A Brief History of the Evolution of Lumbar Spinal Surgical Decompression

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Spine surgery has a fascinating history—from initial understanding of spinal anatomy thousands of years ago clear to present developments in the modern day. Some of the earliest depictions of spinal traction to correct spinal deformity date back to almost 3500 B.C.

Perhaps one of the most interesting historical aspects of spinal surgery, though, is the development of the laminectomy or spinal decompression surgery. The laminectomy is arguably the first spinal surgery performed, and to this day, various permutations of the laminectomy make it the most commonly performed spinal procedure. The lamina is the posterior arch of the spine, sometimes referred to as the roof of the spinal canal. The following will be a brief history of the development and progression in technique of the “cornerstone” procedure for the treatment of spinal pathology.

Review of medical history suggests that the laminectomy procedure was advocated for as early as the 16th century, but it was not performed until the early 1800s. The main indications for laminectomy tended to be decompression of the neural elements for bony compression due to trauma, infection, or tumor. Laminatecmy was the only surgical spinal procedure for more than a century until deformity correction and other developments took place during the 20th century.

The early case reports of laminectomy in the 19th century were not all well-received. Like any new technique, a learning curve existed, and complications occurred. Some of the patients undergoing spinal decompression for spinal cord compression likely had significant spinal instability and neurologic compression, and while laminectomy was an attempt to provide more space for the spinal cord and neural elements, the severity of the underlying injury did not allow for significant recovery. Nonetheless, early mortality following these procedures was high, and there was great debate in British medical circles regarding the efficacy of such procedures.

The first historical description of spinal laminectomy occurred perhaps as early as 650 A.D. Paulus of Aegina is regarded as the first person to perform what is now known as the laminectomy. It is believed that indication was for spinal cord compression following spinal trauma. However, it was more than a century later, following this first description, before open surgical spinal decompression was described again.

Figure 1. Axial view of a lumbar vertebra. The two laminae are bony plates that form the posterior border of the vertebral foramen and connect with the pedicles to form the vertebral arch. Image courtesy of Medtronic, Inc.

Figure 2. Spinal column (left) and single vertebra (right) after the removal of the lamina. Image source: http://www.neurotexasinstitute.com/about-neurotexas-institute/contact-us.aspx.
In retrospect, though, it is likely that substantial contributing factors to mortality following lumbar laminectomy in the 19th century was the lack of modern anesthetic techniques, pain control, and the predating of the widespread use of antiseptic technique. Infection locally or systemically was not uncommon. Prior to the development of antibiotics, systemic infections were associated with high rates of mortality.\(^\text{5}\)

However, despite the initial difficulties, there were successful outcomes reported, including a man who received a laminectomy for lower extremity weakness after falling off a horse and sustaining spinal trauma. He regained partial neurologic function. This case, performed by Dr. Alban G. Smith in 1829 in Kentucky, is one of the earliest reported success stories.\(^\text{6}\) As more experience was gained, the laminectomy procedure gained acceptance. It was generally described in association with conditions of infection, tumor, or fracture. These pathologic entities were well understood from a historical context given the medical understanding of these conditions. However, the most common indications to perform a laminectomy, for spinal stenosis or lumbar disc herniation, were just beginning to evolve.

Today, the surgical laminectomy with excision of herniated disc is one of the most common, if not the most common, spinal surgeries performed. Eliminating pressure on a nerve root from a herniated disc or a bone spur has an outstanding track record of pain relief and return to function. During the early history of lumbar decompression for disc herniation, the pathophysicsology of the herniated disc was not completely understood. Early reports from pathologists suggested that a “chondroma” or benign cartilage tumor was being removed from the spine.\(^\text{7}\) Now we understand that it is actually a ruptured fragment from a degenerating intervertebral disc that causes neural compression and pain. The laminectomy is required to remove the offending disc fragment, a procedure that has an excellent track record.

Over the course of time, the laminectomy has evolved. In the 1930s, the first case report by Mixter and Barr was published in the New England Surgical Society regarding the excision of a herniated disc.\(^\text{8}\) Hemilaminectomy, laminaplasty, laminotomy, and others are all variations on a theme, expanding upon the initial idea of lumbar spinal decompression. While too numerous to detail in this article, from the 1930s until the present time the laminectomy has morphed into various adaptations. Despite terminology differences, the laminectomy or lumbar decompressive procedure maintains its role as a “workhorse” procedure in spinal surgery.

As the laminectomy gained popularity, surgeons began to use the microscope to perform laminectomies and explore nerve roots. This was first reported in the late 1960s, ushering in a world of “microsurgery” involving the lumbar spine.\(^\text{9}\)

One of the pioneers of modern day lumbar microsurgery was Dr. John McCulloch. Prior to the advent of microsurgery, most lumbar laminectomy procedures involved a midline surgical incision with complete release of the lumbar paraspinal muscles from the midline spinous processes, followed by a formal open laminectomy. For better visualization, surgeons typically wore loupes. Dr. McCulloch introduced the concept of anatomic segments to determine location intraoperatively and correlate region of pathology on preoperative MRI scanning.\(^\text{10}\) The improvement in the understanding of local anatomy, including the relationship of the inferior pedicle to the disc space, allows the surgeon to minimize disruption of soft tissues around the spinal segment by focusing on the least amount of bone necessary to remove to expose a herniated disc fragment. This led to decreasing the length of the surgical incision, a significant transition from the long, open midline incision to the shorter, targeted microsurgical incision. Dr. McCulloch’s contributions to lumbar microsurgery are numerous; a commonly used lumbar surgical retractor system bears his name. While he was not the first to utilize the operating microscope, he was instrumental in converting a number of surgeons to using it.\(^\text{11}\)

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**Figure 3.** Herniated disc compressing a nerve root. Image source: http://www.spine.md/herniated-disc.
Foley and Smith developed the “microtubular discectomy.” This idea expanded upon the ideas of lumbar microsurgery, but added an element of tubular dissection to limit soft tissue injury and target neural compressive pathology. The microtubular system involves using a set of dilating tubes under direct fluoroscopy to access the posterior spinal elements. A small stab incision is made in the skin and fascia and the initial dilator is introduced and “docked” on the appropriate posterior spinal landmarks and confirmed fluoroscopically. Progressively larger tubes are then placed over each other until the final tube diameter is decided upon, anywhere from 14mm to 20 mm typically, although it could be larger. The tube is then anchored in placed to the bed via an anchoring arm. The microscope is brought in to assist the surgeon with visualization and then a formal laminectomy or exposure of the targeted nerve root in question is performed, and the pathology is treated through the anchored tubular retractor.

Another technique for limited lumbar decompression—the endoscopic lumbar discectomy emerged. In 1975, Hijikata was the first surgeon credited with percutaneously removing disc, essentially through a tube. Lumbar endoscopic discectomy involved using an endoscope through working portals with instruments to remove bone spurs or herniated fragments of disc under direct visualization. Dr. Anthony Yeung developed the most widely used working channel endoscope in 1997. It basically involves one portal system. Through the portal the surgeon can work with instruments, directly visualize anatomy, and irrigate/suction tissue simultaneously. The benefit of this technique is minimal tissue disruption with very small percutaneous incision. The access is through a posterolateral portal, making treatment of foraminal and extraforaminal disc herniations ideal, although central and larger herniations within the canal can be treated via endoscopic discectomy as well.

Today, all types of techniques for lumbar laminectomy with or without discectomy are utilized. These include formal open laminectomy, endoscopic discectomy, open discectomy with use of the microscope, and tubular microdiscectomy, to name a few. The procedure is so efficacious that it is difficult to measure one technique as being superior to another. Surgeon training and bias likely plays a role in the particular technique utilized. Less invasive techniques have a shorter initial recovery period, although longer term outcomes with each technique appear largely equivalent.

One of the most significant advances paralleling the development of smaller incisions has been the transition of most lumbar laminectomy or decompressive

![Figure 4](image1.png)  
**Figure 4.** Tubular retractor system used to remove a herniated disc. Image courtesy of Medtronic, Inc.

![Figure 5](image2.png)  
**Figure 5.** Laminectomy performed through an endoscope. Image source: [http://www.resurgensspine.com/jeffords/endoscopic-spine-surgery.php](http://www.resurgensspine.com/jeffords/endoscopic-spine-surgery.php)
procedures from hospital to outpatient setting. Typically done in a hospital setting, it was not unusual in some settings in the 1980s and 1990s to stay in the hospital for 2 or 3 days following routine microscopic discectomy procedure. Formal laminectomy patients may have been in the hospital for up to a week at times. Now, most of these procedures are done on an outpatient basis, and some are even performed in free standing surgery centers.

Truly, the lumbar laminectomy procedure has evolved substantially in the last one hundred years. Understanding of anatomy and pathoanatomy has had much to do with this. Ingenuity and engineering have played a role in further developing techniques which allow for minimal, less invasive access to the lumbar spine while still allowing for the appropriate and necessary neural decompression. The microscope has added tremendous illumination and visualization for working in small, confined spaces. Undoubtedly, lumbar decompression will continue to evolve to improve outcomes for patients with symptomatic nerve root compression.

REFERENCES

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Dr. O’Leary is a board-certified, fellowship trained orthopedic spine surgeon at Midwest Orthopaedic Center and is also on staff at all three Peoria, IL hospitals. He earned his medical degree from Loyola University in Chicago, IL and completed his residency in Orthopaedic Surgery and Rehabilitation at Loyola University Medical Center in Maywood, IL. He completed an Adult and Pediatric Spine Fellowship at the Washington University School of Medicine in St. Louis, MO. Dr. O’Leary specializes in the treatment of conditions in the cervical and lumbar spine in both adults and children. His focus is to get his patients back to their everyday lives through either non-surgical treatment or surgical intervention if required.