A Novel Neurovascular Classification System for Lateral Lumbar Surgery

Fernando Villamil-Wiscovitch[1], Jeffrey Moore, Edith Denisha Garcia, Leighton Joseph Lapierre
[1]Caribbean Ortho and Spine Inst

INTRODUCTION:

Lateral access solutions have become commonplace in spine surgery. There are many variations on the traditional transpsoas lateral access approach. This includes prone-transpsoas, anterior to posterior lateral surgery, anterior to the psoas, etc. The procedures can provide a less invasive option to treat degenerative conditions, trauma, and infection in the lumbar spine. The advantages over traditional posterior approaches are well described: faster and higher fusion rates, increased segmental lordosis, decreased blood loss, and shorter hospital stays. Even so, only 80% of spine surgeons have attempted a lateral access surgery, and only 20% utilize it as their main approach to the lumbar spine. The retroperitoneal space is a poorly described anatomical region, and very few training programs spend significant time teaching lateral access or work in the retroperitoneal space. As such, patient anatomical variations can be difficult to describe and deal with among spine surgeons. Additionally, many surgeons are wary of potential neurovascular complications while working in this unfamiliar retroperitoneal space. These include neuropraxias due to plexus injury and great vessel violations. Here we present a classification system which captures the various neurovascular anatomy of the retroperitoneal space in patients; specifically describing the psoas/plexus and great vessels. The hope is that by standardizing patients' anatomy, we will allow for better communication between lateral access surgeons, as well as create more continuity when describing these approaches in an educational setting. Additionally, certain anatomical classifications may direct a surgeon toward a more specific lateral access approach, such as extreme lateral vs. anterior to the psoas approach, to help maximize patient outcomes and minimize complications.

METHODS:

Two surgeons reviewed 7000 levels of lateral surgery done by one surgeon (FV) in the last 10 years. From there, trends in anatomical variations of the great vessels and psoas muscles were reviewed and classified.

RESULTS:

There are two parts to the classification system. The first part deals with the location of the great vessels with respect to its location from the anterior vertebral body/disc margin. Type I is approximately 0% from the anterior body/disc margin, aka in front of the vertebral body. Type II is approximately 25% from the anterior margin, or near the bend of the vertebral body. Type III is approximately 50% from the anterior margin, or lateral to vertebral body/disc. The second part of the classification system is a modifier describing the location of the psoas muscles. An anterolateral psoas orientation, aka "mickey mouse ears," is an "A" modifier. No mickey mouse ears = no "A" modifier. The resulting classification is as such: Type I (anterior vessels with normal psoas anatomy), Type IA (anterior vessels with anterolateral psoas orientation), Type II (great vessels approximately 25% from mid body), Type IIA (great vessels approximately 25% from mid body with anterolateral psoas orientation), Type III (great vessels 50% from mid disc or lateral to the body), and Type IIIA (great vessels 50% from mid disc/lateral to the body with anterolateral psoas orientation). (Figure 1)

DISCUSSION AND CONCLUSION:

Here, we describe a novel classification system, detailing the neurovascular anatomical variations in the retroperitoneal space frequently encountered during lateral access surgery. To our knowledge, it is the first classification system which describes both the psoas/plexus variations, as well as the location of the great vessels. We hope to standardize these anatomical variations and increase cross talk between lateral access surgeons and provide a more consistent method of teaching spinal surgeons who are new to the retroperitoneal space and lateral access surgery. Further studies will be aimed at correlating outcome measures and complications rates associated with each anatomical variation. Additionally, as recent studies have been published quantifying the change in psoas location based on patient positioning, we hope to add modifiers to the classification system based on patient position. Finally, this classification system may be utilized to help safely guide surgeons toward specific lateral access approaches.

Type I

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc

Type II

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc

Type III

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc

Type IA

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc

Type IIA

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc

Type IIIA

A
25%
50%
75%
100%
P

Vein
Artery
L4/L5 Disc