



Ultrasound-guided regional anesthesia in cosmetic plastic surgeries of the breasts

Anestesia regional guiada por ultrassom em cirurgias plásticas estéticas das mamas

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■ ABSTRACT

Primary breast augmentation surgery is one of the most performed cosmetic procedures among women. In the male population, another breast surgery occupies a prominent place: gynecomastia. Regional anesthesia for plastic surgery is part of a multimodal analgesia strategy that can reduce costs, reduce hospitalization, and pain in the postoperative period. The purpose of this article is to review and compare the most used ultrasound-guided regional anesthesia techniques for perioperative analgesia in aesthetic plastic surgery of the breasts. A review of clinical studies that investigated the association of regional anesthesia techniques guided by ultrasound with cosmetic plastic surgery of the breast in the last 5 years was carried out in the MEDLINE/PubMed database. Fourteen articles were selected for review. The most frequently reported techniques of regional anesthesia guided by ultrasound were paravertebral block (PVB), interfascial block (PECS 1 and PECS 2), serratus plane block (SPB), and intercostal block (IB). The lower consumption of opioids and better postoperative pain control were associated with PVB, PECS 1 and PECS 2, and SPB. PVB had a higher incidence of complications and PECS 1 and PECS 2 proved to be easier to perform. Intercostal blocks (PECS 1 and PECS 2) proved to be safer and easier to perform in cosmetic plastic surgery of the breasts than other types of blocks. They decrease the use of opioids and its side effects, reduce the length of hospital stay and recovery in the postoperative period.

Keywords: Mammoplasty; Anesthesia and analgesia; Postoperative pain; Pain management; Breast implants.

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■ RESUMO

A cirurgia de aumento primário de mamas ocupa o topo do ranking dos procedimentos estéticos mais realizado entre as mulheres. Na população masculina, outra cirurgia mamária ocupa lugar de destaque: a ginecomastia. A anestesia regional para as cirurgias plásticas faz parte de uma estratégia de analgesia multimodal que pode reduzir custos, diminuir a hospitalização e a dor no período pós-operatório. O objetivo deste trabalho é revisar e comparar as técnicas de anestesia regional guiadas por ultrassom mais utilizadas para analgesia perioperatória nas cirurgias plásticas estéticas das mamas. Foi realizada a revisão de estudos clínicos que investigaram a associação dos bloqueios anestésicos regionais guiados por ultrassom com cirurgias plásticas estéticas das mamas nos últimos 5 anos na base de dados MEDLINE/PubMed. Foram selecionados 14 artigos para revisão. As técnicas de anestesia regional guiada por ultrassom mais frequentemente relatadas foram o bloqueio paravertebral (BPV), os bloqueios interfasciais (PECS 1 e PECS 2), bloqueio do plano do serrátil (BPS) e bloqueio intercostal (BI). O menor consumo de opioides e melhor controle algico pós-operatório foi associado ao BPV, PECS 1 e PECS 2 e BPS. O BPV apresentou maior incidência de complicações e os PECS 1 e PECS 2 mostraram-se de execução mais fácil. Os bloqueios interfasciais (PECS 1 e PECS 2) se mostraram mais seguros e de fácil execução nas cirurgias plásticas estéticas das mamas do que as outras modalidades de bloqueios. Promovem diminuição do uso de opioides e seus efeitos colaterais, redução no tempo de internação e na recuperação no pós-operatório.

Descritores: Mamoplastia; Anestesia e analgesia; Dor pós-operatória; Manejo da dor; Implantes de mama.

INTRODUCTION

Aesthetic plastic surgery is a growing area of medicine. According to data from the American Society for Aesthetic Plastic Surgery, from 1997 to 2016, there was a 730% increase in the number of cosmetic procedures performed by plastic surgeons in the United States of America, representing an amount of 15 billion dollars spent in 13 million of procedures performed in 2016 alone¹. Around the world, these numbers could exceed 33 million cosmetic procedures performed by plastic surgeons in 2016².

Breast augmentation surgery with implant swelled to the first place among the most frequent operations. This represents a growth of 6.1% compared to 2017 and 27.6% compared to 2014³.

Brazil rose to first place in the world in cosmetic surgery procedures with a total of 1,498,327 cosmetic plastic surgeries performed, ahead of the United States of America with 1,492,383. The most popular surgical procedure for women was breast augmentation surgery, with 1,841,098 procedures performed worldwide. The

most popular surgical procedure for men was the correction of gynecomastia, with 269,720 procedures³.

Regional anesthesia for aesthetic or reconstructive breast surgeries is challenging for anesthesiologists, not only because of the complex nature of chest wall innervation and the variety of techniques described as possible to be performed but also for the constant concern to provide minimal postoperative pain.

Regional blockades decrease the onset of post-surgical chronic pain and decrease opioid consumption and its known side effects. Enabling rapid recovery and early discharge, this type of anesthesia can provide a positive experience to patients with reduced hospital costs⁴.

Regional anesthesia techniques are part of a multimodal analgesic strategy. The growing popularity of ultrasonic-guided regional blockades has profoundly impacted anesthetic practice, improving some established techniques, and introducing new ones as more studies have been conducted⁵. However, in the daily practice of plastic surgeons, anesthetic blocks are not yet a reality.

The review of regional blocks guided by ultrasound for anesthesia of cosmetic breast surgeries

is current and relevant because of the growing scenario of this type of surgery and hospital costs. Anesthetic alternatives that allow reduction of hospital stay, costs, reduction of the use of analgesic medications that cause constipation, nausea, vomiting, urinary retention, among other complications, can ensure greater safety and improve the patient's experience in the transoperative process.

OBJECTIVE

This work aims to review and compare the most used regional anesthesia techniques for anesthesia and perioperative analgesia in breast cosmetic plastic surgeries.

METHODS

Research design

The proposed study is secondary and establishes a relationship with articles already published through the review of clinical studies that investigated the association of regional anesthetic blocks guided by ultrasound with cosmetic plastic surgeries of the breasts.

Ethical-legal precepts

This study does not violate the ethical-legal precepts established by the research ethics committee of the Federal University of São Paulo because it is an observational project to review the literature already published.

Funding

The project presented was developed with its own resources from the responsible researchers.

Casuistry

To perform this work, articles already published in MEDLINE databases were collected, using the PubMed portal as a search tool until December 20, 2019.

The research combined terms for breast cosmetic surgeries, regional anesthesia guided by ultrasound, perioperative anesthesia and postoperative pain. The terms searched in the MEDLINE/PubMed database were: "regional anaesthesia", "breast augmentation", "regional anaesthesia", "aesthetic plastic surgery", "serratus plane block", and "spinae plane block", "paravertebral block", "pecs block" and "post operative pain".

The filters added to this database were: articles published in the last five years, review articles, articles in English and similar articles. The inclusion, non-inclusion and exclusion criteria of the articles found are listed in Chart 1.

Chart 1. Study selection criteria.

Inclusion criteria	Exclusion criteria	Non-inclusion criteria
Published in the last 5 years	Studies of areas not related to cosmetic surgeries of the breasts	Absence of breast surgery relationship - regional blockage
Review articles		Duplication of studies
Articles in English		
Clinical trials		

RESULTS

In the MEDLINE/PubMed database, the search for "regional anaesthesia" AND "breast augmentation" resulted in 27 articles. However, once the filters and criteria and the selection of the studies were applied, only 1 article was selected for analysis.

The search for "regional anaesthesia" AND "aesthetic plastic surgery" did not result in any article.

Researched in combination the terms "regional anaesthesia" AND "aesthetic plastic surgery" AND "breast augmentation", a total of 0 articles were found in the MEDLINE/PubMed database.

By researching the terms "serratus plane block" AND "breast augmentation" and applying the selection criteria of the studies, a total of 7 articles were selected for analysis.

Seeking the terms "erector spinae plane block" AND "breast augmentation" and applying the selection criteria of the studies, no article met the eligibility criteria.

The combination of the terms "paravertebral block" AND "breast augmentation" resulted in a total of 5 articles when applying the filters and selection criteria.

The terms "pecs block" AND "breast augmentation," when researched and applying the selection criteria of the studies, originated a total of 4 articles that were selected for analysis.

The search for "post operative pain" AND "aesthetic plastic surgery" resulted in 0 articles.

In the search for the combination of "post operative pain" AND "aesthetic plastic surgery", a total of 0 articles were found in the MEDLINE/PubMed database.

At the end of the research, the *terms* sought “*post operative pain*” AND “*breast augmentation*” did not result in any article.

In the MEDLINE database, using the PubMed search portal, 16 articles were found with the criteria described. Of these, two articles were in duplicate, resulting in 14 articles that met the inclusion, exclusion and non-inclusion criteria established in the methodology.

Of the studies analyzed, the most used ultrasound-guided regional anesthesia techniques were 5: paravertebral block (PVB) and interfascial blocks (PECS 1 and PECS 2), serratus plane block (SPB) and intercostal block (IB).

Studies analyzing the analgesia provided by paravertebral block for patients undergoing breast surgeries concluded that patients presented better hemodynamic stability and equivalent pain relief compared to thoracic epidural anesthesia⁶. Studies comparing its immediate and long-term effect demonstrated its superior analgesic effect at both times, concerning patients who received only systemic analgesia. At the same time, there was a decrease in opioid consumption and its typical adverse effects, such as nausea and vomiting, for example^{4,7}.

However, when studying patients up to 12 months postoperatively, sequential analysis of the most recent trials did not find sufficient evidence that paravertebral block would be able to avoid long-term chronic pain, in contrast to other meta-analyses with few studies previously presented⁸. Thus, the studies demonstrated its effectiveness in reducing the intensity of conical pain and not its potential to avoid it^{8,9}.

Although outside the scope of the present study, it is important to mention the role of this blockade in reconstructive surgeries. Paravertebral block demonstrated clinically significant postoperative benefits for patients undergoing reconstructive breast surgery related to breast cancer. This type of block performed continuously with a catheter demonstrated more benefits for use in extensive reconstructive thoracic and breast surgeries, with great potential for chronic pain. However, the use of a catheter is not superior to single-injection techniques at single or multiple levels^{4,10}. The complications reported using PVB were pleural puncture with pneumothorax, dispersion of local anesthetic to the epidural space, significant intraoperative hypotension, and inadvertent puncture of vessels.

Studies comparing PECS 2 with a paravertebral block (PVB) in a single injection at the T4 level for breast surgeries observed that patients in the PECS 2 group had lower intraoperative opioid consumption

and better postoperative pain control in the first 12 h. They also had better analgesic coverage of the axillary region and less nausea⁶. However, when the pain scores (visual analog scale-VAS) were evaluated after the first 12 hours postoperatively, the patients in the PVB group presented less pain. In addition, the time to request morphine was longer in the PECS 2 group, and overall opioid consumption was also shorter in this group^{5,10}.

A recent study evaluated the combination of PECS 1 and PVB, comparing it with PVB associated with sedation in 60 patients undergoing breast surgery with the placement of subpectoral implants. This combination was made to provide more perioperative comfort. Pain levels (VAS) were significantly lower in the group treated with the association of PECS 1 and PVB blocks in the first 8 hours, but not after 24 h. In addition, there was a reduced need for intraoperative sedation, with no statistically significant differences concerning postoperative nausea and vomiting¹¹⁻¹³.

When compared only to systemic analgesia, PECS 2 showed a reduction in the need for opioids in the first 24 hours in 13.6 mg of oral morphine, prolonged the first analgesic request by 301 minutes and reduced the score on the pain score (visual analog scale) by 0.9 to 1.9 points, on average¹². In addition, it impacted the reduction of the incidence of nausea and vomiting, providing lower postoperative sedation, with a shorter length of stay in post-anesthetic recovery and hospitalization¹⁰. No complications in the execution of this technique were reported¹⁴.

PECS 2 was also used as an anesthetic technique associated with dexmedetomidine sedation without general anesthesia. After 15 minutes of blockade with 10ml between the pectoralis major and minor muscles, and 20ml between the pectoralis minor and the anterior serratus muscle, with bupivacaine at 0.25%, sufficient analgesia was obtained to start the surgical procedure, maintaining only continuous dexmedetomidine. However, its effect remained for approximately 8 hours, and analgesics were not ordered for one day¹⁴.

Comparative studies evaluated superficial serratus plane block (SPB) and PVB in breast cosmetic surgeries. Lower intraoperative opioid consumption was reported, but the time for the first analgesic request was longer in the group that received bpv¹².

Evaluating intercostals blocks (IB) in subpectoral breast prosthesis placement surgeries, studies showed that there was no difference in pain scores (VAS) with 1, 3, 6, 24, 48 or 72 hours between patients submitted to IB and those who did not receive IB. It was also concluded that there was no difference in opioid consumption in the postoperative period between patients submitted to IB and those not submitted to blockade¹⁰.

In the selected articles, no studies were found relating cosmetic breast surgeries to the blockade of the spinal erector plane following the selection criteria.

DISCUSSION

The various types of breast plastic surgeries involve the manipulation of different tissues and surgical incisions. Therefore, the anatomical knowledge of the various structures involved in each technique is extremely important in perioperative analgesic planning¹⁰.

Primary augmentation mammoplasty with the inclusion of silicone prosthesis has been the most performed cosmetic breast surgery globally, in the USA and Brazil^{3,15}, with a frequent trend increasing in recent years. This expressive importance of the procedure within plastic surgery contrasts with the relative scarcity of studies found in the present study. Considering the recent development of portable ultrasound devices and applying the selection criteria described the total of 14 studies found for final analysis demonstrates the need for greater attention to the theme.

The correlation between the different regional anesthetic blocks and the various access routes (inframammary, periareolar, transaxillary and even umbilical), plans for prostheses insertion, and the various types of breast surgeries represents an extensive field of research still little explored. For example, blocks considered aggressive in the literature studied and not recommended in cosmetic surgery (such as PVB) may be indicated in the transaxillary approach, in which the surgical injury of the intercostobrachial nerve may result in acute and chronic axillary pain¹⁰; similarly, surgical dissection for implant insertion between the pectoralis major and pectoralis minor muscles involves stretching muscle fibers, with the detachment of their parts attached to the cartilaginous rings of the adjacent ribs, generating great potential for postoperative myofascial pain and indicating the need for a more comprehensive blockade. In fact, one of the studies found that 9.5% of the patients submitted to mammoplasty with submuscular insertion of the implants developed persistent postoperative pain, from moderate to severe and 38% met the criteria for the diagnosis of neuropathic pain¹⁰.

Other modalities of cosmetic breast surgeries performed, such as mastopexy, reduction mammoplasty and gynecomastia correction, in which only excess skin and glandular tissue are removed, and pectoral muscles are spared, have lower pain potential from the perioperative analgesic point of view¹⁰.

In the present study, the five regional blocks commonly associated with breast cosmetic surgeries represent a wide range of alternatives to the anesthetic techniques traditionally used, such as epidural and general anesthesia. Since the pioneering introduction of PVB described by Hugo Sellheim in 1905¹⁶, the incorporation of ultrasound in the performance of regional blocks has represented the greatest improvement of the techniques, allowing direct visualization of the needle, anesthetic injection and anatomical structures involved⁵. However, despite precise anatomical knowledge and extensive incorporation of ultrasound, more studies standardizing specific PVB techniques and protocols on direct vision are still needed. Different approaches to the execution of the blockade were proposed, but studies considering outcomes of the various approaches seeking a “gold standard” technique are infrequent. In addition, the heterogeneity of patient selection, different types of surgeries, techniques, local anesthetics, and adjuvants used for blockades made it difficult to compare the techniques¹⁷.

Moreover, although it is tempting to say that ultrasound-guided blocks offer a lower risk of complications due to real-time visualization of the needle and local anesthetic dispersion, there are insufficient data in the literature to support this statement so far. Thus, they are not infrequent reports in the literature of pleural punctures, pneumothorax, placement of intrathoracic catheters, inadvertent intrathecal puncture, and cases of significant intraoperative hypotension in ultrasound guided PVB⁷. Thus, the use of PVB for cosmetic surgeries has not been recommended as a first option. Instead, cosmetic breast surgeries should be conducted with other multimodal analgesia techniques associated with less invasive regional blocks in most patients, with paravertebral block reserved as an analgesic rescue technique or for patients at high risk of chronic pain or excessive postoperative pain⁴.

In addition to PVB, PECS 1, PECS 2, and SPB blocks were the most frequently reported regional anesthesia modalities in the literature studied, establishing themselves as effective and less invasive alternatives than BPV¹⁷.

The main advantages reported concerning PECS and the blockade of the serratus plane are the relative ease of visualization and execution of the ultrasound-guided technique. The superficiality of related anatomical structures, their minimal potential for complications compared to thoracic epidural and paravertebral block, with sensory block and without risk of the sympathetic block are often listed

advantages. Both PECS and serratus block have good coverage of the anterolateral region of the thorax, including for outpatient surgeries, which can also be performed in patients receiving anticoagulation therapy. However, it is worth remembering that, even infrequent, pneumothorax and hematoma due to accidental puncture of the thoracodorsal artery are possible complications to be considered in this type of blockade^{14,18}.

Compared to other blocks, PECS 2 presented clear advantages. Studies show lower intra- and postoperative opioid consumption, prolongation in the first postoperative analgesia request, reduction in VAS scores, lower incidence of nausea and vomiting, less intraoperative sedation with a short stay in post-anesthetic recovery and reduced hospital stay^{5,6,10,14}. Performed in isolation as the only regional block technique, PECS 2 appears in the literature as the safest and most effective alternative for analgesia in cosmetic plastic surgery of the breast, and it may even be the only analgesic technique that can only be associated with sedation. However, it must be considered that PECS 2 effectively blocks the anterior portion of the chest and breasts and may fail in the lateral portions of the breasts. Hence the idea of associating the different modalities of blocking.

The association of PVB with PECS 2 as an anesthetic block proved to be an effective alternative for breast surgery without general anesthesia^{5,18}.

When compared to general anesthesia alone, interfascial blocks were useful in reducing intra- and postoperative analgesic needs. Both PECS 2 and the association between PECS 1 and serratus plan blockade proved to be good analgesic strategies for surgeries involving the anterolateral region of the thorax^{5,18}.

However, because they are a mode of blockades whose efficacy is related to the volume of anesthetic injected and its dispersion between the planes, the greatest risk associated with interfascial blocks is local anesthetic poisoning. In addition, they present a limitation and other techniques of a single injection, restricted duration of the time of action. It is not yet clear whether the use of adjuvants such as clonidine, dexamethasone or dexmedetomidine, for example, can prolong the effect of interfascial blocks as they do on other types of nerve blocks¹².

In the studies evaluated, intercostal blocks demonstrated analgesic efficacy equivalent to infiltration with local anesthetic in the incision, performed intraoperatively by the surgical team¹².

Although thoracic blocks have been widely reported in the literature, it has been observed that many articles have reported the use of regional anesthesia techniques in breast reconstructive surgeries and

thoracic surgeries. One of the main limitations found in the present review study was the scarcity of studies correlating the blocks exclusively to cosmetic plastic breast surgery, in addition to the great heterogeneity among the studies. Thus, quantitative comparisons were made difficult, leaving gaps regarding each type of blockage's efficacy and superiority/inferiority in this specific modality of breast surgery¹⁷.

Most of the evidence produced concerning blocks for cosmetic breast surgery exists in the form of reports or case series, making it necessary more randomized clinical trials, well structured, in homogeneous groups, to evaluate each of these techniques. The different associations of blocks found were conducted without criteria or guidelines regarding the blocks to be used for each type of surgery, specifically. The need for standardization of a given technique that demonstrates maximum efficacy was evidenced after finding the scarcity of studies given the robust universe of aesthetic plastic surgery¹⁷.

This review observed that no blockage effectively covers the entire breast and axillary region. Therefore, a combination of blocks should be used depending on the incision site and access route for placement of the breast prosthesis. Currently, with the scarcity of large randomized well-conducted randomized clinical trials, it is difficult to determine the superiority of one technique over the other¹⁴.

CONCLUSION

The literature has frequently reported the description of the different types of regional blocks for analgesia in breast plastic surgeries. In isolation, interfascial blocks (PECS 1 and PECS 2) are more promising, safe, and easy to perform in aesthetic plastic surgeries of the breasts than the other modalities of blockages. They promote decreased opioid use and side effects, reduction in hospitalization time and postoperative recovery. Furthermore, the association of regional blocks may decrease the use of general anesthesia and neuroaxis blocks and their complications, allowing surgeries only with sedation and regional blocks. Despite encouraging prospects, clinical trials and prospective studies with higher levels of scientific evidence are needed.

COLLABORATIONS

LDF

Analysis and/or data interpretation, Conception and design study, Conceptualization, Data Curation, Final manuscript approval, Formal Analysis, Methodology, Resources, Supervision, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing.

LMLO Analysis and/or data interpretation, Conceptualization, Final manuscript approval, Formal Analysis, Funding Acquisition, Methodology, Realization of operations and/or trials, Visualization, Writing - Original Draft Preparation, Writing - Review & Editing.

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