Interpretation of surgical neuromonitoring data in Canada: a survey of practising surgeons

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SUMMARY

Intraoperative neuromonitoring is a specialized skill set performed in the operating room to reduce the risk of neurologic injury. There appears to be a shortage of qualified personnel and a lack of Canadian guidelines on the performance of the task. We distributed a web-based survey on the attitude of the surgeons to the interpretation of intraoperative neuromonitoring data among surgeons who use the technique. At present, most of the interpretation is performed by either technologists or by the surgeons themselves. Most surgeons would prefer professional oversight from a neurologist or neurophysiologist at the doctoral level. There is a lack of personnel in Canada with the appropriate training and expertise to interpret intraoperative neuromonitoring data.

Intraoperative neuromonitoring (IOM) is a rapidly expanding field designed to reduce the risk of neurologic injuries during surgical procedures. In Canada, there is no recognized standard for the field. In the United States there is a much wider use of IOM than in Canada, and the field is more established. The U.S. model is driven in large part by the demands of the payers — Medicare, Medicaid and the private insurance industry. These payers require that the interpretation of the IOM is performed by a suitably qualified individual with a medical degree and that this individual is someone other than the operating surgeon. The American Medical Association states that IOM is a part of the practice of medicine (AMA policy H-410.957). In practice, there is a technologist in the operating room (OR) who places the electrodes and operates the dedicated IOM equipment. A neurologist who is most often, but not always, outside of the OR interprets the data, using a real-time data connection. The practice guidelines require the real-time interpretation by a medical professional with training in IOM.[1]

There has been a relatively rapid expansion of IOM across Canada, but it is still largely concentrated in academic centres. However, the practice remains unregulated and inconsistent in terms of implementation and quality. There is a widespread view that Canada does not have sufficient staff (at all levels) to provide IOM for all the spine surgeries that may benefit from monitoring.[2,3]

The vast majority of the field of clinical neurophysiology, to which IOM belongs, follows this same pattern. Routine electroencephalography (EEG) and nerve conduction velocity studies are performed by a qualified technologist and interpreted by a qualified and trained physician.[4,5] Chan and colleagues[4] identified a shortage in manpower at all levels across Canada and reported that this shortage was expected to worsen substantially in the coming years.

We sent a survey (English only) via SurveyMonkey to practising surgeons across a number of specialties who might use IOM in Canada. Invitations were sent through the professional organization representing the surgeons (Table 1). In each case, either the society president or secretary agreed to support the survey. The survey questions are provided in the Appendix, available at canjsurg.ca. The survey remained open for 6 months after the initial

invitations were sent out. Responses were anonymous, and aggregate data were collected. Since the surveys were distributed through societies, we do not know the response rate. In total we received 227 completed surveys.

There was a general agreement that, with the exception of cardiac surgeons, surgeons do not wish to be responsible for the online, clinical interpretation of neuromonitoring data. Interestingly, cardiac surgeons primarily use processed EEGs for neuromonitoring. These are, with the aid of more recent signal processing algorithms, some of the easiest data for surgeons to interpret, at least at a low level, using devices such as those based on the bispectral index.

Table 2 shows the spectrum of neuromonitoring being performed by each surgical specialty. Recommendations regarding neuromonitoring practice are not present in Canadian clinical practice, but organizations in the United States have published guidelines.[1,6-8] The practice patterns of Canadian surgeons are generally in line with U.S. guidelines. The major thrust of our survey was the interpretation of the signals. Most surgical teams either performed their own setup and monitoring in real time or had technologists who performed the set-up as well as some of the interpretation. Often this is backed up by neurologists or clinical neurophysiologists. We asked surgeons who they wished to interpret the data obtained from the neuromonitoring (Table 3). Most surgeons did not wish to take responsibility for the interpretation of the data; they preferred that a doctoral-level neurologist or clinical neurophysiologist interpret the data in real time.

Table 1. Organizational affiliation of surgeons who responded to the survey

Organization	No. of responses
Canadian Spine Society	67
Canadian Neurosurgical Society	57
Canadian Society of Cardiac Surgeons	32
Canadian Society of Otolaryngology-Head and Neck Surgery	60
Canadian Pediatric Spinal Deformities Study Group	11
Total	227

Table 2. Self-reported use of IOM techniques*

Group	MEP	SSEP	EMG	EEG	BAEP
Spine surgery	90	75	100	37	0
Neurosurgery	74	65	74	32	25
Cardiovascular surgery	22	22	0	94	0
Otolaryngology	17	0	37	0	30

BAEP = brainstem auditory-evoked potential; EEG = electroencephalography; EMG = electromyography; IOM = intraoperative neuromonitoring; MEP = motor-evoked potential; SSEP = somatosensory-evoked potential.
*Spine surgeons have the highest use of IOM. The pattern of use varies considerably across the specialties.

Interest in the surgical community in the use of neuromonitoring is increasing rapidly, and neuromonitoring is now regarded as an important part of many surgical procedures. The expansion in monitoring within Canada has not always been accompanied by an increase in the availability of suitably qualified staff who can either perform the technical aspects of IOM or interpret the results. The solution in the United States has involved the development of private companies and the use of remote monitoring, whereby many cases are monitored simultaneously by a neurologist who is either in the hospital or elsewhere.[9]

There is a well-documented shortage of clinical neurophysiologists within Canada.[4] The motor-evoked potential (MEP) is not a routine part of clinical neurophysiology; therefore, there is a limited experience with MEPs among clinicians. In order to provide better coverage of IOM by clinical neurophysiologists in Canada, there needs to be increased training as well as many more neurophysiologists. In place of these scarce doctoral-level clinical neurophysiologists, various programs in Canada use specially trained anesthesiologists or OR nurses, surgeons working closely with experienced electrodiagnostic

Table 3. Surgeons' views on the qualifications of individuals interpreting IOM data

	Group, %			
Qualification	Spine surgeons	Neurosurgeons	Cardiovascular surgeons	Otolaryngologists
Current				
Tech	51	38	0	18
MSc Tech	9	11	0	7
Self (surgeon)	63	78	85	72
Neurology	21	15	3	11
PhD Neurophysiology	21	26	9	34
Desired				
Tech	0	0	0	0
MSc Tech	0	0	0	0
Self (surgeon)	15	5	83	7
Neurology	75	63	23	85
PhD Neurophysiology	95	92	29	91

IOM = intraoperative neuromonitoring.

technologists or doctoral-level neurophysiologists to perform IOM studies.

In many cases, the responsibility for interpretation of IOM still lies with the surgeon performing the surgery. Commercial products that encourage this approach are licensed in Canada and widely used among spine surgeons. Our survey data indicate that there are many instances in which a technologist is involved in the case and provides some degree of impression (e.g., a technical impression of an EEG), while the ultimate interpretation is the responsibility of the operating surgeon. With the exception of cardiovascular surgeons, surgeons do not want this responsibility.

The IOM technologist is in short supply in Canada and unregulated except in the province of Alberta. In some instances these individuals perform only IOM and may be highly skilled. The majority are employed in neurophysiology laboratories.

In some Canadian centres, doctoral-level neurophysiologists perform IOM and interpret and report the results. While these individuals may have considerable experience with evoked potentials (including MEPs) as well as spinal cord physiology, they may not have appropriate clinical skills for an OR setting.

Our survey highlights an evolving problem in IOM in Canada: the demand for IOM is growing, but there is a shortage of experienced, qualified individuals to collect the data, interpret the results and report back in real-time to the surgical team.

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