The Role of the Vascular Surgeon in Anterior Retroperitoneal Spine Exposure: Ensuring Patient Safety and Preserving Open Surgical Training

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Introduction

- Open vascular surgical procedures have decreased over the last decade
- Spinal fusion techniques and artificial disc replacement have led to an increase in the need for anterior retroperitoneal spine exposure (ARSE).
  - Exposing the spine poses a risk for vascular injury necessitating operative repair – 11%

Hamdan, AD,. J Vasc Surg 2008

Introduction

- Vascular surgeons often are involved as “exposure surgeons” during spine surgery
  - two team approach provides safety

- We propose that vascular surgeon involvement during spinal surgery is essential from a patient safety and open surgical training prospective.

Methods

- Patients undergoing ARSE over an eight year period were identified retrospectively from our prospectively maintained vascular registry

  - Indications for ARSE included anterior lumbar interbody fusion, total disc replacement , or “hybrid”
  - Indications for surgery were determined by the spine surgeons involved.
  - All patients were evaluated by the vascular surgeon

Methods

- Approach
  - Low transverse- L4-L5, L5-S1
  - Vertical, paramedian- L3-L4
  - Low midline- L5-S1 with severe angulation

Methods

- Vascular injury and influence of
  - Level of exposure
  - Body mass index
  - Prior abdominal surgery
  - Prior spine surgery
  - Fusion vs artificial disc

Methods

- The need for suture repair of vascular structures and timing of vascular injury were recorded
  - » Minor injury- simple suture repair
  - » Major injury- any complex repair of injured artery or vein

- Data was analyzed with unpaired t-test and Chi square.

Results

- 405 ARSE procedures were performed from 2000- 2008.

Age	**48.08 ± 12.74 (15-82)**	
Female:male	**229:176**	**56.5%/43.5%**
CAD	**15**	**3.7%**
DM	**35**	**8.6%**
HTN	**110**	**27.2%**
Smoking	**167**	**41.2%**
PAD	**2**	**0.5%**
Prior AS	**181**	**44.7%**
Prior PLS	**158**	**39.0%**
Prior ALS	**13**	**3.2%**
Body Mass Index	**28.0± 5.3 (14.2-52.1)**	

Indications for Surgery

Degenerative disc disease/back pain	197	48.6%
Radiculopathy/spondylolisthesis	157	38.8%
Pseudoarthrosis	43	10.6%
Failed artificial disc	4	1.0%
Infection	3	0.7%
Tumor	1	0.25%

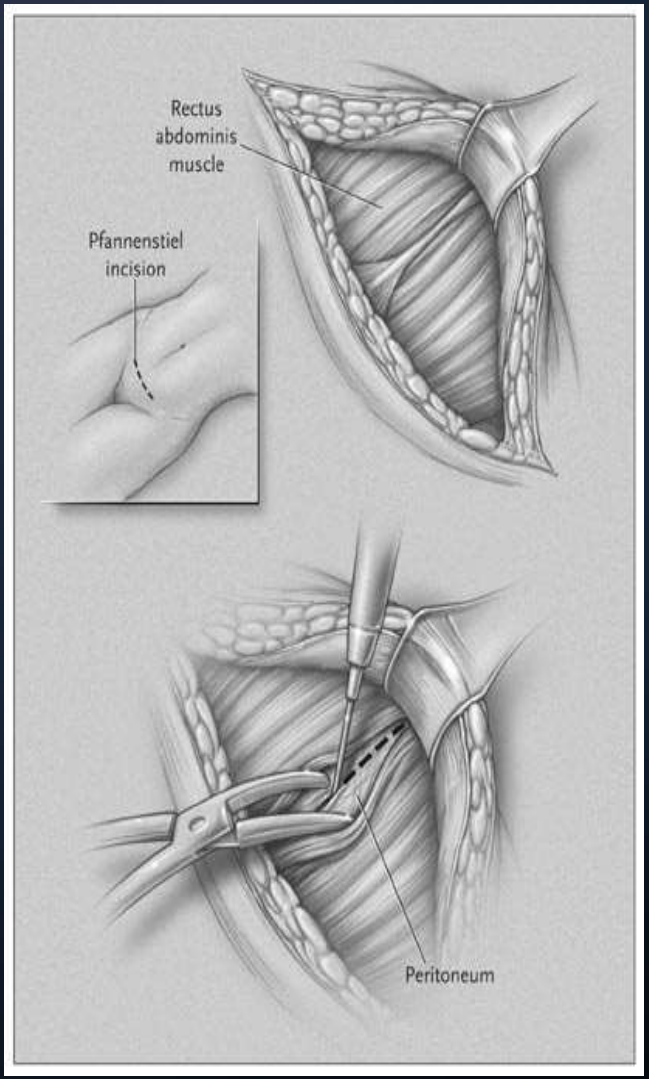
Level of Spine Surgery

L4-5	54	13.3%
L5-S1	128	31.6%
L4-5 & L5-S1	139	34.3%
Multiple including L4-5	50	12.3%
Multiple, not including L4-5	34	8.4%
Total involvement of L4-L5	243	60%

Approach

Incision For Retroperitoneal Approach

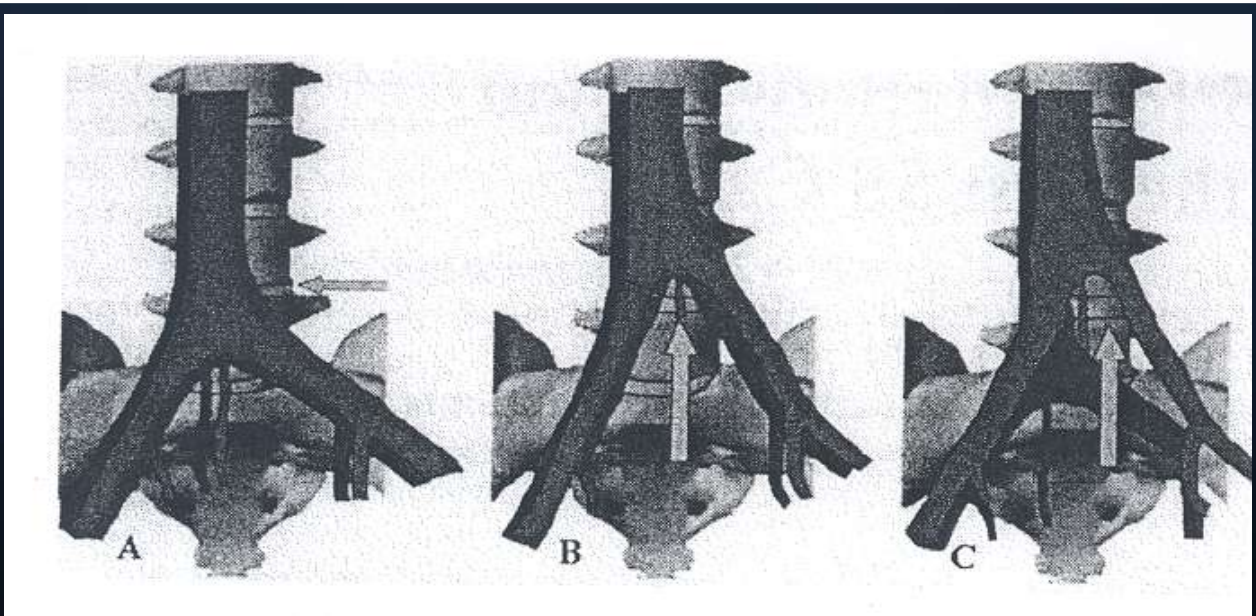
Lower transverse abdominal	346	85.4%
Vertical paramedian	50	12.3%
Vertical midline	9	2.2%



Approach

Exposure of L4-5 relative to iliac vessels

Above left common iliac artery	107	(44.0%)
Between left common iliac artery and vein	109	(44.9%)
Below left common iliac vein	27	(11.1%)



Vascular Injuries

Minor Vascular injuries		
Overall	95/405	(23.5%)
Involving L4-5	77/243	(31.7%)
Not involving L4-5	18/162	(11.1%)*
At L4-5:		
Exposure above	18/107	(16.8%)
Between	49/109	(45.0%)**
Below	10/27	(37.0%)

* $p<.001$

**$p<.001$ between vs. other

Vascular Injuries

Major Vascular Injury

Overall	12/405	(3.0%)
Involving L4-5	10/243	(4.1%)
Not involving L4-5	2/162	(1.2%)*

*p=n.s.

Outcomes

- No difference in incidence of vascular injury
  - BMI
  - Prior abdominal surgery
  - Prior spine surgery
  - Lumbar fusion vs artificial disc

Outcomes

Length of stay:	5.5 $\pm$ 4.5	(2-50 days)
Ileus:	0.77	(0-10 days)
Complications:		
Prolonged ileus	6	(1.5%)
DVT	3	(0.7%)
Arrhythmia/MI	4	(1.0%)
Respiratory failure	3	(0.7%)
UTI	2	(0.5%)

Summary

- Incidence of vascular injury
  - Minor- 23.5%
  - Major- 3%
- Increased incidence of injury at L4-L5
- Increased injury
  - Mobilization between iliac artery and vein
- Injury not dependent on
  - BMI
  - Prior surgery
    - » Abdominal
    - » Spine
  - Lumbar fusion vs artificial disc replacement

Discussion

- Vascular surgery training has undergone a paradigm shift over the last decade
  - concern that vascular surgery residents may not be as able to obtain a sufficient volume of open abdominal vascular surgery procedures

Cronenwett,. 2004;40:660-9.

Arko, F., Lee,. J Vasg Surg 2001; 34:885-91.

Zarins, C.,. Ann Surg, 2000; 232(4):501-7.

Discussion

- ARSE
  - Mimicks open retroperitoneal abdominal vascular exposure
  - Requires identification of major retroperitioneal structures
  - Offers familiarity with major vessel mobilization and repair of vascular injuries

Discussion

- Other authors suggest spine surgery can be performed safely with a single team approach

- We emphasize importance of an exposure surgeon during anterior spine surgery
  - Significant incidence of vascular injury
  - Occurrence of major injuries during instrumentation

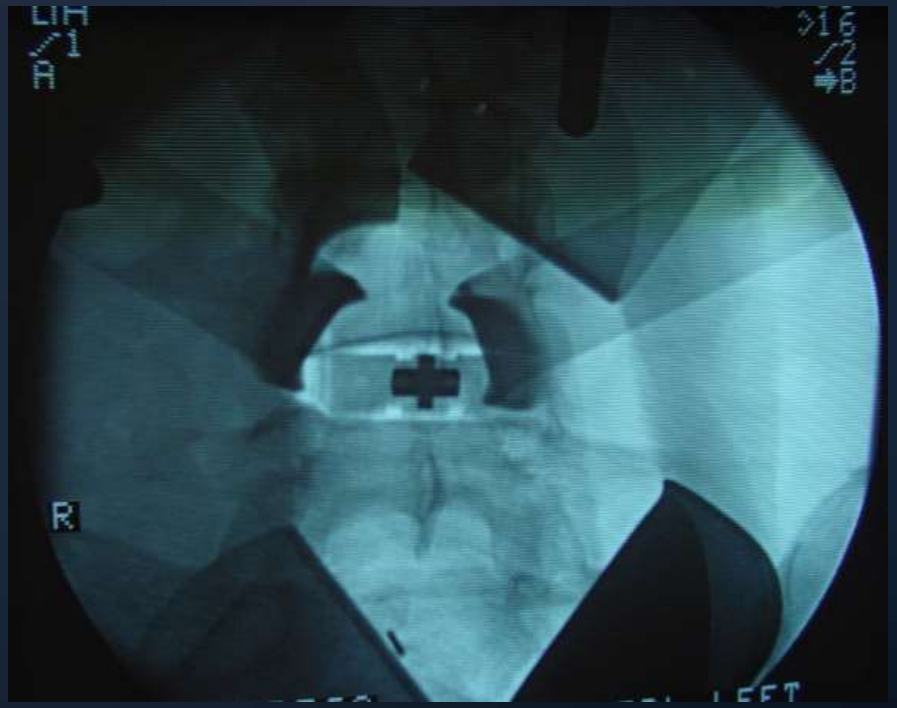
Holt, RT,. J Spinal Disord Tech 2003; 16(5):477-86

Discussion

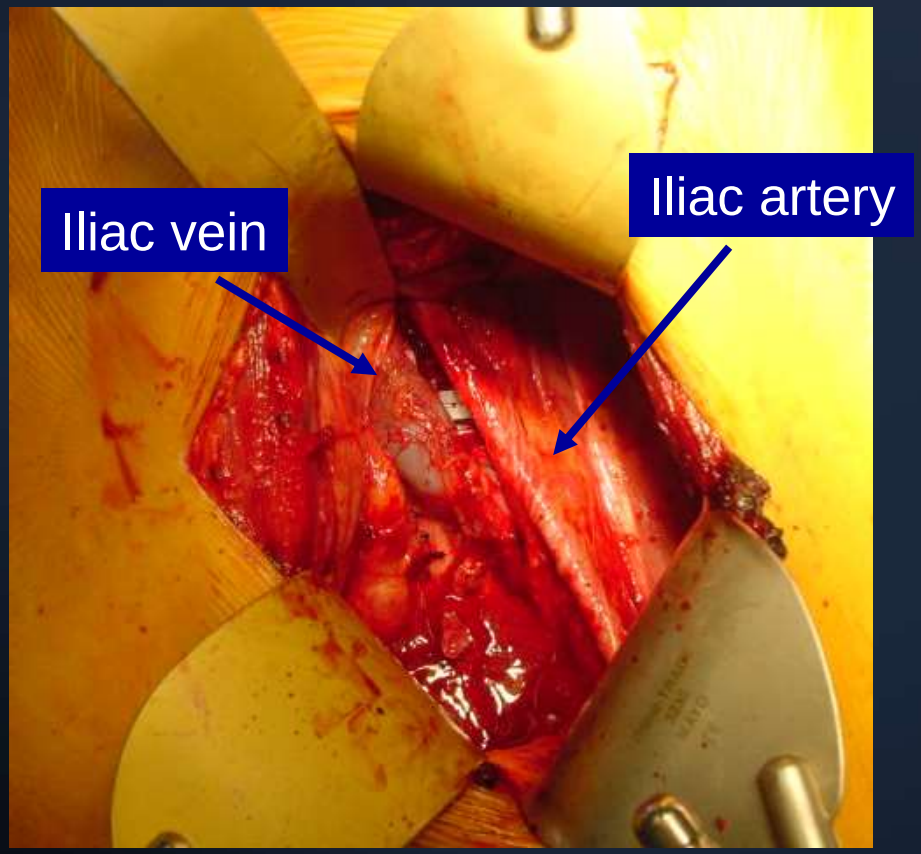
- Vascular injuries-
  - 23.5% minor and 3% major
    - »Reported as high as 40% in other series
  - Excellent outcomes with prompt repair by a vascular surgeon
    - »0% mortality
    - »0.7% vascular complication rate

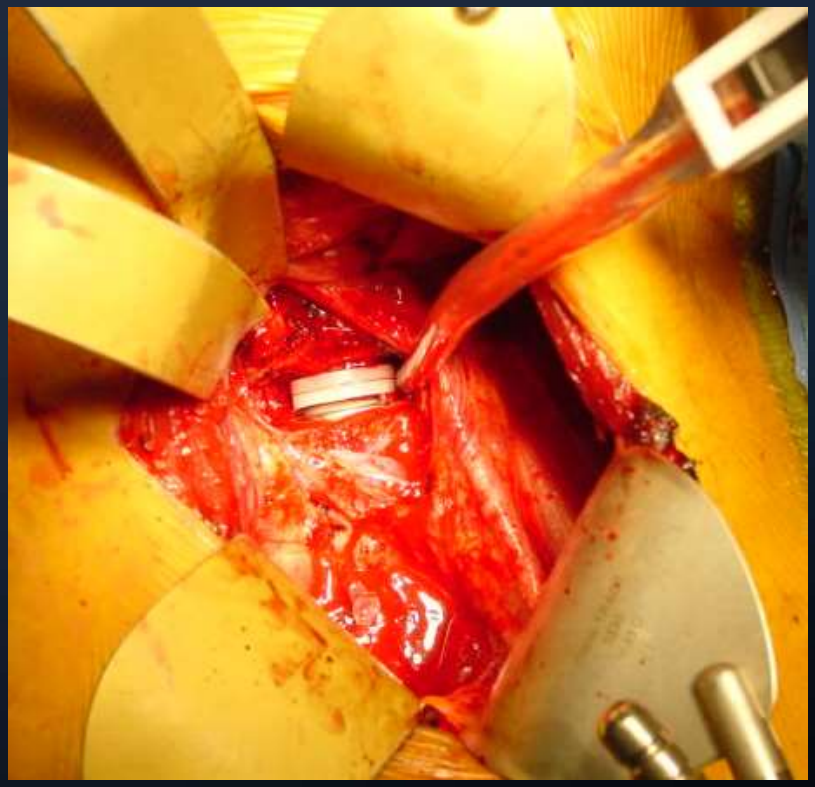
Discussion

- Injury increased at L4-L5
  - L4-5 is often hidden
  - Gaining adequate midline exposure is challenge with the artificial discs
- X-rays make it look easy



Discussion





Discussion

- Study Limitations
  - Retrospective design
  - No direct comparison in incidence of injury or outcome with a single surgeon approach

Conclusions

- Vascular surgery involvement as exposure surgeons during anterior spinal surgery is imperative
- L4-L5 is most commonly involved during ARSE
  - Significant increase in vascular injuries compared to other levels
  - Increased injury when dissection performed between the iliac artery and vein

Conclusions

- A two-team approach capitalizes on unique specialty specific surgical skills
  - Preserves open abdominal vascular surgery training for residents

- Major perioperative complications are unusual using this paradigm regardless of BMI, previous abdominal or spinal surgery, or type of surgery performed