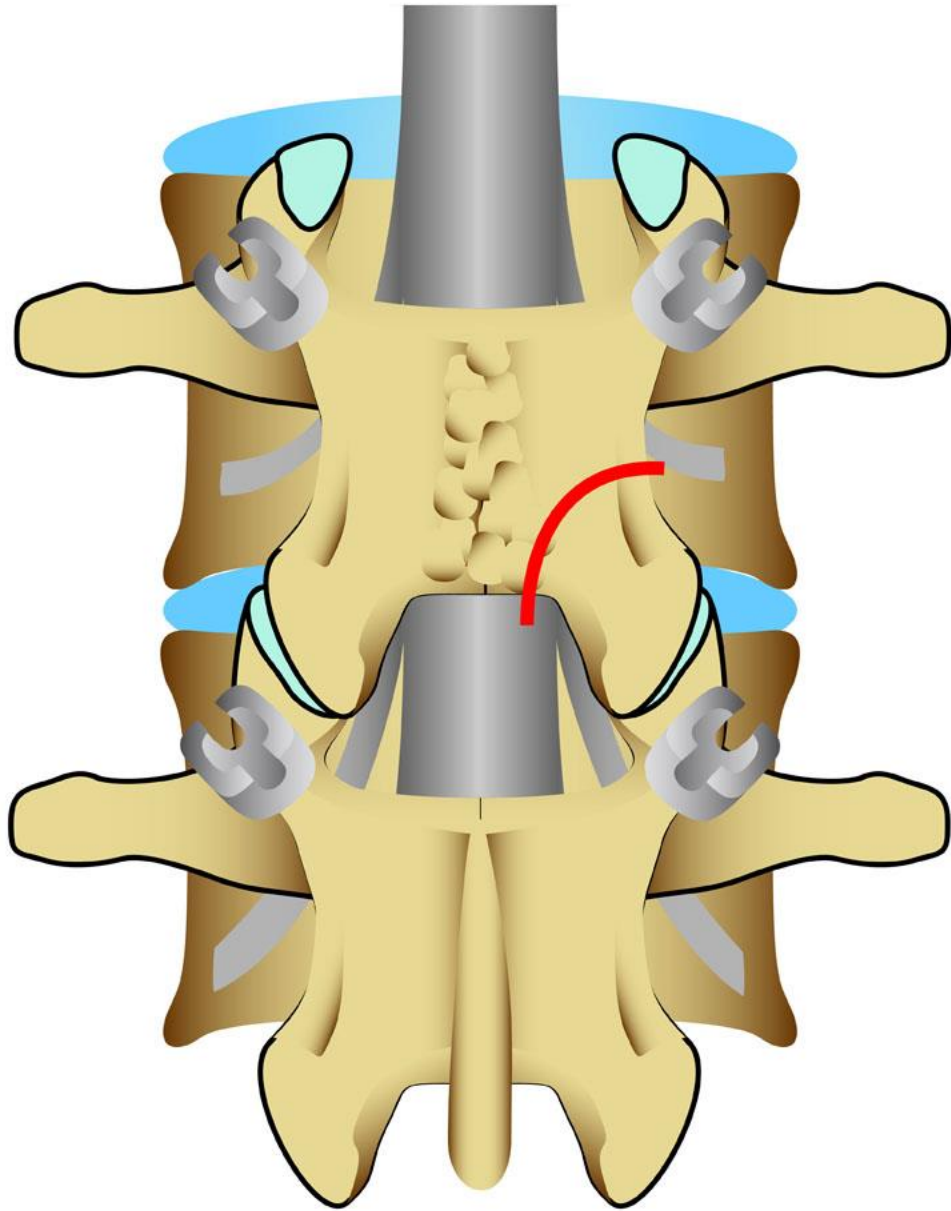
- Developed by **Jürgen Harms** and Rolinger in 1982

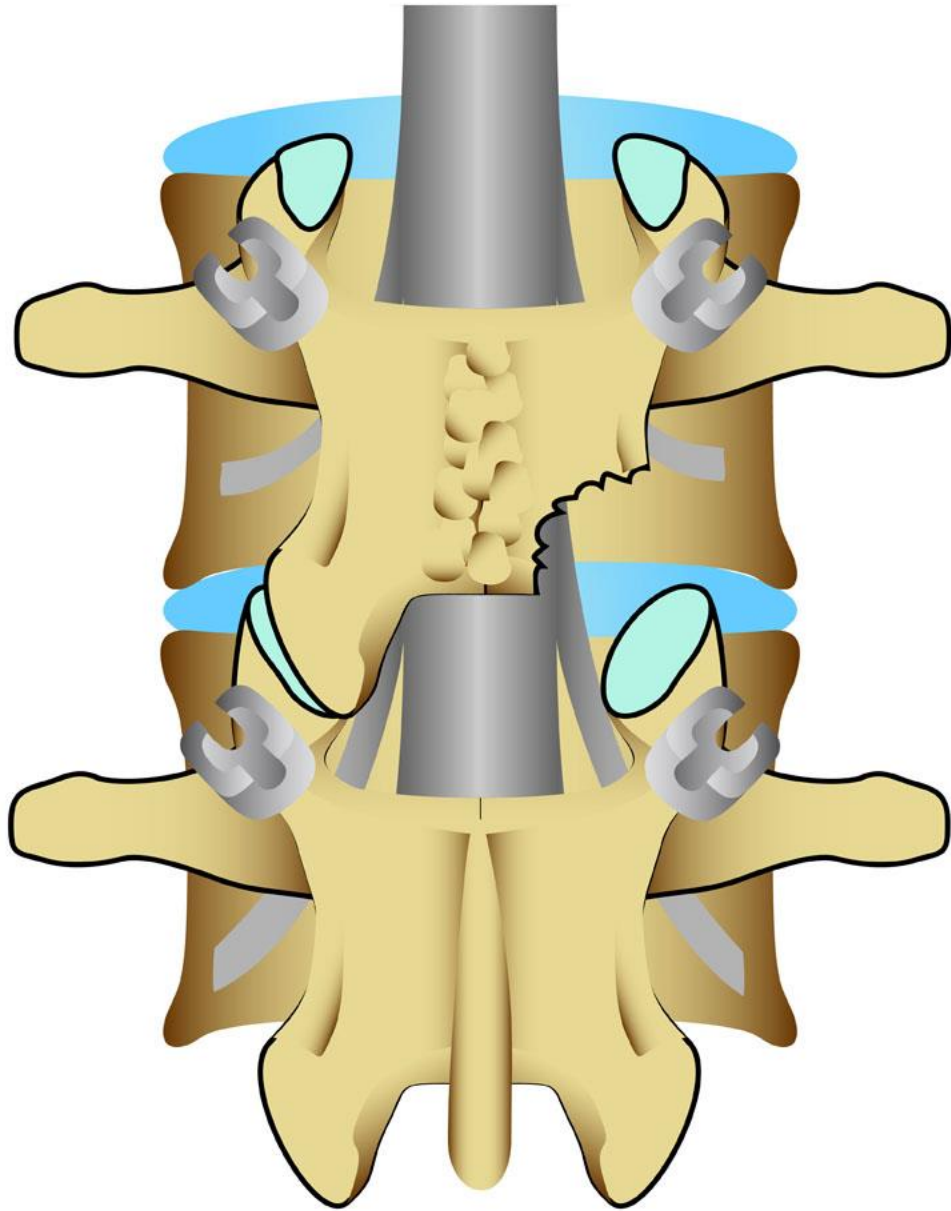


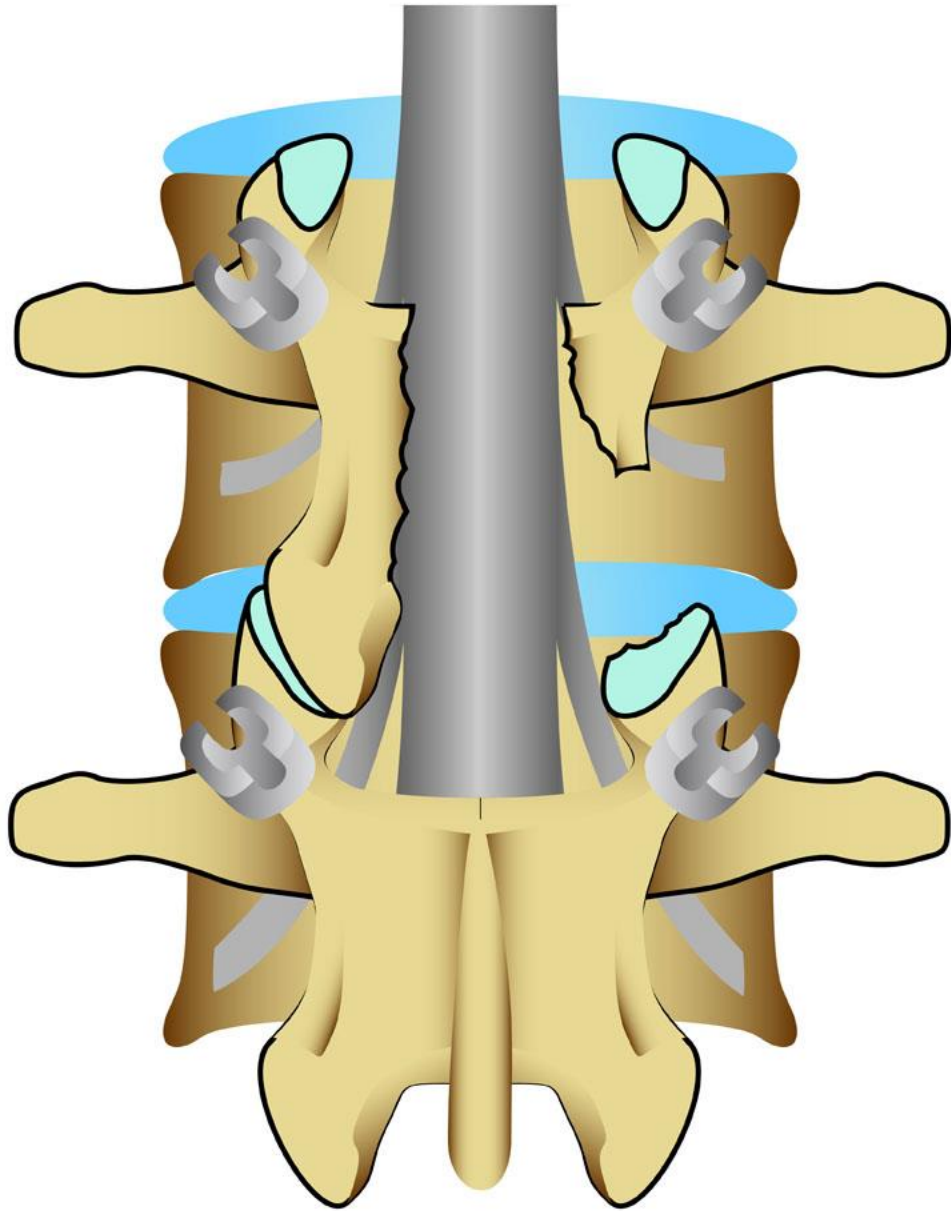
- Minimally invasive TLIF described by Foley in 2005

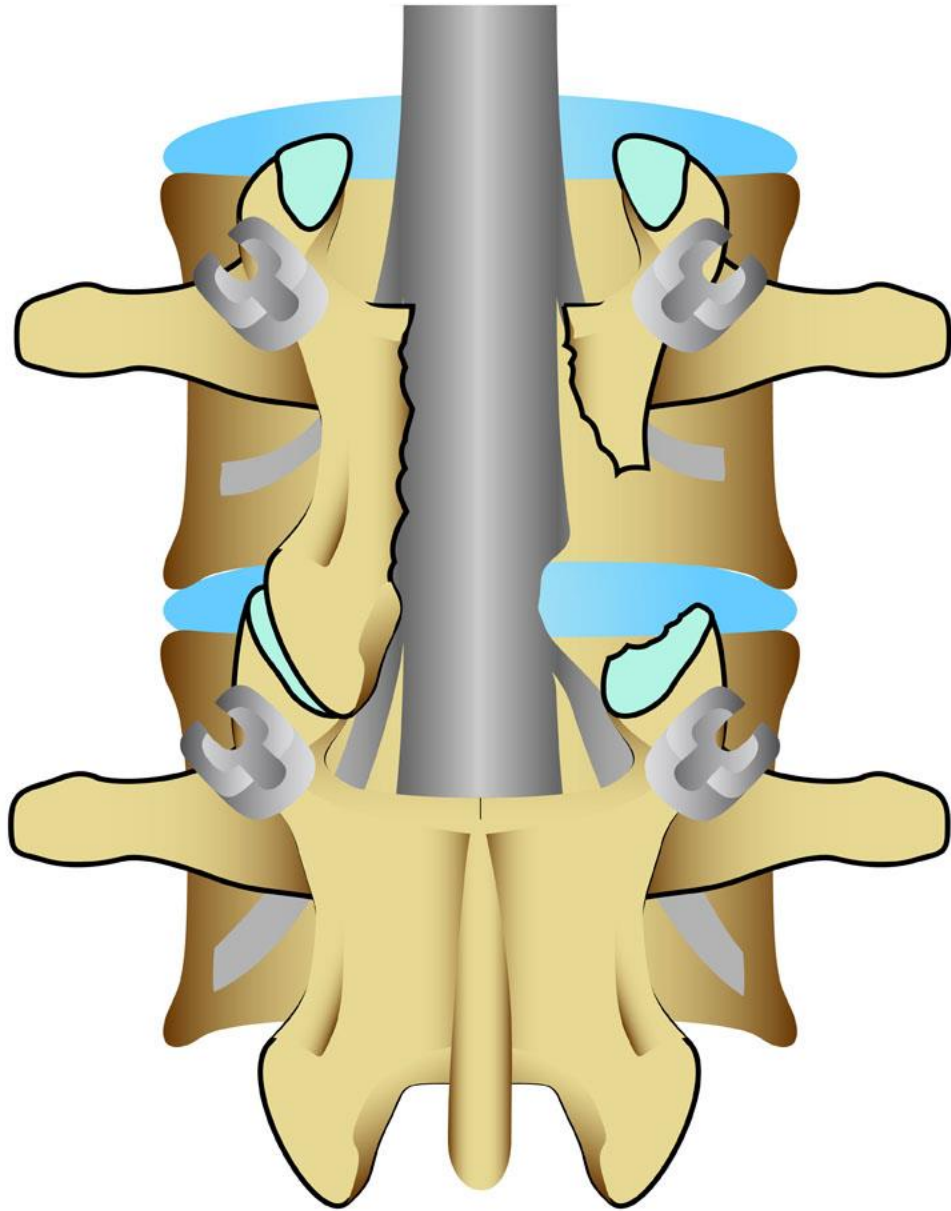


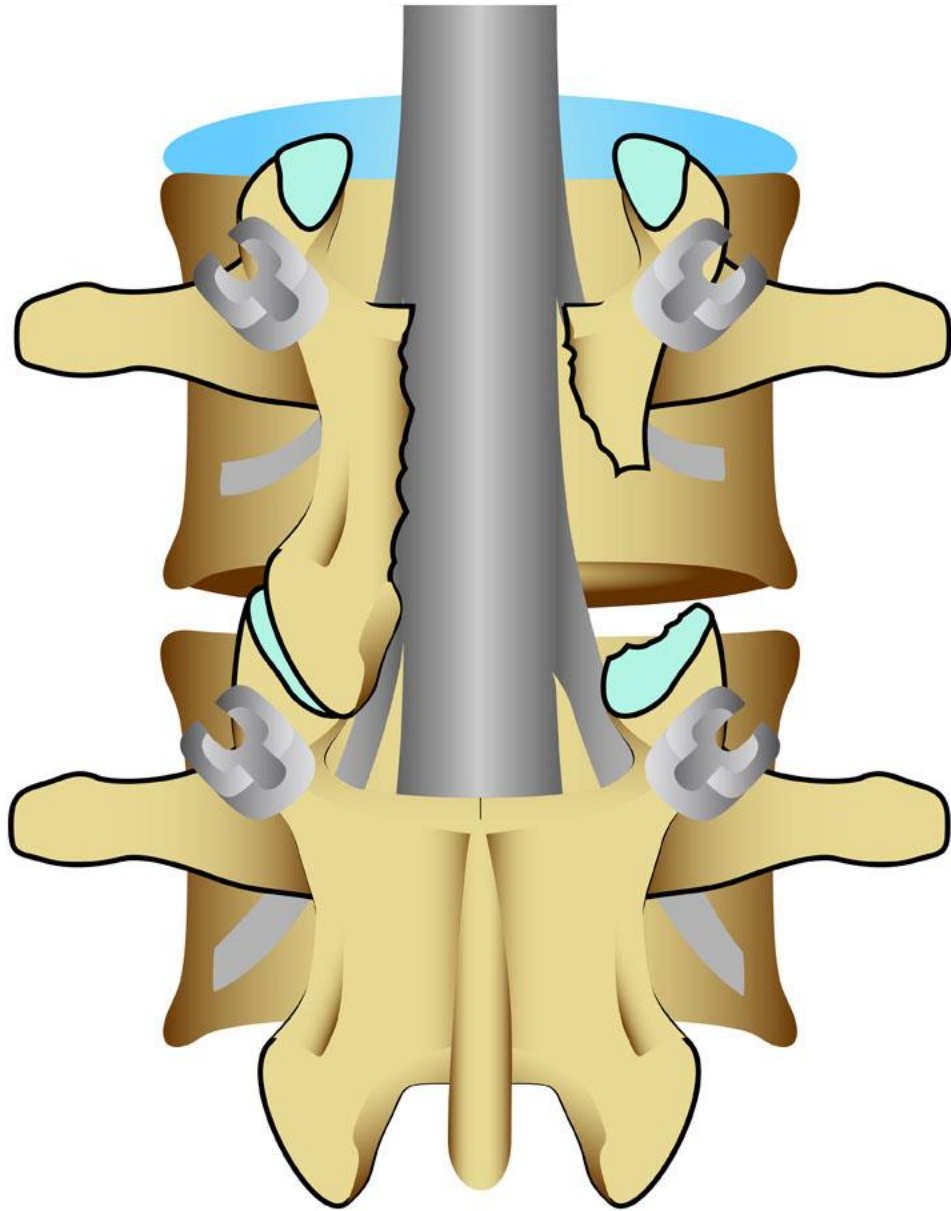


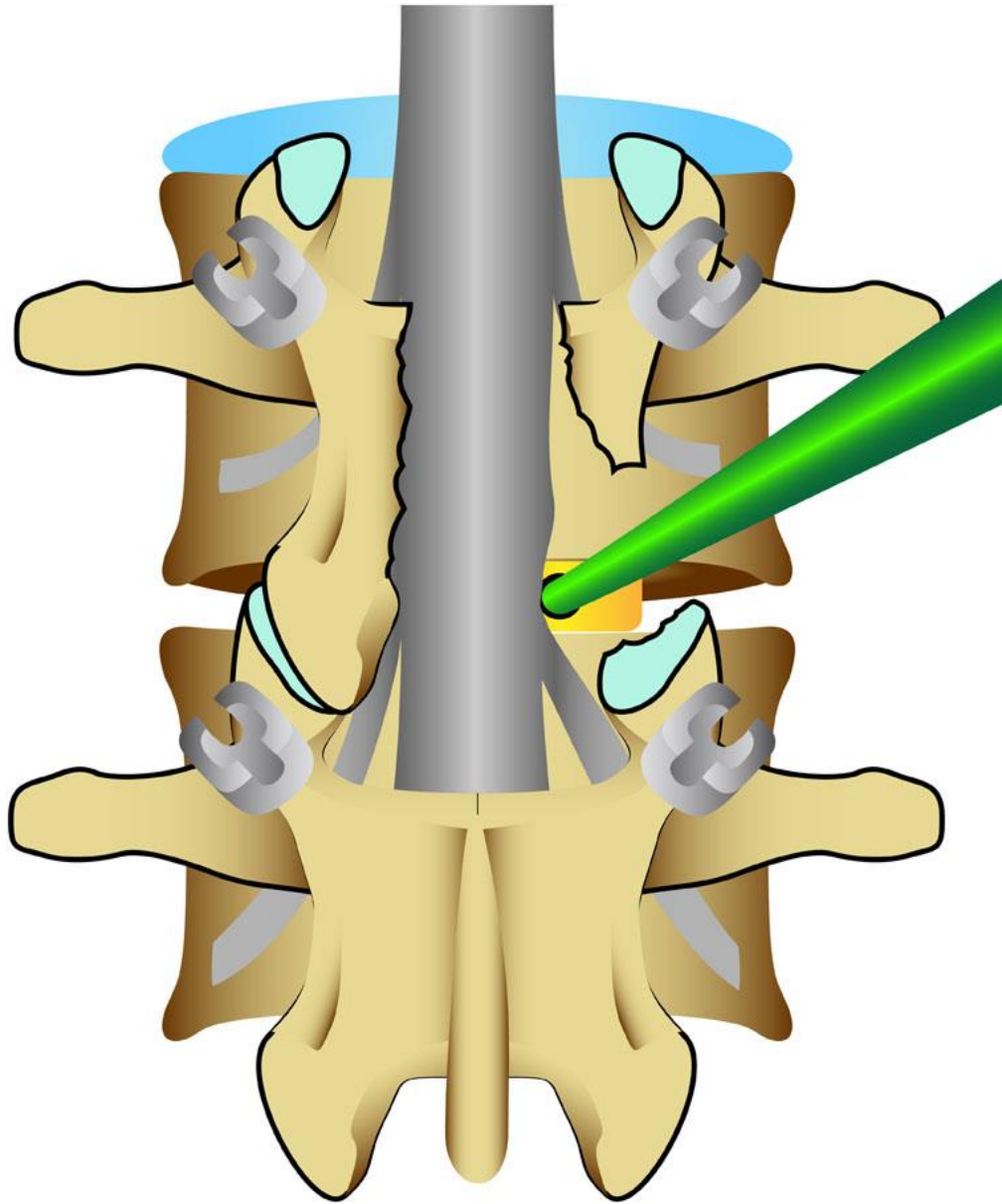


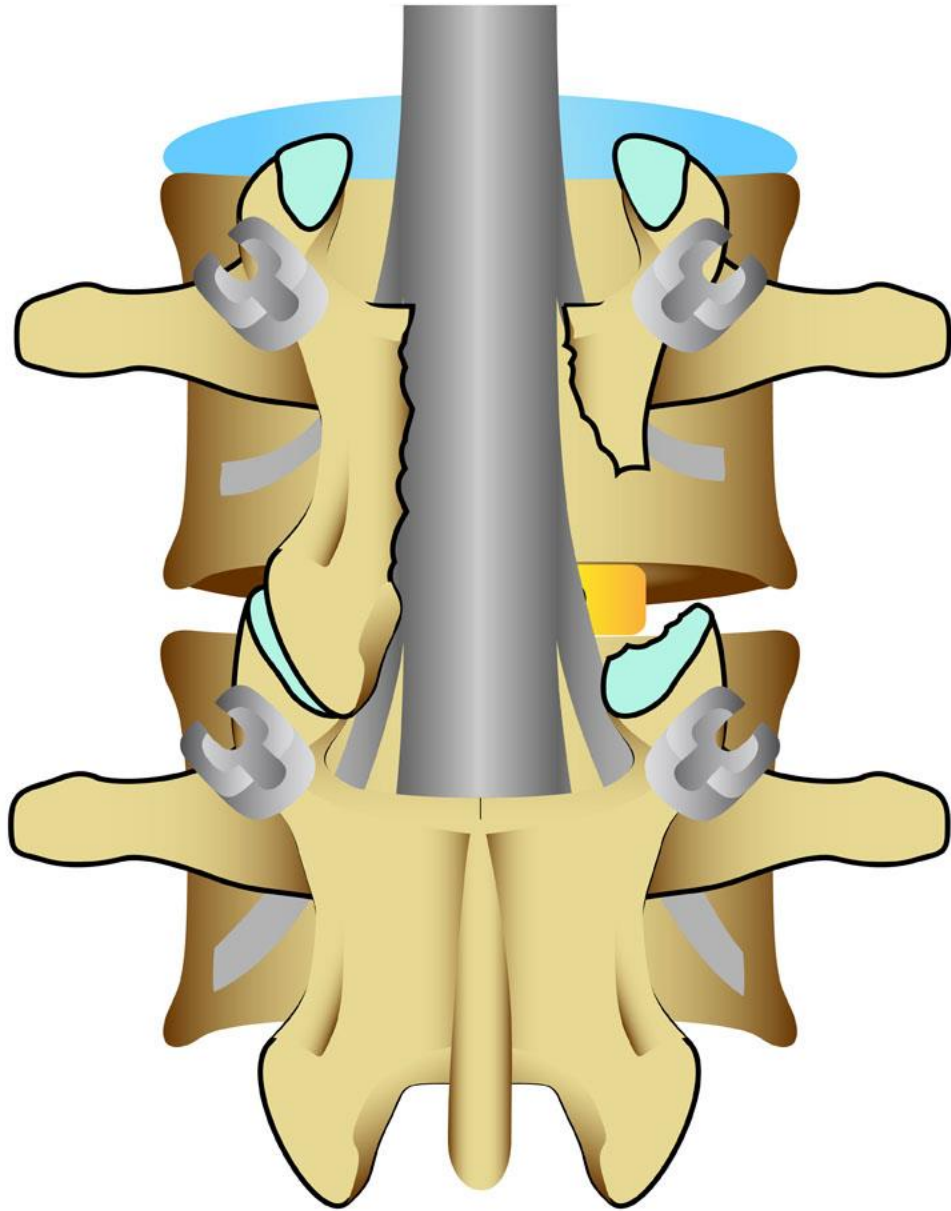






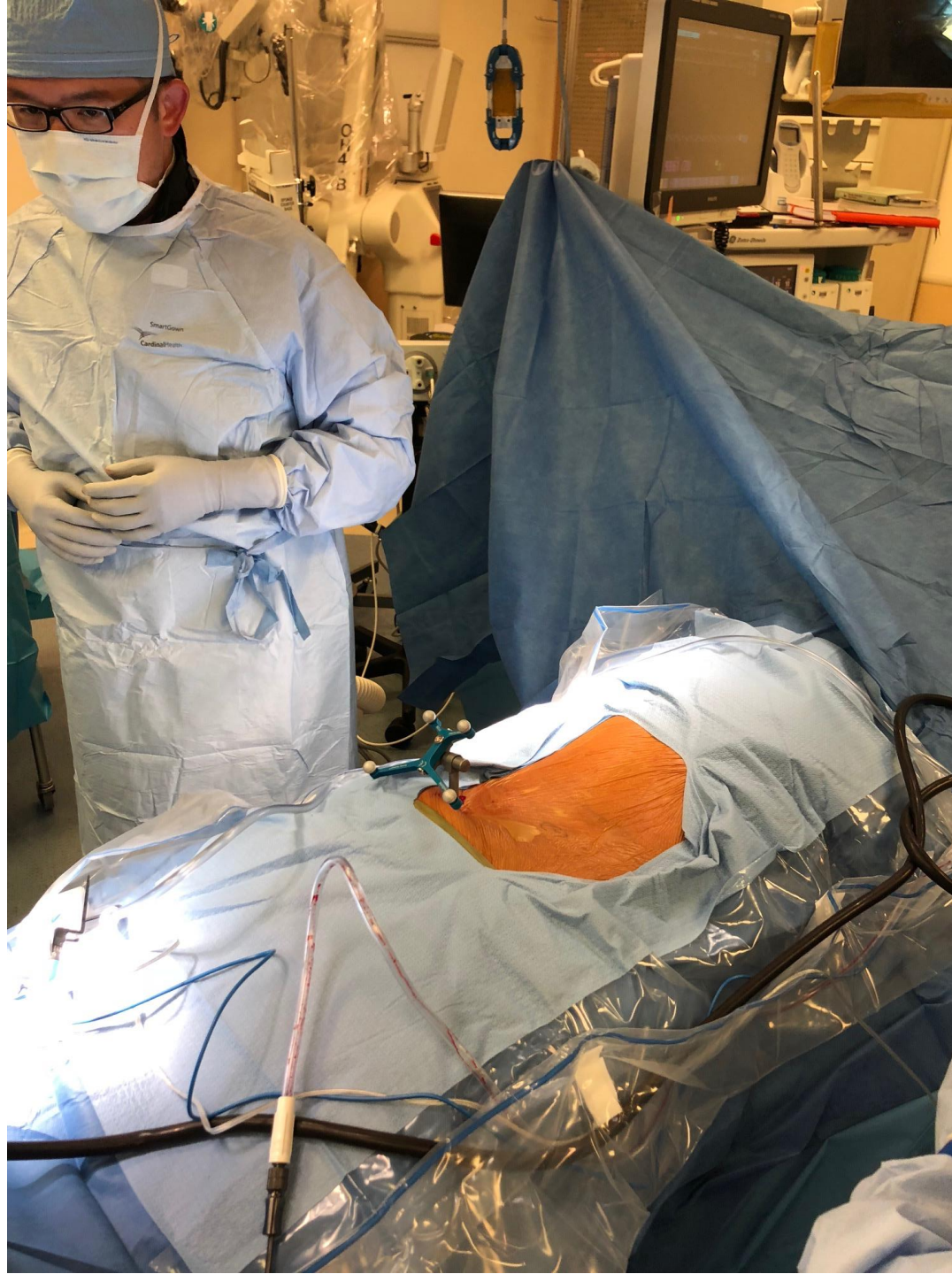


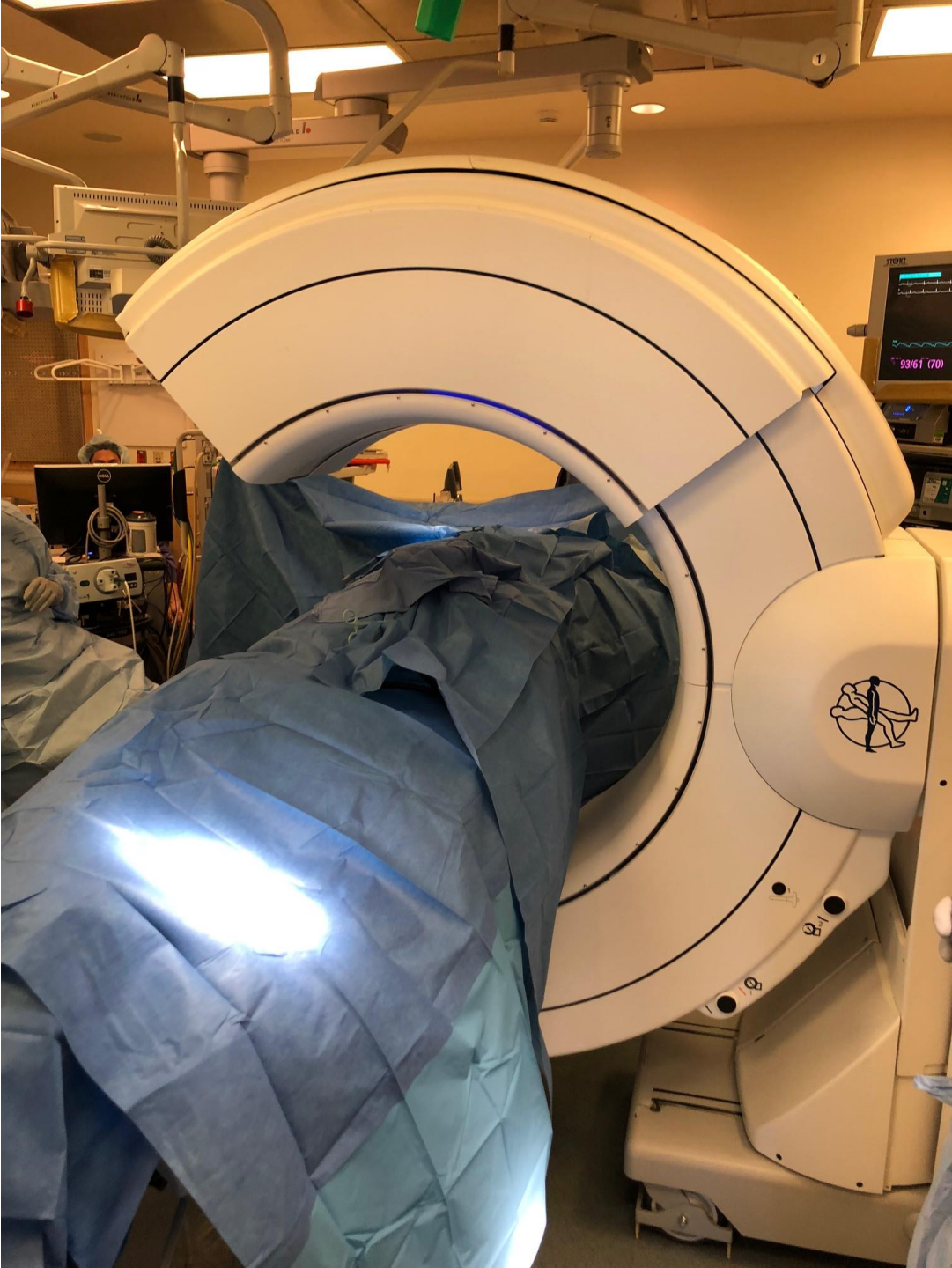


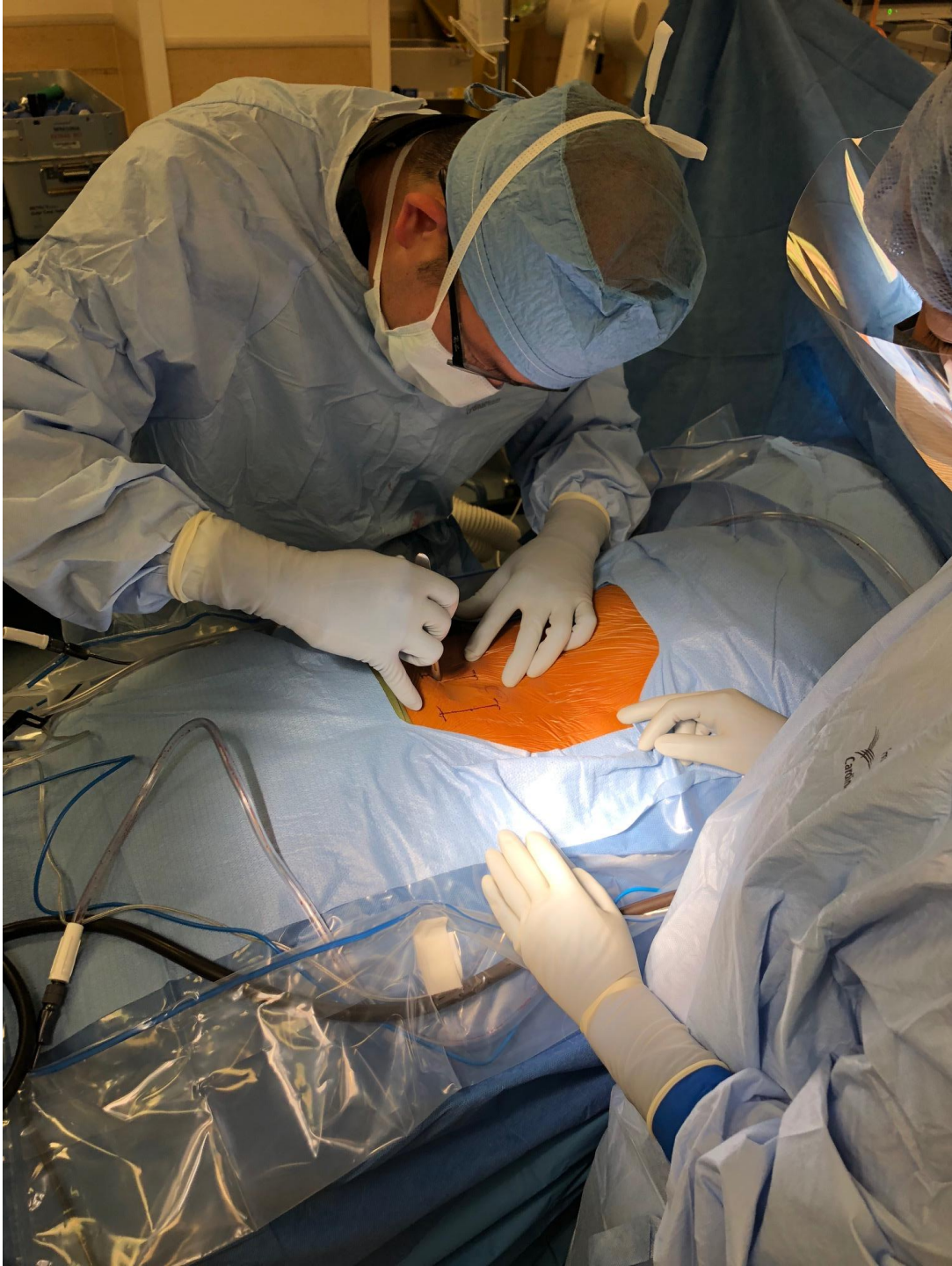










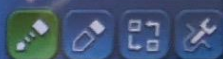


-  Adjust
-  Move
-  Zoom
-  Rotate
-  Flip
-  Browse
-  Recenter
-  Invert
-  Measure
-  Snapshot

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Dr. Than
 Procedure:
 Solera Voyager 4.75
 Fusion: O-arm(R)
 PATIENT:
 BRAL JANET



- Select Projection
- Hide Projection
 - Show as Cylinder
 - Show as Instrument

6.5
 Width (mm)

45
 Length (mm)

- Navigate Instrument
- Navigate Projection



- CONTROL PANEL 1
-  Camera
 -  Help
 -  Admin
 -  Exit

Plan 1: 6.5 x 45 - Projection: 6.5 x 45

Dilator, MAST
 Small Passive Frame



Acquire Scans **Navigate** Archive

Dr. Than
PROCEDURE
Solera Voyage
Fusion: O-arm
PATIENT
BRAL JANET

- Adjust
- Move
- Zoom
- Rotate
- Flip
- Browse
- Recenter
- Invert
- Measure



Select Projection

- Hide Projection
- Show as Cylinder
- Show as Line

5.5

45

Save Plan

- Navigate Instrument
- Navigate Projection

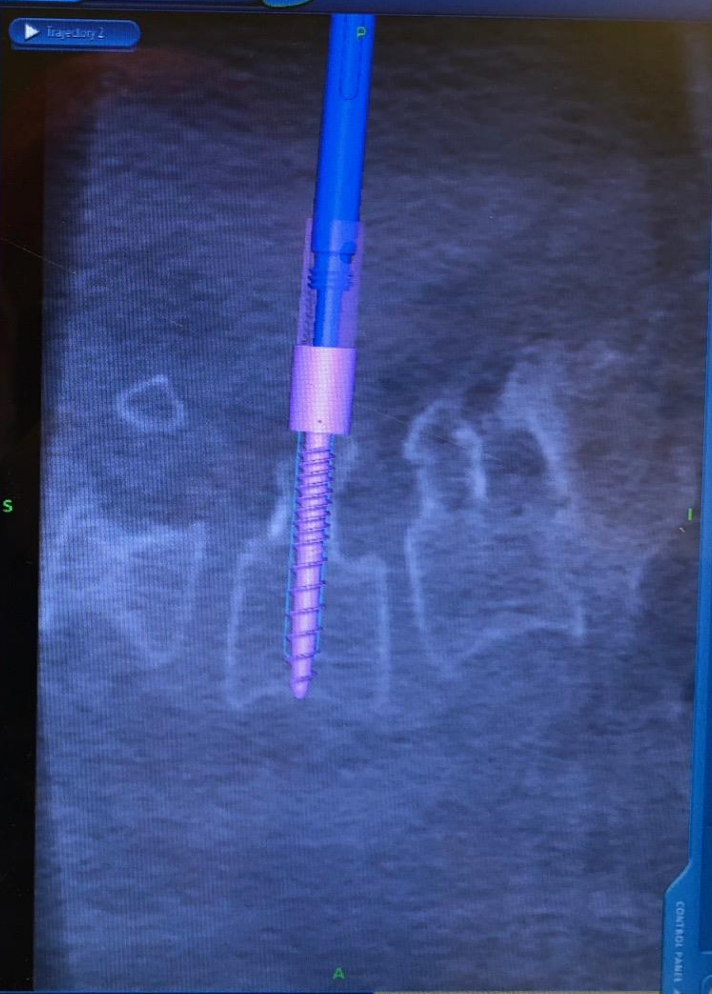


ADAPT TRACK

CONTROL PANEL

- Adjust
- Move
- Zoom
- Rotate
- Flip
- Browse
- Recenter
- Invert
- Measure
- Snapshot

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Dr. Than
 PROCEDURE:
 Solera Voyager 4.75 -
 Fusion: O-arm(R)
 PATIENT:
 BRAL JANET



Select Projection

- Hide Projection
- Show as Outline
- Show as Screw (Voyager 4.75)

Screw Set

▶ Voyager

6.5
 Width (mm)

45
 Length (mm)

Save to Plant

- Navigate Instrument
- Navigate Projection



- Camera
- Help
- Admin
- Exit

● Plan 3: 5.5 x 45 - Projection: 6.5 x 45 (Voyager 4.75)

Voyager 4.75 Driver - NavLock Gray
 Small Passive Frame

CONTROLLER PANEL

TLIF

- Outcomes

Minimally Invasive Transforaminal Lumbar Interbody Fusion (MI-TLIF) Surgical Technique, Long-Term 4-year Prospective Outcomes, and Complications Compared with an Open TLIF Cohort

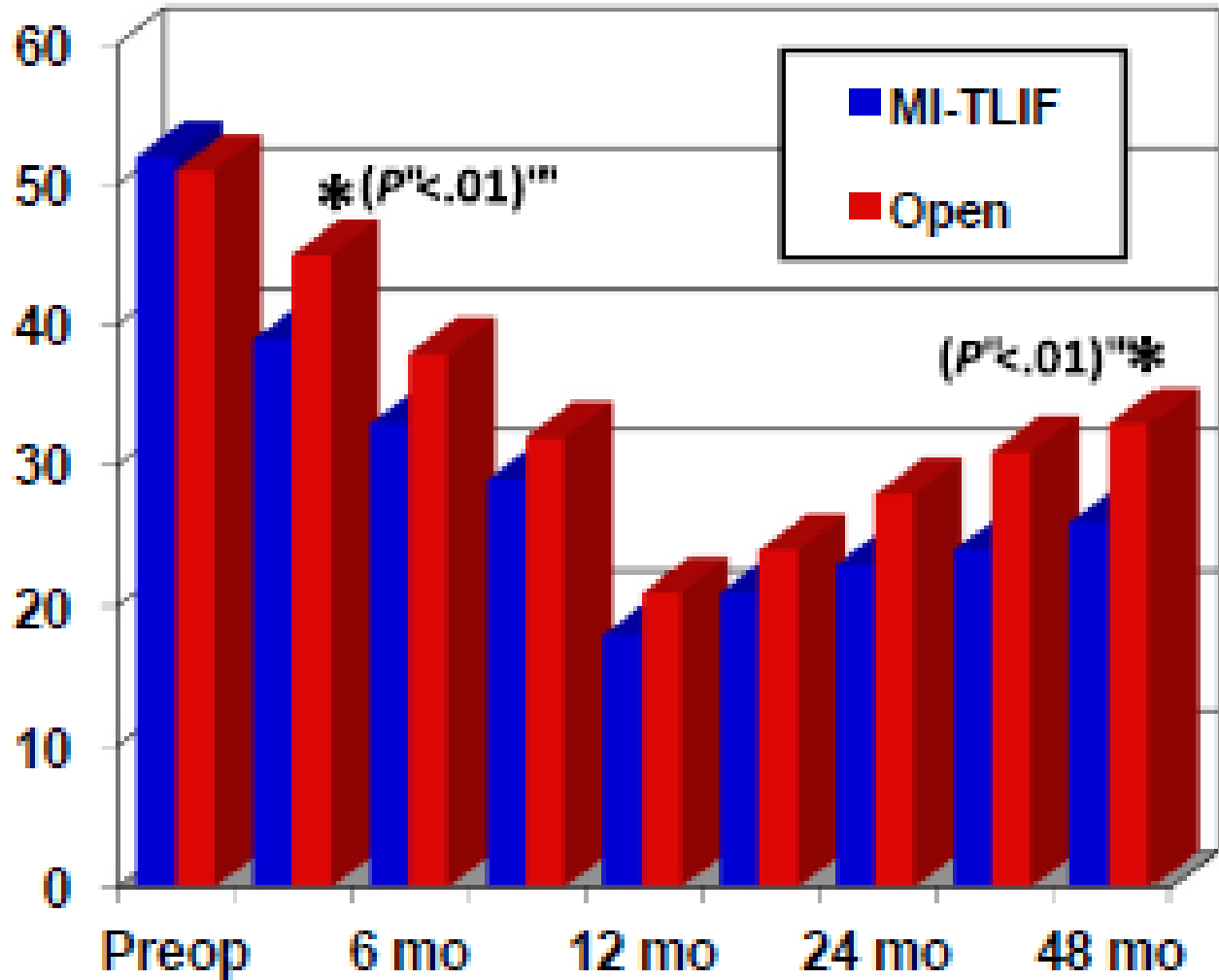
Albert P. Wong, MD^a, Zachary A. Smith, MD^a,
James A. Stadler III, MD^a, Xue Yu Hu, MD^b, Jia Zhi Yan, MD^c,
Xin Feng Li, MD^d, Ji Hyun Lee, PA-C^e, Larry T. Khoo, MD^{e,*}

Table 1
Aggregated perioperative data, outcomes, and complications for MI-TLIF (144) versus open TLIF (54)

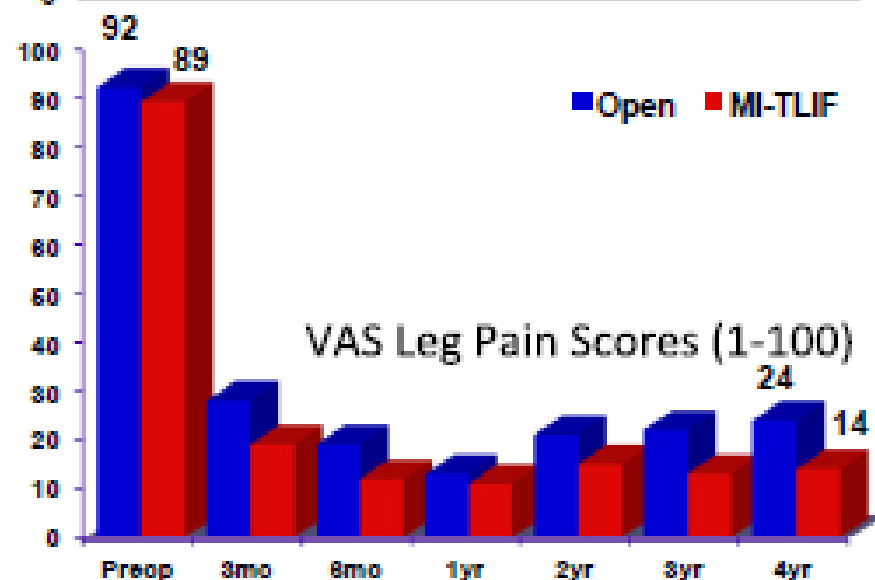
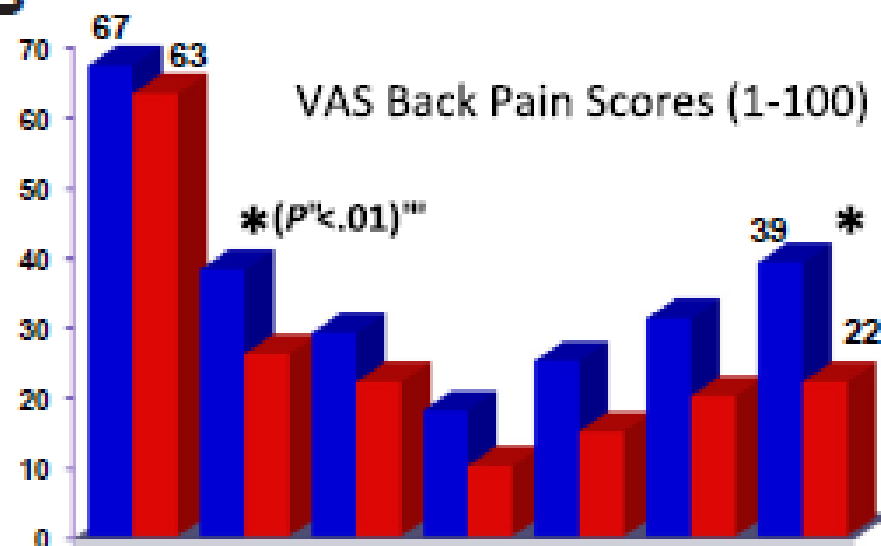
Variable	Present Series of MI-TLIF	Control Series of Open TLIF
Demographics		
No. of patients (levels)	144 (79 1-level, 55 2-level)	54 (35 1-level, 21 2-level)
Mean age (y)	61	58
Males/females	61/83	25/29
Follow-up, mo (range)	45 (34–60)	46 (33–58)
L5/S1, L4/5, L3/4, L2/3 (%)	45, 43, 9, 3	39, 52, 7, 2
Perioperative Data		
Mean operating room time per level (h)	2.05	3.75
Mean blood loss (mL)	115	485
Radiation exposure (mSv/level)	1.90	0.75
Average length of stay (d)	2.75	4.40
Radiographic Outcomes		
CT-Based fusion rate (18–24 mo) (%)	92.5	93.5
Lordotic change (degrees per level)	5.65	4.10
Subsidence (3–6 mo; 6–12 mo) (%)	9.25, 2.5	8.80, 3
Revision for pseudarthrosis	2.1% (3)	1.9% (2)

Table 2
Aggregated outcomes for MI-TLIF studies compared with the present series (n = 198 with 144 MI-TLIF)

Variable	Literature Review	Present Series of MI-TLIF	Control Series of Open TLIF
Total studies			
N	1291	144	54
Follow-up, mo (range)	12–72	45 (34–60)	46 (33–58)
Visual Analog Scale (VAS) Back Pain			
Studies included	17		
No. of patients (levels)	721	144 (79 1-level, 55 2-level)	54 (35 1-level, 21 2-level)
Preoperative score (mean)	6.68	6.37	6.72
Postoperative score (mean)	1.92	1.05 (1 y), 2.25 (4 y)	1.70 (1 y), 3.95 (4 y)
Change (mean)	4.76	5.32 (1 y), 4.12 (4 y)	5.02 (1 y), 2.77 (4 y)
Percentage improvement (mean)	71.2	83 (1 y), 65 (4 y)	75 (1 y), 42 (4 y)
VAS Leg Pain			
Studies included	13		
No. of patients (levels)	556	144 (79 1-level, 55 2-level)	54 (35 1-level, 21 2-level)
Preoperative score (mean)	7.06	8.90	8.82
Postoperative score (mean)	1.72	1.15 (1 y), 1.43 (4 y)	1.30 (1 y), 2.22 (4 y)
Change (mean)	5.34	7.75 (1 y), 7.47 (4 y)	7.52 (1 y), 6.60 (4 y)
Percentage improvement (mean)	75.7	87 (1 y), 83 (4 y)	85 (1 y), 75 (4 y)
Oswestry Disability Index			
Studies included	24		
No. of patients (levels)	1072	144 (79 1-level, 55 2-level)	54 (35 1-level, 21 2-level)
Preoperative score (mean)	48.9	52.8	51.2
Postoperative score (mean)	19.4	18 (1 y), 26 (4 y)	21 (1 y), 33 (4 y)
Change (mean)	29.5	34.8 (1 y), 26.8 (4 y)	30.2 (1 y), 18.2 (4 y)
Percentage improvement (mean)	60.3	66 (1 y), 51 (4 y)	59 (1 y), 36 (4 y)
Fusion Rate			
Studies included	24		
No. of patients (levels)	1132	144 (79 1-level, 55 2-level)	54 (35 1-level, 21 2-level)
Fusion percentage (mean)	93.5	92.5	93.5
Systems Cost			
No. of patients (levels)		34 (34 1-level)	34 (34 1-level)
Hospital surgery/admission costs (US\$)		19,925	23,479

A

	Preop	3mo	6mo	1yr	2yr	3yr	4yr
ODt: MI-TLIF	52	39	33	18	23	24	26
ODt: Open TLIF	51	45	38	21	28	31	33

B

	Preop	3mo	6mo	1yr	2yr	3yr	4yr
VAS Back: MI-TLIF	63	26	22	10	15	20	22
VAS Back: Open TLIF	67	38	29	18	25	31	39
VAS Leg: MI-TLIF	89	19	12	11	15	13	14
VAS Leg: Open TLIF	92	26	19	13	21	22	23

Clinical and radiographic outcomes after minimally invasive transforaminal lumbar interbody fusion

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Department of Neurosurgery, University of Michigan Health System, Ann Arbor, MI

Methods: Literature search using PubMed database.

Results: Eight retrospective clinical studies and 1 prospective clinical study were identified. No randomized studies were found. The indications for surgery were low-back pain and/or radicular symptoms secondary to spondylolisthesis and/or degenerative disc disease. Analysis of radiographic outcomes demonstrated a fusion rate greater than 90% in the vast majority of patients. Patients also experienced a significant improvement in functional outcome parameters at a mean follow-up of 20 months. Comparison of functional outcomes of MI-TLIF patients to a similar matched cohort of patients who underwent conventional open TLIF did not demonstrate any statistically significant difference between both cohorts.

Conclusion: For carefully selected patients, MI-TLIF has a very favorable long term outcome that is comparable to conventional open TLIF, with the added benefit of decreased adjacent tissue injury.

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Surgical Outcomes for Minimally Invasive vs Open Transforaminal Lumbar Interbody Fusion: An Updated Systematic Review and Meta-analysis

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BACKGROUND: Minimally invasive transforaminal lumbar interbody fusion (TLIF)—or MI-TLIF—has been increasing in prevalence compared with open TLIF (O-TLIF) procedures. The use of MI-TLIF is an evolving technique with conflicting reports in the literature about outcomes.

OBJECTIVE: To investigate the impact of MI-TLIF in comparison with O-TLIF for early and late outcomes by using the Visual Analog Scale for back pain (VAS-back) and the Oswestry Disability Index (ODI). Secondary end points include blood loss, operative time, radiation exposure, length of stay, fusion rates, and complications between the 2 procedures.

METHODS: During August 2014, a systematic literature search was performed identifying 987 articles. Of these, 30 met inclusion criteria. A random-effects meta-analysis was performed by using both pooled and subset analyses based on study type.

RESULTS: Our meta-analysis demonstrated that MI-TLIF reduced blood loss ($P < .001$), length of stay ($P < .001$), and complications ($P = .001$) but increased radiation exposure ($P < .001$). No differences were found in fusion rate ($P = .61$) and operative time ($P = .34$). A decrease in late VAS-back scores was demonstrated for MI TLIF ($P < .001$), but no differences were found in early VAS-back, early ODI, and late ODI.

CONCLUSION: MI-TLIF is associated with reduced blood loss, decreased length of stay, decreased complication rates, and increased radiation exposure. The rates of fusion and operative time are similar between MI-TLIF and O-TLIF. Differences in long-term outcomes in MI-TLIF vs O-TLIF are inconclusive and require more research, particularly in the form of large, multi-institutional prospective randomized controlled trials.

KEY WORDS: Minimally invasive, Spine surgery, Transforaminal lumbar interbody fusion

Is MIS TLIF kyphogenic?

Spine

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LITERATURE REVIEW

Preservation or Restoration of Segmental and Regional Spinal Lordosis Using Minimally Invasive Interbody Fusion Techniques in Degenerative Lumbar Conditions

A Literature Review

Juan S. Uribe, MD,* Sue Lynn Myhre, PhD,[†] and Jim A. Youssef, MD[†]

Study Characteristics		Treatment C			Change			
Author	Pro- cedure	Indica- tion	Ant lvls	Lvls	LL Δ (%)	Seg Lord Δ (%)	PT Δ (%)	SVA Δ (%)
Lee <i>et al.</i> ¹²	Mini- open TLIF	Degen / lytic spondy	NR	NR	1.5 (3)	2 (17)	-3.7 (-11)	NR
Wong <i>et al.</i> ²³	MIS TLIF	NR	NR	NR	NR	5.65	NR	NR
Yson <i>et al.</i> ²⁴	MIS TLIF	NR	NR	NR	NR	7.2 (89)	NR	NR
Kim <i>et al.</i> ⁹	MIS TLIF	Degen	NR	NR	7.4 (26)	1.2 (8)	NR	NR
Dahdaleh <i>et al.</i> ⁶	MIS TLIF	Degen spondy	NR	NR	NR	0.4 (3)	NR	NR
Dahdaleh <i>et al.</i> ⁶	MIS TLIF	Degen spondy	NR	NR	NR	2.1 (23)	NR	NR
Min <i>et al.</i> ¹⁵	Unilateral MIS TLIF	NR	NR	NR	7 (24)	NR	NR	NR
Min <i>et al.</i> ¹⁵	Bilateral MIS TLIF	NR	NR	NR	4.81 (14)	NR	NR	NR
Tsutsumimoto <i>et al.</i> ⁹	Mini- open bilateral posterior IBF	Degen	NR	NR	NR	NR	NR	NR
Kim <i>et al.</i> ²⁵	Mini-TLIF	Isthmic spondy	NR	NR	1.4 (3)	2.5 (16)	NR	NR

MIS TLIF

- 1.5-7.4 (median ~5) degrees of lumbar lordosis
- 0.4-7.2 (median ~2) degrees of segmental lordosis
- Unclear how many levels treated

Thank You



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