Anterior Spine Exposure and Large Vessel Mobilization: What Vascular Surgeons Need to Know

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Global View

Muscle Block Access to 5% of Spinal Column

Major Vessels Block Access to 5% of Spinal Column

ALIF
L4-L5 & L5-S1 disc

The rectus muscle is retracted laterally

- Incise posterior rectus muscle/transversalis fascia

- Bluntly develop retroperitoneal space
- Mobilize peritoneum medially

Semi-lunar line
Retract sperm cord inferiorly
Divide round ligament

L3-4, L4-5 exposure:
Blunt dissection of peritoneum from left iliac vessels

L3-4, L4-5 exposure:
ligate/divide left iliolumbar vessels

Vein anomalies:
3 left lumbar veins: 44%
2 right lumbar veins: 37%
Left lumbar vein to renal vein: 43%

L5-S1:
ligate/divide midline sacral vessels, mobilize right iliac vessels

Verify disc space: insert marker needle into disc space

**OLIF Patient Positioning**

- Patient in Lateral Decubitis
- Stand anterior to the patient
- Surgical Table – Radiolucent, tilt and Trendelenburg, No Breaking Needed

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**Fluoroscopic Localization**

1. Mark Iliac Spine
2. Mark L5-S1 Disc Space on Skin under Fluoro
3. Extend mark ~2" past anterior iliac spine
4. Mark 6cm incision in line with ASIS

Tip: Mark the Lordotic angle of Disc to determine C-Arm Wag needed intra operatively

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**Approach to the Retroperitoneal Space**

- Incision – ~6cm in line with iliac spine
- Blunt Muscle Dissection
  - External Oblique
  - Internal Oblique
  - Transversus Abdominus
  - Transversalis Fascia (thin filmy layer)

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**Palpation in the Retroperitoneal Space**

- Through the small paramedian incision use finger to palpate
  - Psoas
  - Major vessels
  - Anterolateral corner of the disk
Approach to the Disc Space

- Use hand-held retractors to down to the spine
  1. Identify Anterior Disc Space
  2. Identify edge of Anterior Longitudinal Ligament
  3. Important landmark is iliac vessel...look for it and palpate
  4. Locate sacral artery and vein and clip or bipolar it.

Adventitial Layer Sweep

- The lighted retractors are then placed sequentially down onto the anterior spine
- The adventitial layers that are on the anterior disc and sacrum are encountered

Retractor Placement

- Place vessel blades and Hohmann’s blade and secure with stability pins
- Secure retractors.
**Disc Preparation**

- Annulotomy is performed with x-ray confirmation of the starting point that is central on disc space.
- Once the retractors are in place, it is helpful to mark midline of disc space.

**ALIF**
- Minimally invasive
- Circular retractor with light
- Single Assistant
- Curved Cobbs
- Decrease surgical time

**OLIF**
- Minimally invasive
- Blade retractor with light
- Single Assistant
- Hohmann retractors
- Decrease surgical time

**CONCLUSION**

- Two-team approach facilitates safe anterior or oblique lumbar spine instrumentation
- Increasing need for retroperitoneal surgeons

**Anterior Approach History**

Muller Transperitoneal Approach

1906
Anterior Approach History

1906 1944

Iwahara
Retroperitoneal
Approach

1944

Hodgson
Extraperitoneal
Approach to Spine
for TB – Modern
ALIF

1950's

Harmon
Retroperitoneal
Approach to Lumbar Spine

1964

Mayer
"Mini-Incision"
Anterolateral

1995

1998

Bergey
Endoscopic
Lateral
Transpsoas
Approach to the
Spine

1998

2004

Pimenta
Transpsoas Lateral
Lumbar Interbody
Fusion
ANTERIOR APPROACH HISTORY

Access to the Spine

OLIF51™ MIS Approach

When placing the retractor blades careful consideration of the bowel and other abdominal contents should be observed to avoid perforation.
THE OLIF51™ PROCEDURE

OLIF

ALIF

Oblique view

ALIF view

Comparisons of the different approaches

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Large interbody
Trajectory outside rectus
Trajectory outside psoas
Abdominal contents fall anteriorly
Away from the lumbar plexus
No need to break the surgical table
Visualization of the anatomy
Small Incision compared to ALIF
Reduce obstacles L2-S1 disc access

Pre-operative disc localization

Technique

- Skin incision
  - Midline
  - Paramedian
  - Pfannenstiel

- Develop skin/subcutaneous flap over the rectus sheath
- Preserve inferior epigastric vessels
- Incise left anterior rectus sheath longitudinally
Advantages of the paramedian retroperitoneal approach

Excellent anterior exposure of L3-S1 vertebrae
Avoids entry into abdominal cavity
Avoids muscle transection

Complications

Nerve injury: superior hypogastric sympathetic plexus injury resulting in retrograde ejaculation or sterility
Vascular injury: hemorrhage, thrombosis, pseudoaneurysm, arteriovenous fistula
Ureter injury

51-year-old female involved in a car accident in 2004 and since then, she has been experiencing severe pain in her back with radiation of pain, numbness and tingling into her right leg, distal to the knee.

Degenerative changes causing spinal canal stenosis at L4-L5 and L5-S1. There is also moderate bilateral neural foraminal narrowing at these levels. Sequestered disc posterior to the L5 vertebral body appearing to contact the exiting right L5 nerve root.

Ht 5’6” (1.676 m) | Wt 213 lb (96.616 kg) | BMI 34.40
Oblique Lateral Interbody Fusion for L5-S1 (OLIF®)

Pre-Op Planning

Selection Criteria

- Size
  - Smaller vs. bigger patients
- Prior Abdominal surgery
  - Especially colon resection
- General Health
  - The usual suspects (DM, CVD, COPD)
- Vascular Anatomy
  - The Left Iliac vein is not your friend
- Disc pathology (indicated in patients with DDD)
  - Spondylolisthesis
  - Often means low groin incision
  - Disc collapse
  - Modic changes
  - Vessels may be scarred down

Access to the Spine

- L5, S1 Disc
- Psoas
- Vessels
- Iliac Crest

Access to the Spine

Pre-operative Planning

- Check Axial MRIs
  - Identify Common Iliac Veins and Common Iliac Arteries
- Left or right side approach?
  - Based on Iliac Artery and Vein location
  - Based on prior surgery
  - Left Side approach preferable based on vasculature above L5-S1

Pre-op Planning

Take 5 min with your co-surgeon to go over the game plan.
Detailed Pre-operative Planning

Start with the X-rays

Select Axial MRI through L5-S1 Disc

Pre-operative Planning

Add the Vascular Anatomy and Approach Angle

Left Iliac Vein

Pre-operative Planning

Plump wide Vein
Oval Vein
Fat under vein

Pre-operative Planning

Thin Vein

No fat under vein

Pre-operative Planning

Midline Vein

Pre-operative Planning

Add Arterial Anatomy

Pre-operative Planning

Add Venous Anatomy

Coronal MRI
Pre-operative Planning

Confirm Venous Anatomy

Pre-operative Planning

Add Disc

Pre-operative Planning

Put it all together
Pre-operative Planning

Use Sagittal to determine pin placement

Pre-operative Planning

Think in 3-Dimensions

Left lateral retractor pin

Proximal retractor pin

Red Flags

Modic Changes

Osteophyte

Red Flags

Vein lateral enough

Osteophyte surrounding vein

No space between vein and disc

Axial slice above disc
Red Flags

Osteophyte

Vein thin and no space

Not much room for pin

Treated like OLIF 25

Development of Inferior Vena Cava

• The IVC develops during a series of changes in the primordial veins
  Composed of:
   Hepatic segment derived from the right vitelline vein
   Prerenal segment derived from the right subcardinal vein
   Renal segment derived from the subcardinal-supracardinal anastomosis
   Postrenal segment derived from the right suprarenal vein
   Iliac veins derived from the cardinal veins