

Predicting Surgical Approach Safety with a Novel Psoas MRI Classification System

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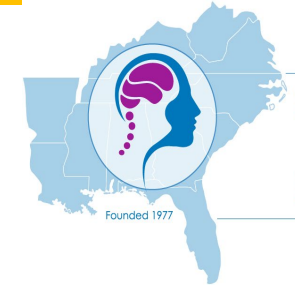
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Disclosures:

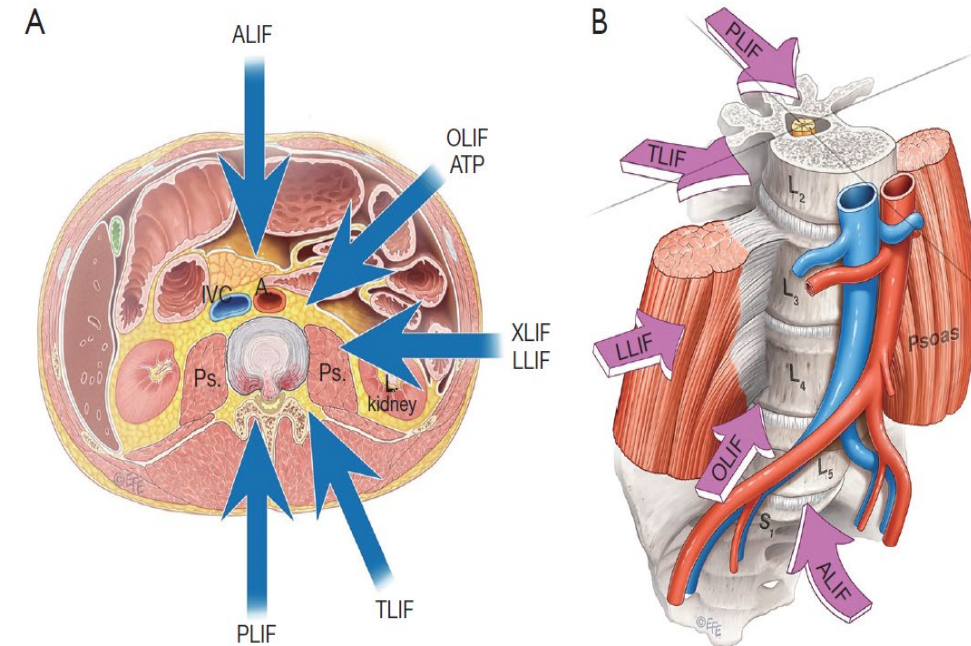
- Ki Hwang is a consultant for Stryker Spine
- Arash Emami receives research grants from NuVasive

None of which are related to this study

Background and Purpose



- Comparison of OLIF and XLIF:
 - XLIF: Higher incidence of nerve injuries
 - OLIF: Higher incidence of vascular injuries
- **Purpose:** To introduce a novel classification system using magnetic resonance imaging (MRI) to describe psoas morphology and examine its association with the position of nearby neurovascular structures.



Methods: Modified Oblique Corridor

- 253 MRI scans reviewed
- Measurements taken on **left psoas muscle** at the level of the L4 inferior endplate.
- Classification of psoas muscles:
 - A: Ventral border > 2 mm anterior to vertebral body
 - B: Ventral border ≤ 2 mm anterior or posterior to vertebral body.
 - Ventral border > 2 mm posterior to vertebral body.
- Modified oblique corridor between psoas muscle and lateral nearest aortoiliac structure.

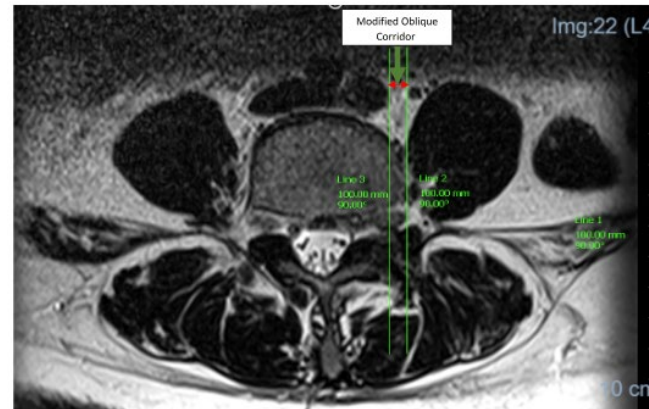
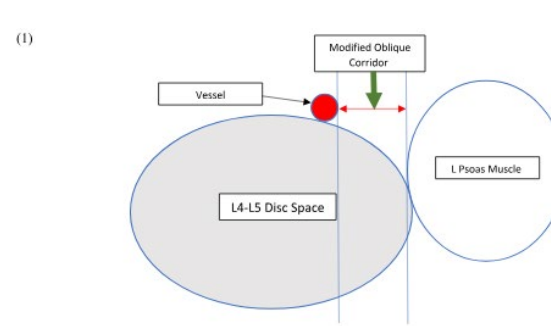


Figure 1. An example of a Class A psoas morphology demonstrating an open, positively valued modified oblique corridor.

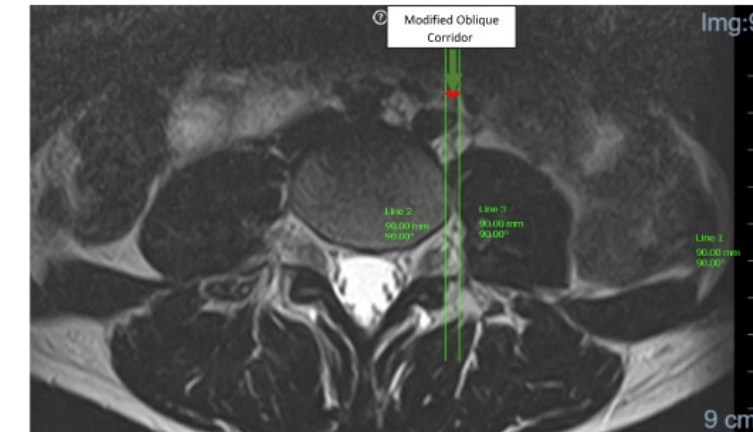
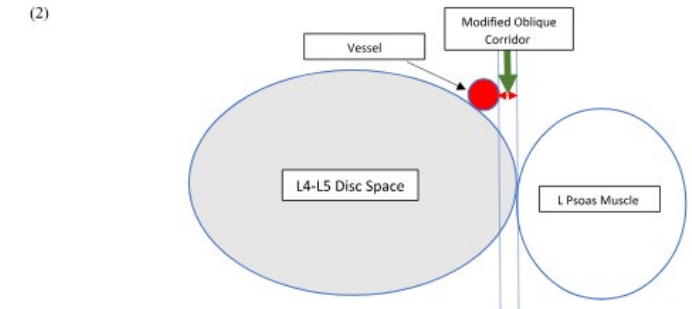


Figure 2. An example of Class C psoas morphology demonstrating a narrow, closed modified oblique corridor.

Methods: Trajectory for an LLIF Approach

- AP distances of the psoas measured at the mid-substance portion where these distances were greatest.
- Psoas segmented into 3 equal portions, with the posterior third termed the "**danger zone**" due to the presence of the lumbar plexus.
- Preferred XLIF trajectory aimed at midsagittal point of the intervertebral disc projected onto a T2 axial image.
- Trajectory violating the posterior third of the psoas considered dangerous due to potential iatrogenic nerve injury.

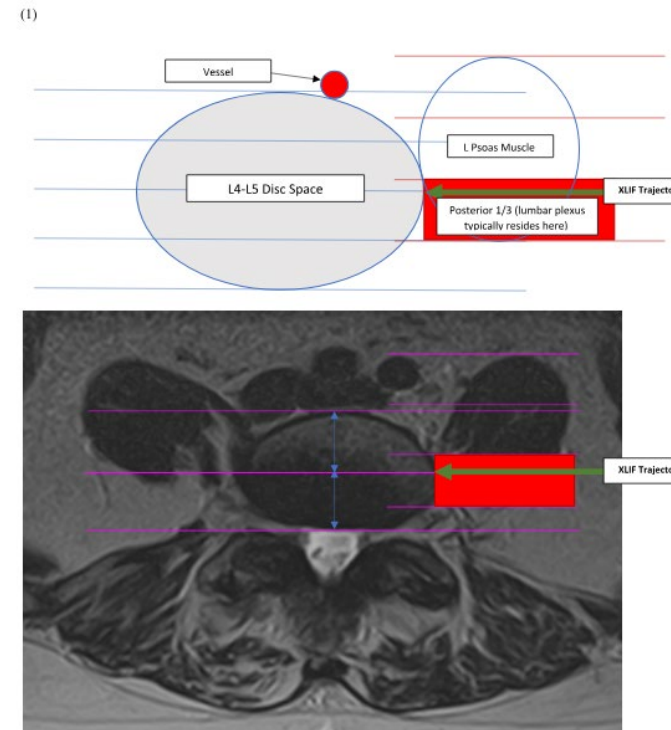


Figure 3. An example of a Class A psoas morphology demonstrating a dangerous XLIF trajectory.

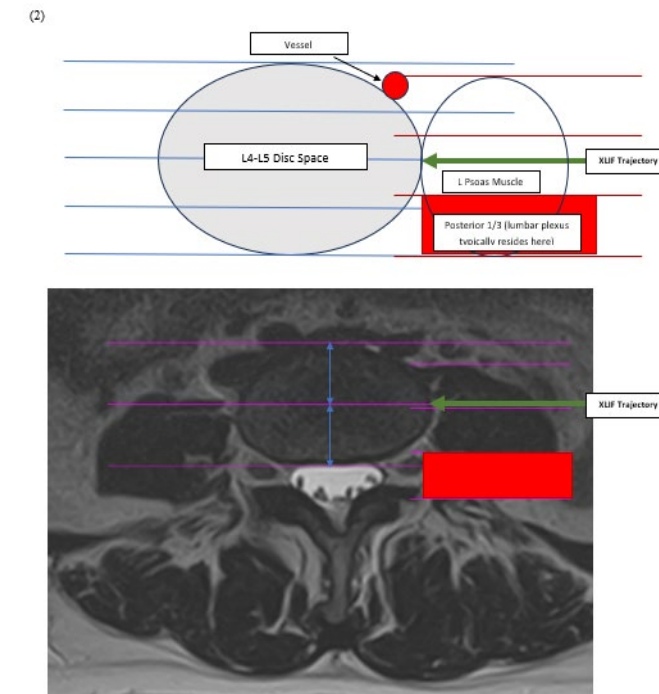


Figure 4. An example of Class C psoas morphology demonstrating a safe XLIF trajectory.



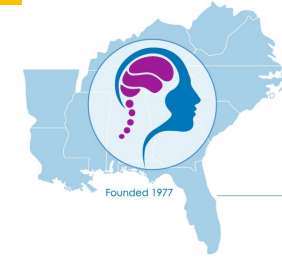
Results

- Those with Class A psoas morphology
 - Largest modified oblique corridor (8.99 mm)
 - Highest XLIF trajectories that penetrated through the “danger zone” (34.1%)
- Those with Class C psoas morphology
 - Narrowest modified oblique corridor (4.66 mm)
 - No XLIF trajectories that penetrated through the “danger zone” (0.0%)

Table 1: Comparison of Psoas Morphologies and XLIF Trajectory at L4 Endplate

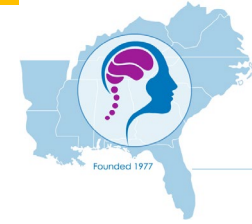
	A	B	C	p-value
Patients	44	27	29	N/A
Age (years)	56.52	60.30	52.34	0.227
Males (%)	38.6%	37.0%	24.1%	0.409
Modified Oblique Corridor (mm)	8.99	8.10	4.66	0.040*
LLA (°)	45.87	51.92	54.01	0.011*
AP Distance (mm)	51.13	41.26	37.62	<0.001*
Posterior Third ('Danger Zone') (mm)	16.66	13.75	12.54	<0.001*
XLIF Trajectory Intersecting 'Danger Zone' (%)	34.1%	3.7%	0.0%	<0.001*

LLA= Lumbar Lordosis Angle; AP=Anteroposterior; mm= millimeters; XLIF=extreme lateral lumbar interbody fusion; *denotes statistical significance



Conclusions

- We introduce a user-friendly classification system for psoas muscle morphology for clinical practice.
- **Class A psoas:**
 - Largest modified oblique corridor (lowest likelihood of vascular injury with OLIF)
 - Highest proportion of dangerous XLIF trajectories (highest likelihood of neural injury with LLIF)
 - Safest with OLIF procedure.
- **Class C psoas:**
 - Narrowest modified oblique corridor (highest likelihood of vascular injury with OLIF)
 - No dangerous XLIF trajectories were identified (lowest likelihood of neural injury with LLIF)
 - Safest with XLIF procedure.



Limitations

- Distances measured on axial MRI images were based on supine positioning
- LLIF and OLIF performed in the lateral decubitus position
 - Anatomical positions of the aorta, IVC, and psoas may vary, impacting the oblique corridor intraoperatively
- Psoas morphology can change with age and in various pathological conditions
- Using a simplified and standardized methodology may affect the accuracy and individualization of specific patient needs

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Thank You!

