

## Anterior Lumbar Interbody Fusion Exposures Complicated by Vascular Anomalies

Anas M. Abbas<sup>1</sup>, Robert E. Carrier<sup>1</sup>, Alexandra C. Echevarria<sup>1</sup>, Bongseok Jung<sup>1</sup>, Alex Ngan<sup>1</sup>, Sarah Trent<sup>1</sup>, Richard Tan<sup>1</sup>, Mark Kissin<sup>1</sup>, Rohit B. Verma<sup>1</sup>

<sup>1</sup>Zucker School of Medicine, Uniondale, NY  
abbasa@upstate.edu

**Disclosures:** Anas M. Abbas (N), Robert E. Carrier (N), Alexandra C. Echevarria (N), Bongseok Jung (N), Alex Ngan (N), Sarah Trent (N), Richard Tan (N), Mark Kissin (N), Rohit B. Verma (N).

**INTRODUCTION:** Within the surgical options for the treatment of lumbar disc disease, anterior lumbar interbody fusion (ALIF) provides greater spinal canal and foraminal decompression, direct access for reconstruction with implants, greater disc distraction on insertion, and lower rates of lumbar paraspinal muscle trauma or denervation. A significant difficulty for this approach lies in the vascular anatomy of the lumbar region. Surgical complications and injury primarily involve the venous structures on the left side in up to 24% of cases. Currently, there is no protocol for preoperative imaging to identify these conditions. We present a case series on three patients who underwent two-stage anterior-posterior lumbar interbody fusions (ALIF-PSF) in which the surgeons identified the vascular anomalies through preoperative imaging or through an incidental intraoperative finding secondary to unremarkable imaging.

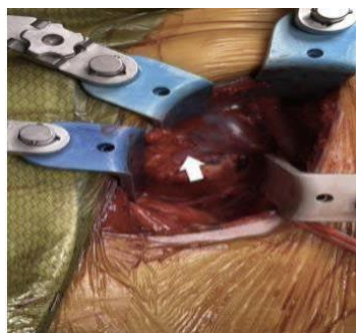
**METHODS:** Retrospective chart review on three patients was accomplished to collect preoperative and intraoperative imaging for the first stage of the ALIF-PSF (ALIF). Consent was obtained from each patient.

**RESULTS SECTION:** The three patients presented were planned for a two-stage ALIF-PSF. Case 1 presents the right internal iliac vein originating from the left common iliac vein (LCIV) which was transected for L4-L5 disc exposure (Figure 1). Preoperative magnetic resonance imaging (MRI) of lumbar spine did not reveal anomalous vasculature and computed tomography of abdomen and pelvis (CT) was not obtained. Case 2 presents the left internal iliac vein originating from the right common iliac vein which required an oblique approach (Figure 2). Case 3 presents a duplicated inferior vena cava (IVC) which was accounted for from preoperative planning and reviewing imaging while performing the exposure. The duplicated IVC would have affected exposure and ALIF at higher levels of the lumbar spine but did not interfere with disc exposure at the L5-S1 disc space (Figure 3). Cases 2 and 3 had preoperative CT allowing the surgeons to review and plan the procedures to maximize patient safety and efficiency.

**DISCUSSION:** The ALIF approach is most suitable for the levels of L4-L5 and L5-S1 due to vascular anatomy. It is limited above the L4 level secondary to extensive peritoneal and kidney retraction with possible, but rare complications of superior mesenteric artery thrombosis. However, a retroperitoneal approach involves mobilization of the great vessels, peritoneal contents, sympathetic plexus, and the ureter. A study on 447 patients undergoing an ALIF procedure found 11% of major (pulmonary) and 24% of minor (genitourinary) complications post-operation. Posterior approached patients had higher risk of neurologic and dura related complications while anterior approached patients tended to have visceral or vascular complications. Vascular injury associated with ALIF commonly affected the L4-L5 disc space at the bifurcation of the great vessels. Venous damage of the LCIV was most frequent while arterial damage was much less frequent. Other reported vascular injuries involved laceration of the iliolumbar vein, avulsion of the medial sacral and lumbar vein, injury to IVC or abdominal aorta, retroperitoneal hematoma, and left iliac artery thrombosis. Up to 55% of vascular injuries from an anterior approach occurred at the spinal instrumentation stage. Preoperatively, CT provides the surgeons with invaluable information that can reduce the risk of perioperative vascular complications. CT with iodinated contrast material is often used to visualize the vascular tree as part of pre-surgical planning. The major advantage of the CT scan over MRI is the spatial resolution, which provides high quality imaging of every segment of the vessel. Many patients have multiple comorbidities such as diabetes or kidney failure, and due to the critical importance of iodinated contrast for vascular imaging, decreased dosage is preferred in these patients. In two of the three cases presented, the vascular surgeon was aware of each patient's venous anatomy and associated variations prior to surgery by examining medical imaging. Our case series describes ALIF in the context of rare anatomical variations of venous anatomy. We highlight the need for preoperative imaging and a working detailed knowledge of anatomy to avoid damaging vasculature that can potentially lead to fatal consequences.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Our surgeons recommend and practice careful review of patient's history, physical examination, and preoperative imaging to plan the approach. Images to review include MRI of the lumbosacral spine, CT scan of the abdomen and pelvis, and CT scan of the lumbar spine to depict the total anatomy of the surgical site and peripheral anatomic structures.

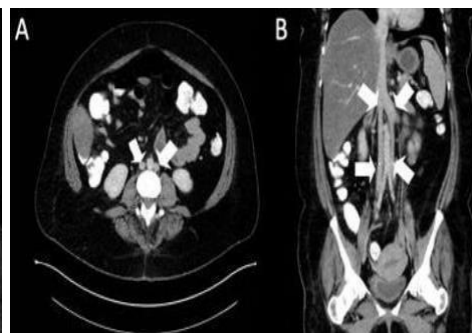
### IMAGES AND TABLES:



**Figure 1.** Intraoperative image of patient taken during the exposure portion of ALIF. The right internal iliac vein is originating from the left common iliac vein (arrow).



**Figure 2.** CT of abdomen and pelvis taken two years prior to ALIF. Axial (A) and coronal (B) images display an aberrant left internal iliac vein originating from the right common iliac vein (arrows) and the inferior vena cava bifurcation impeding access to the L4-L5 disc space.



**Figure 3.** CT of abdomen and pelvis taken prior to history of lateral lumbar interbody fusion. Axial (A) and coronal (B) images show a duplicated IVC (arrows). The L5-S1 disc space was not affected by the vessels anteriorly.