

Spine surgeons' requirements for imaging at the time of referral: a survey of Canadian spine surgeons

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Background: Routine imaging of patients with spine-related complaints referred for surgical assessment may represent an inefficient use of technological resources. Our objective was to explore Canadian spine surgeons' requirements with respect to imaging studies accompanying spine-related referrals.

Methods: We administered an 8-item survey to all 100 actively practising surgeon members of the Canadian Spine Society that inquired about demographic variables and imaging requirements for patients referred with spine-related complaints.

Results: Fifty-five spine surgeons completed our survey, for a response rate of 55%. Most respondents (43; 78%) required imaging studies to accompany all spine-related referrals. The type of imaging required was highly variable, with respondents endorsing 7 different combinations. Half (47%) required magnetic resonance imaging and 38% required plain radiographs either alone or in combination with other forms of imaging. Half of the respondents refused to see 20% or more of all patients referred for spine-related complaints.

Conclusion: Most Canadian spine surgeons require imaging studies to accompany spine-related referrals; however, the type and combination of studies is highly variable, and many patients who are referred are never seen (for a consultation). Standardization and optimization of imaging practices for patients with spine-related complaints referred for surgical assessment may be an important area for cost savings.

Contexte : Le recours systématique aux épreuves d'imagerie chez les patients qui se plaignent de maux de dos et qui sont référés pour consultation en chirurgie pourrait constituer une utilisation inefficace des ressources technologiques. Notre objectif était d'analyser les épreuves d'imagerie demandées par les chirurgiens canadiens spécialistes de la colonne vertébrale, suite aux demandes de consultation qui leur sont adressées pour des patients qui ont des problèmes de colonne vertébrale.

Méthodes : Nous avons administré un sondage en 8 questions aux 100 chirurgiens en pratique active qui forment la Canadian Spine Society; le questionnaire portait sur des variables démographiques et sur les demandes d'épreuves d'imagerie pour les patients qui leur sont référés pour des maux de dos.

Résultats : Cinquante-cinq chirurgiens de la colonne ont répondu à notre sondage, pour un taux de réponse de 55 %. La plupart des répondants (43; 78 %) ont dit demander des épreuves d'imagerie pour toutes les références qui leur sont adressées pour des problèmes de colonne vertébrale. Les types d'épreuves d'imagerie demandés variaient considérablement et les répondants ont mentionné 7 combinaisons d'épreuves différentes. La moitié d'entre eux (47 %) demandaient une imagerie par résonance magnétique et 38 % demandaient des radiographies ordinaires, seules ou combinées à d'autres modalités d'imagerie. La moitié des répondants ont dit refuser de voir 20 % ou plus de tous les patients qui leur étaient référés pour des maux de dos.

Conclusion : La plupart des chirurgiens spécialistes de la colonne vertébrale au Canada demandent des épreuves d'imagerie pour tous les patients qui leur sont référés pour des problèmes de colonne vertébrale; toutefois, les types d'épreuves et leurs combinaisons sont très variables et de nombreux patients qui sont référés en consultation ne réussissent jamais à voir les spécialistes. La standardisation et l'optimisation des pratiques au chapitre de l'imagerie pour les patients qui souffrent de maux de dos et qui sont référés à un chirurgien représentent un poste budgétaire important où des économies pourraient être réalisées.

Spine-related complaints are common among adults,¹ and patients whose symptoms fail to resolve in a timely manner or who present with neurologic involvement are often referred for surgical assessment. Anecdotally, surgeons often require imaging studies to accompany requests for consultation, but the extent and nature of this practice are unknown. Canada currently spends 10% of total outpatient expenditure on diagnostic imaging,² and the actual costs are higher if one also considers the capital costs of equipment and the costs of downstream tests and interventions owing to imaging results.

Given fiscal pressures facing the Canadian government, there is a pressing need to find efficiencies in the use of diagnostic imaging technology.³ It is widely acknowledged that normal variants of the spine are common and that many of the changes that occur with aging are relatively benign, so clinical correlation is essential before assigning significance to lesions revealed by imaging.⁴ It has also been established that many spine-related referrals to surgeons in Canada are inappropriate⁵ and that the majority of patients seen in surgical consultation do not require surgery.⁶ As such, routine imaging of patients with spine-related complaints referred for surgical assessment may represent an inefficient use of resources. The aim of the present study was to survey Canadian spine surgeons about their requirements for imaging studies when receiving new referrals for patients with spine-related complaints.

METHODS

Questionnaire development

With the assistance of clinical epidemiologists and content experts we developed an 8-item, English language questionnaire to examine Canadian spinal surgeons' use of spine-related imaging as part of the referral process. The final questionnaire framed response options with closed-ended questions, as a previous report has shown that this format results in fewer incomplete questionnaires than open-ended response options (see the Appendix, available at canjsurg.ca).⁷ We also included an option for surgeons to provide written comments regarding any other thoughts they may have on imaging for spine-related referrals. We pretested the final questionnaire on a group of 3 spine surgeons who also commented on its clarity and comprehensiveness and on the time required to complete it. No modifications were suggested by pretest participants.

Questionnaire administration

We used SurveyMonkey (www.surveymonkey.com/) to facilitate online completion of our questionnaire. We obtained permission from the Canadian Spine Society

(CSS), an organization composed almost entirely of spine surgeons (www.spinecanada.ca/), to distribute our questionnaire to their members. Participants who logged on to the link were provided with a disclosure letter detailing the intent of the survey and explicit instructions that, should they choose not to complete the survey, they could convey their decision to us by email or fax. At 3 and 6 weeks after the initial email distribution, a CSS representative sent an email to all nonresponders who had not indicated that they did not wish to participate, requesting that they complete the questionnaire. The Canadian Memorial Chiropractic College Research Ethics Board approved our study.

Data analysis

We generated frequencies for all collected data. We acquired information on surgical training of respondents from a previous survey of the same population.⁶ One of us (J.W.B.) reviewed written comments in order to establish common themes.

We hypothesized a priori that surgeons would be more likely to refuse spine-related referrals if they required imaging to accompany all referrals, if they were older and if they spent a greater portion of their practices performing elective spine surgery. The dependent continuous variable was the proportion of spine-related referrals that were declined, as reported by spine surgeons. We planned to enter these variables into a linear regression model on the condition that we had sufficient data to ensure reliability of our model. We calculated that we would require at least 30 completed surveys to ensure reliability of our linear regression model (10 respondents for each independent variable considered).⁸

We planned, but did not conduct, an analysis to explore the association between surgeons' age and the proportion of their practices dedicated to elective spine surgery with requiring imaging to accompany spine-related referrals as our threshold for ensuring a reliable model was not met: 20 completed surveys in which surgeons reported they did or did not require imaging for spine-related referrals (whichever was the least common response).

All comparisons were 2-tailed, and we considered a variable to be significant if it had a $p < 0.05$ in the final multivariable model. For our linear regression model, we report the unstandardized regression coefficient and 95% confidence interval (CI) for each significant variable in the analysis. The value of the unstandardized regression coefficient represents the change in response score on the dependent variable, which was measured as a continuous variable on a 6-point Likert scale (< 10%, 10%–20%, 21%–30%, 31%–50%, 51%–75% and > 75%). We plotted residuals from the linear regression analysis to ensure that their distributions were reasonably normal, and multicollinearity

was deemed concerning if the variance inflation factor for any independent variable was greater than 5.⁹ We performed all analyses using PASW Statistics 18 statistical software (SPSS Inc.).

RESULTS

Characteristics of respondents

From August to September 2012, a representative from the CSS sent a link to our online survey to all 101 of their surgeon members. Fifty-six surgeons provided a completed survey, with 1 surgeon advising he maintained a nonsurgical practice, for an eligible response rate of 55% (55 of 100). Most respondents were men (98.2%), and approximately half (45.5%) had been in practice for more than 20 years (Table 1). Most respondents (65.4%) dedicated more than half their practices to elective spine surgery. The majority of respondents

(43 of 55, 78.2%) required imaging studies to accompany all spine-related referrals; the types of imaging studies required were highly variable, with respondents endorsing 7 different types of imaging or imaging combinations (Fig. 1). Of the 11 surgeons who did not require imaging to accompany spine-related referrals, 4 indicated a preference for magnetic resonance imaging (MRI) scans with referrals.

Half of surgeons (27 of 55, 49.0%) either required ($n = 13$) or preferred ($n = 14$) MRI, alone or in combination with other forms of imaging studies, in order to consider a spine-related referral. Twenty-one surgeons (38%) required plain radiographs alone or in combination with other forms of imaging studies. None of our respondents reported that they acquired postoperative MRIs as part of routine practice after performing spine surgery.

Factors associated with refusing spine-related surgical referrals

Half of our respondents refused at least 20% of all spine-related referrals (without a consultation). In our adjusted model, only requiring imaging with spine-related referrals and surgical practices with greater dedication to elective spine surgery were associated with refusing spine-related referrals (Table 2). The unstandardized regression coefficients presented in Table 2 represent the impact of each baseline characteristic toward increasing the proportion of patients in a surgeon's practice who are referred but not scheduled for consultation. For example, in our adjusted analysis surgeons who required imaging studies for all spine-related referrals demonstrated an average increase of 1.27 points on the 6-point scale associated with the question, "What is your estimate of the proportion of spine-related referrals you receive that do not result in a consultation?" (see the Appendix). Standardized

Characteristic	No. (%) [*]
Age, mean \pm SD yr	50.2 \pm 11.3
Sex	
Male	54 (98.2)
Female	1 (1.8)
Type of surgeon	
Orthopedic surgeon	45 (81.8)
Neurosurgeon	10 (18.2)
Years in practice	
< 5 yr	7 (12.7)
5–10 yr	15 (27.3)
11–20 yr	8 (14.5)
> 20 yr	25 (45.5)
Patient population	
Pediatric	5 (9.1)
Adult and pediatric	5 (9.1)
Adult	45 (81.8)
Proportion of practice spent on elective spine surgery	
< 25%	7 (12.7)
25%–50%	12 (21.8)
51%–75%	19 (34.5)
> 75%	17 (30.9)
Proportion of patients with spine-related complaints referred, but not accepted	
< 10%	15 (27.3)
10%–20%	12 (21.8)
21%–30%	13 (23.6)
31%–50%	5 (9.1)
51%–75%	7 (12.7)
> 75%	3 (5.5)
Require imaging studies to accompany all spine-related referrals	43 (78.2)

SD = standard deviation.
^{*}Unless otherwise indicated.

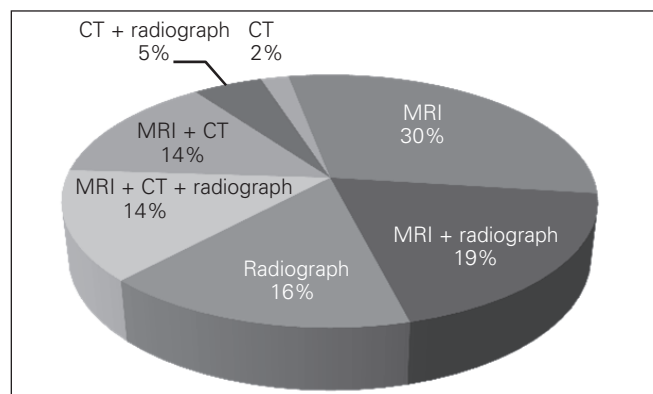


Fig. 1. Combinations of imaging required for accepting a spine-related referral among respondents who indicated that they require imaging to accompany a new referral, $n = 43$. CT = computed tomography; MRI = magnetic resonance imaging.

residual plots showed no violation of model assumptions. The variance inflation factor was less than 2 for each independent variable, suggesting no issues with multicollinearity. Our model explained approximately 13% of the variation (adjusted $R^2 = 0.13$) in the proportion of patients referred with spine-related complaints who our respondents refused to see.

Written comments

Written comments were provided by 23 respondents, and the most common themes were contradictory: imaging is an essential part of spine-related referrals, better triaging of referrals can reduce unnecessary imaging, and most spine-related referrals do not require imaging. For example, we received the following comments:

MRI is the gold-standard for imaging of the spine. We went through this same debate for [computed tomography] scans about 15 years ago. It is useless to resist. Patients want them. Referring physicians want them. Spine surgeons want them. It is only a matter of time before MRI will become the key to spine referrals anywhere it already hasn't. Regulating or restricting it only makes the system less efficient.

We have a triage clinic now which doesn't require an MRI. Patients get a phone call from a spine nurse, and if potentially surgical, get an MRI... We phoned about 700 patients last year, and less than 10% were surgical.

The vast majority of investigations are not indicated, or if indicated do not change management, resulting in inordinately long waiting times to obtain scan in those where they are indicated for management.

DISCUSSION

Summary of findings

Our survey found that the majority of Canadian spine surgeons require imaging studies to accompany all spine-related referrals; however, the type of imaging varies considerably and approximately 1 in 5 referrals are not scheduled for consultation. Requiring imaging as a condition of referral and spending a greater proportion of practice on elective spine surgery were associated with a higher rate of refusing referrals.

Strengths and limitations

The strengths of our study include a comprehensive sampling of Canadian spine surgeons from both academic and community practices, survey design and conduct consistent with best practices,¹⁰ and a high survey response rate for health care professionals (55% provided completed surveys) that is comparable with the mean physician response rate of 54% reported by Asch and colleagues¹¹ in a systematic review of postal surveys.

Our study does have limitations. We did not explore the patient composition of surgeons' practices, and it may be that some surgeons predominantly see the kinds of patients for whom most experts/guidelines suggest that imaging is appropriate at the time of referral; however, the wide variation in imaging types required, common use of multiple forms of imaging and the finding that 1 in 5 spine surgeons do not require imaging to consider spine-related referrals suggests that inefficiencies exist. Our results may have limited generalizability to non-Canadian spine surgeons. Our model exploring factors associated with spine surgeons' refusal of spine-related referrals explained only 13% of the variation among respondents, suggesting that other variables that we did not assess are important in influencing this decision. Some potentially important factors that should be explored in future studies are surgeons' referral volumes, surgeons' operative wait times, the number of previous surgical consultations, factors suggesting that the patients are not surgical candidates (e.g., back-dominant pain with diffuse multilevel degenerative disc disease, established chronic pain syndrome in the absence of significant neurologic involvement)¹² and ongoing litigation.¹³

Relevant literature

Increases in use of diagnostic imaging in Canada have far exceeded population growth; between 1993/94 and 2003/04 there was a 300% increase in the number of computed tomography (CT) scans and a 600% increase in the number of MRI scans — more rapid growth than

Table 2. Variables associated with a greater proportion of spine-related referrals to spine surgeons that do not result in a consultation, n = 55

Variable	Univariable		Multivariable	
	Unstandardized regression coefficient (95% CI)	p value	Unstandardized regression coefficient (95% CI)	p value
Surgeon age for each 10 year increment	0.11 (-0.26 to 0.49)	0.55	0.22 (-0.14 to 0.58)	0.22
Greater proportion of practice dedicated to elective lumbar spine surgery	0.36 (-0.05 to 0.76)	0.09	0.41 (0.02 to 0.80)	0.041
Require imaging studies for all lumbar spine referrals	1.06 (0.08 to 2.04)	0.034	1.27 (0.30 to 2.24)	0.011

CI = confidence interval.

almost any other type of Canadian health service.¹⁴ Imaging of the lumbar spine accounts for approximately one-third of all MRIs in some provinces, such as Alberta where 25 000 lumbar spine MRIs were ordered in the fiscal year 2009/10 (Dr. Mauro Chies, Alberta Health Services, Edmonton, Alta.: personal communication, 2011). A recent study of Ontario patients with degenerative spine disease referred for surgical consultation found that 100% of CT scans and 60% of MRIs were unnecessary, resulting in an additional cost estimated at \$24 million per year.¹⁵ Another recent study found that more than half of lumbar spine MRIs ordered in Edmonton and Ottawa were either inappropriate or of uncertain value.¹⁶

Reasons for high rates of inappropriate spine-related imaging are not clear; however, it appears to be a combination of patient demand owing to the persistent and often recurrent nature of degenerative spinal disorders¹⁷⁻²¹ as well as the limited confidence that many primary care physicians have in assessing and managing patients with chronic musculoskeletal complaints.²²⁻²⁴ This may drive referrals for both imaging and surgical consultation owing to concerns over further management needs or missing important findings. Spine surgeons faced with large numbers of (often nonsurgical) referrals may require imaging for consultation in an attempt to refuse clearly nonsurgical candidates and reduce wait times for patients who are likely to benefit from surgery.¹⁸ A potential solution to this problem may be an alternate mechanism for early standardized and skilled assessment during primary care of patients being considered for referral to a spine surgeon.

In their written comments, a number of respondents advocated the use of triaging systems to prescreen spine-related referrals, which reportedly reduced the proportion of unnecessary imaging. There has been very little formal research exploring the role of nonsurgeon clinicians for screening patients referred for surgical consultation secondary to spine-related complaints, but preliminary findings are promising.²⁵⁻²⁸ We have also found that the majority of Canadian spine surgeons would participate in this model of care.⁶ One of us (Y.R.R.) is currently leading a pilot study sponsored by the Ontario Ministry of Health and Long-Term Care to explore the feasibility and impact on health care utilization of an interprofessional shared-care model (primary care, allied health and specialist) that involves chiropractors and physical therapists assessing and educating patients with low-back pain or low back-related leg pain with persistent or recurrent symptoms beyond the acute phase (www.isaec.org/).

CONCLUSION

It is likely that requiring imaging to accompany all spine-related referrals for surgical consultation does not represent optimal use of technology or resources, and

further research is required to better understand why most Canadian spine surgeons have adopted this approach. Clinical trials to formally evaluate models of care for patients with spine-related complaints that incorporate skilled nonsurgeons to provide advanced patient education and management, including appropriateness criteria for imaging and specialist referral in Canada, are urgently needed.

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