ORIGINAL ARTICLE

Spinal Subspecialization in Post-Graduate Neurosurgical Education

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ABSTRACT: ***Background:*** The growing science and technology of various neurosurgical areas fosters subspecialization. The transmission of this expanding knowledge base to the neurosurgical resident becomes an increasing challenge. A survey of neurosurgical residency program directors was undertaken to evaluate their response to the budding subspecialization of spine surgery within general neurosurgery. ***Methods:*** A survey requesting background data, educational infrastructure and prevailing opinion was distributed to all 13 neurosurgical program directors in Canada. The responses were tabulated and results recorded. It is upon these results that conclusions and proposed directions are based. ***Results/Conclusions:*** The current practice of the overwhelming majority of Canadian academic neurosurgical centers is to have neurosurgical spinal subspecialists working under the umbrella of the general neurosurgical division. A large percentage of neurosurgical program directors in Canada believe that the management of spinal disease, including both intradural procedures and instrumentation, is and should remain an integral part of general neurosurgical training. A consensus statement regarding the requirements of neurosurgical training in spinal disorders is the expressed desire of almost all program directors. A proposed direction and resolution is discussed.

RÉSUMÉ: Surspécialisation en pathologies spinales pendant la formation post-graduée en neurochirurgie. ***Introduction***: L'augmentation des connaissances et la multiplicationdes techniques dans différents champs de la neurochirurgie favorise la surspécialisation. La transmission de ces connaissances sans cesse croissantes aux résidents en neurochirurgie est un défi. Un sondage a été réalisé auprès des directeurs de programme de résidence en neurochirurgie afin de savoir comment ils percevaient l'émergence d'une surspécialisation en chirurgie spinale dans le programme de neurochirurgie générale. ***Méthodes***: Un questionnaire sur le contexte général, l'infrastructure éducationnelle et l'opinion courante a été distribué aux directeurs des 13 programmes de formation en neurochirurgie au Canada. Les conclusions et les directions proposées sont basées sur un relevé des réponses obtenues. ***Résultats/Conclusions***: La pratique courante dans la grande majorité des centres académiques canadiens de neurochirurgie est d'intégrer des surspécialistes en neurochirurgie spinale au sein de l'équipe de neurochirurgie générale. Plusieurs directeurs de programme de neurochirurgie au Canada croient que le traitement des maladies spinales, incluant les interventions intradurales et l'instrumentation, est et doit demeurer une partie intégrante de la formation en neurochirurgie générale. Presque tous les directeurs de programme ont exprimé le désire qu'il y ait un énoncé de consensus au sujet des normes de formation en neurochirurgie des troubles spinaux. Nous discutons d'une proposition d'orientation et de résolution en ce sens.

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Post-graduate education faces several challenges. Many of these derive from dwindling hospital and University resources as well as changes in which medicine is delivered. For example, the development of 'same-day-admissions' prior to elective surgical procedures has eliminated the trainee's 'pre-operative' assessment; a crucial element of a surgical resident's experience. Due to rapidly expanding science and technology, subspecialization has evolved into an established trend within all areas of medicine, and this too has impacted residency education. One example of its occurrence and impact is the subspecialization of 'spinal surgery' and its relationship with 'cranial' neurosurgery. How the expansive knowledge base of subspecialized fields is managed and taught, is crucial to the success of a training program. This paper examines the attitudes of neurosurgical program directors across Canada and reflects on the need to make definitive decisions on how subspecialization should be managed within the context of 'general'neurosurgical training.

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METHODS

A survey questionnaire was developed to establish baseline information on each Canadian neurosurgical residency program and attain information on the structure of spinal education at each institution. Additionally, opinions were sought regarding the various abilities and expectations with respect to reaching spinal training objectives. As such, the survey was split into sections requesting background information on the training program, on the actual infrastructure of spinal education and on the theoretical and practical training objectives for spinal education. Opinions were garnered by responses, quantified on a 1 to 5 scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), in response to rhetorical statements. This questionnaire was electronically mailed to all 13 program directors in Canada.

Program directors were chosen as the appropriate individual to answer the survey, since it is their charge to oversee the teaching structure of their residents. Specifically, it is their job to decide and direct what aspects of neurosurgery are to be taught. Furthermore they must construct a program that ensures that standards and expectations, both cognitive and technical, are met. As such, their opinions were felt to be the functional barometer of what and how residents are taught their spinal education. In turn, this was felt to reflect the management strategy regarding the issue of spinal subspecialization.

Answers to the survey were tabulated and conclusions based on quantification of the prevailing opinions.

RESULTS

Of the 13 Canadian neurosurgical residency programs, 12 responded to the survey (92% response rate).

In terms of background data (Table 1), the median number of residents within each program was seven (range 4-28) and the median number of consultant neurosurgeons was seven (range 5-25). From the 12 program directors, nine documented the presence of dedicated spine surgeons within their teaching staff. At four centers the dedicated spine surgeons still did a regular allotment of intracranial neurosurgery; at another four centers the spine surgeons only did intracranial work while taking regular, general neurosurgical on call; and at only one institution did the spinal surgeons completely restrict their practice to spinal disorders, without any involvement in intracranial neurosurgery.

The depth of instrumentation expertise was simply categorized as ‘limited’ and ‘comprehensive’. Amongst all 12 teaching sites, an average of 47.5% of the surgeons were capable of limited instrumentation, with a range of 8-86% at individual programs. For comprehensive instrumentation, an average of 19.25% were capable, with a range at each institution of 0-40%. This, in turn, indicates that of all the recorded Canadian neurosurgical teaching faculty (107 reported), 47.5% are capable of limited spinal instrumentation and 19.25% are capable of comprehensive instrumentation.

Among the 12 reporting academic centres, seven describe a ‘spinal program’ that involves a clinical practice arrangement with both neurosurgeons and orthopedists. The physical infrastructure at all teaching institutions was also audited in terms of its spinal services. Only two of 12 centers described dedicated clinical spinal units where only patients with spinal pathology were managed, and were not mixed into the ‘general’ cranial neurosurgical population. Three of the reporting institutions declare the presence of a dedicated spinal cord injury unit. At three of the 12 teaching centres the resident exposure to spinal disorders and education was achieved exclusively through dedicated ‘spine rotations’. In other words, at these institutions the residents rotated on services where only spinal pathology was managed, exclusive of cranial disease. Four of the reporting Canadian neurosurgical residency programs support fellowships in spinal surgery.

Table 1: Clinical and Educational Spinal Infrastructure

Presence of a:	Yes	No
spinal program	7	5
spinal ward	2	10
spinal cord unit	3	9
spinal rotation	3	9
spinal fellowship	4	8

All training programs believed that degenerative spinal disease management should be a facet of neurosurgical education (Table 2). Similarly all 12 programs felt that limited instrumentation is an obligatory objective of training for neurosurgical residents. The feelings were split equally, however, regarding more comprehensive instrumentation. In extension to these sentiments, all programs felt it was quite feasible for limited instrumentation to be taught during the regular six years of neurosurgical residency. A number of program directors (5/12) felt it was also possible for programs to teach comprehensive instrumentation in the current infrastructure of training. In terms of competence in spinal instrumentation, only a small number (3/12) of respondents felt it could only be achieved through a postgraduate fellowship experience. The majority felt it was within the realms of standard neurosurgical training. As an assessment of their own program in its current state, most directors (11/12) felt they were successfully teaching their residents competence in limited instrumentation and a majority (8/12) felt they were also providing competence at comprehensive instrumentation. For intradural spinal procedures, the large majority of centres (10/12) felt it should remain within the providence of general neurosurgery with a split of opinion about its relegation to the exclusive management of a spinal neurosurgeon.

Specifically addressing issues of resident experience, the question of dedicated clinical spinal teaching units/wards was raised. Opinions on this were generally split, with a minority feeling that such a unit was a benefit to general neurosurgical education (5/12), and as a corollary, a small majority (6/9 responses) felt that such a unit was detrimental to general neurosurgical education. In similar light, a small majority felt that a dedicated spinal rotation, where only spinal pathology is encountered, does not represent the best means of teaching competence in the management of spinal disease (7/12 responses).

That spinal surgery should represent a specialty separate from cranial neurosurgery was proposed, but uniformly discounted by

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Table 2: Summary of Survey Results

Statement/Response	agree	neutral	disagree
Degenerative spinal disease education a necessity of neurosurgical education	12	0	0
Program obligation to teach limited instrumentation	12	0	0
Program obligation to teach comprehensive instrumentation	5	2	5
Feasible to teach limited instrumentation in current 6-year training	12	0	0
Feasible to teach comprehensive instrumentation in current 6-year training	5	2	3
Spinal instrumentation can only be taught in a fellowship	3	1	8
Programs currently teaching limited instrumentation	11	0	1
Programs currently teaching comprehensive instrumentation	8	0	4
Intradural spinal disorders should be the providence of general neurosurgery	10	2	0
Dedicated spinal ward beneficial to neurosurgical education	5	0	7
Dedicated spinal ward detrimental to neurosurgical education	6	0	3
Exclusive spinal rotations superior means of spinal education	4	1	7
Spinal surgery should become a specialty distinct from cranial neurosurgery	0	1	11
Royal College requirements of training should include limited instrumentation	12	0	0
Royal College requirements of training should include comprehensive instrumentation	2	3	6
Need for a Program Director's consensus statement on neurosurgical spinal training standards	9	2	1

11 of 12 responses, with one neutral opinion. All program directors felt that the future of spinal surgery should be maintained under the umbrella of neurosurgery, with some form of participation by the spinal orthopedists.

In terms of future direction, all the programs felt that limited spinal instrumentation should be a standard of training imposed by the Royal College of Canada, whereas a majority felt that comprehensive instrumentation competency should not be a standard. As a template for further discussion, nine respondents felt that a consensus statement should be made by all Canadian program directors in regard to neurosurgical spinal training, with two 'neutral'opinions and one feeling it was unnecessary.

Discussion

Reviewing the survey responses reveals a relatively uniform set of sentiments in regard to the clinical subspecialization of spinal neurosurgery and the pragmatic educational response from the program directors. Except for two institutions, 33-86% of the neurosurgical teaching staff are able to perform limited instrumentation. For comprehensive instrumentation this rate is 8-40%, barring one center. Acknowledging the variable interpretation of 'limited' versus 'comprehensive', this still represents a significant number of Canadian academic faculty who are well-poised to teach spinal instrumentation to the trainee. Thus there is clearly adequate manpower to provide this knowledge and skill set to the Canadian resident.

Although seven centres describe a declared spinal service, only two of these sites have formalized an actual clinical unit. Otherwise the spinal population of patients is mixed with the general neurosurgical patients. Furthermore, only three of the twelve responding centres have organized dedicated spinal rotations for their residents. For the rest, spinal education continues to be intertwined with general neurosurgical training.

There are pragmatic reasons for the actual infrastructure present at these university centres. Some of these practical realities may run contrary to the actual philosophy of the program directors, and so the current opinions of the program directors may be more instructive. There are two important conclusions that can be drawn from these opinions. The first is that an overwhelming number of programs are currently teaching limited spinal instrumentation, and believe it to be an important and achievable objective of training for the neurosurgical graduate. This belief is supported by the unanimous desire for this to be a Royal College standard of training. In regards to comprehensive instrumentation, the opinion is more divided. Although a surprising majority feels they are presently imparting this skill to their graduates, there is a reasonable amount of doubt expressed as to whether this is possible for all programs or if it should be a Royal College standard. The second important revelation is the method by which the program directors believe this education is best transmitted. A majority of academic neurosurgical centres in Canada feel that spinal education is best kept within the structure of general neurosurgical training. This concept is supported by the relative lack of exclusive spine rotations, the belief that the general neurosurgeon should maintain intra-dural work, and the sentiment that segregated spinal wards and exclusive spine rotations are not the optimum means of spinal training.

The actual mechanics of how postgraduate trainees become successful, independently practicing professionals has been previously reviewed, and it would seem that much is based on role modeling and apprenticeship.[1-4] Similarly the impact of subspecialization has been analyzed in the context of under-

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graduate medical education, but not for postgraduate residencies.[5-8] Part of the discussion on how subspecialization impacts residency education requires an understanding of exactly how the resident acquires their knowledge base and learns their technical skill set. Once this is better understood, perhaps the best methods to reconcile the advanced objectives of subspecialty practice with the fundamental needs of the 'generalist'trainee will be more obvious.

That subspecialization is necessary and beneficial, is not contested. However the management of subspecialty fields within general neurosurgical education is of primary concern to those responsible for the graduating resident. This survey has revealed how different programs, as orchestrated by their program director, have responded to this organizational challenge. As much as this survey has described what and how neurosurgical residency programs are teaching spinal neurosurgery, the logical next step is to analyze the success of the different strategies. Success not only defined by the abilities of the graduates to manage spinal disorders, but also in the maintenance of general neurosurgical standards.

The majority of present day neurosurgical subspecialists were actually taught their fundamental skills by 'generalists'and not subspecialists. We are in a stage of educational evolution where subspecialists now teach fundamental skills. The development of a consensus statement and the establishment of up-to-date Royal College standards are fundamental signposts in the diverse movements of academic centres across the country. As witnessed with the introduction of the CanMEDs objectives,[9] defined standards clarify targets to which energy must be placed and also provide a basis for leveraging necessary resources to maintain educational programs. They also establish a definable quality to Canadian neurosurgical training that enhances its international stature. Due to the small numbers, responsible efforts and familiarity to each other, Canadian neurosurgical residency programs are in a unique position to advance an already high standard of national training objectives. To this end, conscientious analysis and reaction to educational challenges must be instituted.

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