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SCIENTIFIC ARTICLE

Paravertebral block for management of acute postoperative pain and intercostobrachial neuralgia in major breast surgery

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DN4;
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Intercostal nerve

Abstract
Background: Several locoregional techniques have been described for the management of acute and chronic pain after breast surgery. The optimal technique should be easy to perform, reproducible, with little discomfort to the patient, little complications, allowing good control of acute pain and a decreased incidence of chronic pain, namely intercostobrachial neuralgia for being the most frequent entity.
Objectives: The aim of this study was to evaluate the paravertebral block with preoperative single needle prick for major breast surgery and assess initially the control of postoperative nausea and vomiting (PONV) and acute pain in the first 24 h and secondly the incidence of neuropathic pain in the intercostobrachial nerve region six months after surgery.
Methods: The study included 80 female patients, ASA I-II, aged 18–70 years, undergoing major breast surgery, under general anesthesia, stratified into 2 groups: general anesthesia (inhalation anesthesia with opioids, according to hemodynamic response) and paravertebral (paravertebral block with single needle prick in T4 with 0.5% ropivacaine + adrenaline 3 $\mu g\,mL^{-1}$ with a volume of 0.3 $mL\,kg^{-1}$ preoperatively and subsequent induction and maintenance with general inhalational anesthesia). In the early postoperative period, patient-controlled analgesia (PCA) was placed with morphine set for bolus on demand for 24 h. Intraoperative fentanyl, postoperative morphine consumption, technique-related complications, pain at rest and during movement

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were recorded at 0 h, 1 h, 6 h and 24 h, as well as episodes of PONV. All variables identified as *factors* contributing to *pain chronicity* age, type of surgery, anxiety according to the Hospital Anxiety and Depression Scale (HADS), preoperative pain, monitoring at home; body mass index (BMI) and adjuvant chemotherapy/radiation therapy were analyzed, checking the homogeneity of the samples. Six months after surgery, the incidence of neuropathic pain in the intercostobrachial nerve was assessed using the DN4 scale.
Results: The Visual Analog Scale (VAS) values of paravertebral group at rest were lower throughout the 24 h of study 0 h 1.90 (±2.59) versus 0.88 (±1.5) 1 h 2.23 (±2.2) versus 1.53 (±1.8) 6 h 1.15 (±1.3) versus 0.35 (±0.8); 24 h 0.55 (±0.9) versus 0.25 (±0.8) with statistical significance at 0 h and 6 h. Regarding movement, paravertebral group had VAS values lower and statistically significant in all four time points: 0 h 2.95 (±3.1) versus 1.55 (±2.1); 1 h 3.90 (±2.7) versus 2.43 (±1.9) 6 h 2.75 (±2.2) versus 1.68 (±1.5); 24 h 2.43 (±2.4) versus 1.00 (±1.4). The paravertebral group consumed less postoperative fentanyl (2.38 ± 0.81 μg kg^{-1} versus 3.51 ± 0.81 μg kg^{-1}) and morphine (3.5 mg ± 3.4 versus 7 mg ± 6.4) with statistically significant difference. Chronic pain evaluation of at 6 months of paravertebral group found fewer cases of neuropathic pain in the intercostobrachial nerve region (3 cases versus 7 cases), although not statistically significant.
Conclusions: Single-injection paravertebral block allows proper control of acute pain with less intraoperative and postoperative consumption of opioids but apparently it cannot prevent pain chronicity. Further studies are needed to clarify the role of paravertebral block in pain chronicity in major breast surgery.

PALAVRAS-CHAVE
Bloqueio paravertebral;
Cirurgia de mama;
Dor aguda;
DN4;
Dor neuropática;
Nervo intercostobraquial

Bloqueio paravertebral no controle da dor aguda pós-operatória e dor neuropática do nervo intercostobraquial em cirurgia mamária de grande porte

Resumo
Justificativa: Estão descritas várias técnicas locorregionais para a abordagem da dor aguda e dor crônica após cirurgia de mama. O ideal seria uma técnica fácil de fazer, reprodutível, com pouco desconforto para as doentes, com poucas complicações e que permitirá um bom controle da dor aguda e uma diminuição da incidência de dor crônica, notadamente dor neuropática do intercostobraquial, por ser a entidade mais frequente.
Objetivos: Estudar a aplicação de bloqueio paravertebral com picada única no pré-operatório de cirurgia mamária de grande porte. Avaliar numa primeira fase o controle de dor aguda e náuseas-vômitos no pós-operatório (NVPO) nas primeiras 24 horas e numa segunda fase a incidência de dor neuropática na região do nervo intercostobraquial seis meses após a cirurgia.
Métodos: Foram incluídas 80 doentes do sexo feminino, ASA I-II, entre 18 e 70 anos, submetidas a cirurgia mamária de grande porte sob anestesia geral, estratificadas em dois grupos: anestesia geral (anestesia geral inalatória com opioides segundo resposta hemodinâmica) e paravertebral (bloqueio paravertebral com picada única em T4 com ropivacaína 0,5% + adrenalina 3 μg/mL com um volume de 0,3 mL/kg pré-operatoriamente e posterior indução e manutenção com anestesia geral inalatória). No pós-operatório imediato foi colocada PCA (*Patient-controlled analgesia*) de morfina programada com bolus a demanda durante 24 horas. Foram registados fentanil intraoperatório, consumo de morfina pós-operatória, complicações relacionadas com as técnicas, dor em repouso e ao movimento a 0, 1 h, 6 h e 24 h, assim como os episódios de NVPO. Foram analisadas todas as variáveis identificadas como fatores de cronificação da dor idade, tipo de cirurgia, ansiedade segundo escala de HADS (*Hospital Anxiety and Depression scale*), dor pré-operatória; acompanhamento no domicílio; índice de massa corporal (IMC), tratamentos adjuvantes de quimioterapia/radioterapia e foi verificada a homogeneidade das amostras. Aos seis meses da cirurgia foi avaliada, segundo escala DN4, a incidência de dor neuropática na área do nervo intercostobraquial.
Resultados: O grupo paravertebral teve valores de VAS (Escala Visual Analógica) em repouso mais baixos ao longo das 24 horas de estudo 0 h 1,90 (± 2,59) *versus* 0,88 (± 1,5); 1 h 2,23 (± 2,2) *versus* 1,53 (± 1,8); 6 h 1,15 (± 1,3) *versus* 0,35 (± 0,8); 24 h 0,55 (± 0,9) *versus* 0,25 (± 0,8) com significado estatístico às 0 e às 6 horas. Em relação ao movimento o grupo paravertebral teve valores de VAS mais baixos e com significância estatística nos quatro momentos de avaliação: 0 h 2,95 (± 3,1) *versus* 1,55 (± 2,1); 1 h 3,90 (± 2,7) *versus* 2,43 (± 1,9) 6 h 2,75 (± 2,2) *versus* 1,68 (± 1,5); 24 h 2,43 (± 2,4) *versus* 1,00 (± 1,4). O grupo paravertebral consumiu menos fentanil

(2,38 ± 0,81 μg/Kg *versus* 3,51 ± 0,81 μg/Kg) e menos morfina no pós-operatório (3,5 mg ± 3,4 *versus* 7 mg ± 6,4), com diferença estatisticamente significativa. Na avaliação de dor crônica aos seis meses no grupo paravertebral houve menos casos de dor neuropática na região do nervo intercostobraquial (três *versus sete*) embora sem significância estatística. *Conclusões:* O bloqueio paravertebral com picada única permite um adequado controlr da dor aguda com menor consumo de opioides intraopreatórios e pós-operatórios, mas aparentemente não consegue evitar a cronificação da dor. Mais estudos são necessários para esclarecer o papel do bloqueio paravertebral na cronificação da dor em cirurgia mamária de grande porte.

Introduction

In recent years breast cancer the most frequent cancer in women[1] has decreased its mortality, but unfortunately often associated with increased morbidity due to sequelae of the treatment used.[2]

Breast cancer surgery has many risk factors for postoperative nausea and vomiting (PONV), reaching up to 70% in some series. In 0.2% of cases, it corresponds to uncontrollable cases that delay hospital discharge, require unexpected admissions, lower rates of patient satisfaction, and increased hospital costs.[3,4]

Chronically, half of patients undergoing breast surgery had some kind of surgery-related pain,[5,6] either nociceptive or neuropathic. Pain in the intercostobrachial nerve area is the most common neuropathic pain.[7] Among the factors that may influence chronic pain, the most readily modifiable are postoperative pain and opioid consumption, so that the greater the intensity of postoperative pain and analgesic consumption, the higher the risk of chronic pain.[8]

Paravertebral block seems to produce an effective block of the painful pathways, characterized by unilateral regional blockade of several dermatomes. It also allows a sympathetic block that could have some benefit in oncology.[9] Currently, there are ongoing studies aimed at identifying if there is a relationship between the loco-regional technique and tumor recurrence, particularly in the breast area.[10]

The usefulness of this technique for effective postoperative pain management has already been evaluated in different studies,[11,12] although there are still some doubts about the paravertebral space approach, more effective and with fewer side effects. There are reports of single- and multiple-injection techniques with or without a catheter placement are described.[13,14]

This study was designed in two stages in order to compare two different approaches in breast surgery anesthesia: a paravertebral block with single-injection associated with general anesthesia versus general anesthesia alone. At the first stage we intended to evaluate the acute pain management in the immediate postoperative period and occurrence of PONV in patients undergoing major surgery for breast cancer. At the second stage we evaluated the presence of neuropathic pain in the intercostobrachial region in the same group of patients six months after the surgery.

Material and methods

A prospective, stratified observational study was designed. It was assumed a difference of 2.64 in the average assessment of the Visual Analog Scale (VAS) at 24 h between the patients who underwent paravertebral block and general anesthesia and patients who underwent general anesthesia alone, with 80% study power, 5% significance level, and sample stratification according to the anxiety, age group, and type of surgery variables, and we estimated the inclusion of 80 patients – 40 in each group. The sample stratification variables were chosen for being the most often cited factors as independent variables for the development of acute pain and/or chronic pain.

Anxiety was assessed using the Hospital Anxiety and Depression scale (HADS). HADS is a hospital tool widely used for screening situations of anxiety and depression in hospitalized cancer patients.[15] It consists of 14 questions (odd-numbered questions assess anxiety the even-numbered assess depression) with responses scored on a scale of 0–3. Total score is obtained by summing the values of each subscale. In both cases the higher the score, the higher the level of anxiety or depression. This scale was completed by patients in the pre-anesthetic visit before surgery. For this study we used a cut-off >8 points.

Inclusion and exclusion criteria are shown in Table 1. The study was performed between January 2012 and January 2013. It was approved by the Ethics Committee of the institution and all patients gave their written informed consent to participate in the study.

First phase of the study

Preoperatively, all patients were stratified into two groups according to the type of surgery, HADS score, and age: paravertebral group (general anesthesia combined with paravertebral block) and general anesthesia group.

Before the induction of anesthesia, peripheral route catheterization was performed, and patients were

Table 1 Inclusion and exclusion criteria of the study.

Inclusion criteria
Female
Age between 18 and 70 years
Breast cancer, undergoing major resection (lumpectomy with axillary dissection, MRM, and mastectomy with/without axillary dissection)
ASA I-II
Informed consent to participate in the study
Exclusion criteria
Allergy to nonsteroidal anti-inflammatory drugs (NSAIDs); local anesthetics; propofol; opioids; paracetamol; antiemetic
Patients on chronic treatment with antibiotics
Obesity (BMI > 30)
Bilateral or multiple surgical procedure
Contraindication to paravertebral block (including coagulation disorders/anatomical changes)
Severe respiratory disease
Pregnancy
Inability to normal understanding of the Visual Analog Scale (VAS)

monitored according to ASA standards and bispectral index (BIS) anesthetic depth.

Paravertebral group

Paravertebral block was performed with single-injection, according to the classic technique,[16] at the T4 level with Tuohy needle 18G, with 0.5% ropivacaine + adrenaline 3 $\mu g\,mL^{-1}$, with a volume of 0.3 mL kg^{-1} (maximum total volume of 30 mL). Subsequently, anesthesia was induced with propofol (1.5 mg kg^{-1} h^{-1}) and fentanyl (2 $\mu g\,kg^{-1}$) and laryngeal mask airway (LMA) was inserted.

General anesthesia group

Anesthesia was induced with propofol (1.5 mg kg^{-1} h^{-1}) and fentanyl (2 $\mu g\,kg^{-1}$) and LMA was inserted. The maintenance of anesthesia was performed in both groups with desflurane to maintain BIS values at 45–60 with a mixture of O_2/air.

Both groups received parecoxib 40 mg IV before the start of surgery. During maintenance, fentanyl (1.5 $\mu g\,kg^{-1}$) was administered if there was an increase of 20% from baseline values of mean arterial pressure (MAP) and heart rate (HR).

For maintenance of hemodynamic stability, ephedrine or atropine was administered, at the anesthesiologist's discretion, if verified a decreased in MAP > 20% or HR < 50 beats/min of baseline values.

In all patients, the institutional protocol for the prevention of nausea and vomiting was administered, according to the predictive model by Apfel and colleagues, with three antiemetic intervention lines (Table 2).

Table 2 Preventive protocol of PONV used in the study.

Institutional preventive protocol of postoperative nausea and vomiting
2 risk factors or a history of PONV: prophylaxis with one drug (Droperidol);
3 risk factors or history of NVPO + 1 risk factor: prophylaxis with 2 drugs (Droperidol + Ondansetrom);
Previous history of PONV more than once + another risk factor: Prophylaxis with 3 drugs (Dexamethasone, Droperidol, Ondansetron).

At the end of surgery, patient-controlled analgesia (PCA) with morphine was initiated, programmed with bolus of 2 mg on demand and 5 min lock-out and a maximum dose of 6 mg h^{-1} during the first 24 h postoperatively.

In the different phases of the study (preoperative, intraoperative, postoperative), we recorded different variables that were considered relevant in the development of acute and/or chronic pain or that could interfere with the study results. These variables are shown in Table 3.

We assessed pain at rest according to the VAS score (0–10), as well as pain with mobilization of the ipsilateral arm interpreted as 90° arm abduction at four different times after surgery: 0 h; 1 h; 6 h and 24 h after surgery.

We evaluated the occurrence of PONV using a categorical scale of the institution (0 = no nausea; 1 = motion sickness; 2 = nausea at rest; 3 = vomiting; 4 = vomiting despite antiemetics) and the need for antiemetic rescue medication, in the first 24 h.

Statistical analysis

A descriptive analysis of all variables was performed and given the absolute and relative frequencies for categorical variables and mean and standard deviation or median and interquartile range for continuous variables, according to the adequacy for each variable.

Continuous variables were compared using the independent sample *t*-test and categorical variables using the chi-square test. If there were no statistical assumptions for their application, we used the optional statistical tests: Mann–Whitney and Fisher, respectively. The analysis was performed with a significance level of 0.05.

First phase results

We checked the homogeneity of the two groups and there were no statistically significant differences in variables, such as age, type of surgery, and HADS. The groups proved to be homogeneous in the analysis of other variables that characterize the sample, such as the duration of surgery; and variables related to the onset of chronic pain, such as the presence of breast pain before surgery, body mass index body (BMI), and family support (Table 4).

During surgery, the average consumption of fentanyl was significantly lower ($p < 0.01$) in the paravertebral group (2.38 ± 0.81 $\mu g\,kg^{-1}$) compared with the general anesthesia group (3.51 ± 0.81 $\mu g\,kg^{-1}$) (Table 5).

Table 3 Parameters recorded in the preoperative, intraoperative, and postoperative periods.

Preoperative	Intraoperative	Postoperative	Six months after surgery
HADS	Fentanyl		
Age	Ephedrine	- VAS at rest	Presence of neuropathic pain
Type of surgery	Atropine	(0 h–1 h–6 h–24 h)	in the intercostobrachial
BMI	Complications:	- VAS on movement	nerve region
Family support	- Hypotension: > 20%	(0 h–1 h–6 h–24 h)	- DN4
	baseline	- PONV (0 h-1 h-6 h-24 h)	
Presence of breast pain	- Bradycardia < 50 bpm;		- EORTC-QLQ C30
	Pleural puncture;	- Morphine	- EORTC-QLQ-BR23
	- Pneumothorax		
	- Local hematoma;		
	- Local bleeding;		
	- Convulsions;		
	- Allergic reaction.		

Table 4 Variables related to acute and chronic pain in the study first phase.

Variable	Paravertebral group ($n = 40$)	General anesthesia group ($n = 40$)	p
Age	55.10 (±9.8)	52.68 (±8.9)	0.2
HADS (%)			0.82
HADS ≤ 8	51.3	48.7	
HADS > 8	46.7	52.3	
Type of surgery (%)			0.85
TA + lymphadenectomy	54.5	45.5	
Simple mastectomy	50	50	
MRM	46.4	53.6	
BMI (%)	25.6 (±3.4)	25.21 (±3.5)	0.6
Duration of surgery (min)	86.9 (±26.9)	84.75 (±28.6)	0.7
Preoperative pain (%)	33.3	66.7	0.31
Family support (%)	53.6	46.4	0.056

Table 5 VAS score at rest and on movement; fentanyl and morphine consumption.

	General anesthesia (mean)	Paravertebral + GA (mean)	p
VAS at rest			
0 h	1.90 (±2.59)	0.88 (±1.5)	0.027
1 h	2.23 (±2.2)	1.53 (±1.8)	0.124
6 h	1.15 (±1.3)	0.35 (±0.8)	0.002
24 h	0.55 (±0.9)	0.25 (±0.8)	0.128
VAS on movement			
0 h	2.95 (±3.1)	1.55 (±2.1)	0.018
1 h	3.90 (±2.7)	2.43 (±1.9)	0.006
6 h	2.75 (±2.2)	1.68 (±1.5)	0.011
24 h	2.43 (±2.4)	1.00 (±1.4)	0.002
Fentanil (μg/Kg)	3.51 (±0.81)	2.38 (±0.81)	<0.01
Morphine (mg)	7 (±6.4)	3.5 (±3.4)	0.002

Table 6 Postoperative episodes of nausea and vomiting.

PONV	General anesthesia	Paravertebral + GA	*p*
0 h	1	1	0.6
1 h	3	1	0.5
6 h	2	2	0.6
24 h	0	0	0.3

When the mean values of VAS at rest were compared between the anesthesia groups at the several times measured, it appears to be always higher in the general anesthesia group. Only at times 0 h and 6 h, the differences in mean VAS were significant. So, one can say that mean VAS at rest at 0 h and 6 h is significantly higher in the general anesthesia group (Table 5).

Regarding VAS evaluated during movement, which involves a 90° abduction of the limb ipsilateral to surgery, at all time-points, the general anesthesia group had mean values higher than those recorded for the paravertebral group with statistical significance (Table 5).

The group general anesthesia had a higher number of patients (14; 35%) with severe pain (VAS at rest ≥ 7) over 24 h compared with the paravertebral group (6; 6%). However, this difference is not significant ($p = 0.069$).

Compared to postoperative morphine consumption, there was a higher proportion of patients in the general anesthesia group: 80% of patients in contrast to 67.5% of the paravertebral group, although there was no statistically significant differences ($p = 0.3$).

Of the patients who consumed morphine, the general anesthesia group consumed more than twice the paravertebral group, with an average of 7 mg (± 6.4) in general anesthesia group and 3.5 mg (± 3.4) in paravertebral group, a difference statistically significant ($p = 0.002$).

Regarding nausea and vomiting there were few events in each subtype according to the institution's scale, so the results are presented as the sum of any episode of nausea and/or vomiting 24 h after surgery. We found that the general anesthesia group had more episodes of NVPO, with six cases (15%), compared to four cases (10.3%) recorded for the paravertebral group. There were no statistically significant differences between groups (Table 6).

There were no serious complications related to the technique throughout the study. There was a greater number of intraoperative hypotension in the paravertebral group (9 versus 3 cases), with statistically significant difference ($p = 0.007$) and need for ephedrine administration in 22.5% of patients in paravertebral group and 2.5% in the general anesthesia group; five cases had bradycardia (HR < 50) in both groups, with 12.5% of patients in paravertebral group and 7.5% in the general anesthesia group requiring atropine administration. There was one case of pleural puncture in the paravertebral group without pneumothorax signs postoperatively. There were no occurrences of local hematoma, bleeding, convulsions and allergic reactions.

Second phase of the study

Six months after the surgery all patients were contacted to start the second phase of the study, which aimed to determine the presence of chronic pain, particularly intercostobrachial neuralgia, and the quality of life of these patients.

From the initial sample of 80 patients who had participated in the first phase, there was a loss of 14 patients who were not included in the second phase for different reasons: follow-up visits and adjuvant treatments made in other hospitals that did not allow coming to the consultation (four); refusal to participate in the second phase (three); death (one); patients undergoing new breast surgery during the six months (six).

The sample for the second phase consisted of 66 patients: 34 in the general anesthesia group and 32 in the paravertebral group. The chemotherapy (CT) and radiation therapy (RT) received by the patients were recorded.

The 66 patients included in the second stage were invited to a consultation in which a clinical interview was performed to assess the presence of pain in the area of the operated breast and/or ipsilateral arm. To determine if the pain had neuropathic characteristics, the DN4 scale was applied by trained personnel.[17] DN4 is a screening scale for neuropathic pain, translated and validated for the Portuguese language and culture, which has a specificity and sensitivity of 90% and 83%, respectively. It is a simple questionnaire, easily applicable, consisting of four questions, two responded by the patient and two objectively responded by the clinician. A total score greater than four classifies pain as neuropathic (Fig. 1).

To assess these patients' quality of life, the European Organization for Research and Treatment of Cancer (EORTC) scale was used.[18] It incorporates five functional scales, three to assess symptoms and one each to assess quality of life and overall health. The score ranges from 0 to 100 (0 = the worst health status and 100 = the best health status), except for the symptom scales in which higher scores represent more symptoms and worse quality of life. The EORTC QLQ-C30 uses modules with a nucleus of the generic questionnaire, followed by a combination of modules for specific diseases. The EORTC QLQ-C30 is followed by the Breast Specific Module (BR-23), which evaluates specific aspects of breast cancer (Tables 7 and 8).

Second phase results

Regarding both groups comparison in the second phase, it can be said that demographic characteristics, such as age and BMI, are relatively homogeneous and that there were no significant differences between the two groups regarding these variables.

There were no significant differences for other variables that, according to the literature, may increase the likelihood of eventually developing chronic pain, such as type of surgery, anxiety, previous breast pain or adjuvant treatments (CT/RT), which are equally distributed between both groups (Table 9).

Questionnaire for neuropathic pain diagnosis: DN4,

Please complete this questionnaire by ticking one answer for each number:

Interview of the patient

Question 1: Does the pain have one or more of the following characteristics?

	Yes	No
1- Burning		
2- Painful cold		
3- Electric shocks		

Question 2: Is the pain associated with one of more of the following symptoms in the same area?

	Yes	No
4- Tingling		
5- Pins and needles		
6- Numbness		
7- Itching		

Examination of the patient

Question 3: Is the pain located in an area where the physical examination may reveal one or more of the following characteristics?

	Yes	No
8- Hypoesthesia to touch		
9- Hypoesthesia to prick		

Question 4: In the painful area, can the pain be caused or increased by:

	Yes	No
10- Brushing		

Score

0 – For each negative response 1 – For each positive response

Neuropathic pain: Total score from 4/10.

( ) Nociceptive pain ( ) Neuropathic pain

Figure 1 Questionnaire for neuropathic pain diagnosis: DN4, validated for Portuguese.

Table 7 EORTC QLQ-C30.

EORTC QLQ-C30
General scale
- Global health status and quality of life
Functional scale
- Physical functioning
- Role performance
- Emotional functioning
- Cognitive functioning
- Social functioning
Symptomatic scale
- Fatigue
- Pain
- Breathlessness
- Insomnia
- Lack of appetite; constipation, diarrhea; nausea/vomiting
- Financial difficulties

Of the 66 evaluated patients, 10 were diagnosed with pain characteristic of intercostobrachial neuralgia (seven in the general anesthesia group and three in the paravertebral group), although the difference was not significant ($p = 0.3$).

Regarding the EORTC-QLQ C30 score, we found that patients in the paravertebral group had the highest scores in both overall quality of life and in the five functional scales, although it was statistically significant only for social function. In the evaluation of symptoms, the paravertebral group had lower values compared to the general anesthesia group, although it was not statistically significant (Table 10).

Regarding the EORTC-BR23 score, the paravertebral group showed better scores in body image, with fewer symptoms compared to treatment side effects, as well as symptoms in the breast or arm, and we found no statistically significant differences (Table 11).

Table 8 EORTC QLQ-BR23.

QLQ-BR23
Functional scale
- Body image
- Sexual functioning
- Sexual pleasure
- Perspectives
Symptomatic scale
- Chemotherapy effects
- Breast symptoms
- Arm symptoms
- Concern with hair loss

Table 9 Variables related to pain chronicity in the study second phase.

	General anesthesia	Paravertebral + GA	*P*
Age	57	53.22	0.098
Type of surgery			0.2
Mastectomy	11	15	
MRM	10	11	
Lumpectomy with axillary dissection	13	6	
BMI	25.755 (3.401)	25.165 (4.0399)	0.5
RT	21	18	0.8
CT	29	25	0.5
Preoperative breast pain	4	1	0.2
HADS			0.6
<8	51.3%	48.7%	
≥8	46.7%	52.3%	

Discussion

This study intended to know if with an easy to perform technique, such as paravertebral block, and with little discomfort to the patient, such as the single-injection, a good management of acute pain could be achieved and if it would help to achieve a lower incidence of pain in the intercostobrachial nerve area in the long run.

In the first phase of our study it was seen a decreased VAS score in the paravertebral group for pain at rest and on movement. The duration of the anesthetic block at rest with significant scores only at times 0–6 shows shorter times compared to other published studies. This could be related to the lower concentrations of adrenaline used, which decrease the time-effect of the local anesthetic. Although for pain on movement, the paravertebral group had significantly lower VAS score over 24 h.

The decreased consumption of opioids both intraoperatively (fentanyl) and postoperatively (morphine) in the paravertebral group demonstrates the effectiveness of the single-injection paravertebral technique for postoperative acute pain management without serious complications and improves comfort and hospital discharge of patients.

The cases of PONV seen in both groups throughout the study were less than expect based on the type of surgery and patients' characteristics. This demonstrates that the use of a preventive protocol allows reducing the onset of these events with the consequent comfort for patients.

The second phase of the study intended to evaluate the incidence of intercostobrachial neuralgia. The evaluation was performed six months after surgery because radiation can worsen the painful symptoms from that moment.

The diagnosis was based on clinical assessment of patients physically present, with the DN4 scale application

Table 10 Results of EORTC QLQ-C30.

	General anesthesia (%)	Paravertebral (%)	*p*
Quality of life	60 ± 18.4	63 ± 20	0.52
Physical function	80.1 ± 16.7	84.3 ± 13.5	0.36
Role performance	77 ± 26.2	81.2 ± 22.6	0.55
Emotional function	69.3 ± 25.4	73.2 ± 19.7	0.63
Cognitive Function	82.3 ± 20.5	83.8 ± 16.6	0.99
Social role	82.3 ± 22.8	92.2 ± 14	0.043
Tiredness	30 ± 23.14	20 ± 18	0.12
Pain	21 ± 24.3	13.5 ± 20.5	0.2
Insomnia	30.4 ± 28.8	18.7 ± 23.8	0.8

Table 11 Results of EORTC QLQ-BR23.

	General anesthesia (%)	Paravertebral + GA (%)	*p*
Body image	74 ± 23.3	78.6 ± 23.4	0.4
Perspectives	42.1 ± 36	39.5 ± 36.3	0.8
Treatment side effects	25.6 ± 17.1	19.7 ± 17.7	0.15
Breast symptoms	14.9 ± 16.2	12 ± 12.1	0.55
Arm symptoms	21.2 ± 17.6	17.7 ± 16	0.44

to characterize the type of pain. We are aware that this traveling to a new consultation caused the loss of some patients for the second phase.

In this study, we achieved homogenization of the intercostobrachial neuralgia conditioning characteristics in the sample. The studies by Tasmuth et al.[19] report a decrease in pain when the intercostobrachial nerve is preserved. Other studies[20] did not achieve the same result, so the internal policy of our surgical team remains the non-preservation of the intercostobrachial nerve.

In the first phase of our study, there was less consumption of opioids in the GA and PVB groups, this is the best indicator of better analgesic control and, according to the meta-analysis performed by Ong et al., it is the best indicator of the analgesia preventive effects.

However, the result of our study shows that there are statistically significant differences in the development of intercostobrachial neuralgia between groups. The intercostobrachial nerve is a thoracic nerve originating in T2. The technique used in this study was a single-injection at T4 level. We know that the spread of solution with the single-injection technique is erratic, a reason why groups, such as Greengrass et al., advocate the multiple-injection technique in surgical anesthesia. For this reason, we believe that the single-injection paravertebral block technique has a patchy and poorly reproducible distribution and conditions the local anesthetic arrival, or not, at T2 at a sufficiently long time to avoid a central sensitization that favors the onset of postoperative chronic pain, specifically intercostobrachial neuralgia.

Because the sample was calculated based on the evaluation of acute pain in the immediate postoperative period and there were a loss of patients for the second phase, in addition to a lower than expected incidence of chronic pain, more studies to assess chronic intercostobrachial neuralgia after major breast surgery are needed to evaluate the possible benefits of this technique.

Summary

A prospective observational study with a sample of 80 patients stratified into two groups of 40 patients each. The groups were homogeneous, with no statistically significant differences in age, type of surgery, HADS, BMI, presence of breast pain before surgery, and family support variables. All these are factors frequently reported as independent variables for the development of acute and/or chronic pain. The study aim was to compare two different anesthetic techniques for breast surgery: a single-injection paravertebral block technique associated with general anesthesia versus general anesthesia technique alone. The study was performed over 24 h in the immediate postoperative period and a second evaluation six months after surgery. The single-injection paravertebral block allows adequate control of acute pain with less intraoperative and postoperative consumption of opioids in the first 24 h, but apparently it cannot prevent pain chronicity, particularly intercostobrachial neuralgia. More studies are needed to establish the beneficial effects of paravertebral block in pain chronicity in major breast surgery.

Conflicts of interest

The authors declare no conflicts of interest.

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