



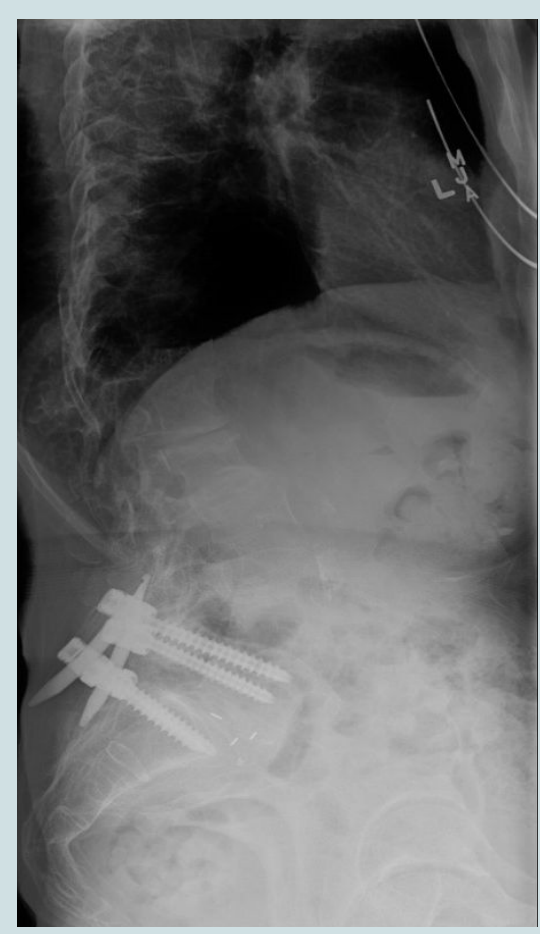
Catastrophic Vascular Injury in Lateral Lumbar Interbody Fusion: A Case Report and Review of Risk Mitigation Strategies

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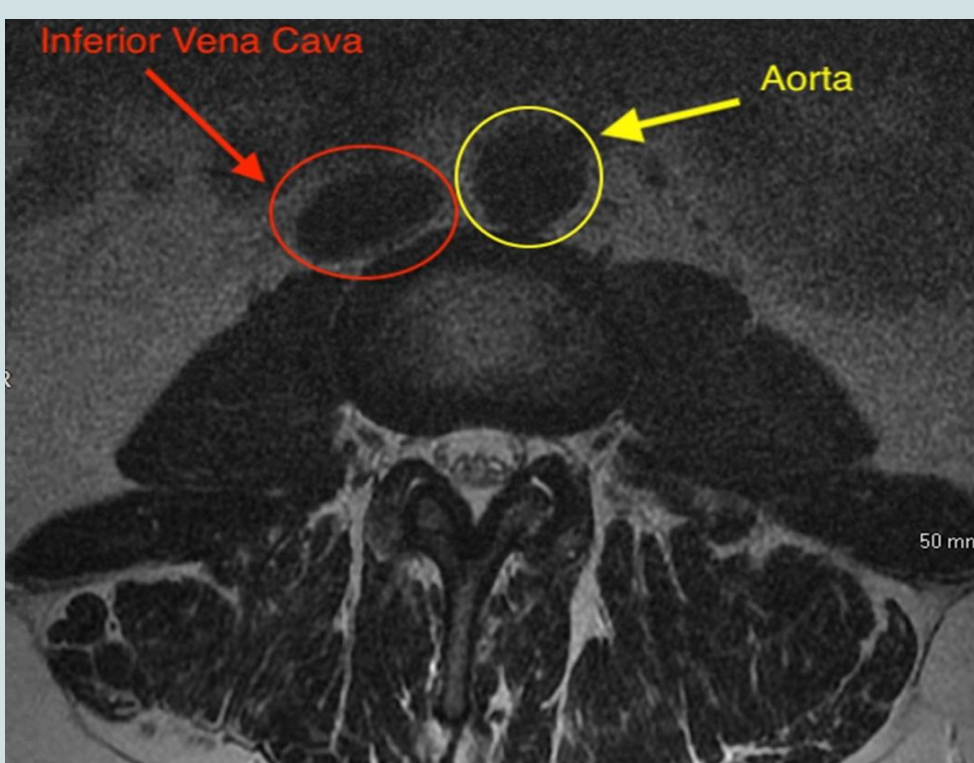
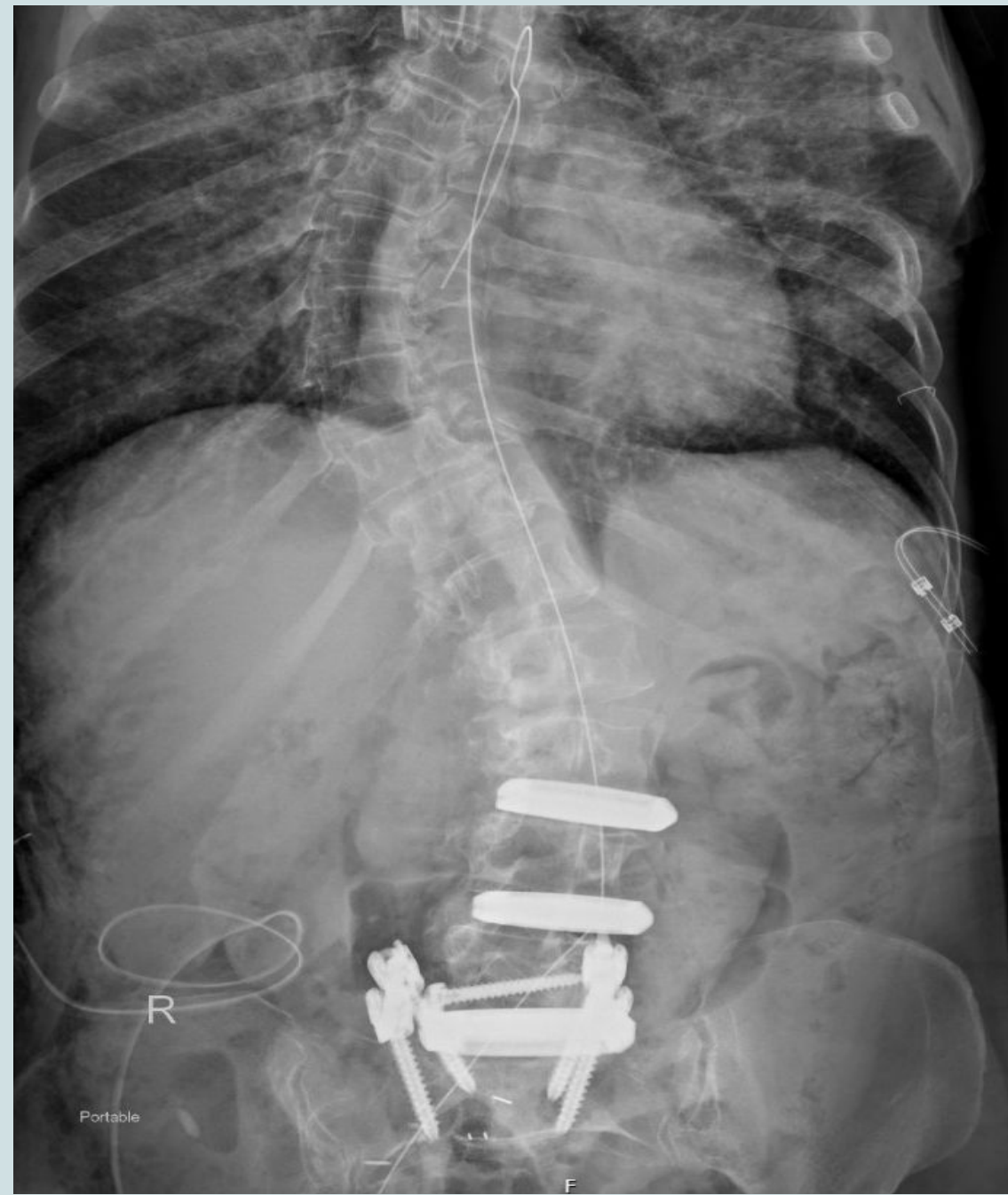
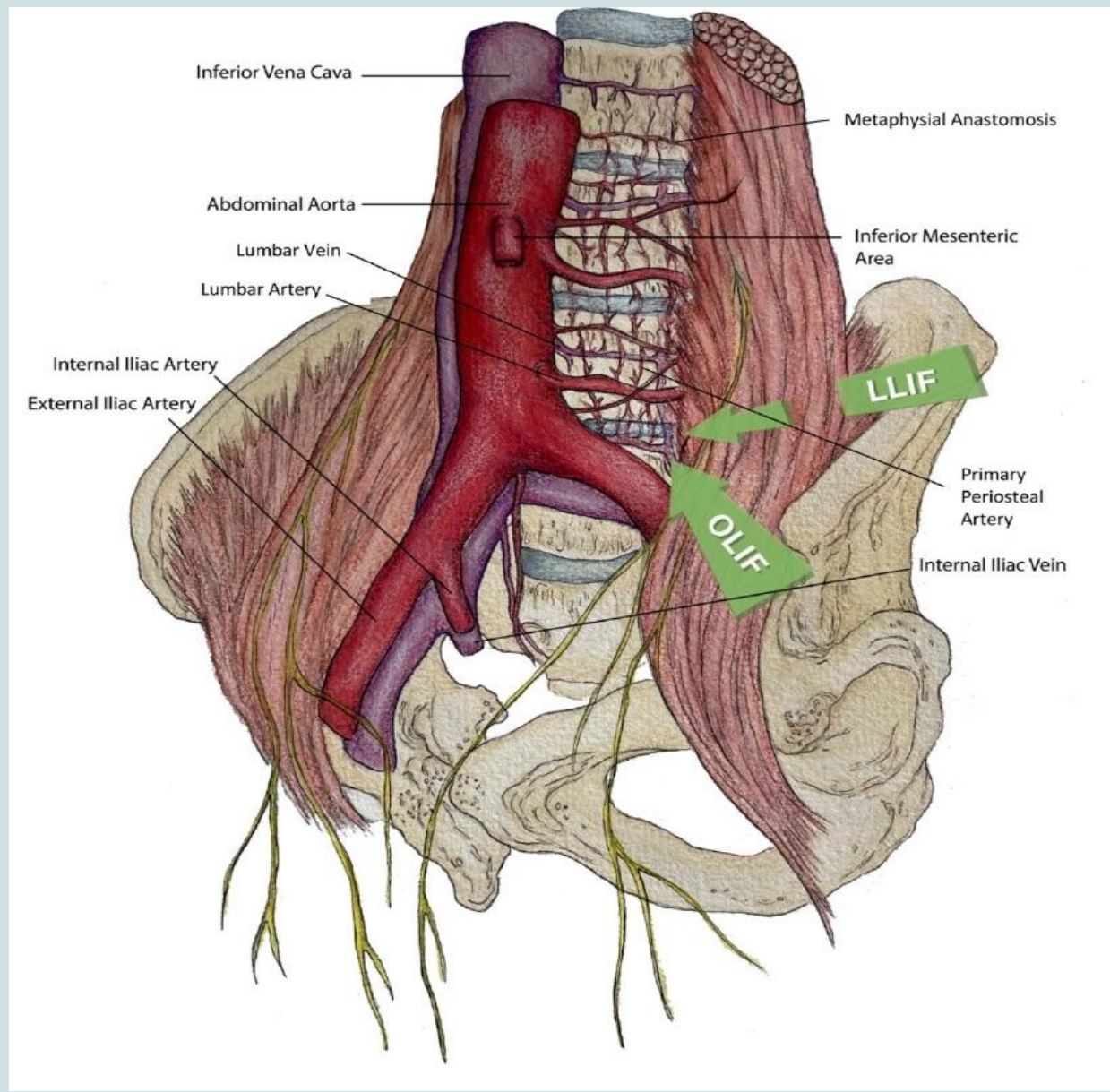
CASE DESCRIPTION

A 56-year-old female with adolescent-onset severe progressive scoliosis, and failed back surgery syndrome after posterior lumbar interbody fusion of L4-5 and L5-S1 in 2001 underwent L2-3, L3-4, and L4-5 lateral lumbar interbody fusion. After removal of the retractor postoperatively, the patient experienced sudden hypotension without visible bleeding. She became hemodynamically unstable, prompting emergent angiography and subsequent laparotomy for suspected vascular injury. There were multiple tears in the inferior vena cava (IVC) and iliac vein junction, where massive venous bleeding was identified and temporized. The patient did not regain a palpable pulse or recordable blood pressure. Despite aggressive resuscitation and surgical efforts, the patient expired.

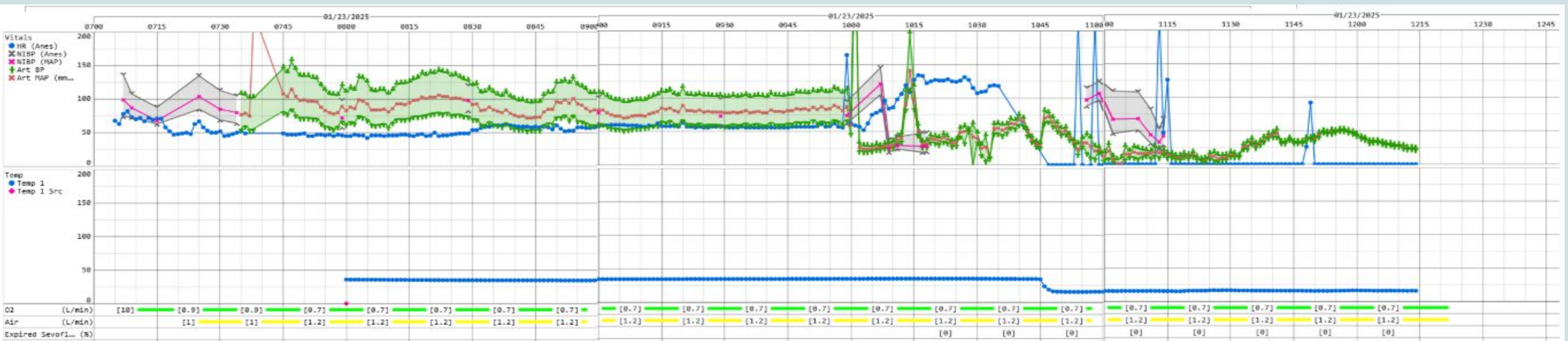


lidocaine 1% (mL)	3 mL
propofol 10 mg (mg)	150 mg
fentanyl 50 mcg (mcg)	50 mcg
succinylcholine (mg)	100 mg
propofol (mcg/kg/min)	1000 mg
remifentanyl (mcg/kg/min)	1.164 mg
dexamethasone (mg)	10 mg
ketamine 50 mg (mg)	50 mg
methadone 10 mg (mg)	5 mg
bupivacaine 0.5% (mL)	20 mL
bupivacaine 0.5% (mL)	10 mL
epinephrine 1:10,000 (mg)	50 mg
phenylephrine (mcg/min)	5350 mcg
cefazolin (ANM) (g)	2 g
transferrin ac (mg)	1000 mg
normesin (mcg/kg/d)	4240 mcg
EPINEPHRINE 0.5% (mg)	9.05 mg
calcium chloride (g)	3 g
vasopressin (units)	20 units
EPINEPHRINE (mcg/min)	3400 mcg
sodium bicarbonate (mEq)	100 mEq
LR (mL)	
PRBC	750 mL
FFP	750 mL
PLATELETS	400 mL

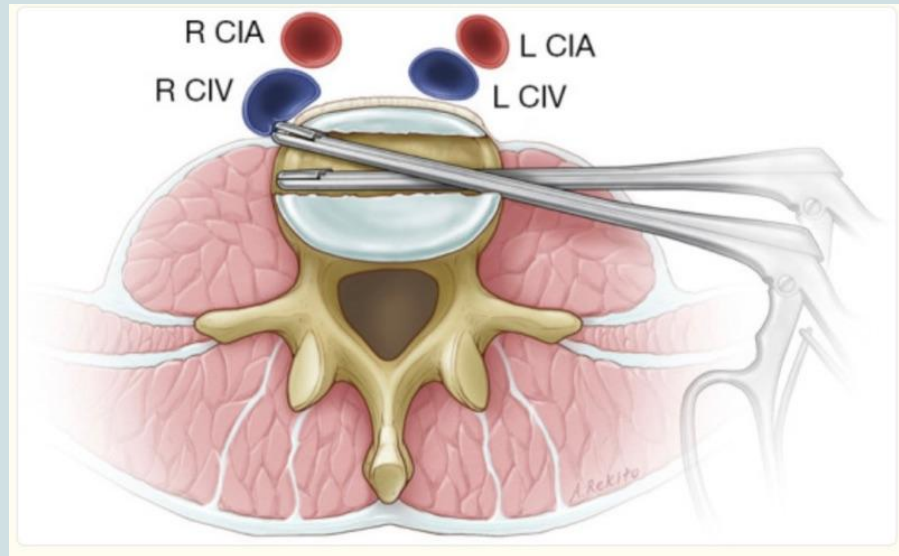
Hematocrit	123 10.36 (collected)	Serum
	14.0 %	
Ref range: 34 - 47 %		
Resolving Lab: St Vincent Medical Center/Pulmonary Lab		
Related Results	Ref Range & Units	
POC Ionized Calcium	4.60 - 5.32 mg/dL	7.38 ^
Lactate, POC	0.4 - 0.8 mmol/L	10.7 ^
Sodium	136 - 145 mmol/L	133 v
Potassium	3.5 - 5.1 mmol/L	5.5 ^
Hemoglobin	24 - 47 %	9.9 v
Hemoglobin POC	11.7 - 16.1 g/dL	9.8 v
Glucose POC	70 - 108 mg/dL	215 ^
Sample Type	-	Arterial
pH, Arterial	7.35 - 7.45	7.23 v
pCO2, Arterial	35 - 45 mmHg	25 v
pO2, Arterial	80 - 100 mmHg	235 ^
HCO3	22 - 26 mmol/L	10.0 v
O2 Saturation, Arterial	95 - 100 %	100.0
Base Deficit, Arterial	mmol/L	15.5
REFERENCE RANGE: NEGATIVE 2 TO POSITIVE 2		



ANESTHETIC RECORD



The role of preoperative vascular mapping The right common iliac vein and the IVC are consistently the most at-risk for injury during transpsoas LLIF regardless of a right- or left-sided approach as they are the most posteriorly located, have the narrowest angle of surgical trajectory, and are frequently within one millimeter of the disc edge.



Identification of predictive factors for vascular injury

	Vascular injury (n=1)	No vascular injury (n=25)	p-value
Demographics			
Age (years)	68.50 ± 11.75	63.71 ± 9.67	0.47
BMI	30.00 ± 7.54	30.35 ± 6.98	0.99
ASA Score	2.25 ± 0.50	2.40 ± 0.42	0.38
Charlson Comorbidity Index	2.75 ± 0.50	2.02 ± 1.77	0.75
Patient sex			
Male	1 (25.0)	138 (86.1)	0.40
Female	3 (75.0)	138 (83.9)	
Diagnosis			
Lumbar instability	2 (50.0)	103 (40.2)	0.79
Diagnosis/operative details			
Unilaterally	2 (50.0)	128 (50.0)	
Number of operative levels			
One level	2 (50.0)	180 (70.3)	0.37
Two level	1 (25.0)	57 (22.3)	
Three level	1 (25.0)	18 (7.0)	
Four level	0 (0.0)	1 (0.4)	
Operative details			
Operative time	129.25 ± 55.14	130.00 ± 65.31	0.97
Blood loss (mL)	227.50 ± 107.28	95.52 ± 66.30	0.11
Reoperation (days)	4.50 ± 2.50	2.31 ± 1.76	0.19
Side of approach			
Right	3 (75.0)	242 (94.5)	0.30
Left	1 (25.0)	14 (5.5)	
Level of operation (n=356)			
L1-2	0 (0.0)	12 (3.4)	0.92
L2-3	0 (0.0)	51 (14.0)	
L3-4	2 (50.0)	128 (50.8)	
L4-5	2 (50.0)	162 (64.4)	
L5-S1	0 (0.0)	1 (0.4)	
Incidence of vascular injury during procedure			
LLIF	2 (50.0)	209 (81.6)	0.11
OLIF	2 (50.0)	47 (18.4)	

*Data are presented as means with standard deviation or medians with percentages.
Abbreviations: ASA, American Society of Anesthesiology; BMI, body mass index; LLIF, lateral lumbar interbody fusion; OLIF, oblique lumbar interbody fusion.

Vascular injury risk stratification for lateral lumbar interbody fusion	
Risk category	Point value
Anterior disc line to posterior vessel wall distance	
> 5.0 mm posterior	2
0.0-5.0 mm posterior	1
< 0.0 mm posterior (anterior vessels)	0
Disc vessel angle	
0 - 30	2
> 30 - 60	1
> 60	0
Disc edge to vessel distance	
< 1.0 mm	2
1.0 - 2.5 mm	1
> 2.5 mm	0
Sum of scores: <3, low risk; 3-4, moderate risk; >4, high risk.	

Vessels injured during lateral approach surgery in a systematic review of 25,740 patients	
Major vascular injuries (n=119)	
Unidentifiable or undefined	72 (60.5)
Inferior vena cava	22 (18.5)
Abdominal aorta	3 (2.5)
Common iliac vein	2 (1.7)
Ovarian vein	1 (0.9)
Renal artery	1 (0.9)
Minor vascular injuries (n=49)	
Segmental artery	37 (75.5)
Ascending ilio-lumbar vein	9 (18.4)
Unidentifiable or undefined	3 (6.1)

Table 1. Risk factors for massive intraoperative blood loss in spine surgery			
Patient-Related	Surgical Site	Anatomical Site	Associated with Medical Conditions
Demographics: Advanced age (>65 years)	Complexity surgery: Multilevel instruction (>5 levels), combined anterior-posterior approaches	Vascular Proximity: Major vessel proximity (aorta, vena cava, vertebral arteries)	Tumors: Hypervascular metastases (renal, thyroid)
Hematologic: Preoperative anemia (Hb < 12 g/dL), comorbidity: bleeding disorders	Techniques: Osteotomies (PSO, VCR, SPO)	Venous Anatomy: Dense external-venous plexus, especially at thoracolumbar junction	Deformity: Severe scoliosis (>75 degree Cobb angle)
Physical: Obesity (BMI > 30 gm²), poor nutritional status	Duration: Operative time > 4 h	Bone Vascularity: Highly vascularized vertebrae bodies	Kyphoscoliosis
Medications: NSAIDs, patient agents aspirin, clopidogrel, NOACs (dabigatran, rivaroxaban)	Approach: Anterior cervical approaches	Bone Quality: Metabolic bone disease	Inflammatory: Ankylosing spondylitis, rheumatoid arthritis
	Revision Status: Scar tissue, altered anatomy, hardware removal	Dural Considerations: Adherent dura	Infection: Consistencies: Liver disease, renal dysfunction, cardiovascular disease

Intraoperative Blood Loss and Management Strategies in complex spine surgery Antifibrinolytic agents, optimal prone positioning, intraoperative cell salvage, early endovascular intervention, and minimally invasive surgical technique markedly reduced intraoperative blood loss

Management of intraoperative massive hemorrhage in spine surgery Implementation of Code Hemorrhage, a structured response strategy that has enhanced communication, decision making, and patient care.



Click here for references
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