



The practice of regional anesthesia during the COVID-19 pandemic: an international survey of members of three regional anesthesia societies

Pratique de l'anesthésie régionale pendant la pandémie de COVID-19 : un sondage international auprès des membres de trois sociétés d'anesthésie régionale

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Abstract

Purpose To determine the preferences and attitudes of members of regional anesthesia societies during the COVID-19 pandemic.

Methods We distributed an electronic survey to members of the American Society of Regional Anesthesia and Pain Medicine, Regional Anaesthesia-UK, and the European Society of Regional Anaesthesia & Pain Therapy. A questionnaire consisting of 19 questions was developed by a panel of experienced regional anesthesiologists and distributed by email to the participants. The survey covered the following domains: participant information, practice

settings, preference for the type of anesthetic technique, the use of personal protective equipment, and oxygen therapy.

Results The survey was completed by 729 participants from 73 different countries, with a response rate of 20.1% (729/3,630) for the number of emails opened and 8.5% (729/8,572) for the number of emails sent. Most respondents (87.7%) identified as anesthesia staff (faculty or consultant) and practiced obstetric and non-obstetric anesthesia (55.3%). The practice of regional anesthesia either expanded or remained the same, with only 2% of respondents decreasing their use compared with the pre-pandemic period. The top reasons for an increase in the use of regional anesthesia was to reduce the need for an aerosol-generating medical procedure and to reduce the risk of possible complications to patients. The most common reason for decreased use of regional anesthesia was the risk of urgent conversion to general anesthesia.

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Approximately 70% of the responders used airborne precautions when providing care to a patient under regional anesthesia. The most common oxygen delivery method was nasal prongs (cannula) with a surgical mask layered over it (61%).

Conclusions Given the perceived benefits of regional over general anesthesia, approximately half of the members of three regional anesthesia societies seem to have expanded their use of regional anesthesia techniques during the initial surge of the COVID-19 pandemic.

Résumé

Objectif Déterminer les préférences et les attitudes des membres des sociétés d'anesthésie régionale pendant la pandémie de COVID-19.

Méthode Nous avons distribué un sondage électronique aux membres de l'American Society of Regional Anesthesia and Pain Medicine, de Regional Anesthesia-UK et de l'European Society of Regional Anaesthesia & Pain Therapy. Un questionnaire composé de 19 questions a été élaboré par un panel d'anesthésiologistes régionaux d'expérience et distribué par courriel aux participants. Le sondage couvrait les domaines suivants : les renseignements sur les participants, les contextes de pratique, leur préférence quant au type de technique d'anesthésie, l'utilisation d'équipement de protection individuelle et l'oxygénothérapie

Résultats Le sondage a été complété par 729 participants provenant de 73 pays différents, avec un taux de réponse de 20,1 % (729/3630) pour le nombre de courriels ouverts et de 8,5 % (729/8572) pour le nombre de courriels envoyés. La plupart des répondants (87,7 %) se sont identifiés comme anesthésiologistes (académique ou consultant) et pratiquaient l'anesthésie obstétricale et non obstétricale (55,3 %). Leur pratique de l'anesthésie régionale s'est étendue ou est demeurée inchangée, et seulement 2 % des

répondants ont indiqué avoir diminué leur utilisation de cette pratique par rapport à la période pré-pandémique. Les principales raisons d'une augmentation de l'utilisation de l'anesthésie régionale étaient de réduire la nécessité d'une intervention médicale générant des aérosols et de réduire le risque de complications potentielles pour les patients. La raison la plus courante de diminution du recours à l'anesthésie régionale était le risque de conversion urgente à une anesthésie générale. Environ 70 % des intervenants ont utilisé des précautions en matière de propagation des aérosols lorsqu'ils procuraient des soins à un patient sous anesthésie régionale. La méthode d'administration d'oxygène la plus fréquemment utilisée était les canules nasales avec un masque chirurgical superposé (61 %).

Conclusion Compte tenu des avantages perçus de l'anesthésie régionale par rapport à l'anesthésie générale, environ la moitié des membres de trois sociétés d'anesthésie régionale semblent avoir élargi leur utilisation des techniques d'anesthésie régionale pendant la vague initiale de la pandémie de COVID-19.

Keywords COVID-19 · regional anesthesia · nerve block · SARS-CoV-2 · anesthesia · surveys and questionnaires

The COVID-19 pandemic caused by the SARS-CoV-2 virus has challenged society and healthcare systems. The early response to the pandemic necessitated cancellations of many elective and non-urgent surgeries. It is estimated that more than 28 million adult elective surgical procedures were cancelled worldwide during the first 12 weeks of peak disruption due to the COVID-19 pandemic.¹ This response was to conserve hospital resources needed to manage patients with SARS-CoV-2 infection.

An international cohort study found high 30-day mortality (23.8%) and pulmonary complication rates (51.2%) in patients with perioperative SARS-CoV-2 infection.² In this context, choosing a safe and appropriate anesthetic plan has implications for the perioperative team and the patient.³ The conduct of general anesthesia typically requires airway interventions, which may lead to aerosol-generation. Data from the previous SARS epidemic showed that the odds of transmission of acute respiratory infection to healthcare workers during tracheal intubation were 6.6 times higher compared with those who were not exposed to tracheal intubation.⁴ Therefore, some practitioners attempted to avoid general anesthesia (if possible) to protect healthcare personnel and to reduce the risk of viral transmission.

During the COVID-19 pandemic, regional anesthesia (either neuraxial anesthesia or peripheral nerve blocks) has

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been recommended as a better choice for anesthesia provision when possible, citing the avoidance of aerosol-generating medical procedures among other advantages.^{5, 6} Although a recent cohort study indicated a possible favourable trend for lower mortality and fewer pulmonary complications in SARS-CoV-2 positive surgical patients who received regional anesthesia compared with general anesthesia, this has been a matter of debate.^{2,3,7} In the absence of firm evidence on the modes of SARS-CoV-2 transmission, the anesthesia provider may be concerned about aerosol transmission from a coughing patient, whether under regional anesthesia or during tracheal extubation.

While the prevalence of SARS-CoV-2 infection continues to change and is highly variable in each geographic region, most institutions have gradually restarted non-urgent and elective surgeries. Certain types of surgeries can be performed either under general or regional anesthesia. Although several surgical, medical, and patient factors affect the choice of the anesthetic technique, “patient preference” and “practitioner comfort with the technique” play a vital role in the final decision. Our group has recently published a position statement and evidence review on the practice of regional anesthesia during the COVID-19 pandemic with the aim of providing practice parameters to practitioners.^{5,6} Nevertheless, an understanding of changes in the practice of regional anesthesia during the COVID-19 pandemic may help provide guidance during the current and future pandemics. Hence, a survey was developed to discover both the preferences and attitudes of anesthesia providers, and the impact of the COVID-19 pandemic on their choices during the first wave of the pandemic when there were no vaccines, limited testing, and only essential surgical procedures were being performed. This electronic survey was conducted among members of the American Society of Regional Anesthesia and Pain Medicine (ASRA), Regional Anaesthesia-UK (RA-UK), and the European Society of Regional Anaesthesia & Pain Therapy (ESRA).

Methods

Survey development

A questionnaire consisting of 19 questions was developed by a panel of experienced regional anesthesiologists and a statistician (Electronic Supplementary Material [ESM] eAppendix 1).⁸ The questions were distilled to produce a brief survey, to capture the most relevant aspects of regional anesthesia practice during the pandemic. The survey instrument was pre-tested and piloted within the authorship team and a number of ASRA, ESRA, and RA-

UK board members for clarity and comprehensiveness, and to refine responses.⁹ The survey questions were built into a REDCap (Research Electronic Data Capture) survey form to be used for each participant.

Survey distribution

Following ethics board approval by the Nova Scotia Health Authority, Halifax, Canada (reference number 1025910), we conducted an online survey offered to ASRA, RA-UK, and ESRA society members. Participation was voluntary, and the responses were anonymous. Only members in current practice were permitted to complete the survey, but thereafter all anesthesia providers, irrespective of level or category of practice, were allowed to participate. A survey link was sent by email from the societies in the first week of September, which was subsequently followed by three reminders. The survey was closed on 19 October 2020.

Outcomes

The survey included the following domains: participant information, practice settings, preference on the type of anesthesia before and during the pandemic peak, given an equal opportunity between general and neuraxial anesthetic, the practice of peripheral nerve blockade before and during the pandemic peak, reasons to support the choice of primary anesthetic and peripheral nerve block during the pandemic peak, the conduct of regional procedures and the use of personal protective equipment (PPE) when treating SARS-CoV-2-positive patients, and the use of oxygen therapy during the conduct of regional anesthesia. Preference on choosing neuraxial anesthesia was elicited by providing a clinical scenario of a healthy 60-yr-old female patient with a hip fracture requiring urgent surgical repair of less than 90 min surgical duration.

Statistical methods

Since survey items were intended to screen for participants' real practices before and during the COVID-19 pandemic, no attempt was made to test the internal consistency of the questionnaire. Likewise, no assumptions were made regarding the presence of dimensions for a latent construct, and no principal component analysis was conducted for dimension reduction.

Categorical variables are presented as valid counts and percentages. We screened for a relationship between increased use of neuraxial or peripheral nerve blocks during the COVID-19 pandemic and participants' characteristics and preferences prior to the pandemic using Cramer's V. The Pearson Chi square test was used to test relations among categorical variables. To identify

predictors of change in the use of regional anesthesia during the pandemic, we conducted a multivariable binary logistic analysis. Variables included in the multivariable analysis were selected both on a statistical and substantive basis. Variables found at bivariate analysis to be associated with increased use of regional anesthesia at a permissive level of $P \leq 0.25$ were selected. Further, variables expected or assumed to influence the use of regional anesthesia were also included as confounding factors. For logistic regression, mutually exclusive categorical variables were re-coded such that one level of the variable is identified as the reference category against which all other levels are compared. For mutually non-exclusive categorical variables, each variable was regarded as an independent factor, and a reference category is identified within each variable. The “enter” method was used to force all potential predictors into the regression model.

The IBM SPSS Statistics for Windows package, Version 23.0 (IBM Corp., Armonk, NY, USA) was used for data analysis. All statistical tests were two-sided, and a P value < 0.05 was considered statistically significant.

Results

An email invitation was sent to 3,399 ASRA, 660 RA-UK, and 4,513 ESRA members to complete the survey (numbers obtained based on active membership at the time of distribution). This email was opened by 1304 ASRA members, 352 RA-UK members, and 1,974 ESRA members (total 3,630). The survey was completed by 729 participants, which gave a response rate of 20.1% (729/3,630) based on the number of emails opened and 8.5% (729/8,572) based on the number of emails sent. Table 1 shows the characteristics of the participants, including the number of participants in each age quartile.

Regarding gender, 63.4% of respondents identified as male and 35.8% as female. Most respondents (87.7%) identified as anesthesia staff (faculty or consultant). Of all respondents, 45.5% worked at an academic institute or university hospital, 27.7% at a community hospital, and 15.9% in a private clinic.

Respondents were from 73 different countries. Electronic Supplementary Material eAppendices 2.1 and 2.2 show the number of participants for each country and each geographical region, respectively. Most respondents (55.3%) practiced a mix of obstetric and non-obstetric anesthesia, 43.1% did not practice any obstetric anesthesia, and 1.6% practiced predominantly obstetric anesthesia. The specific areas of non-obstetric practice of participants are presented in Table 1.

The Figure (infographic) summarizes the key survey finding. With regards to the preference for neuraxial

anesthesia in a clinical scenario with similar potential for regional or general anesthesia before the pandemic, 85.6% of respondents preferred regional anesthesia, and 14.4% preferred general anesthesia. Before the COVID-19 pandemic, 78.2% of respondents would perform neuraxial anesthesia in the operating room, while 10.4% did so in the designated block area. Regarding peripheral nerve blocks, 88.7% of respondents reported offering peripheral nerve blocks as primary anesthetics in their practice, and 55.1% performed them in the operating room or anesthetic room. The remaining blocks were performed in a designated block or other areas.

Table 2 shows the responses of the participants regarding the increase, decrease, or no changes in the practice of neuraxial anesthesia and peripheral nerve blocks for surgical anesthesia at the height of the COVID-19 pandemic, along with reasons for their practice. Expanded use of neuraxial anesthesia was reported by 52% of participants, and 45% expanded the use of peripheral nerve blocks. In general, the practice of regional anesthesia either expanded or remained the same, with only 2% of respondents decreasing their use compared with the pre-pandemic period. The top reasons for increasing the use of regional anesthesia were to reduce the incidence of aerosol-generating medical procedures and to reduce the risk of possible complications to patients. The top reason for reducing the use of regional anesthesia was the perception that there was an increased risk of SARS-CoV-2 transmission to healthcare professionals with an awake patient.

The responses to questions regarding the performance of regional anesthesia, use of PPE, and oxygen therapy are shown in Table 3. Approximately 70% of respondents performed procedures in the operating room during the pandemic peak. Similarly, approximately 70% of the respondents used airborne precautions when providing care to a patient under regional anesthesia. Attempts to minimize oxygen flow were used by 76.0% of participants if the patient needed supplemental oxygen during surgery. The most common oxygen delivery methods were nasal prongs (cannula) with a surgical mask layered over it (60.8%), followed by an oxygen mask with a surgical mask layered over it (21.0%). A negative pressure room was used by 11.7–13.7% of participants for performing a regional anesthesia procedure.

The factors associated with the expansion of regional anesthesia in the bivariate analysis are presented in ESM eAppendices 3.1 and 3.2. The factors identified by the multivariable analysis to be independently associated with the increased use of neuraxial anesthesia during the pandemic are shown in Table 4. Increasing age was associated with a lower chance of expanding the practice of neuraxial anesthesia during the COVID-19 pandemic (OR,

Table 1 Personal characteristics of participants

Variable	<i>n</i> /total <i>N</i>	%
Age quartile		
< 40 yr	146/624	23.4%
40-44 yr	145/624	23.2%
45-52 yr	167/624	26.8%
≥ 53 yr	166/624	26.6%
Gender		
Male	395/623	63.4%
Female	223/623	35.8%
Prefer not to answer	5/623	0.8%
Category of practitioner		
Staff/faculty/consultant	521/594	87.7%
Certified registered nurse anesthetist (CRNA)	5/594	0.8%
Anesthesia assistant	9/594	1.5%
Nurse	1/594	0.2%
Fellow	16/594	2.7%
Resident/trainee	36/594	6.1%
Other	6/594	1.0%
Practice setting		
Academic institute or university hospital	332/729	45.5%
Military/Veterans Affairs hospital	15/729	2.1%
Community hospital	202/729	27.7%
Private clinic	116/729	15.9%
Other settings	29/729	4.0%
Country of practice		
Americas	136/619	22.0
Europe	273/619	44.1
UK	99/619	16.0
Asia	87/619	14.1
Africa	15/619	2.4
Australia and New Zealand	9/619	1.5
Area of anesthesia practice		
Predominantly obstetric anesthesia	10/619	1.6%
A mix of obstetric and non-obstetric anesthesia	342/619	55.3%
Non-obstetric anesthesia	267/619	43.1%
Subspecialty of anesthesia practice		
Orthopedic surgery	563/729	77.2%
Trauma surgery	449/729	61.6%
Plastic surgery	350/729	48.0%
General surgery including urology	507/729	69.5%
Other areas	122/729	16.7%

Data are presented as valid number/total number (*n*/total *N*) and valid percentage (%)

0.96; 95% CI, 0.94 to 0.99; $P = 0.01$). Practicing in a private clinic setting (OR, 2.02; 95% CI, 1.05 to 3.87; $P = 0.03$) and increased use of peripheral nerve blocks during the pandemic (OR, 14.86; 95% CI, 9.15 to 24.16, $P < 0.001$) were independent predictors of increased use of

neuraxial techniques. Practicing in the UK was marginally associated with increased utilization of neuraxial techniques compared with practice in the Americas, as the reference region (OR, 2.36; 95% CI, 0.99 to 5.60; $P = 0.052$). A significant association did not exist between any

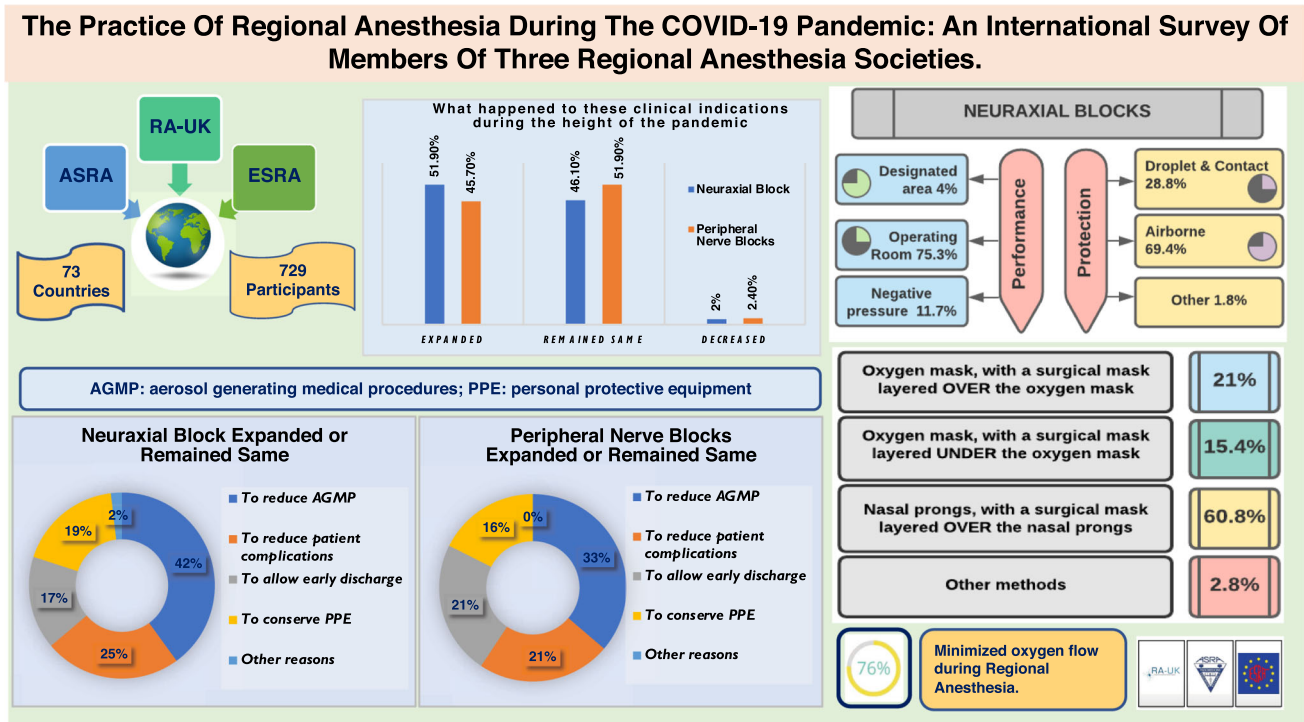


Figure The practice of regional anesthesia during the COVID-19 pandemic: an international survey of members of three regional anesthesia societies

particular subspecialty area of practice and expanded use of neuraxial block (Table 4).

Factors independently associated with the increased use of peripheral nerve blocks during the pandemic are shown in Table 5. Increasing age (OR, 1.03; 95% CI, 1.00 to 1.06; $P = 0.03$), area of practice predominantly involving obstetric or a mix of obstetric and non-obstetric anesthesia (OR, 1.66; 95% CI, 1.00 to 2.73; $P = 0.048$), and increased use of neuraxial anesthesia during the pandemic (OR, 14.90; 95% CI, 9.17 to 24.23; $P < 0.001$) were independent predictors of an increase in peripheral nerve block.

Compared with the Americas, practicing in Africa, Australia, or New Zealand was not significantly associated with an increased use of peripheral nerve blocks (OR, 3.52; 95% CI, 0.81 to 15.33; $P = 0.10$). Practicing in a private clinic setting (OR, 0.47; 95% CI, 0.24 to 0.92; $P = 0.03$) and a general surgery/urology practice subspecialty was independently associated with a reduced probability of an increase in the use of peripheral nerve blocks during the height of the COVID-19 pandemic. The possible relation between responders' age or practice setting and their preferences regarding use of neuraxial versus general anesthesia before the pandemic was explored by visualizing the descriptive data for these categories (ESM eAppendices 4.1, 4.2, 4.3, and 4.4).

We conducted a sensitivity analysis on either regression model for predicting increased use of neuraxial anesthesia or increased use of peripheral nerve blocks during the COVID-19 pandemic. We were interested in learning the effect of other predictors on either outcome when increased use of neuraxial anesthesia or increased use of peripheral nerve blocks was eliminated from the corresponding model.

After exclusion of increased use of peripheral nerve blocks from the first model, practicing in the UK was the only independent predictor of increased use of neuraxial blocks during the COVID-19 pandemic (aOR, 2.44; 95% CI, 1.25 to 4.78; $P = 0.01$). The previously observed association between increased use of neuraxial anesthesia and age or practicing at a private clinic could not be established.

On the other hand, after exclusion of increased use of neuraxial anesthesia from the second model, practicing in Asian countries was independently associated with increased use of peripheral nerve blocks during the COVID-19 pandemic (aOR, 2.2; 95% CI, 1.13 to 4.29; $P = 0.02$). A general surgery/urology subspecialty was an independent predictor of decreased used of peripheral nerve blocks (aOR, 0.55; 95% CI, 0.32 to 0.95; $P = 0.03$), whereas a predominantly obstetric or a mix of the obstetric and non-obstetric area of practice was marginally associated with decreased use of peripheral nerve blocks

Table 2 Changes in participants' practice for neuraxial anesthesia and peripheral nerve blocks during the height of the COVID-19 pandemic

Survey question	<i>n/total N</i>	%
The clinical indications for my use of neuraxial anesthesia during the height of the COVID-19 pandemic		
Expanded	311/599	51.9%
Stayed the same	276/599	46.1%
Decreased	12/599	2.0%
What are your reasons for the increase in use?		
To reduce aerosol-generating medical procedures	308/311	99.0%
To reduce the risk of possible complications to patients	179/311	57.6%
To allow early discharge from hospitals	125/311	40.2%
To conserve PPE	138/311	44.4%
Other reasons	16/311	5.1%
What are the reasons for the decrease in use?		
Risk of SARS-CoV-2 transmission to healthcare professional by an awake patient	5/12	41.7%
Unclear evidence on the benefit of neuraxial anesthesia for a patient with SARS-CoV-2 infection	2/12	16.7%
Risk of urgent conversion to GA for a patient with SARS-CoV-2 infection	7/12	58.3%
Other reasons	4/12	33.3%
The clinical indications for my use of peripheral nerve block for surgical anesthesia (without GA) during the height of the COVID-19 pandemic:		
Expanded	244/534	45.7%
Stayed the same	277/534	51.9%
Decreased	13/534	2.4%
What are your reasons for the increase in use?		
To reduce aerosol-generating medical procedures	240/244	98.4%
To reduce the risk of possible complications to patients	156/244	63.9%
To allow early discharge from hospitals	150/244	61.5%
To conserve PPE	119/244	48.8%
What are the reasons for the decrease in use?		
Risk of SARS-CoV-2 transmission to healthcare professional by an awake patient	6/13	46.2%
Unclear evidence on the benefit of neuraxial anesthesia for a patient with SARS-CoV-2 infection	1/13	7.7%
Risks of complications of peripheral nerve blocks outweigh the benefits	1/13	7.7%
Risk of urgent conversion to GA for a patient with SARS-CoV-2 infection	5/13	38.5%
Other reasons	5/13	38.5%

Data are presented as valid number / total number (*n/total N*) and valid percentage (%)

GA = general anesthesia; NAB = neuraxial block; PNB = peripheral nerve block; PPE = personal protective equipment

(aOR, 0.66; 95% CI, 0.44 to 0.99; $P = 0.045$). The previously observed association between increased use of peripheral nerve blocks and age or practicing at a private clinic could not be established. The details of these sensitivity analyses are provided as supplementary material in ESM eAppendix 5.1 and eAppendix 5.2, respectively.

Discussion

This survey of three regional anesthesia organizations captured responses from an international sample of respondents from 73 different countries during the first surge of the COVID-19 pandemic. Our results indicate that just over half of the respondents expanded their practice of

Table 3 Strategies employed by participants for management of SARS-CoV-2-positive or suspected SARS-CoV-2-positive patients

Variable	<i>n/total N</i>	%
Area where neuraxial blocks are performed for patient with SARS-CoV-2 infection		
Operating room or anesthetic room	549/729	75.3%
Designated block area	29/729	4.0%
Negative pressure room	85/729	11.7%
Type of PPE used by the practitioner while providing neuraxial blocks for a patient with SARS-CoV-2 infection		
Droplet and contact precautions	174/605	28.8%
Airborne precautions	420/605	69.4%
Other	11/605	1.8%
Area where peripheral nerve blocks are performed for patients with SARS-CoV-2 infection		
Operating room or anesthetic room	508/729	69.7%
Designated block area	61/729	8.4%
Negative pressure room	100/729	13.7%
Type of PPE used by the practitioner while providing peripheral nerve block for a patient with SARS-CoV-2 infection		
Droplet and contact precautions	163/602	27.1%
Airborne precautions	430/602	71.4%
Other	9/602	1.5%
Attempting to minimize oxygen flow during surgery under RA (without GA) for a patient suspected or positive for SARS-CoV-2 infection		
No	145/605	24.0%
Yes	460/605	76.0%
Requiring that a surgical mask is worn by a SARS-CoV-2 suspected or positive patient undergoing a surgical procedure under RA		
No	27/605	4.5%
Yes	578/605	95.5%
Preferred practice regarding the use of a surgical mask should a patient suspected or positive for SARS-CoV-2 infection undergoing a surgical procedure under RA mask need supplemental oxygen		
Oxygen mask, with a surgical mask layered over the oxygen mask	121/577	21.0%
Oxygen mask, with a surgical mask layered under the oxygen mask	89/577	15.4%
Nasal prongs (cannula), with a surgical mask layered over the nasal prongs	351/577	60.8%
Other methods	16/577	2.8%

Data are presented as valid number/total number (*n/total N*) and valid percentage (%)

GA = general anesthesia NAB = neuraxial block; PAPR = powered air-purified respirator; PNB = peripheral nerve block; PPE = personal protective equipment; RA = regional anesthesia

regional anesthesia during the first surge of the COVID-19 pandemic. The two main reasons for the increase in the use of regional anesthesia were to reduce the need for an aerosol-generating medical procedure and to reduce the risk of possible complications to the patients. Approximately 70% of the respondents used airborne precautions when caring for patients having surgery under a regional anesthetic technique and attempted to reduce the supplemental oxygen flow. Nasal prongs with surgical masks layered over it appear to be the most common

technique for providing oxygen supplementation, followed by surgical masks layered over the oxygen mask.

Despite advice from public health organizations worldwide to avoid social contact and remain at home where possible, the number of patients requiring urgent surgery (such as hip fracture surgery) may not have changed.¹⁰ Given the continuing increase in the number of people affected worldwide by SARS-CoV-2 and the serious consequences of having any surgery with a potential infection, any option to mitigate the spread and

Table 4 Multivariable binary logistic regression analysis for determinants of expanded use of neuraxial blocks during the height of the COVID-19 pandemic

Variable	B	SE	Wald	df	P value	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Age (years)	- 0.038	0.014	7.275	1	0.01	0.963	0.936	0.990
Male sex (=1) ^a	- 0.257	0.249	1.068	1	0.30	0.773	0.474	1.260
Country of practice			6.103	4	0.19			
Europe (=1) ^b	0.029	0.321	0.008	1	0.93	1.030	0.549	1.933
UK (=1) ^b	0.859	0.441	3.786	1	0.05	2.360	0.994	5.604
Asia (=1) ^b	0.469	0.415	1.280	1	0.26	1.598	0.709	3.602
Africa/Australia and New Zealand (=1) ^b	- 0.144	0.697	0.042	1	0.84	0.866	0.221	3.394
Practitioner's category staff/faculty/consultant (=1) ^c	0.114	0.396	0.083	1	0.77	1.121	0.516	2.436
Setting of practice								
Academic institute/university hospital (=1) ^d	0.073	0.336	0.047	1	0.83	1.075	0.557	2.077
Military/Veterans Affairs hospital (=1) ^e	- 0.893	0.885	1.017	1	0.31	0.409	0.072	2.322
Community hospital (=1) ^f	0.310	0.359	0.744	1	0.39	1.363	0.674	2.756
Private clinic (=1) ^g	0.702	0.332	4.477	1	0.03	2.018	1.053	3.869
Area of practice predominantly obstetric or mix of obstetric and non-obstetric surgery (=1) ^h	- 0.183	0.252	0.527	1	0.47	0.833	0.508	1.365
Subspecialty								
Orthopedic surgery (=1) ⁱ	0.018	0.513	0.001	1	0.97	1.018	0.373	2.780
Trauma surgery (=1) ^j	- 0.306	0.308	0.984	1	0.32	0.737	0.402	1.348
Plastic surgery (=1) ^k	0.037	0.250	0.022	1	0.88	1.038	0.636	1.695
General surgery including urology (=1) ^l	0.271	0.333	0.664	1	0.42	1.312	0.683	2.517
NAB preferred to GA before pandemic (=1) ^m	- 0.122	0.350	0.121	1	0.73	0.885	0.446	1.757
Area SA performed before the pandemic								
Operating room or anesthetic room (=1) ⁿ	0.586	0.624	0.882	1	0.35	1.798	0.529	6.113
Designated block area (=1) ^o	0.415	0.589	0.497	1	0.48	1.515	0.477	4.808
Area PNB performed before the pandemic								
Operating room or anesthetic room (=1) ^p	0.026	0.284	0.008	1	0.93	1.026	0.588	1.793
Designated block area (=1) ^q	0.409	0.469	0.759	1	0.38	1.505	0.600	3.772
Increased use of PNB during the height of COVID-19 pandemic (=1) ^r	2.699	0.248	118.647	1	< 0.001	14.865	9.146	24.159
Constant	- 0.142	1.202	0.014	1	0.91	0.868		

*"Pre-COVID-19 preference for PNB" was omitted because of collinearity

^a Referenced to "female sex" (= 0)

^b Referenced to "Americas" (= 0)

^c Referenced to "practitioner's category other than staff/faculty/consultant" (= 0)

^d Referenced to "setting other than academic institute/university hospital" (= 0)

^e Referenced to "setting other than military/Veterans Affairs hospital" (= 0)

^f Referenced to "setting other than community hospital" (= 0)

^g Referenced to "setting other than private clinic" (= 0)

^h Referenced to "area of practice predominantly non-obstetric" (= 0)

ⁱ Referenced to "subspecialty other than orthopedic surgery" (= 0)

^j Referenced to "subspecialty other than trauma surgery" (= 0)

^k Referenced to "subspecialty other than plastic surgery" (= 0)

^l Referenced to "subspecialty other than general surgery including urology" (= 0)

^m Referenced to "GA is preferred to NAB before pandemic" (= 0)

ⁿ Referenced to "NAB performed at area other than operating room before pandemic" (= 0)

^o Referenced to "NAB performed at area other than an RA-designated area before pandemic" (= 0)

^p Referenced to "PNB performed at area other than operating room before pandemic" (= 0)

^q Referenced to "PNB performed at area other than an RA-designated area before pandemic" (= 0)

^r Referenced to "use of PNB decreased or remained the same during height of COVID-19 pandemic" (= 0)

B = regression coefficient; CI = confidence interval; df = degree of freedom; Exp(B) = adjusted odds ratio; GA = general anesthesia; NAB = neuraxial block; PNB = peripheral nerve block; SA = spinal anesthesia; SE = standard error; Wald = Wald statistic

Table 5 Multivariable binary logistic regression analysis for determinants of expanded use of peripheral nerve blocks during the height of the COVID-19 pandemic

Variable*	B	SE	Wald	df	P value	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Age (years)	0.032	0.014	4.803	1	0.03	1.032	1.003	1.062
Male sex (= 1) ^a	0.063	0.249	0.064	1	0.80	1.065	0.654	1.735
Country of practice			4.582	4	0.33			
Europe (= 1) ^b	0.082	0.336	0.060	1	0.81	1.086	0.562	2.096
UK (= 1) ^b	0.213	0.440	0.234	1	0.63	1.237	0.523	2.929
Asia (= 1) ^b	0.569	0.422	1.820	1	0.18	1.766	0.773	4.036
Africa/Australia and New Zealand (= 1) ^b	1.258	0.751	2.803	1	0.09	3.517	0.807	15.331
Practitioner's category staff/faculty/consultant (= 1) ^c	0.043	0.399	0.012	1	0.92	1.044	0.478	2.280
Setting of practice								
Academic institute/university hospital (= 1) ^d	- 0.331	0.354	0.877	1	0.35	0.718	0.359	1.436
Military/Veterans Affairs hospital (= 1) ^e	1.096	0.891	1.511	1	0.22	2.991	0.521	17.165
Community hospital (= 1) ^f	- 0.528	0.375	1.980	1	0.16	0.590	0.283	1.230
Private clinic (= 1) ^g	- 0.762	0.348	4.806	1	0.03	0.467	0.236	0.922
Area of practice predominantly obstetric or mix of obstetric and non-obstetric surgery (= 1) ^h	0.505	0.256	3.899	1	0.048	1.656	1.004	2.733
Subspecialty								
Orthopedic surgery (= 1) ⁱ	0.243	0.540	0.203	1	0.65	1.276	0.442	3.677
Trauma surgery (= 1) ^j	0.171	0.310	0.306	1	0.58	1.187	0.647	2.178
Plastic surgery (= 1) ^k	0.082	0.252	0.106	1	0.74	1.086	0.662	1.781
General surgery including urology (= 1) ^l	- 0.703	0.340	4.272	1	0.04	0.495	0.254	0.964
NAB preferred to GA before pandemic (= 1) ^m	- 0.063	0.347	0.033	1	0.86	0.939	0.475	1.854
Area SA performed before the pandemic								
Operating room or anesthetic room (= 1) ⁿ	- 0.473	0.624	0.576	1	0.45	0.623	0.183	2.115
Designated block area (= 1) ^o	0.514	0.572	0.807	1	0.37	1.672	0.545	5.128
Area PNB performed before the pandemic								
Operating room or anesthetic room (= 1) ^p	0.043	0.287	0.023	1	0.88	1.044	0.595	1.833
Designated block area (= 1) ^q	- 0.337	0.485	0.483	1	0.49	0.714	0.276	1.847
Increased use of NAB during the height of COVID-19 pandemic (= 1) ^r	2.701	0.248	118.738	1	< 0.001	14.901	9.166	24.223
Constant	- 2.648	1.277	4.301	1	0.04	0.071		

*"Pre-COVID-19 preference for NAB" was omitted because of collinearity

^a Referenced to "female sex" (= 0)

^b Referenced to "Americas" (= 0)

^c Referenced to "practitioner's category other than staff/faculty/consultant" (= 0)

^d Referenced to "setting other than academic institute/university hospital" (= 0)

^e Referenced to "setting other than military/Veterans Affairs hospital" (= 0)

^f Referenced to "setting other than community hospital" (= 0)

^g Referenced to "setting other than private clinic" (= 0)

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^j Referenced to "subspecialty other than trauma surgery" (= 0)

^k Referenced to "subspecialty other than plastic surgery" (= 0)

^l Referenced to "subspecialty other than general surgery including urology" (= 0)

^m Referenced to "GA is preferred to NAB before pandemic" (= 0)

ⁿ Referenced to "NAB performed at area other than operating room before pandemic" (= 0)

^o Referenced to "NAB performed at area other than an RA-designated area before pandemic" (= 0)

^p Referenced to "PNB performed at area other than operating room before pandemic" (= 0)

^q Referenced to "PNB performed at area other than an RA-designated area before pandemic" (= 0)

^r Referenced to "use of PNB decreased or remained the same during height of COVID-19 pandemic" (= 0)

B = regression coefficient; CI = confidence interval; df = degree of freedom; Exp(B) = adjusted odds ratio; GA = general anesthesia; NAB = neuraxial block; PNB = peripheral nerve block; SA = spinal anesthesia; SE = standard error; Wald = Wald statistic

acuity of infection was potentially significant. The results from our survey that regional anesthesia techniques increased over general anesthesia (whenever appropriate) suggest that some providers believed regional anesthesia techniques to be safer. Similar to many other uncertainties regarding the SARS-CoV2 infection, firm evidence showing any beneficial role of regional anesthesia in modifying outcomes is lacking. Nevertheless, it is imperative that anesthesia providers make a decision based on the present understanding and put these considerations into the right perspective for a patient to make an informed decision.^{11,12}

While various arguments have been presented in the literature,⁷ current best available evidence states that aerosol-generating medical procedures pose a higher risk to healthcare workers;⁴ therefore, it may be wise to avoid these altogether where possible, particularly because PPE can breach during a procedure. Further, it is well established that the risk of transmission to healthcare workers is highest during the doffing of PPE.^{13,14} Besides the choice of anesthetic, appropriate clinical judgement must be exercised when dealing with any critically ill patient. This may include other considerations such as the potential for prolonged surgery and the need for conversion.¹¹ Some have even commented on the need for continuous regional blocks in patients requiring multiple surgeries or with prolonged pain.¹⁵ Although we considered assessing these domains, we did not include them to keep the survey short and broadly informative. As a comparison, we did not find any similar report within the published literature to inform us regarding the choice of anesthetic or perception of anesthesiologists regarding their choice of anesthetic technique.

Recently, Cesur *et al.* reported a survey of the practice of regional anesthesia in 126 members of the Turkish Society of Anesthesiology.¹⁶ This focused on the types of blocks used for different types of surgeries during the pandemic in Turkey. We were more interested however in finding anesthesiologist's practice and their reasoning behind the practice. Similar to their results, our survey showed that most practitioners used airborne precautions when providing care to a patient undergoing surgery under regional anesthesia. This is not surprising considering the uncertainties regarding the mode of transmission of the SARS-CoV-2 virus, albeit the predominant mode of transmission is thought to be via droplet and contact routes.¹⁷ Furthermore, an anesthesiologist has to remain in close contact with the patient for intraoperative monitoring, and the possibility of urgent conversion to general anesthesia cannot be discounted.¹⁸

Minor variations in a change of practice among different geographical areas were noticed. In this regard, other geographical areas expanded the practice of regional

anesthesia more than the Americas did. The participants more likely to use neuraxial anesthesia were also more likely to use peripheral nerve blocks for surgical anesthesia and vice versa. One of the most intriguing findings of the survey was the effect of anesthesiologist age on the change in regional anesthesia practice. Increasing age was more likely to expand the role of peripheral nerve block for surgical anesthesia but unlikely to expand the role of neuraxial anesthesia. This may be because the older anesthesiologists were using fewer peripheral nerve blocks before the pandemic compared with their younger colleagues.

Practitioners working in private clinics were more likely to expand the use of neuraxial anesthesia during the pandemic. Although it is difficult to ascertain the exact reason for this change, it appears that prior to the pandemic, less neuraxial anesthesia was being used in private clinics compared with other settings. The possible explanations for the expansion of neuraxial anesthesia in private clinics include an attempt to conserve the already limited PPE or other resources by avoiding general anesthesia. Finally, it was not surprising to see that anesthesiologists who practiced obstetric or a mix of obstetric and non-obstetric anesthesia were more likely to expand their peripheral nerve block practice, possibly because of more familiarity with providing care to patients with regional anesthesia. Along the same lines, institutions have reported reduced regional to general anesthesia conversion rates for Cesarean delivery during the pandemic.¹⁹

Apart from common limitations of survey methods research such as recall bias, response bias, and question order bias, the most significant limitation of our survey was the response rate (20%) based on the number of emails opened and the number of emails sent (8.5%). Unfortunately, response rates to web-based surveys distributed to physicians are typically low.²⁰ In addition, the increased workload of healthcare workers during the initial surge and ongoing pandemic, as well as survey fatigue, may have reduced the response rate further. The survey also obtained responses from members of regional anesthesia societies, thereby possibly reflecting a favourable attitude towards regional anesthesia. The opportunity to engage with a broader anesthesia provider community was limited, given that major national anesthesia societies generally do not support the distribution of surveys to their members.

We did not test whether the survey sample was representative of the membership of participating societies. Although this may be regarded as a limitation of the present findings, such comparisons may be unnecessary for two reasons. First, since the sampling process was totally random through electronically

generated emails sent to all active members of each society, there is no reason to be concerned about selection bias. On the other hand, trying to verify equalization between the participants' characteristics and those of the main population of interest through a series of statistical tests would only serve to inflate the type one error. Second, verifying that characteristics of the sample are not different from those of the main population of the societies' membership would be an issue if the survey was conducted to investigate the change in responses and attitudes of the members of a particular society, e.g., as part of a local auditing process. In the current broader context of attempting to examine changes in attitudes and practices of practitioners of regional anesthesia at large, this was a rather minor issue.

Conclusions and implications

Given the purported benefits of regional anesthesia over general anesthesia, approximately half of the members of three regional anesthesia societies seem to have expanded the use of their regional anesthesia techniques during the initial surge of the COVID-19 pandemic. As many large studies continue to provide new information, we must continue to ask the appropriate questions in our quest for better evidence to inform our decisions.

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