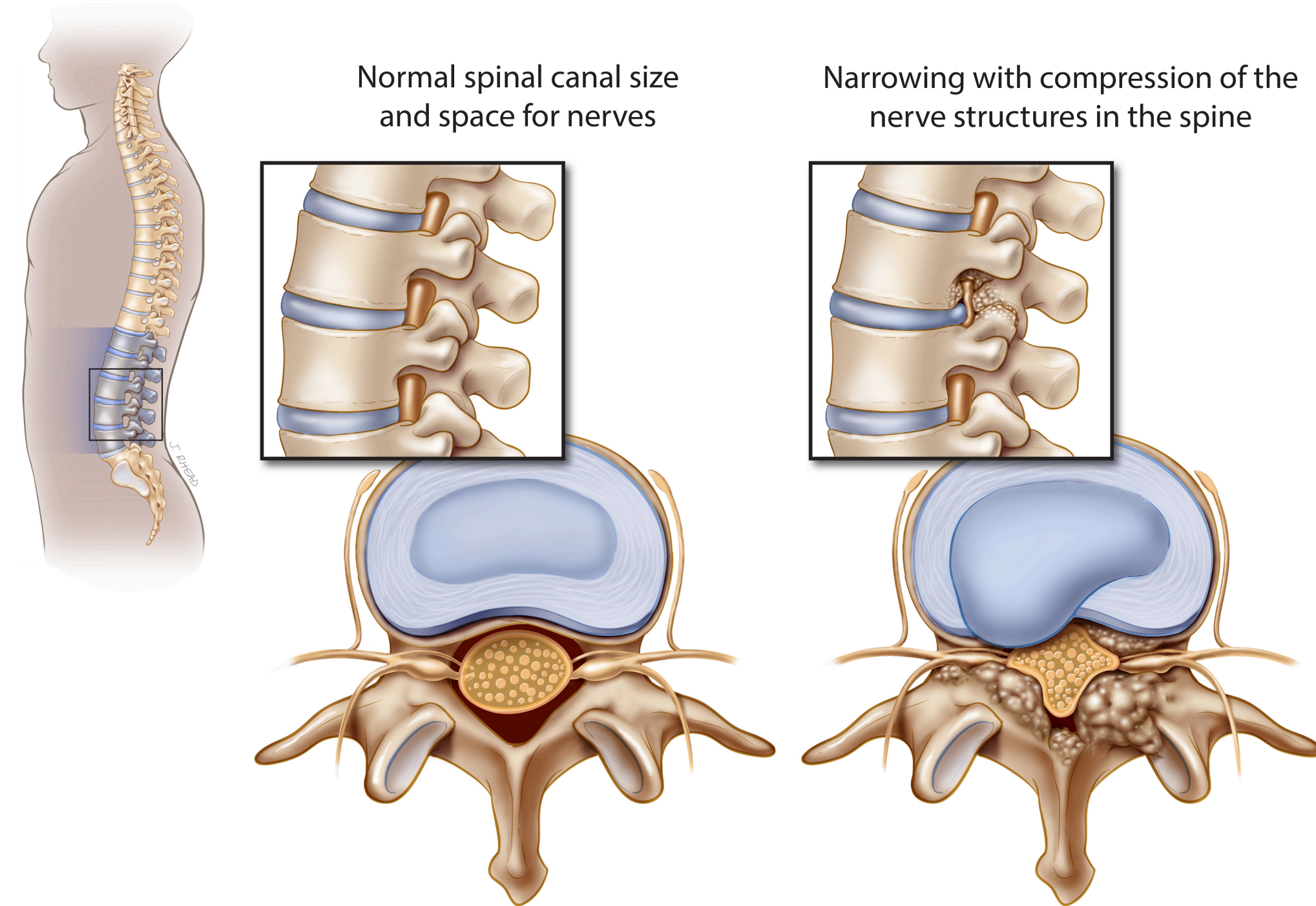


#### INTRODUCTION

- A literature review of 10 primary research studies was conducted to analyze the effectiveness of pharmacotherapy versus surgical interventions in the treatment of adult patients with spinal stenosis.
- The human vertebral column, also known as the spine, or vertebral column, to consist of 33 vertebrae. The spinal bones or vertebrae form the spinal canal that houses the spinal cord. One of the main functions of the spinal bones is to protect the spinal cord which they surround and allow flexibility in movement.
- The spine also contains 23 Intervertebral discs that consist of fibrocartilage structures that connect the movable vertebrae of the spine.
- The Intervertebral discs allow the flexibility and movement of the spine while providing a cushion to the weight loads and compression placed on the spine.
- Each intervertebral disc consists of three main structures, the nucleus pulposus in the center of each disc, the annulus fibrosus that raps around the nucleus, and the vertebral endplate that connect each disc to the vertebral bodies above it or below it.
- There are 6 Intervertebral discs in the neck (the cervical region), 12 in the upper and middle back (the Thoracic region, and 5 in the lower back (the lumbar region).
- The intervertebral discs and vertebral bodies are surrounded by tough ligaments that hold the vertebrae of the spine together with additional support, protection, and flexibility to the spine.



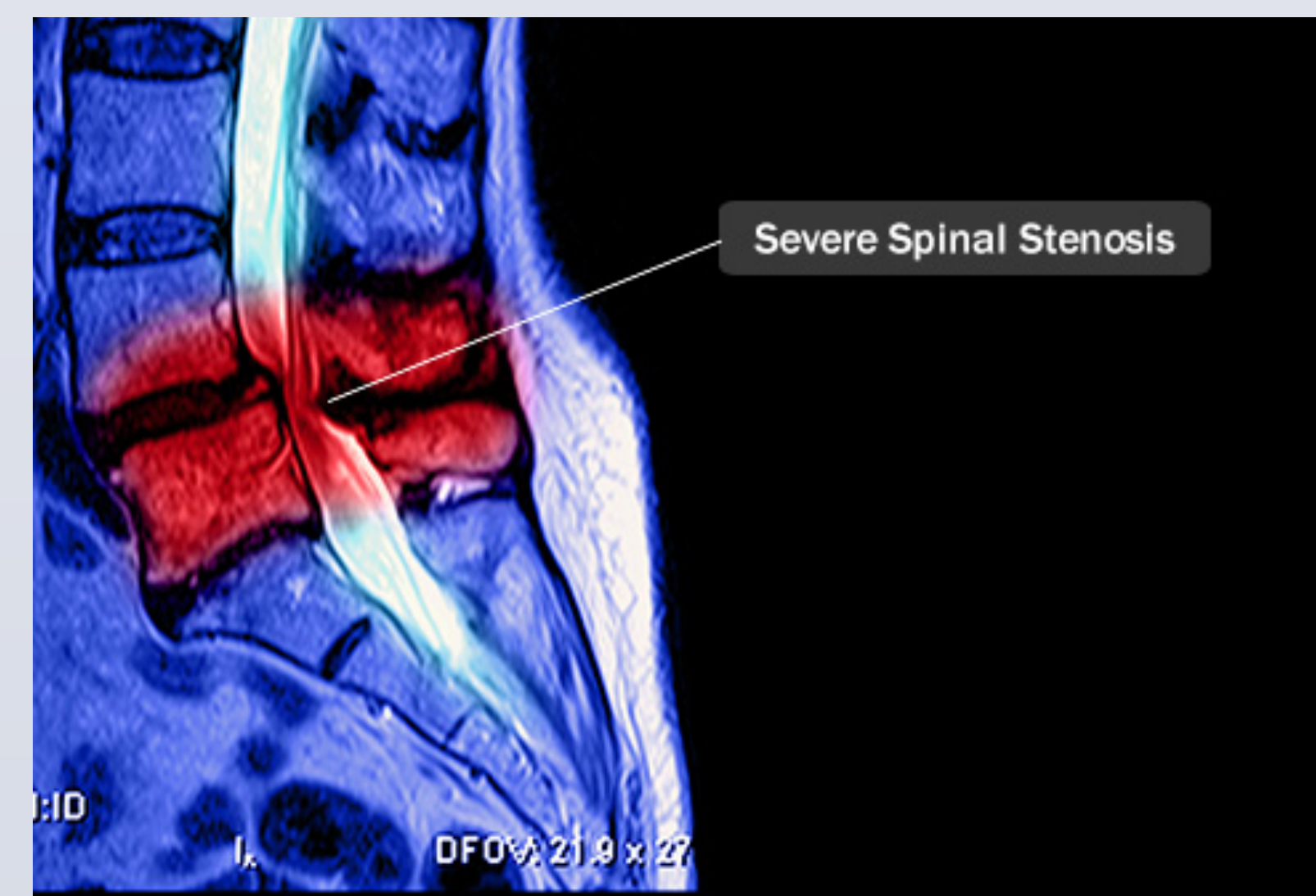
#### OBJECTIVES

- The goal of the review is to collect and explore collected data to provide primary care providers with adequate information to advise their patients of the best treatment for their spinal stenosis pain and limitation in daily functions .



#### What is Spinal Stenosis

- Spinal stenosis is a condition that occurs when the spinal canal narrows or constricts.
- Spinal stenosis can be caused by soft tissue and bone overgrowth or degeneration, or by disc herniation as seen in Appendix B.
- The neck and the lower back are the most common sites of spinal stenosis.
- Some people with spinal stenosis may not experience any symptoms; whereas others may experience severe functional limitations in their daily activities triggered by joints stiffness, muscle weakness, pain, tingling, and numbness.
- There are many causes of spinal stenosis, but the most common cause is wear-and-tear of the spinal bones, which can be caused by osteoarthritis changes, over and excessive use of the spine, and aging.
- Disc herniation is among the most common causes of spinal stenosis. The soft spongy discs tend to dry out with age, which causes a reduction in their volume and consequently reduces the functional ability of it.
- Such dryness, and wear-and-tear can also cause cracks in the annulus fibrosus that raps around the nucleus, allowing some of the soft inner material to escape from their central location and bulge or herniate into the spinal canal and press on the spinal cord or nerves in the area creating pain and limitation of movement.
- Spinal stenosis can also be caused by a thickening of the ligaments that support the spine, or abnormal growth or a tumor in the tissue or bones surrounding the spinal cord, Osteoarthritis of the spinal bones, Paget's disease, and ast but not least, traumas such as car accidents or Falls.



#### METHODS

- This literature review focused on recent clinical trials and randomized studies related to the effectiveness of treatments for spinal stenosis.
- A systematic review of the referenced studies was performed.
- The research was conducted electronically by searching the net and accessing clinical database search engines such as the NEJM, CINAHL, PubMed, MEDLINE, and UpToDate.
- Articles were selected for inclusion based on the following three criteria. (1) The article had to be a randomized controlled trial or clinical research study, and not a peer-review article. (2) The article had to be relevant to the clinical question and contained information that can be used to answer the proposed question.
- The research of literature had some significant limitations that had an impact on the result, findings and the concluded recommendations.
- The number of studies included in this research may not be an adequate reflection of the most common spinal stenosis causes and treatment.
- The limitation of full-text studies available, the lack of availability of randomized controlled trials in the past 10 years on the topic discussed also impacted the study.

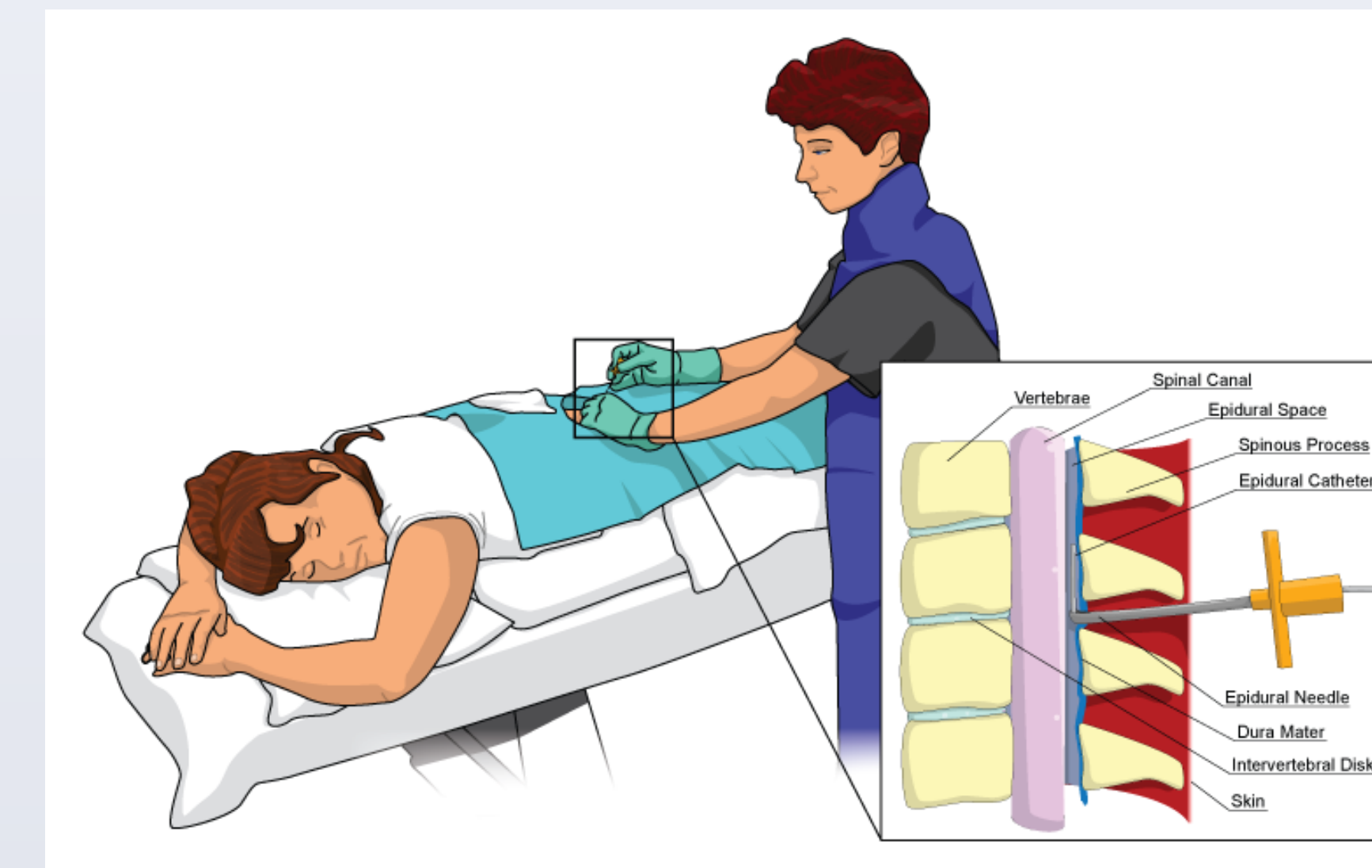
#### Summary of the Literature

##### Weinstein et al., (2008)

- This study evaluated the effectiveness of surgical decompression treatment for spinal stenosis with nonsurgical treatment.
- Despite the high level of non-adherence, this study found that patients who had surgical treatments had a better outcome than the patients that were treated non-surgically.

##### Friedly et al., (2014)

- This double-blind study of 400 patients who had lumbar central spinal stenosis with moderate-to-severe leg pain, and disability whom were randomly assigned to receive epidural injections of glucocorticoids mixed with lidocaine or lidocaine injection alone.
- The epidural injection of steroid and lidocaine provided "minimal or no short-term benefit as compared with epidural injection of lidocaine alone" (Friedly, et al., 2014).

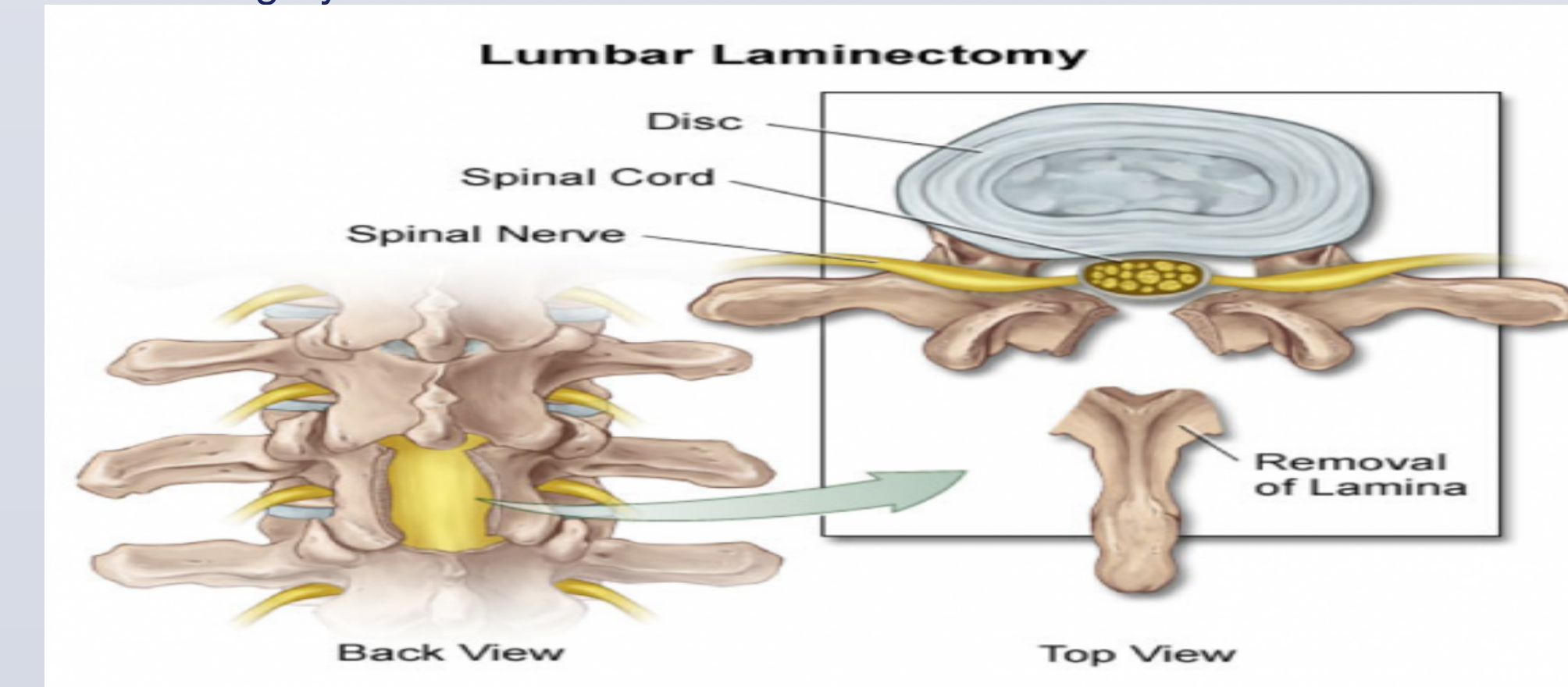


##### Försth et al., (2016)

- This study evaluated the efficacy of fusion surgery in addition to decompression surgery in 247 patients who have lumbar spinal stenosis, with or without degenerative spondylolisthesis.
- No significant difference was found between the two groups in the study. However the fusion group had longer operating time, more blood loss, longer hospitalization time, and higher surgical costs.

##### Ghogawala et al., (2016)

- This study also performed a randomized controlled trial to compare the spinal stenosis treatment of either decompressive laminectomy alone and lumbar spinal fusion with the decompressive laminectomy.
- The fusion group had a higher SF-36 score at 2, 3 & 4 years after surgery than did in the decompression-alone group. However, the Oswestry Disability Index scores did not differ significantly between the study groups at 2 years after surgery.



##### Peul et al., (2007)

- performed a randomized study that included 283 patients who had had 6 to 12 weeks of severe sciatica pain to have either a surgery treatment or to have a prolonged conservative treatment with an option for surgery.
- The patient that received early surgery reported faster recovery and reduction in pain. However, There was no significant overall difference in disability scores during the first year in both groups.

##### Weinstein et al., (2007)

- A nonrandomized controlled trials study on patients with symptoms of degenerative spondylolisthesis that was confirmed by imaging.
- The study was designed to evaluate the management of degenerative spondylolisthesis with spinal stenosis by comparing the effectiveness of surgical treatment with that of nonsurgical treatment.
- The study found that the surgical treatment of decompressive laminectomy to treat degenerative spondylolisthesis and spinal stenosis, had substantially greater improvement in pain and function over 2 year period when compared to nonsurgical treatment.

##### Bao, et al., (2019)

- performed a study that included 55 patients who had symptomatic lumbar stenosis to undergo a surgical treatment using a percutaneous transforaminal endoscopic discectomy (PTED) and foraminoplasty techniques.
- The study result of the PTED and foraminoplasty technique can be a safe and effective minimally invasive therapeutic surgical option for patients with lumbar stenosis.

#### CONCLUSIONS

- Spinal stenosis can cause significant pain, discomfort and functional limitations and adequate treatment for it is very important to restore optimal functionality and reduce pain.
- Due to the different causes of spinal stenosis, it is hard to find a generalized treatment that would be suitable for every patient with such a condition.
- The discussed articles make it clear that more studies are needed to reach a better conclusion of the best treatment option for each condition.
- The discussed literature suggests that patients should not rush to surgery when possible.
- Patients with spinal stenosis should try none surgical and least invasive treatment to reduce their symptoms before considering surgical treatment.
- Patients should educate themselves about their condition and learn and understand the risk of the treatment they receive.

#### RECOMMENDATIONS

- The first and the most important recommendation for the practice is to advise patients not to rush to surgery as was noted in the Peul et al., (2007), unless nerve damage can be caused if surgery is not done promptly.
- Patients with spinal stenosis should be encouraged to educate themselves on their condition and to seek a second opinion on the best treatment option for their condition.
- Patients should be advised to try the least invasive treatment first before considering more invasive treatment. As indicated in the Schneider, et al., (2019) study showed that the manual therapy/ individualized exercise had greater improvement of symptoms and physical function than the other two groups that had self excises or medical treatment.
- The epidural steroid injection is considered less invasive compared to surgical intervention. Despite the fact that Epidural steroid injection is less invasive when compared to surgical intervention, it can have serious risks such as infection or even death is that was discussed by the Smith, et al., (2013) investigation.
- Surgical intervention may be recommended if the other none or less invasive treatments were not successful.
- In patients that have spinal stenosis caused by spondylolisthesis or tumor, surgical intervention may be a good option to restore the alignment of the spine, reduce their pain, and improve their function.

#### REFERENCES

- Ammendolia, C., Côté, P., Southerst, D., Schneider, M., Budgell, B., Bombardier, C., Rampersaud, Y. R. (2018). Comprehensive Nonsurgical Treatment Versus Self-directed Care to Improve Walking Ability in Lumbar Spinal Stenosis: A Randomized Trial. Archives of Physical Medicine and Rehabilitation, 99 (12). doi: 10.1016/j.apmr.2018.05.014
- Bao, B. X., Zhou, J. W., Yu, P. F., Chi, C., Qiang, H., & Yan, H. (2019). Transforaminal Endoscopic Discectomy and Foraminoplasty for Treating Central Lumbar Stenosis. Orthopaedic Surgery. doi: 10.1111/os.12559
- Friedly, J. L., Comstock, B. A., Turner, J. A., Heagerty, P. J., Deyo, R. A., Sullivan, S. D., ... Jarvik, J. G. (2014). A Randomized Trial of Epidural Glucocorticoid Injections for Spinal Stenosis. New England Journal of Medicine, 371 (1), 11–21. doi: 10.1056/nejmoa1313265
- Försth, P., Ölafsson, G., Carlsson, T., Frost, A., Borgström, F., Fritzell, P., ... Sandén, B. (2016). A Randomized, Controlled Trial of Fusion Surgery for Lumbar Spinal Stenosis. New England Journal of Medicine , 374 (15), 1413–1423. doi: 10.1056/nejmoa1513721
- Ghogawala, Z., Dziura, J., Butler, W. E., Dai, F., Terrin, N., Magge, S. N., ... Benzell, E. C. (2016). Laminectomy plus Fusion versus Laminectomy Alone for Lumbar Spondylolisthesis. New England Journal of Medicine , 374 (15), 1424–1434. doi: 10.1056/nejmoa1508788
- Peul, W. C., Houwelingen, H. C. V., Hout, W. B. V. D., Brand, R., Eekhof, J. A., Tans, J. T., ... 20 EFFECTIVE TREATMENT OF SPINAL STENOSIS IN ADULT PATIENTS: Koes, B. W. (2007). Surgery versus Prolonged Conservative Treatment for Sciatica. New England Journal of Medicine, 356(22), 2245–2256. doi: 10.1056/nejmoa064039
- Ropper, A. H., & Zafonte, R. D. (2015). Sciatica. New England Journal of Medicine, 372(13), 1240–1248. doi: 10.1056/nejma1410151
- Schneider, M. J., Ammendolia, C., Murphy, D. R., Glick, R. M., Hile, E., Tudorascu, D. L., ... Piva, S. R. (2019). Comparative Clinical Effectiveness of Nonsurgical Treatment Methods in Patients With Lumbar Spinal Stenosis: A Randomized Clinical Trial. JAMA network open, 2 (1), e186828. doi: 10.1001/jamanetworkopen.2018.6828
- Smith, R. M., Schaefer, M. K., Kainer, M. A., Wise, M., Finks, J., Duwve, J., ... Park, B. J. (2013). Fungal Infections Associated with Contaminated Methylprednisolone Injections. New England Journal of Medicine , 369 (17), 1598–1609. doi: 10.1056/nejmoa1213978
- Spinal stenosis. (2018, March 8). Retrieved January 28, 2020, from https://www.mayoclinic.org/diseases-conditions/spinal-stenosis/symptoms-causes/syc-20352961
- Vertebral Column. (n.d.). Retrieved January 28, 2020, from https://www.sciencedirect.com/topics/neuroscience/vertebral-column