



# Intrapandemic regional anesthesia as practice: a historical cohort study in patients undergoing breast cancer surgery

## L'anesthésie régionale en tant que pratique intrapandémique : une étude de cohorte historique chez des patientes bénéficiant d'une chirurgie de cancer du sein

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### Abstract

**Background** The COVID-19 pandemic has markedly increased delays in oncologic surgeries because of the virus's impact on traditional anesthetic management. Novel protocols, developed to protect patients and medical professionals, have altered the ways and instances in which general anesthesia (GA) can be safely performed. To reduce virus exposure related to aerosol-generating procedures, it is now recommended to avoid GA when feasible and promote regional anesthesia instead. At our institution, we observed faster postoperative recovery in patients who received paravertebral blocks for breast

cancer surgery instead of GA. This led us to formally evaluate whether regional anesthesia instead of GA helped improve time to hospital discharge.

**Methods** We conducted a historical cohort study to retrospectively analyze two cohorts of patients: prepandemic vs intrapandemic. We obtained approval from our institutional ethics committee to review files of consecutive patients who underwent breast cancer surgery between 30 March 2020 and 30 June 2020 (intrapandemic group;  $N = 106$ ) and consecutive patients—moving backwards—from 28 February 2020 to 6 December 2019 (prepandemic group;  $N = 104$ ). The primary outcome was the length of time between the end of surgery to readiness for hospital discharge. Secondary outcomes included the incidence of postoperative nausea and vomiting (PONV), the need for postoperative analgesia, and the duration of stay in the postanesthesia care unit (PACU).

**Results** The median [interquartile range (IQR)] time to readiness for hospital discharge was significantly lower in patients who received paravertebral blocks for breast cancer surgery compared with GA (intrapandemic group, 119 [99–170] min vs prepandemic group, 191 [164–234] min;  $P < 0.001$ ) as was the incidence of PONV (3% vs 11%;  $P = 0.03$ ) and median [IQR] PACU durations of stay (29 [21–39] min vs 46 [37–63] min;  $P < 0.001$ ).

**Conclusions** Patients who received paravertebral blocks for breast cancer surgery in the intrapandemic group were ready for hospital discharge earlier, spent less time in the PACU, and experienced less PONV than those who received GA in the prepandemic group. With growing

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*surgical wait times, concerns related to aerosol-generating procedures, and recommendations to avoid GA when feasible, paravertebral blocks as the principal anesthetic modality for breast cancer surgery offered benefits for patients and medical teams.*

## Résumé

**Contexte** La pandémie de COVID-19 a considérablement augmenté les retards dans les chirurgies oncologiques en raison de l'impact du virus sur la prise en charge anesthésique traditionnelle. De nouveaux protocoles, mis au point pour protéger les patients et les professionnels de la santé, ont modifié les façons et les cas dans lesquels une anesthésie générale (AG) peut être réalisée en toute sécurité. Afin de réduire l'exposition au virus liée aux interventions génératrices d'aérosols, il est maintenant recommandé d'éviter l'AG lorsque possible et de privilégier l'anesthésie régionale. Dans notre établissement, nous avons observé une récupération postopératoire plus rapide chez les patientes ayant reçu des blocs paravertébraux pour une chirurgie de cancer du sein au lieu d'une AG. Cela nous a menés à évaluer de façon formelle si l'anesthésie régionale au lieu de l'AG avait contribué à réduire les délais jusqu'au congé de l'hôpital.

**Méthode** Nous avons réalisé une étude de cohorte historique afin d'analyser rétrospectivement deux cohortes de patientes : prépandémie vs intrapandémie. Nous avons obtenu l'approbation de notre comité d'éthique institutionnel pour examiner les dossiers de patientes consécutives ayant bénéficié d'une chirurgie de cancer du sein entre le 30 mars 2020 et le 30 juin 2020 (groupe intrapandémie;  $n = 106$ ) et des patientes consécutives – en reculant – du 28 février 2020 au 6 décembre 2019 (groupe prépandémie;  $n = 104$ ). Le critère d'évaluation principal était le délai entre la fin de la chirurgie et le moment où les patientes étaient prêtes à recevoir leur congé de l'hôpital. Les critères d'évaluation secondaires comprenaient l'incidence de nausées et vomissements postopératoires (NVPO), la nécessité d'une analgésie postopératoire et la durée de séjour en salle de réveil (SDR).

**Résultats** Le délai médian [écart interquartile (ÉIQ)] jusqu'à la disposition au congé de l'hôpital était significativement plus court chez les patientes ayant reçu des blocs paravertébraux pour une chirurgie de cancer du sein plutôt qu'une AG (groupe intrapandémie, 119 [99–170] min vs groupe prépandémie, 191 [164–234] min;  $P < 0,001$ ), tout comme l'incidence de NVPO (3 % vs 11 %;  $P = 0,03$ ) et les durées médianes [ÉIQ] de séjour en salle de réveil (29 [21–39] min vs 46 [37–63] min;  $P < 0,001$ ).

**Conclusion** Les patientes qui ont reçu des blocs paravertébraux pour une chirurgie de cancer du sein dans le groupe intrapandémie étaient prêtes à quitter

*l'hôpital plus tôt, ont passé moins de temps en salle de réveil et ont ressenti moins de NVPO que celles qui ont reçu une AG dans le groupe prépandémie. Avec des temps d'attente pour accès à la chirurgie de plus en plus longs, des préoccupations liées aux interventions génératrices d'aérosols et les recommandations d'éviter l'AG lorsque possible, les blocs paravertébraux ont offert des avantages aux patientes et aux équipes médicales en tant que principale modalité anesthésique pour la chirurgie de cancer du sein.*

**Keywords** paravertebral block · breast cancer surgery · COVID-19 · pandemic · Recovery

The COVID-19 pandemic has forced the global medical community to dramatically innovate its standards of care.<sup>1</sup> Novel protocols, developed to protect patients and medical professionals, have altered the ways and instances in which general anesthesia (GA) can be safely performed. These new standards include circumvention of exposure risks by reducing the number of healthcare workers in the operating room (OR) during aerosol-generating procedures, usage of more advanced personal protection equipment, performing rapid sequence inductions without bag-mask ventilation, and waiting for adequate air turnover to clear potential viral particles.<sup>2,3</sup> The pandemic and these new protocols have increased anesthesia times and reduced the number of performed surgeries.

In patients infected with SARS-CoV-2, 30-day mortality and postoperative pulmonary complications greatly increase even if symptoms began in the postoperative period.<sup>4</sup> In response, the European Society of Regional Anesthesia and Pain Therapy and the American Society of Regional Anesthesia and Pain Medicine have recommended avoiding GA and promote regional anesthesia for both patients with negative and positive COVID-19 test results.<sup>5</sup> Dexter *et al.* have suggested prioritizing procedures that do not require GA to help increase surgical caseloads and reduce waiting lists.<sup>2</sup> Another important aspect of prioritizing regional anesthesia and avoiding aerosol-generating procedures is the protection healthcare workers.

In a context of limited medical staff and growing wait lists, our anesthetic practice needs to evolve and adapt. Breast cancer surgery is mainly an outpatient surgery. Complications leading to hospitalizations such as nausea, vomiting, and pain must be avoided. Multiple regional anesthesia techniques have been proposed for breast cancer surgery, including paravertebral blockade,<sup>6</sup> and some studies have compared GA with this modality.<sup>7–16</sup> Woodworth *et al.* concluded that with or without GA,

paravertebral blockade in breast cancer surgery reduces pain scores, analgesic consumption, nausea and vomiting, hospital stay, and chronic postsurgical pain.<sup>17</sup>

In response to the COVID-19 pandemic, we have markedly modified our anesthetic practices to provide safer environments for our patients and our staff. Starting 30 March 2020, the option of paravertebral blockade and sedation as sole anesthetic technique was made available to all patients undergoing breast cancer surgery. Over time, we observed faster postoperative recovery in patients who received paravertebral blocks instead of GA during breast cancer surgery. This led us to evaluate whether paravertebral blockade as principal anesthetic modality could help improve time to hospital discharge compared with GA.

## Methods

We conducted a historical cohort study to retrospectively compare two cohorts of patients: prepandemic vs intrapandemic. The primary outcome was the length of time between the end of surgery to readiness for hospital discharge. *Readiness* meant that patients had met all criteria for hospital discharge, but might not have physically left the hospital for various non-medical reasons (e.g., waiting for transportation). Secondary outcomes included the incidence of postoperative nausea and vomiting (PONV), the need for postoperative analgesia, and the duration of stay in the postanesthesia care unit (PACU).

This study was conducted at the Maisonneuve-Rosemont Hospital in Montréal, CIUSSS de l'Est de l'Île de Montréal, Québec, Canada. We obtained approval from our institutional ethics committee (21 June 2020; CIUSSS de l'Est-de-l'Île-de-Montreal's Research Ethics Board; project# 2021-2305) to retrospectively review files of all consecutive patients who underwent breast cancer surgery between 30 March 2020 and 30 June 2020 (intrapandemic group) and—moving backwards—28 February 2020 to 6 December 2019 (prepandemic group). We included patients who underwent a total or partial mastectomy with or without axillary intervention. We abstracted patient data from the hospital electronic chart relating to demographics, comorbidities, type of surgery, and type of anesthesia or regional block used. We also abstracted data on the duration of surgery, total time spent in the OR, time spent in the PACU, incidence of PONV in the PACU and ambulatory surgery ward, and the total postoperative time spent in hospital. The duration of stay in PACU was defined as the time spent from arrival until the patient met our discharge criteria, based on a modified Aldrete score<sup>18</sup> augmented by the absence of pain, PONV, and surgical

bleeding. The Maisonneuve-Rosemont local PACU score includes these latter criteria and the highest possible score is 16 points. Patients need a local score of  $\geq 15$  out of 16 to be discharged from the PACU. The postoperative time spent in hospital was defined as the time between the end of surgery and being ready for hospital discharge.

For the intraoperative data, we abstracted the total fentanyl doses used for induction and intraoperative maintenance of anesthesia. If remifentanyl was used for induction and/or maintenance, we used a 1:1 ratio to convert it to a fentanyl equivalent dose. We also recorded the number of PONV prophylaxis medications used for each patient. We also recorded whether patients in the prepandemic group had a plane block added to their GA and if so, which block.

We obtained free and informed consent for the paravertebral blocks. We performed the paravertebral blocks with the patients in the sitting position with an intravenous line placed, supplemental oxygen *via* nasal cannula, and standard Canadian Anesthesiologists' Society monitoring. Patients received 1–2 mg of *iv* midazolam and 25–50  $\mu\text{g}$  of *iv* fentanyl before the block. We performed the block using an in-plane parasagittal ultrasound-guided approach<sup>19</sup> on 3–5 levels with 5–10 mL 0.5% ropivacaine per level. The T2/T3, T3/T4, and T4/T5 levels were blocked for all patients. The T1/T2 level was also blocked when the surgery included an intervention with axillary ganglion(s). The T5/T6 level was sometimes also blocked at the discretion of the attending anesthesiologist. We administered a total of 20–30 mL of 0.5% ropivacaine to each patient. Readiness for surgery was established by a prick test by the surgeon immediately before the incision. A block failure was defined as the instance of inadequate regional anesthesia requiring GA to commence surgery. Intraoperatively, patients were sedated with a propofol infusion for additional comfort.

## Statistical analysis

We included a convenience sample of all eligible patients who underwent surgery during the observation period, but because of the limited sample size, the reported analyses are primarily descriptive. Continuous data are presented as mean (standard deviation) for variables showing a normal distribution and as median [interquartile range] for parameters with a non-normal distribution, while categorical data were presented as count (percentage). We assessed the distribution of continuous variables using plots, normality tests (Shapiro–Wilk, Kolmogorov–Smirnov), and skewness and kurtosis indexes. Groups were compared using Student's *t* test (difference in means, 95% confidence interval [CI]) for continuous normally distributed parameters or the Mann–Whitney–Wilcoxon

(difference in medians [estimated using the Hodges-Lehmann method], 95% CI) test for variables not normally distributed, and the Chi square test (difference in percentages, 95% CI) or Fisher's exact test (when cells had expected counts less than 5) for categorical parameters. We used SAS version 9.4 or higher (SAS Institute Inc., Cary, NC, USA) for statistical analyses and used a two-sided 0.05 significance level. We did not adjust for multiple testing and no imputations of missing data were done.

## Results

We selected and screened 217 women for this study based on our inclusion criteria and timeframe; 109 charts were reviewed in the intrapandemic group and 108 in the prepandemic group. Five patients were excluded in the intrapandemic group: one patient had undergone a simultaneous thyroid surgery, one patient had undergone an immediate flap reconstruction surgery, and three patients had missing data. A total of  $N = 104$  patients were included in the intrapandemic group for analysis. We excluded two patients from the prepandemic group because of missing data and a total of  $N = 106$  patients were included for analysis. Demographic data and patient characteristics are presented in Table 1. There were no significant differences between the two groups concerning age, body mass index, and type of surgery.

More patients in the intrapandemic groups received preoperative chemotherapy and/or radiotherapy. The pandemic significantly slowed the breast cancer screening program at our institution, which dramatically reduced the number of new breast tumour diagnoses. Patients who presented to the OR during the pandemic were likely already diagnosed, under adjuvant treatment, or had large palpable masses. Hence, more patients had received chemotherapy or radiotherapy preoperatively in the intrapandemic group. There were no differences between the two groups regarding comorbidities, except for cardiac valvulopathy, which was present in 4/104 (4%) patients in the intrapandemic group (Table 1).

In the prepandemic group, most surgeries were performed under GA without any form of regional anesthesia. Great care was taken in the intrapandemic group to provide regional anesthesia to improve postoperative analgesia and minimize the risk of hospitalization for pain or PONV as hospitalization carried a significant risk of being infected with SARS-CoV-2. In the prepandemic group, 70/106 (66%) of patients underwent GA without any regional anesthesia; this figure dropped to 8/104 (8%) in the intrapandemic group. Zero patients (0/106; 0%) in the prepandemic group received a paravertebral block combined with intravenous

light sedation during surgery, as opposed to 80/104 (77%) in the intrapandemic group. The proportion of patients with GA combined with pectoralis nerve block (PECS) block was 34/106 (32%) in the prepandemic group and 11/104 (46%) in the intrapandemic group. In the intrapandemic group, one patient underwent surgery under erector spinae plane block with sedation and one patient under thoracic epidural. Three patients had a block failure that required GA in the intrapandemic group (Table 2).

Regarding our primary outcome, the median time between the end of surgery and readiness for hospital discharge was markedly shorter for patients in the intrapandemic group who received paravertebral blockade with no GA than for patients in the prepandemic group who underwent GA (absolute difference, 69 min; 95% CI, 55 to 82;  $P < 0.001$ ) (Table 3).

In terms of secondary outcomes, the PONV incidence was not significantly different in the PACU but in the ambulatory surgery unit was lower in the intrapandemic group (than in the prepandemic group (3/104 [3%] vs 11/106 [11%];  $P = 0.03$ ) (Table 3). This lower incidence occurred despite fewer patients in the intrapandemic group receiving two or more prophylactic agents to reduce PONV than in the prepandemic group (45/104 [43%] vs 91/106 [86%]) (Table 2). The duration of time spent in the PACU was also reduced when surgeries were performed under paravertebral blockade, and PACU was even bypassed for some of these patients. The intrapandemic patients spent 17 min less in the PACU (median [interquartile range (IQR)] time, 29 [21–39] vs 46 [37–63] min;  $P < 0.001$ ). In the intrapandemic group, 7/104 (7%) of patients bypassed the PACU completely compared with 0/106 (0%) in the prepandemic group ( $P = 0.01$ ). There were no differences in opioid doses or PONV in the PACU between the two groups. The hospitalization rate (4/106 [4%] vs 4/104 [4%]) was the same in the two groups and patients were only hospitalized for surgical considerations. No block-related complications, such as pneumothorax or local anesthetic systemic toxicity, occurred in any group.

## Discussion

The main finding of our historical cohort study is that patients who underwent breast cancer surgery under paravertebral blockade as the principal anesthetic modality were ready for hospital discharge markedly faster than those who underwent GA. This could be of clinical, economic, and administrative significance.

The COVID-19 pandemic has forced the global medical community to dramatically innovate its traditional standards of care. At our centre, we have shifted to a regional anesthesia approach for mastectomies. While our

**Table 1** Demographic data and patient characteristics

Characteristics	Prepandemic group <i>N</i> = 106	Intrapandemic group <i>N</i> = 104	Absolute difference (95% CI)	<i>P</i> value
Age (yr)	61 (13)	57 (15)	3% (-1 to 7)	0.09 <sup>c</sup>
Weight (kg)	71 (17)	72 (17)	-1% (-6 to 3)	0.59 <sup>c</sup>
Adjusted weight (kg)	61 (9)	62 (9)	-1% (-3 to 2)	0.48 <sup>c</sup>
Height (cm)	161 (9)	162 (8)	-1% (-3 to 2)	0.64 <sup>c</sup>
BMI (kg·m <sup>-2</sup> )	28 (7)	28 (8)	0% (-2 to 2)	1.00 <sup>c</sup>
ASA Physical Status score				0.67 <sup>a</sup>
I	11/106 (10%)	14/104 (13%)	-3% (-12 to 6)	
II	83/106 (78%)	76/104 (73%)	5% (-6 to 17)	
III	12/106 (11%)	14/104 (13%)	-2% (-11 to 7)	
Type of mastectomy				0.77 <sup>a</sup>
Partial mastectomy	44/106 (42%)	45/104 (43%)	-2% (-15 to 12)	
Partial mastectomy + AX	48/106 (45%)	44/104 (42%)	3% (-10 to 16)	
Total mastectomy	10/106 (9%)	8/104 (8%)	2% (-6 to 9)	
Total mastectomy + AX	4/106 (4%)	6/104 (6%)	-2% (-8 to 4)	
Radical modified mastectomy + AX	0/106 (0%)	1/104 (1%)	-1% (-3 to 1)	
Preop chemotherapy	3/106 (3%)	17/104 (16%)	-13% (-21 to -6)	< 0.001 <sup>a</sup>
Preop radiotherapy	0/106 (0%)	5/104 (5%)	-5% (-11 to -1)	0.03 <sup>b</sup>
Hypertension	40/106 (38%)	31/104 (30%)	8% (-5 to 21)	0.22 <sup>a</sup>
Dyslipidemia	29/106 (27%)	27/104 (26%)	1% (-11 to 13)	0.82 <sup>a</sup>
Arrhythmia	5/106 (5%)	3/104 (3%)	2% (-4 to 8)	0.72 <sup>b</sup>
Atherosclerotic coronary heart disease	1/106 (1%)	3/104 (3%)	-2% (-7 to 3)	0.37 <sup>b</sup>
Heart failure	1/106 (1%)	0/104 (0%)	1% (-3 to 5)	1.00 <sup>b</sup>
Cardiac valvulopathy	0/106 (0%)	4/104 (4%)	-4% (-10 to 0)	0.06 <sup>b</sup>
Atherosclerotic vascular disease	0/106 (0%)	1/104 (1%)	-1% (-5 to 3)	0.50 <sup>b</sup>
Active smoker	13/106 (12%)	13/104 (13%)	0% (-9 to 9)	0.96 <sup>a</sup>
Asthma	11/106 (10%)	18/104 (17%)	-7% (-16 to 2)	0.15 <sup>a</sup>
Chronic obstructive pulmonary disease	7/106 (7%)	13/104 (13%)	-6% (-14 to 2)	0.15 <sup>a</sup>
Obstructive sleep apnea	5/106 (5%)	5/104 (5%)	0% (-6 to 6)	0.98 <sup>a</sup>
Chronic kidney disease	2/106 (2%)	3/104 (3%)	-1% (-7 to 4)	0.68 <sup>b</sup>
Type 2 diabetes	17/106 (16%)	14/104 (13%)	3% (-7 to 12)	0.60 <sup>a</sup>
Stroke	1/106 (1%)	2/104 (2%)	-1% (-6 to 4)	0.62 <sup>b</sup>
Obesity	27/106 (26%)	26/104 (25%)	0% (-12% to 12)	0.97 <sup>a</sup>
Preoperative fibromyalgia	2/106 (2%)	3/104 (3%)	-1% (-7 to 4)	0.68 <sup>b</sup>

Numbers are represented as mean (standard deviation) or *n*/total *N* (%)

Differences are (prepandemic – intrapandemic):

ASA = American Society of Anesthesiologists; AX = axillary intervention; BMI = body mass index; CI = confidence interval

<sup>a</sup> Chi square test, difference in percentages (95% CI)

<sup>b</sup> Fisher's exact test, difference in percentages (exact 95% CI)

<sup>c</sup> *t* test, difference in means (95% CI)

initial goal was to protect the medical personnel from COVID-19 by limiting aerosol-generating procedures, this approach greatly increased our efficiency and reduced patients' side effects. Patients who had their mastectomy under paravertebral blockade and sedation spent significantly less time in hospital following their surgery. The shift from GA to regional anesthesia also reduced the

PONV rate, even though we administered less PONV prophylaxis to patients undergoing regional anesthesia. We have little doubt that the lower PONV rate of along with the prolonged analgesia conferred by the blocks contributed to the earlier readiness for discharge. These patients also bypassed the PACU more frequently, and those who did not spent less time in the PACU.

**Table 2** Intraoperative data

Outcome	Prepandemic group N = 106	Intrapandemic group N = 104	Absolute difference (95% CI)	P value
General anesthesia			77% (69 to 85)	< 0.001 <sup>a</sup>
Yes	106/106 (100%)	24/104 (23%)		
No	0/106 (0%)	80/104 (77%)		
General anesthesia				< 0.001 <sup>a</sup>
Paravertebral block	0/106 (0%)	5/104 (21%)	-21% (-37 to -5)	
PEC2 block	34/106 (32%)	11/104 (46%)	-14% (-36 to 8)	
Serratus block	1/106 (1%)	5/104 (21%)	-20% (-36 to -4)	
ESP block	1/106 (1%)	1/104 (4%)	-3% (-11 to 5)	
Without block	70/106 (66%)	2/104 (8%)	58% (43 to 72)	
Regional anesthesia and sedation				NA
Paravertebral block		78/104 (98%)		
ESP block		1/104 (1%)		
Epidural		1/104 (1%)		
TIVA	2/106 (2%)	0/104 (0%)	2% (-14 to 7)	1.00 <sup>b</sup>
Volatile	104/106 (98%)	24/104 (100%)	-2% (-7 to 14)	1.00 <sup>b</sup>
Block failure		3/104 (3%)		NA
Total intraoperative fentanyl (μg)	121 [99–200]	50 [0–150]	50 (36 to 78)	< 0.001 <sup>c</sup>
Number of intraoperatively administered PONV prophylaxis medications*				< 0.001 <sup>a</sup>
0	4/106 (4%)	16/104 (15%)	-12% (-19 to -4)	
1	11/106 (10%)	43/104 (41%)	-31% (-42 to -20)	
2	63/106 (59%)	32/104 (31%)	29% (16 to 42)	
3	28/106 (26%)	13/104 (13%)	14% (3 to 24)	
PONV prophylaxis with 2 or more treatments	91/106 (86%)	45/104 (43%)	43% (31 to 54)	< 0.001 <sup>a</sup>

All numbers are represented as median [interquartile range] or as *n*/total *N* (%); differences are (prepandemic – intrapandemic)

CI = confidence interval; ESP = erector spinae plane; PEC2 = plane block between pectoralis minor and serratus anterior; PONV = postoperative nausea and vomiting; TIVA = total intravenous anesthesia

<sup>a</sup> Chi square test, difference in percentages (95% CI)

<sup>b</sup> Fisher's exact test, difference in percentages (exact 95% CI)

<sup>c</sup> Mann–Whitney–Wilcoxon test, difference in medians (95% CI) [estimated using the Hodges–Lehmann method]

\*Dexamethasone, haloperidol, ondansetron, or aprepitant

Other positive implications of regional anesthesia are efficiency-based. Having patients leave the hospital earlier reduces contact with healthcare personnel and reduces burdens on an already strained public healthcare system. With fewer available hospital beds, the pressure to switch to same-day surgery is high. Lowering surgical- and anesthetic-induced side effects is key to discharging patients home sooner and healthier. As our findings show, paravertebral blocks for breast cancer surgery reduce the burden on the PACU and the same-day surgery unit.

Our data do not include the higher number of surgeries we were able to perform by avoiding aerosol-generating procedures. We completed up to eight mastectomies (including two total mastectomies) per day in a single

OR during the COVID-19 pandemic, which is more patients than were scheduled for surgery in an OR before switching to regional anesthesia. Despite the delay of mastectomy procedures, they were performed within the recommended period of time as per oncologic guidelines. The mastectomy wait list was cleared by the end of June 2020—a true accomplishment in our patient care during an ongoing pandemic.

Our block failure rate was 3/104 (3%), which is lower than reported for anatomical landmark-based paravertebral blocks.<sup>11</sup> More work needs to be done to establish the failure rate of ultrasound-guided paravertebral blocks for surgical anesthesia. We successfully conducted total mastectomies under paravertebral blocks even in patients with severe obesity—two of our patients had BMIs of 11

**Table 3** Postoperative data

Outcome	Prepandemic group N = 106	Intrapandemic group N = 104	Absolute difference (95% CI)	P value
<i>Primary outcome</i>				
Time to readiness for hospital discharge (min)* (all patients)	191 [164–234]	134 [101–191]	56 (39 to 70)	< 0.001 <sup>c</sup>
Time to readiness for hospital discharge (min) <sup>†</sup> (intrapandemic GAs excluded)	191 [164–234]	119 [99–170]	69 (55 to 82)	< 0.001 <sup>c</sup>
<i>Secondary outcomes</i>				
PACU stay (yes)	106/106 (100%)	97/104 (93%)	7% (2 to 12)	0.01 <sup>a</sup>
Time spent in PACU (min) <sup>‡</sup>	46 [37–63]	29 [21–39]	18 (14 to 22)	< 0.001 <sup>c</sup>
Opioid dose in PACU <sup>§</sup>	0 [0–0] <sup>  </sup>	0 [0–0] <sup>  </sup>	0 (0 to 0)	0.28 <sup>c</sup>
PONV in PACU	6/106 (6%)	2/104 (2%)	4% (-2 to 10)	0.28 <sup>b</sup>
Opioid dose in ambulatory surgery <sup>§</sup>	0 [0–0] <sup>¶</sup>	0 [0–0] <sup>¶</sup>	0 (0 to 0)	0.50 <sup>c</sup>
PONV in ambulatory surgery	11/106 (11%)	3/104 (3%)	8% (1 to 15)	0.03 <sup>a</sup>
Hospitalization	4/106 (4%)	4/104 (4%)	0% (-6 to 06)	1.00 <sup>b</sup>

Numbers are represented as median [interquartile range] or n/total N (%); differences are (prepandemic – intrapandemic)

CI = confidence interval; GA = general anesthesia; PACU = postanesthesia care unit; PONV = postoperative nausea and vomiting

<sup>a</sup> Chi square test, difference in percentages (95% CI)

<sup>b</sup> Fisher's exact test, difference in percentages (exact 95% CI)

<sup>c</sup> Mann–Whitney–Wilcoxon test, difference in medians (95% CI) [estimated using the Hodges–Lehmann method]

\*Between end of surgery and readiness for hospital discharge (all patients)

<sup>†</sup> Between end of surgery and readiness for hospital discharge (excluding 24/104 [23%] patients who underwent general anesthesia in intrapandemic group)

<sup>‡</sup> Defined as the time spent from arrival until the patient met our discharge criteria, based on a modified Aldrete score<sup>18</sup> augmented by the absence of pain, PONV, and surgical bleeding (*cf.* body text, Methods)

<sup>§</sup> Morphine equivalent *po* (mg)

<sup>||</sup> The percentage of subjects with 0 as opioid dose was 79% and the median [interquartile range] dose of subjects with an opioid dose different of 0 was 6 [4–10].

<sup>¶</sup> The percentage of subjects with 0 as opioid dose was 93% and the median [interquartile range] dose of subjects with an opioid dose different of 0 was 5 [5–10].

and 56 kg·m<sup>-2</sup>. The doses of intraoperative fentanyl were significantly reduced in the intrapandemic group compared to the prepandemic group, even when including the patients who received GA in the intrapandemic group. In light of the opioid crisis and the possibility of inducing some degree of opioid-induced hyperalgesia, the provision of anesthetic care that reduces the amount of opioids administered to the patient in the perioperative period is a notable added aspect.<sup>20</sup>

We did not evaluate postoperative analgesia in our study, but we can easily hypothesize that it was greatly improved with paravertebral blockade, which is known to last about 18 hr, and long-acting local anesthetics (ropivacaine 0.5%); Cassi *et al.* reported that the analgesic effect of paravertebral blocks in breast surgery lasted up to 72 hr.<sup>21</sup> Paravertebral blocks in breast surgery have also been shown to reduce the incidence as well as the intensity of chronic pain.<sup>21</sup> In a recent Cochrane review, Weinstein *et al.* concluded that using regional anesthesia in

breast cancer surgery could prevent chronic pain at 12 months after surgery (odds ratio, 0.43; 95% CI, 0.28 to 0.68).<sup>22</sup> Pre-emptive blockade of pain pathways seems to prevent pain sensitization caused by the tissue trauma caused in surgery.<sup>21</sup>

In 1999, Pusch *et al.* stated that it was difficult to explain the low interest in this block.<sup>11</sup> Sadly, it seems this is still the case, even in our institution before the COVID-19 pandemic. Paravertebral blocks became less favourable to new less invasive ultrasound-guided interfascial plane blocks performed further away from the pleura, which may have contributed to the paravertebral block's loss of popularity. Interfascial blocks offer great advantages to mastectomy patients but are not adequate surgical blocks. Nevertheless, with new highly performing ultrasound machines, paravertebral blocks with low side effect and risk profile conveys undeniable advantages for breast surgery patients. Niesen *et al.* reported a pneumothorax risk of 0.9/1000 per blocked level with ultrasound-guided

thoracic paravertebral blocks for breast surgery.<sup>23</sup> It is a neuraxial technique in a noncompressible site and care must also be taken to strictly enforce the American Society of Regional Anesthesia and Pain Medicine guidelines concerning anticoagulation before performing paravertebral blocks. We did not encounter any block-related complications in the intrapandemic group such as pneumothorax or local anesthetic systemic toxicity. Twenty to 30 mL of ropivacaine 0.5% were used for the blocks, adjusting the dose for weight to remain under 3 mg·kg<sup>-1</sup>. Maximizing local anesthetic doses while keeping them nontoxic allows for prolonged block duration and prolonged analgesia.

There are some limitations to our study. First, it is a retrospective observational historical cohort study based on electronic hospital patient files. Patients were not randomized to either group. Nevertheless, the breast cancer population is rather homogeneous and so were our two groups (Table 1), which render comparisons suitable. Second, we compared our intrapandemic group to a historical prepandemic cohort with the same number of patients in each group. To avoid selection biases, both cohorts comprised consecutive patients scheduled for breast cancer surgery. Nevertheless, the included cases were not matched before inclusion of the prepandemic cohort. Although our clinical experience with total mastectomies is conclusive, it should also be noted that most of the patients included in this study underwent a partial mastectomy. Lastly, there were no strict protocols to follow for the anesthetic technique in the intrapandemic group, but the practice of the regional anesthetists in our centre was very similar, which might not impact the value of the aforementioned results.

## Conclusion

Taken together, our findings show that patients scheduled for breast cancer same-day surgery were ready for hospital discharge over an hour earlier than those who had surgery under GA. Less PONV and prolonged analgesia conferred by the blocks almost certainly contributed to these findings. Paravertebral blocks are the regional technique of choice for breast cancer surgery. They are safe, efficient, and have a low incidence of side effects and complications compared with patients receiving a GA. The low side-effect profile and shorter hospital stay are undoubtedly favourable to patients in this pandemic period.

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Clairoux, Maxim Soucy-Proulx, François Preto, Victoria Courgeon, Maxime Caron-Goudreau, Moulay Idrissi and Philippe Richebé contributed to recording data. Ariane Clairoux, Maxim Soucy-Proulx, François Preto, Victoria Courgeon, Moulay Idrissi, Annik Fortier, and Philippe Richebé contributed to data analysis. Ariane Clairoux, Maxim Soucy-Proulx, Annik Fortier, and Philippe Richebé contributed to writing the manuscript. Kyle Vaughn Roerick contributed to English editing.

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