Original Study

Survey of lumbar discectomy practices: 10 years in the making

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Background: Lumbar discectomy is a common spinal procedure. The purpose of this survey is to ascertain neurosurgeons' practices in the surgical management of one-level lumbar discectomies in the Canadian adult population and to determine changes over a 10-year period.

Methods: One-page questionnaire distributed electronically to neurosurgeons in Canada and results were compared with similarly completed survey from 2007.

Results: A total of 109 completed surveys were returned representing 43.8% response rate. This is compared to 112 completed surveys in 2007 reaching 64.4% response rate. Statistically significant differences between the two points in time were noted. There was an increase in spine fellowship training [26 (33.3%) 2017 *vs.* 15 (15.3%) 2007 (P=0.007)], use of pre-operative magnetic resonance imaging (MRI) [65 (83.3%) 2017 *vs.* 27 (27.6%) 2007] (P<0.001), use of intramuscular injection [58 (74.4%) 2017 *vs.* 43 (43.9%) 2007 (P<0.001)], use of both microscope and loupes [20 (25.6%) 2017 *vs.* 3 (3.1%) 2007 (P<0.001)], use of tubular retraction [26 (33.3%) 2017 *vs.* 12 (12.2%) 2007 (P=0.001)], use of fibrin glue for a durotomy [72 (92.3%) 2017 *vs.* 75 (76.5%) 2007 (P=0.007)]. There was an increased rate of same-day discharge in 2017 [46 (59.0%) *vs.* 18 (18.4%) 2007 (P<0.001)], and quicker return to work [62.8% in 6 weeks or less *vs.* 39.7% (P=0.003)]. No statistical differences were noted with pre-incision localization, pre-op antibiotics, pre-incision local anesthetic use, use of fat graft or epidural steroids. In either survey the majority would not perform lumbar discectomy on a patient whose primary complaint is back pain.

Conclusions: Our survey identified changes in practice patterns amongst Canadian neurosurgeons with respect to performing one-level lumbar discectomy over the past 10 years. These changes include increased preference for minimally invasive surgical technique, same-day discharge and sooner return to work. Randomized trials would be helpful to provide evidence regarding which practices are associated with better outcomes.

Keywords: Lumbar; discectomy; herniation, survey

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Introduction

Lumbar discectomy is a common neurosurgical procedure. Nearly 300,000 operations are performed annually in the USA (1). The North American Spine Society (NASS) has provided grade B recommendation that earlier surgery (within 6 months to 1 year) is associated with faster recovery and improved long-term outcomes (2). The SPORT trial indicated that surgery for lumbar disc herniation provides superior long-term results in comparison to conservative treatment (3). Variability exists among neurosurgeons in pre-, intra- and post-operative management strategies

with lumbar discectomy. In 2007, the authors A Cenic and E Kachur conducted a questionnaire survey to measure differences in practice between neurosurgeons in Canada (4). We repeated the survey conducted in 2007 to assess and compare changes in practice patterns among neurosurgeons in Canada over 10-year period. We present the following survey in accordance with the SURGE reporting checklist (available at: http://dx.doi.org/10.21037/jss-20-519).

Methods

This study design was a cross-sectional survey of neurosurgeons in Canada. A 17-item questionnaire was distributed electronically to neurosurgeons practicing in Canada using the REDCap online platform. This 17-item questionnaire was created, tested and used in 2007. A list of certified neurosurgeons was obtained from the Royal College of Physicians and Surgeons of Canada. Contact information, e-mail addresses and fax numbers for the neurosurgeons was collected from previously existing distribution lists and publicly accessible websites, particularly neurosurgical department websites from academic institutions. Contact information for 249 neurosurgeons practicing in Canada was identified. Survey invitations were sent out electronically by A Martyniuk and E Kachur with several electronic reminders. For those who did not respond, or no e-mail address was identified, an invitation was faxed. No incentives (financial or other) were offered to neurosurgeons who received the survey. The research was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Research ethics approval was not required as per our institutional research ethics board. Participants have completed and submitted the survey implied consent.

The following questions were included in the survey:

(I) Number of years in practice?
(II) Do you perform Lumbar Discectomy(s) in your practice?
(III) Is your practice predominantly: adult, pediatric or both?
(IV) Do you have a spine fellowship?
(V) Do you use pre-incision localizing plain film X-ray?
(VI) What is your favorite preoperative imaging?
(VII) Do you use preoperative antibiotics?
(VIII) Do you use pre-incision local anesthetic injection?
(IX) Intramuscular local anesthetic injection prior to closure?
(X) What is your magnification preference?
(XI) Do you use tubular retractors (e.g., METRx® system, Sofamor-Danek, Memphis, TN, USA)?
(XII) For dural tears, do you use fibrin glue (e.g., Tisseel®, Baxter, Deerfield, IL, USA)?
(XIII) Prior to closure, do you use fat graft?
(XIV) Do you use epidural steroids prior to closure?
(XV) If there are no complications, when do you discharge from hospital?
(XVI) If patient's job requires physical labour, when do you recommend a post-operative return to work?
(XVII) Would you operate on a patient whose major complaint is back pain?

Descriptive statistics were reported using counts and percentages. Group differences in response rates for each question were assessed using Chi-square Goodness-of-fit test assuming no difference in response between the categories. Differences in responses between the two surveys (2017 and 2007) were assessed using Chi-square or Fisher's exact test. The statistical significance was achieved with a P value ≤ 0.05. SPSS statistical software version 25 (www.IBM.com) was used for analysis.

Results

Of the 249 Canadian neurosurgeons invited to participate in the survey, 109 responded, resulting in a 43.8% response rate. This was lower than the 64.4% response rate in 2007 (112 responses from 174 potential participants). Of the 109 respondents, 83 (76.1%) reported their predominant neurosurgical practice group (adult and/or pediatric). The analysis included only 78 responses that indicated their practice was adult only [76] or both adult and pediatric [2], compared to 98 in 2007. All 78 participants in 2017 performed lumbar discectomy in their practice, in comparison to 87.8% in 2007 (P=0.002). There was a significant increase in the number of neurosurgeons that had a spine fellowship in 2017 from 2007 (33.3% in 2017 *vs.* 15.3% in 2007; P=0.007). The average number of years of practice for the 2017 participants was 14.7 years. *Table 1* demonstrates the demographics of the respondents. *Table 2* demonstrates the results of the 2017 survey and *Table 3* shows a comparison of the 2007 and 2017 surveys.

Imaging

There was a significant difference in regards to the radiological modality of choice in 2017 for pre-operative diagnosis and planning, 83.3% preferred magnetic

Table 1 Demographics of the respondents

Demographics	2017 survey (N=78), n (%)	2007 survey (N=98), n (%)	P value
Perform lumber discectomy	78 (100.0)	86 (87.8)	0.002
Mean years of practice (SD)	14.7 (10.0)	N/A	–
Spine fellowship	26 (33.3)	15 (15.3)	0.007

SD, standard deviation.

Table 2 Responses to 2017 survey

Questions	2017 survey (N=78), n (%)	P value
1. Do you use pre-incision localizing plain film X-ray?		
Yes	52 (66.7)	0.004
No	26 (33.3)	
2. Is your predominant pre-operation imaging		
MRI	65 (83.3)	<0.001
CT	0 (0)	
Both	13 (16.7)	
Either	0 (0)	
3. Do you use pre-operative antibiotics?		
Yes	77 (98.7)	<0.001
No	1 (1.3)	
4. Do you use pre-incision local anaesthetic?		
Yes	54 (69.2)	<0.001
No	24 (30.8)	
5. Do you use intramuscular local anaesthetic injection?		
Yes	58 (74.4)	<0.001
No	20 (25.6)	
6. Your magnification preference is:		
Loupes	8 (10.3)	<0.001
Microscope	50 (64.1)	
Both	20 (25.6)	
7. Do you use tubular retractors?		
Yes	26 (33.3)	0.003
No	52 (66.7)	
8. For dural tears, do you use fibrin glue?		
Yes	72 (92.3)	<0.001
No	6 (7.7)	
9. Prior to closure do you use fat graft?		
Yes	14 (17.9)	<0.001
No	64 (82.1)	
10. Do you use epidural steroids prior to closure?		
Yes	38 (48.7)	0.821
No	40 (51.3)	
11. If there are no complications, when do you discharge from hospital:		
Same day	46 (59.0)	<0.001
Next day	30 (38.5)	
2 days or more days	2 (2.6)	
12. If patients job requires physical labour, when do you recommend a post-operative return to work (in weeks)?		
2 weeks	0 (0)	<0.001
4 weeks	6 (7.7)	
6 weeks	43 (55.1)	
More than 6 weeks	29 (37.2)	
13. Would you operate on a patient whose major complain is back pain?		
Yes	8 (10.3)	<0.001
No	70 (89.7)	

Table 3 Comparison of change in practice between responses to 2017 survey and 2007 survey

Questions	2017 survey, n (%)	2007 survey, n (%)	P value
1. Do you use pre-incision localizing plain film X-ray?			
Yes	52 (66.7)	56 (57.1)	0.281
No	26 (33.3)	42 (42.9)	
2. What Is your predominant pre-operation imaging			
MRI	65 (83.3)	27 (27.6)	<0.0001
CT	0 (0)	15 (15.3)	
Both	13 (16.7)	43 (43.9)	
Either	0 (0)	13 (13.3)	
3. Do you use preoperative antibiotics?			
Yes	77 (98.7)	90 (91.8)	0.045
No	1 (1.3)	8 (8.2)	
4. Do you use pre-incision local anesthetic?			
No	24 (30.8)	39 (39.8)	0.345
Yes	54 (69.2)	59 (60.2)	
5. Do you use intramuscular local anaesthetic injection?			
Yes	58 (74.4)	43 (43.9)	<0.001
No	20 (25.6)	55 (56.1)	
6. Your magnification preference is:			
Loupes	8 (10.3)	19 (19.4)	<0.001
Microscope	50 (64.1)	68 (69.4)	
Both	20 (25.6)	3 (3.1)	
Neither	0 (0)	8 (8.2)	
7. Do you use tubular retractors?			
Yes	26 (33.3)	12 (12.2)	0.001
No	52 (66.7)	86 (87.8)	
8. For dural tears, do you use fibrin glue?			
Yes	72 (92.3)	75 (76.5)	0.007
No	6 (7.7)	23 (23.5)	
9. Prior to closure do you use fat graft?			
Yes	14 (17.9)	26 (26.5)	0.207
No	64 (82.1)	71 (72.4)	
Depends/sometime	0 (0)	1 (1.0)	
10. Do you use epidural steroids prior to closure?			
Yes	38 (48.7)	60 (61.2)	0.127
No	40 (51.3)	36 (36.7)	
Depends/sometime	0 (0)	2 (2.0)	
11. If there are no complications, when do you discharge from hospital:			
Same day	46 (59.0)	18 (18.4)	<0.001
Next day	30 (38.5)	57 (58.2)	
2 days or more days	2 (2.6)	23 (24.5)	
12. If patients job requires physical labour, when do you recommend a post-operative return to work (in weeks)?			
2 weeks	0 (0)	2 (2.0)	0.003
4 weeks	6 (7.7)	2 (2.0)	
6 weeks	43 (55.1)	35 (35.7)	
More than 6 weeks	29 (37.2)	59 (60.2)	
13. Would you operate on a patient whose major complain is back pain?			
Yes	8 (10.3)	7 (7.1)	0.589
No	70 (89.7)	91 (92.9)	

resonance imaging (MRI) while 16.7% used both MRI and computed tomography (CT), and no one predominantly used CT alone (P<0.001). This has significantly changed from 2007, when MRI was used predominantly by only 27.6% of surgeons, CT by 15.3%, 43.9% used both, and 13.3% used either (P<0.001). The majority of respondents (66.7%, P<0.05) used a pre-incision localization plain film X-ray, not significantly changed from the previous study (57.1%; P=0.281).

Use of intraoperative local anesthetic

Most neurosurgeons in the survey (69.2%; P<0.001) used a pre-incision local anesthetic, consistent with 60.2% in the previous survey (P=0.345). The practice of intra-muscular local anesthetic injection has significantly changed with 74.4% of the current survey respondents reporting using it, compared to only 43.9% in the 2007 study (P<0.001).

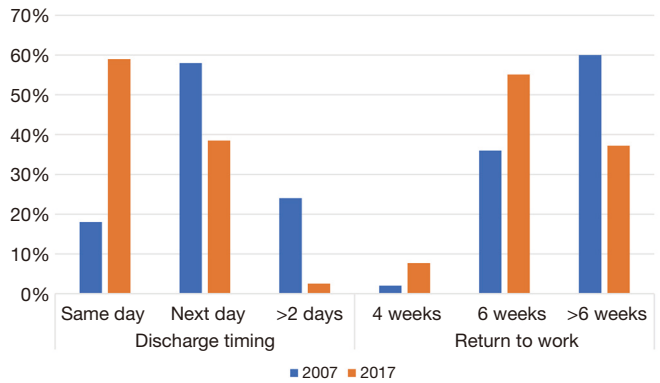

Figure 1 Changes in responses to discharge timing and return to work over one decade.

Peri-operative antibiotics

Nearly all the surgeons (98.7%, P<0.001) use pre-operative antibiotics in the 2017 survey. This has significantly increased from an already high rate in 2007 (91.8%; P<0.05).

Epidural fat and steroids

According to the current analysis, the practice of placing a fat graft over the exposed nerve root has not significantly changed over the past decade (26.5% in 2007 *vs*. 17.9% in 2017; P=0.207). Regarding the use of epidural steroids before closure, the practice continues to be split with 48.7% using them in 2017 and 61.2% in 2007 (P=0.127).

Discharge and return to work

The majority of respondents (59.0%) discharge their patient the same day of surgery, in the absence of complications, while 38.5% discharge the next day, and 2.6% discharge 2 days or later (P<0.001). This is statistically different from the previous survey where only 18.4% would discharge on the same day, 58.2% the next day, and 24.5% 2 days or later (P<0.001) (*Figure 1*). With respect to return to work, if patient's job requires physical labor, 55.1% of participants would recommend return to work in 6 weeks, 37.2% more than 6 weeks, and 7.7% in 4 weeks (P=0.001). This has significantly changed compared to the 2007 survey, when the majority of surgeons (60.2%) would recommend return to work after more than 6 weeks and only 35.7% at 6 weeks (P<0.05) (*Figure 1*).

Technical aspects

With respect to the intraoperative magnification of choice, 64.1% used microscope, 10.3% loupes, and 25.6% use both (P<0.001). This has significantly changed from the in 2007 survey where, 69.4% used microscope, 19.4% loupes, 3.1% both, and 8.2% neither (P<0.001). The use of minimally invasive tubular retractor systems (e.g., METRx®) has become more popular as shown by the current survey (33.3% yes in 2017 *vs*. 12.2% yes in 2007; P=0.001) (*Figure 2*). In case of dural tears, there is a significantly increased utility of fibrin glue (e.g., Tisseel®) as 92.3% responded yes in 2017 compared to 76.5% in 2007 (P=0.007).

Surgical indications

Most surgeons (89.7%) will not operate on patients whose major complaint is back pain (P<0.001). There has not been a significant change in this practice over the past decade (89.7% in 2017 *vs*. 92.9% in 2007, P=0.589) (*Figure 3*).

Discussion

In this study we examined the multitude of variables in the surgical management of lumbar disc herniation. The present study is the first in the literature to assess lumbar discectomy management at 2 distinct periods of time. Studies in the literature have explored individual aspects of the questions presented in our surveys. The incidence of surgical site infection (SSI) in lumbar discectomy surgery is reported as less than 1% (5). In our recent survey, nearly all respondents support the use of pre-incisional antibiotics for

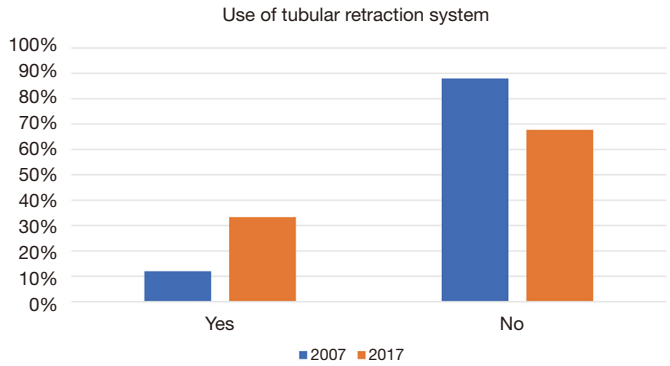

Figure 2 Changes in responses to the use of tubular retractor systems over one decade.

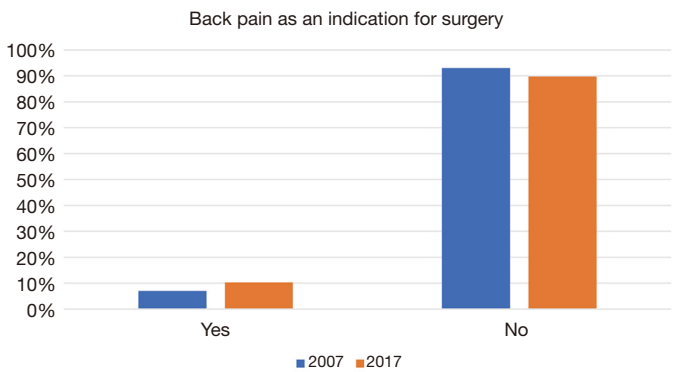

Figure 3 Changes in responses to back pain as surgical indication over one decade.

lumbar discectomy. The practice of peri-operative antibiotic prophylaxis has been recommended by the Centers for Disease Control and Prevention (CDC) guidelines to reduce SSI (6). In a retrospective study by Kanayama *et al.* including 1,597 patients, a single dose of preoperative antibiotics was found to be equally effective when compared to multiple doses (7).

Both the recent and previous survey showed that the majority of neurosurgeons in Canada are using pre-incision local anesthetic agents. A significant increase in the use of local anesthetic intra-muscularly prior to wound closure was seen in the present survey. This practice is well-described in the literature to reduce post-operative pain (8). A recent meta-analysis of 11 prospective randomized trials showed reduction in postoperative analgesic requirements, prolonged time to first analgesic demand and reduced visual analogue score (VAS) score at 1 hour post-operatively was associated with use of intra-muscular local anesthesia in lumbar spine patients, the majority of whom underwent lumbar microdiscectomy (9). A prospective, blinded, placebo-controlled study by Yörükoglu *et al.* was conducted to compare the postoperative analgesic efficacy of low-dose intrathecal and epidural morphine with paraspinal muscle infiltration of bupivacaine in lumbar discectomy patients (10). The trial showed that low-dose intrathecal and epidural morphine was associated with more post-operative pain control and lower analgesic requirements with no increase in the side effects.

MRI has been shown to be a superior test for accurately pre-operatively predicting a lumbar disc herniation *vs.* CT and CT-myelogram (11). In the recent survey, MRI was the modality of choice among the majority of neurosurgeons in Canada. There was a significant increase in the utility of MRI as the preferred pre-operative imaging modality. Wittenberg found that preoperative MRI is highly correlated with intraoperative findings of structural changes in the lumbar disc, in terms of nerve root compression by the disc and the presence of free disc sequestration or subligamentous extrusion (12).

Both of our surveys found the microscope to be

the dominant tool used in lumbar microdiscectomy. However, the recent survey found more combined usage of microscope and loupes *vs*. individual use of each in the previous survey. Kumar *et al.* found improved clinical outcomes with the use of the microscope *vs*. magnifying loupes for patients undergoing single level unilateral microdiscectomy and microdecompression (13). In the consecutive case series of 51 patients per group, microscope *vs*. loupes, patients in the microscope group had significantly improved satisfaction scores and VAS for pain, but not complication rates. In his retrospective analysis of the American College of Surgeons National Surgical Quality Improvement (ACS-NSQIP) database for elective spinal procedures, Basques *et al.* analyzed spinal procedures with and without operating microscope for the years 2011 and 2012 (14). No significant difference in 30-day infection rates occurred between the microscope and non-microscope groups. The use of microscope was associated with minor increase in total operating room time.

Bioglue or fibrin glue are both safe and effective dural sealants in non-instrumented lumbar spine surgeries (15). Jankowitz *et al.* performed a retrospective analysis of 4,835 lumbar spine procedures for a 10-year period. Five hundred and forty-seven patients (11.3%) experienced a durotomy during surgery and fibrin glue was used in approximately half of these cases (50.8%) to assist in the repair. There was no statistical difference in the post-operative cerebrospinal fluid (CSF) leak rate between cases in which fibrin glue was or was not used (16). In a survey of spinal dural repair to the Canadian Neurologic Surgical Society, Oitment *et al.* found a sealant was used in 36.7% of cases for a pin hole durotomy and up to 80% for a large size tear. The majority used Tisseel (80%) as their preferred sealant (17). Our survey demonstrated significant increase in utility of fibrin glue over the past 10 years.

Epidural fat grafts have been placed over the dural sac and nerve root following lumbar microdiscectomy in an effort to prevent chronic pain from epidural fibrosis and scar formation which may cause nerve root tethering and irritation (18). Our survey detected no significant change regarding this practice. In a study by Dobran *et al.*, lumbar microdiscectomy patients were randomized into two groups, with fat graft (N=18) and those without (N=18). No difference was shown in VAS or Oswestry Disability Index (ODI) post-operatively at 1 and 6 months (19). Our study showed a trend away from fat graft usage. It is possible that no change in the use of fat graft in our survey occurred because of the lack of evidence in the literature to support this practice.

In our survey, half the respondents are using epidural steroid in an effort to decrease post-operative pain. In a systemic review and meta-analysis of epidural steroid use in lumbar discectomy, Akinduro *et al.* found supportive evidence of decrease short term post-operative pain and narcotic use. However, there was a trend toward increased infections with epidural steroid use at 0.94% [epidural steriod (ES)] *vs*. 0.08% (no ES), P=0.10 (20). In a retrospective cohort trial of epidural steroid application to the decompressed nerve, lumbar microdiscectomy patients (N=53) showed less disability on the Roland-Morris Disability Index and health-related quality of life health survey on post-operative day 3 and at 6 weeks *vs*. matched control patients not receiving epidural steroids. However, the author noted that the group differences were lower than the commonly accepted minimally important clinical difference for each metric (21).

The recommendation to restrict activities and return to work usually vary based on the nature of the job. In the recent survey more surgeons recommended a faster return to work *vs*. the previous survey. The prevailing recommendation in the 2017 survey was to return to work at 6 weeks, instead of more than 6 weeks, as recommended in the 2007 survey. A randomized control trial suggested no difference in clinical outcome or re-herniation rate with activity restriction for 2 *vs*. 6 weeks (22). A prospective study by Carragee *et al.* of 152 patients with no post-operative activity restrictions found an average work loss of 1.2 weeks and return to full activity after 8 weeks (23). In an Australian survey addressing peri-operative management of lumbar discectomy, 52.9% of respondents would recommend lifting restriction for 4–8 weeks (24). Written post-operative instruction sheets could be helpful to avoid complications.

There is a new trend among neurosurgeons in the current survey to discharge their patient on the same day of surgery in the absence of a complication compared to the first post-operative day in 2007 study (*Figure 1*). In a survey by Zoia *et al.*, most of the respondents discharge their patients within the next 2 days postoperatively (8). The literature support early discharge in cases of good pain control and no complications, such as CSF leak (25).

Minimally invasive spinal surgery (MIS) has increased in popularity over the last decade due to its benefits in decreasing length of stay in hospital and cost associated with the procedure. Additionally, it has been shown to have lower rates of SSI (26,27). However, MIS might pose higher rate of recurrent disc herniation (28). Our survey demonstrates more neurosurgeons are using minimally invasive spine

techniques (tubular retractors) in their practice (33.3% compared to 12.2%) (*Figure 2*).

The majority of Canadian neurosurgeons in our survey do not consider back pain as an indication to perform lumbar discectomy (89.7%), not significantly different from the last survey (92.9%) (*Figure 3*). There is a common belief among neurosurgeons that lumbar discectomy is not an effective treatment to treat low back pain in the absence of sciatica. This is contrary to several studies in the literature who investigated this question. In a prospective pilot study by Chin *et al.*, patients with low back pain and sciatica with and without Modic changes were followed after lumbar discectomy. It was reported that both sciatica and low back pain have improved significantly at 6 months and 1 year follow-up in term of VAS and ODI (29).

Our survey has several limitations. Firstly, only neurosurgeons practicing in Canada were surveyed so the results are not necessarily generalizable to other countries. Secondly, the response rate was 43% therefore non-responders bias should be considered when interpreting the results of the survey. In our study, a 17-item questionnaire was used in order to ascertain practise patterns among Canadian neurosurgeons regarding the peri-operative management of lumbar microdiscectomy. We also intended to detect possible changes in practice over a period of 10 years. A trend toward earlier home discharge, sooner return to work and more utility of tubular retractor systems have been identified as changes over the past decade. Thus, having the impact of lumbar discectomy surgery lessened on a person's life. Randomized controlled trails would be helpful to provide evidences regarding which practice is associated with better outcomes and help standardize the lumbar discectomy procedure.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at http://dx.doi.org/10.21037/jss-20-519

Data Sharing Statement: Available at http://dx.doi.org/10.21037/jss-20-519

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jss-20-519). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The research was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Research ethics approval was not required as per our institutional research ethics board. Participants have completed and submitted the survey implied consent.

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