

Retrospective Review

Endoscopic Spine Surgery: Distance Patients Will Travel for Minimally Invasive Spine Surgery

Albert Edward Telfeian, MD, PhD, Menno Ipreburg, MD, and Ralf Wagner, MD

From: Brown University,
Providence, RI

Address Correspondence:
Albert E. Telfeian, MD, PhD
Brown University
Rhode Island Hospital
Dept. of Neurosurgery
593 Eddy Street
Providence, RI 02903
E-mail: atelfeian@lifespan.org

Disclaimer: There was no external funding in the preparation of this manuscript.

Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

Manuscript received:
03-28-2016

Revised manuscript received:
05-02-2016

Accepted for publication:
06-29-2016

Free full manuscript:
www.painphysicianjournal.com

Background: Transforaminal lumbar endoscopic discectomy is a minimally invasive spine surgery procedure performed principally for the treatment of lumbar herniated discs. Endoscopic spine surgeons around the world have noted how far patients will travel to undergo this minimally invasive spine surgery, but the actual distance patients travel has never been investigated.

Objective: We present here our analysis of how far patients will travel for endoscopic spine surgery by studying the referral patterns of patients to 3 centers in 3 different countries.

Study Design: Retrospective chart review of de-identified patient data was performed to analyze the distance patients travel for spine surgery.

Methods: Patient demographic data was analyzed for patients undergoing transforaminal lumbar endoscopic discectomy procedures over the same 8 month period in 2015 at centers in the United States (U.S.), Netherlands, and Germany.

Results: Travel distances for patients were determined for 327 patients. The average distance traveled for the U.S. center was 91 miles, the Dutch center was 287 miles, and the German center was 103 miles. For the U.S. center 16% of patients traveled out of state for surgery and for the European centers combined, 4% of patients traveled out of the country for surgery.

Limitations: The period of data analyzed was less than one year and the data collected was analyzed retrospectively.

Conclusions: Quality metrics in health care tend to be focused on how health care is delivered. Another health care metric that focuses more on what patients desire is presented here: how far patients will travel for innovative spine care.

Key words: Endoscopic spine surgery, transforaminal, minimally invasive, travel, lumbar disc herniation

Pain Physician 2017; 20:E145-E149

Transforaminal lumbar endoscopic discectomy is a minimally invasive surgical option for the treatment of lumbar herniated discs. The development of improved endoscopes and instruments, the increased experience of endoscopic spine surgeons, and the continued demand by patients for minimally invasive spine techniques have led to an explosion of innovation in endoscopic spine surgical techniques since the first endoscopic views of a herniated nucleus

pulposus were published by Kambin et al in 1988 (1). Published experience is available to patients and physicians on cervical approaches (2), thoracic approaches (3), and approaches to the thoracolumbar junction (4), as well as the treatment of far lateral disc herniations (5-7), reherniations (8-9), extruded discs (10-13), spondylolisthesis (14-15), radiculopathy in the setting of instrumented fusion (16), discitis (17), discogenic back pain (18), and spinal tumors (19-20).

Centers that offer the most efficient, effective, or innovative health care solutions often attract patients from outside their local catchment area. Quality measures in health care are developed to give us means to compare institutions and processes in the delivery and outcomes in health care. The metrics measured are often related to achieving the goals of effective, safe, efficient, and patient-centered care. One unique perspective on measuring the quality of health care delivery is observing the distances patients will travel for specialty care. Here we investigate the distances patients will travel for minimally invasive, awake, endoscopic spine surgery for the treatment of lumbar disc disease. The data from 3 centers in the United States, the Netherlands, and Germany is presented.

METHODS

Patient de-identified demographic data from 8 consecutive months in 2015 were examined from 3 international centers performing endoscopic spine surgery in awake patients. All surgeries were performed as outpatient procedures under local analgesia and intravenous sedation. The Joimax TESSYS endoscopic system was used for the procedure. Percutaneous entry was established entering through the skin 8–14 cm lateral to the midline depending on patient anatomy and disc level treated. Using intermittent fluoroscopic guidance, alternating between lateral and anterior-posterior (AP) view, a 25 cm 18 gauge needle was advanced and placed in the disc space through Kambin's triangle, between the exiting and traversing nerves. Sequential reamers and drills were used to enlarge the neural foramen by removing the ventral aspect of the superior facet. A 7.5 mm outer diameter beveled cannula was then docked in the foramen and the discectomy was performed through a working channel endoscope using straight, up going, and bendable graspers with the

disc and nerve roots directly visualized through the high definition endoscopic camera.

RESULTS

Rhode Island, United States

The city of Providence is the capitol of the state of Rhode Island and the surgeries studied were performed at Rhode Island Hospital, the principal teaching hospital of the Warren Alpert School of Medicine at Brown University. Rhode Island is unique in that it is the smallest state in the United States. Other major Ivy League medical centers are only 50 (Harvard) and 102 miles (Yale) away, so patients have considerable options for choosing where they go for specialized surgical care. A total of 77 patients underwent endoscopic lumbar spine surgeries in the 8 month period in 2015 at the Rhode Island center. Twelve (16%) came from out of state. The average distance patients traveled was 91 miles. Table 1, Fig. 1A, and Fig. 2 demonstrate the geographic data for Rhode Island. Rhode Island residents who underwent surgery traveled on average 30 miles while out of state residents traveled on average 416 miles.

Veenhuizen, Netherlands

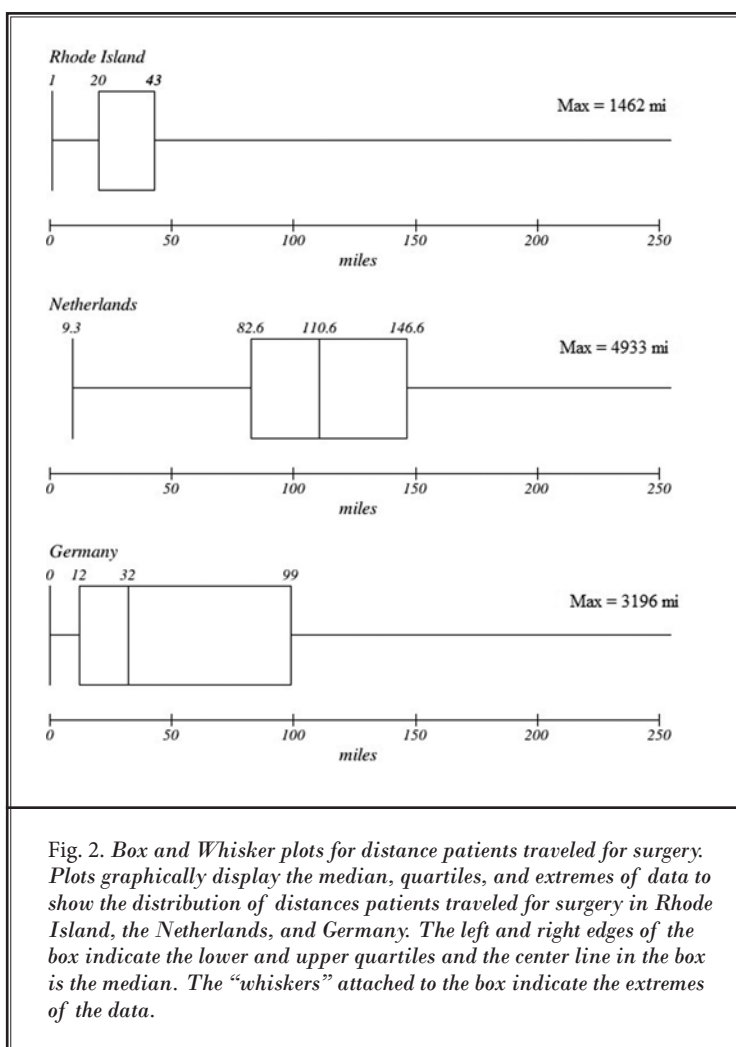
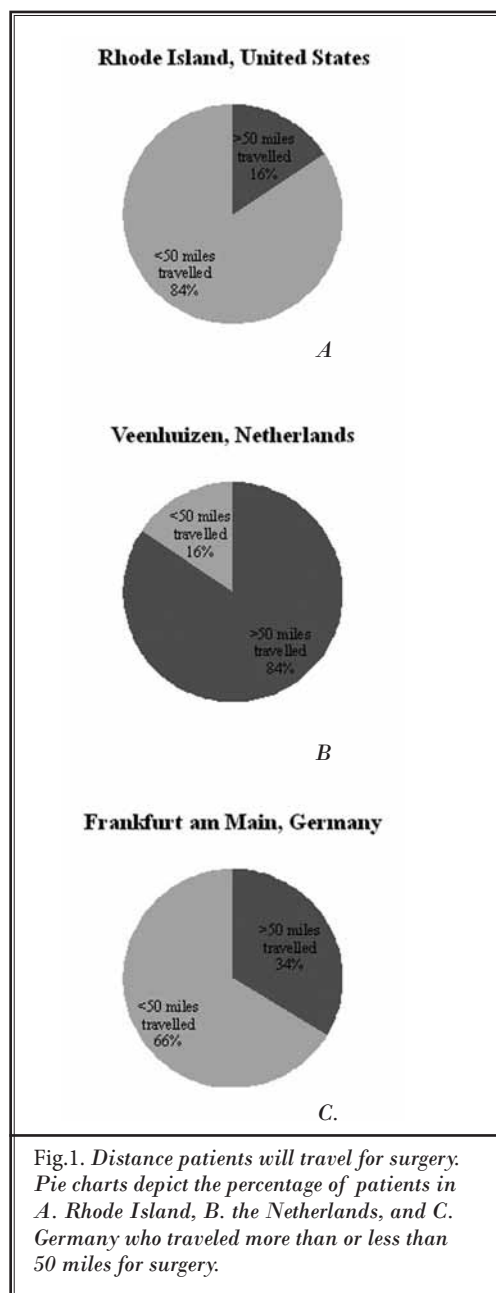
Veenhuizen is a village with approximately 800 inhabitants in the province of Drenthe in the northern part of the Netherlands. It is 95 miles from Amsterdam. The orthopedic surgeon Menno Ipreburg has a private clinic there. He has performed over 2,000 endoscopic lumbar spine surgeries. In the 8 month period in 2015 he performed 122 endoscopic lumbar discectomies. Seven (6%) came from outside of the Netherlands. The average distance patients traveled was 287 miles. Table 2, Fig. 1B, and Fig. 2 demonstrate the geographic data for the Veenhuizen site. Residents of the Netherlands

Table 1. *Rhode Island, United States.*

	Number of Patients	Miles traveled (Average +/- Standard Deviation)
All Patients	77	91 ± 246
Rhode Island Patients	65 (84%)	30 ± 16
Out of State Patients	12 (16%)	416 ± 529

Table 2. *Veenhuizen, Netherlands.*

	Number of Patients (%)	Miles traveled (Average +/- Standard Deviation)
All Patients	122	287 +/- 859
Netherlands Patients	115 (94%)	107 +/- 50
International Patients	7 (6%)	3275 +/- 1975



There are many distinguished university medical centers within close proximity in the region. The orthopedic surgeon Ralf Wagner has a private clinic in Frankfurt. In the 8 month period in 2015 he performed 128 endoscopic lumbar discectomies. Three patients (2%) came from outside of Germany for surgery. The average distance traveled was 103 miles. Table 3, Fig. 1C, and Fig. 2 demonstrate the geographic data for the Frankfurt site. Residents of Germany who underwent surgery traveled on average 55 miles (n = 125). German patients not from the city of Frankfurt (n = 108) traveled 63 miles on average. International patients traveled 2,075 miles on average for surgery.

DISCUSSION

Minimally invasive endoscopic spine surgery offers patients the advantage of an awake outpatient surgical treatment for lumbar disc herniation through an endoscopic cannula the di-

Table 3. *Frankfurt am Main, Germany.*

	Number of Patients (%)	Miles traveled (Average +/- Standard Deviation)
All Patients	128	103 +/- 362
German Patients	125 (98%)	55 +/- 63
All Non-locals (Patients residing outside of Frankfurt)	111 (87%)	118 +/- 386
German Non-Locals (German Patients residing outside of Frankfurt)	108 (84%)	63 +/- 63
International Patients	3 (2%)	2075 +/- 1179

imeter of a number 2 pencil. Health care delivery in the United States is, for the most part, based on local (most primary care) and regional (primary and specialty care) models. The geographic data presented here provides 1) a means to evaluate the distances patients will travel for specialized elective surgical treatment, 2) an opportunity to compare how far patients will travel for specialty spine surgical care in the U.S. and Europe, and 3) an answer to the question of whether patients will overstep even large university health care systems in seeking out what they perceive to be the most minimally invasive spine surgical options.

One study in the *British Medical Journal* in 1990 surveyed 116 patients in the British National Health System about the acceptability of traveling a distance for elective surgery versus waiting for local care (21). Patients were waiting an average of 28 months for surgery. The study points out that many assumptions have been made about patients' attitudes toward traveling for routine elective surgery but there is little researched material. A large portion of patients preferred to travel than wait for surgery: 39% would travel rather than wait one month, 53% would travel rather than wait 3 months, and 91% would travel rather than wait 12 months. Of the patients surveyed, 90% would travel 50 miles and 60% would travel 300 miles.

There certainly are many significant reasons that make local specialty surgical care preferable to patients: cost, convenience, and dealing with complications would certainly top the list. Patients who leave local insurance networks often pay additional costs in the U.S. Travel expenses involved in leaving local areas for care are a burden. Complications after surgery are

more easily dealt with if the surgical provider is local. In the case of lumbar discectomy surgery, the reherniation rate is as high as 5% – 15% and additional physician visits or surgeries become more burdensome the further the distance the patient has to travel (22-23).

The transforaminal lumbar endoscopic discectomy procedure is not very well known in the US. The popularity of the procedure is greater outside the U.S., especially in Europe and Asia. Worldwide roughly 2,800 physicians have been trained in TESSYS surgery, and TESSYS surgical procedures are actively performed in about 700 centers. Patients presented in the data from the U.S. center and German center were patients who used health insurance to pay for their procedures. There did not seem to be a bias in the data on patients seeking out a less expensive minimally invasive spine surgery procedure.

In the data presented here, the surgeon (Dutch) with the greatest experience in endoscopic spine surgery had the patients who traveled the furthest. The most striking feature in regards to the European data was that patients were obviously bypassing multiple academic medical centers with full spectrum orthopedic and neurosurgical spine care to be treated in private clinics for their disc pathology. For the U.S. data, it was interesting that many patients chose to travel further for surgical care in Rhode Island than be treated at another Ivy League medical center nearer their homes. In conclusion, distance patients are willing to travel for elective spine surgical care may be a quality metric that reflects the broader spectrum of quality and reminds health care providers that in the end what we provide may not be as important as what the patient wants.

REFERENCES

1. Kambin P, Nixon JE, Chait A, Schaffer JL. Annular protrusion: Pathophysiology and roentgenographic appearance. *Spine (Phila Pa 1976)* 1988; 13:671-675.
2. Yang JS, Chu L, Chen L, Chen F, Ke ZY, Deng ZL. Anterior or posterior approach of full-endoscopic cervical discectomy for cervical intervertebral disc herniation? A comparative cohort study. *Spine (Phila Pa 1976)* 2014; 39:1743-1750.
3. Choi KY, Eun SS, Lee SH, Lee HY. Percutaneous endoscopic thoracic discectomy; transforaminal approach. *Minim Invasive Neurosurg* 2010; 53:25-28.
4. Ahn Y, Lee SH, Lee JH, Kim JU, Liu WC. Transforaminal percutaneous endoscopic lumbar discectomy for upper lumbar disc herniation: Clinical outcome, prognostic factors, and technical consideration. *Acta Neurochir (Wien)* 2009; 151:199-206.
5. Jang JS, An SH, Lee SH. Transforaminal percutaneous endoscopic discectomy in the treatment of foraminal and extraforaminal lumbar disc herniations. *J Spinal Disord Tech* 2006; 19:338-343.
6. Lew SM, Mehalic TF, Fagone KL. Transforaminal percutaneous endoscopic discectomy in the treatment of far-lateral and foraminal lumbar disc herniations. *J Neurosurg* 2001; 94:216-220.
7. Liao Z, Chen W, Wang CH. Transforaminal percutaneous endoscopic surgery for far lateral lumbar intervertebral disk herniation. *Orthopedics* 2014; 37:e717-e727.
8. Hoogland T, van den Brekel-Dijkstra K, Schubert M, Miklitz B. Endoscopic transforaminal discectomy for recurrent lumbar disc herniation: A prospective, cohort evaluation of 262 consecutive cases. *Spine (Phila Pa 1976)* 2008; 33:973-978.
9. Ruetten S, Komp M, Merk H, Godolias G. Recurrent lumbar disc herniation after conventional discectomy: A prospective, randomized study comparing full-endoscopic interlaminar and transforaminal versus microsurgical revision. *J Spinal Disord Tech* 2009; 22:122-129.
10. Choi G, Lee SH, Lokhande P, Kong BJ, Shim CS, Jung B, Kim JS. Percutaneous endoscopic approach for highly migrated intracanal disc herniations by foraminoplasty technique using rigid working channel endoscope. *Spine (Phila Pa 1976)* 2008; 33:E508-E515.
11. Jasper GP, Francisco GM, Telfeian AE. Endoscopic transforaminal discectomy for an extruded lumbar disc herniation. *Pain Physician* 2013; 16:E31-E35.
12. Tsou PM, Yeung AT. Transforaminal endoscopic decompression for radiculopathy secondary to intracanal noncontained lumbar disc herniations: Outcome and technique. *Spine* 2002; J 2:41-48.
13. Yeom KS, Choi YS. Full endoscopic contralateral transforaminal discectomy for distally migrated lumbar disc herniation. *J Orthop Sci* 2011; 16:263-269.
14. Jasper GP, Francisco GM, Aghion D, Telfeian AE. Technical considerations in transforaminal endoscopic discectomy with foraminoplasty for the treatment of spondylolisthesis: Case report. *Clin Neurol Neurosurg* 2014; 119:84-87.
15. Jasper GP, Francisco GM, Telfeian AE. Transforaminal endoscopic discectomy with foraminoplasty for the treatment of spondylolisthesis. *Pain Physician* 2014; 17:E703-E708.
16. Telfeian AE, Jasper GP, Francisco GM. Transforaminal endoscopic treatment of lumbar radiculopathy after instrumented lumbar spine fusion. *Pain Physician* 2015; 18:179-184.
17. Ito M, Abumi K, Kotani Y, Kadoya K, Minami A. Clinical outcome of posterolateral endoscopic surgery for pyogenic spondylodiscitis: Results of 15 patients with serious comorbid conditions. *Spine (Phila Pa 1976)* 2007; 32:200-206.
18. Tsou PM, Yeung CA, Yeung AT. Posterolateral transforaminal selective endoscopic discectomy and thermal annuloplasty for chronic lumbar discogenic pain: A minimal access visualized intradiscal surgical procedure. *Spine J* 2004; 4:564-573.
19. Joo YC, Ok WK, Baik SH, Kim HJ, Kwon OS, Kim KH. Removal of a vertebral metastatic tumor compressing the spinal nerve roots via a single-port, transforaminal, endoscopic approach under monitored anesthesia care. *Pain Physician* 2012; 15:297-302.
20. Telfeian AE, Choi DB, Aghion DM. Transforaminal endoscopic surgery under local analgesia for ventral epidural thoracic spinal tumor: Case report. *Clin Neurol Neurosurg* 2015; 134:1-3.
21. Howell GP, Richardson D, Forester A, Sibson J, Ryan JM, Morgans BT. Long distance travel for routine elective surgery: Questionnaire survey of patients' attitudes. *Br Med J* 1990; 300:1171-1173.
22. Lee JK. Recurrent lumbar disk herniation. *J Am Acad Orthop Surg* 2010; 18:327-337.
23. Suk KS, Lee HM, Moon SH, Kim NH. Recurrent lumbar disc herniation: Results of operative management. *Spine* 2001; 26:672-676.

