

The Effect of Rib-Sparing Internal Mammarian Vascular Approach with in Breast Reconstruction on Postoperative Pain Management

Meme Rekonstrüksiyonunda Kosta Koruyuculu İnternal Mammaryan Damar Yaklaşımının Ameliyat Sonrası Dönemde Ağrı Yönetimine Etkisi

Burak Sercan Ercin¹

¹Bahçeşehir University, Faculty of Medicine, Department of Plastic Surgery, VM Pendik Medicalpark Hospital Plastic Surgery Department, Istanbul, Turkey

Address correspondence to: Burak Sercan Ercin, Bahçeşehir University, Faculty of Medicine, Department of Plastic Surgery, VM Pendik Medicalpark Hospital Plastic Surgery Department, Istanbul, Turkey
e-mail: bsercin@gmail.com

Geliş Tarihi/Received: 20 November 2022
Kabul Tarihi/Accepted: 11 February 2023

Öz

Amaç: Ototolog meme rekonstrüksiyonunda postoperatif dönemde kosta kırıkdağı müdahalesine bağlı olarak alıcı bölgede ağrı olur. Bu çalışmada meme rekonstrüksiyonunda alıcı saha hazırlanırken kosta koruyucu cerrahi yaklaşımının postoperatif ağrı üzerine etkisini kosta koruyucu olmayan yaklaşımla karşılaştırarak ortaya koymayı amaçladık.

Hastalar ve Yöntem: Çalışmaya 2018-2022 yılları arasında opere edilen 25 hasta dahil edildi. Gruplar internal mammarian arter (IMA) izole etme tekniklerine göre ayrıldı. Grup 1: Kosta koruyucu cerrahi uygulanan hastalar(n=9), Grup 2: Kosta kırıkdağı rezeksiyonu uygulanan hastalar(n=16). Postoperatif dönemde her iki grupta da Hasta Kontrollü Analjezi pompası (HKA) kullanım süresi, kullanılan morfin dozu, erken ve geç ağrı skorları kaydedildi.

Bulgular: Hastaların yaş ortalaması 49,8 idi. Postoperatif erken ve geç dönemde herhangi bir komplikasyonla karşılaşılmadı. Tüm flep transferleri başarılı oldu. Ortalama HKA süresi grup 1'de 24±1,41 saat, grup 2'de 26,31±1,62 saat idi. Grup 1'de morfin dozu 9,67±1 mg, grup 2'de 23,93±3,02 mg idi. Erken ağrı skoru grup 1'de 2,89±1,16, grup 2'de ise 5,18±1,22 idi. Geç ağrı skorları grup 1'de 2,11±0,98 ve grup 2'de 2,75±0,77 idi. Grupların morfin dozu ve erken ağrı skorları arasında istatistiksel olarak anlamlı fark vardı (p<0,01). HKA kullanım süresi(p=0,3) ile geç ağrı skorları(p=0,07) arasında anlamlı fark yoktu (p>0,05).

Sonuç: Sonuç olarak, otolog meme rekonstrüksiyonunda alıcı bölge hazırlığında erken dönemde kosta koruyucu cerrahinin ağrıyı önemli ölçüde azalttığını düşünüyoruz.

Anahtar Kelimeler: Meme rekonstrüksiyonu, ağrı, kosta, internal mammarian damarlar

Abstract

Aim: In autologous breast reconstruction, there is pain in the recipient site due to rib cartilage intervention in the postoperative period. In this study, we aimed to reveal the effect of the rib-sparing internal mammarian vessel approach on postoperative pain in breast reconstruction by comparing it with the non-costal-sparing approach.

Patients and Methods: Between 2018 and 2022 twenty five patients underwent surgery were included in the study. Groups were divided according to internal mammary artery(IMA) exposure techniques. Group 1: Patients who underwent rib-sparing surgery(n=9), Group 2: Patients who underwent rib cartilage resection(n=16). Patient Controlled Analgesia(PCA) pump usage time, morphine dose used, and early and late pain scores were noted in both groups in the postoperative period.

Results: The mean age of the patients was 49.8 years. No complications were encountered in the early and late postoperative period. All flap transfers were successful. Mean PCA duration was 24±1.41 hours in group 1 and 26.31±1.62 hours in group 2. The dose of morphine was 9.67±1 mg in group 1 and 23.93±3.02 mg in group 2. The early pain score was 2.89±1.16 in group 1 and 5.18±1.22 in group 2. Late pain scores were 2.11±0.98 in group 1 and 2.75±0.77 in group 2.

There was a statistically significant difference between the morphine dose and early pain scores of the groups (p<0.01). There was no significant difference between the duration of PCA use (p=0.3) and late pain scores (p=0.07) (p>0.05).

Conclusion: In conclusion, we think that costal sparing surgery significantly reduces pain in the early period during recipient site preparation in autologous breast reconstruction.

Key words: Breast reconstruction, pain, rib, internal mammarian vessels

Cite this article as: Ercin BS. The Effect of Rib-Sparing Internal Mammarian Vascular Approach with in Breast Reconstruction on Postoperative Pain Management. Selcuk Med J 2023;39(1): 7-11

Disclosure: Author has not a financial interest in any of the products, devices, or drugs mentioned in this article. The research was not sponsored by an outside organization. Author has agreed to allow full access to the primary data and to allow the journal to review the data if requested.



"This article is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International License](https://creativecommons.org/licenses/by-nc/4.0/) (CC BY-NC 4.0)"

INTRODUCTION

Autologous breast reconstruction is a frequently used reconstruction method in breast cancer treatment. Pain due to the costal approach used in this method is a common complaint in the early and late postoperative periods. Management of postoperative pain is vital, as pain relief can minimize perioperative opioid use, shorten hospital stay, speed up patient recovery, and reduce healthcare costs (1-5). Furthermore, several studies have shown that inadequate acute postoperative pain control is linked to persistent postoperative pain (6). Furthermore, 5% of autologous breast reconstruction patients who had not used opioids before their surgery continued to use opioids three months afterward, increasing the risk of long-term addiction and sequela (7).

From our literature review, we found it noteworthy that, although the positive effect of the rib-sparing internal mammary artery approach on postoperative pain has been emphasized, no statistical comparison has been performed. In this study, we reveal the effect of using a costal sparing approach while preparing the recipient area during breast reconstruction surgery on postoperative pain by comparing the costal sparing approach with a non-costal sparing approach.

PATIENTS AND METHODS

Study Protocol

This is a retrospective study conducted between March 2018 and April 2022. Ethics committee approval was obtained for the study, and informed consent was obtained from each patient. (Protocol number:23-24 Istinye University Ethical Committee). The inclusion criteria were as follows: breast cancer patients undergoing immediate and unilateral autologous breast reconstruction using the deep inferior epigastric perforator (DIEP) flap technique. The exclusion criteria were as follows: patients undergoing delayed or bilateral autologous breast reconstruction. Twenty-five patients were recruited to the study and divided into two groups based on the internal mammary artery (IMA) isolation technique used in the surgery. Group 1 comprised patients who underwent rib-sparing surgery, while Group 2 comprised patients who underwent costal cartilage resection. During the postoperative period, morphine dose, early and late postoperative pain scores, and patient-controlled analgesia (PCA) pump usage time were recorded for patients in both groups.

Surgical Technique

All surgical procedures were performed by the

same surgeon using a $\times 4.5$ magnification loop. In preparing the recipient area, the pectoral muscle fibers on the third rib were first separated using electrocautery, exposing the third costal cartilage. In the non-costal sparing approach, the perichondrium on the rib was opened, and the perichondrium of the posterior aspect of the rib was elevated with a blunt dissection; approximately 4 cm of cartilage segment was resected, and the internal mammary vessels were reached via perichondrium resection. In the costal sparing approach, the internal mammary vessels were accessed via the third intercostal space. The internal mammary arteries were exposed in all participating patients, typically in less than 15 minutes. After the DIEP flap was temporarily placed in a stable position, arterial and vein anastomoses were performed under a microscope using the back-wall-first technique and 9-0 nylon sutures in each anastomosis. The anastomoses were performed first between the internal mammary vein and the flap veins and then between the arteries.

Postoperative Period

All participants in this study were given 20 mg of intravenous morphine and 1 g of paracetamol prior to extubation. Subsequently (i.e., postoperatively), they were allowed to self-regulate the amount of morphine they needed via a PCA system. During the postoperative period, flaps were checked every two hours during the first 24 hours. The early assessment pain score was measured at the 24th hour post operation. In contrast, the pain score for the late postoperative period was measured at the 168th hour post operation to account for the effect of anesthesia on pain in the chest area where the breast reconstruction was performed. The pain scores were evaluated on a scale of 0 to 10. All assessments were performed by the same clinician. The total time each patient used the PCA pump to self-administer analgesia for pain relief (labeled PCA duration) and the morphine dose used was noted.

Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Mac, version 21.0 (IBM Corp., Armonk, NY, USA). The mean, standard deviation, minimum/maximum values, and the first/third quartile (Q1/Q3) values of the two groups were calculated. An independent t-test was used for continuous parameters, while the Mann-Whitney U test was used for ordinal parameters. A p value of less than 0.05 was considered statistically significant.

Table 1. Parameter values in groups

	Group 1(n:9) (Mean±SD) (Max-Min) (Q1-Q3)	Group 2(n:16) (Mean±SD) (Max-Min) (Q1-Q3)	p value
PCA Time(hr)	24±1,41 (26-22) (23-25)	26,31±1,62 (30-24) (25-27,25)	0.3
Morphine Dose(mg)	9,67±1 (11-8) (9-10)	23,93±3,02 (28-19) (21-26)	<0.01*
Early Pain Score	2,89±1,16 (5-1) (2-3)	5,18±1,22 (7-3) (6-4,75)	
Late Pain Score	2.11±0.98 (4-1) (2-2)	2.75±0.77 (4-2) (2-3)	0.07

-Mean: Mean Value
 -SD:Standart Deviation
 -Max:Maximum Value
 -Min:Minimum Value
 Q1:First quarter
 Q3:Third quarter
 *:Statistically Significant

RESULTS

A total of 25 patients were included in the study. The mean age of the patients was 49.8 years. No complications were encountered in the early and late postoperative periods, and all flap transfers were successful.

The mean PCA duration was 24 ± 1.41 h for Group 1 and 26.31 ± 1.62 h for Group 2. The average morphine dose was 9.67 ± 1 mg for Group 1 and 23.93 ± 3.02 mg for Group 2. The average early postoperative pain score was 2.89 ± 1.16 for Group 1, and 5.18 ± 1.22 for Group 2. The average late postoperative pain score was 2.11 ± 0.98 for Group 1 and 2.75 ± 0.77 for Group 2. All relevant data are presented in Table 1.

There was a statistically significant difference

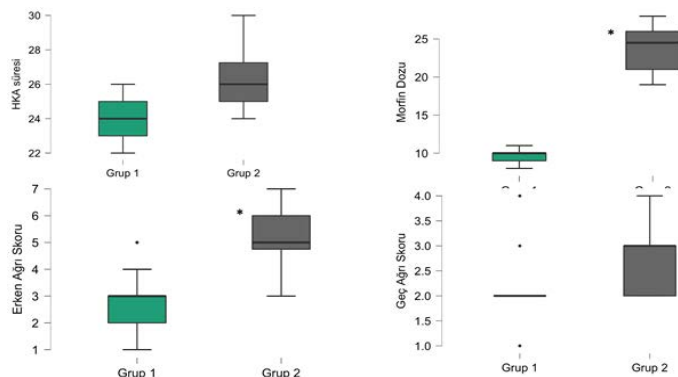


Figure 1. Graphical display of parameters

between the morphine dose and the early postoperative pain scores of both groups (p < 0.01). However, there was no significant relationship between the PCA duration (p= 0.3) and the late postoperative pain scores (p= 0.07) (p > 0.05). (Figure 1)

DISCUSSION

Breast cancer is diagnosed in one out of every eight women, and its incidence is increasing every year. Consequently, the number of patients who are potential candidates for breast reconstruction is increasing at the same rate. Although implants are presently a more commonly used option in breast reconstruction, autologous reconstruction is also performed quite frequently. The most preferred donor site for autologous reconstruction is the abdomen (8). The IMA and internal mammary vein are generally used as recipient vessels for the transfer of flaps taken from the abdomen.

In conventional autologous breast reconstruction, anastomosis is performed with resection of the third costal cartilage for a coastal approach to the internal mammary vessels; however, postoperative pain in the recipient area, chronic pain during the late postoperative period, and contour disorder in chest walls with costal defects are common complications (8).

The importance of postoperative pain control cannot be overestimated as it contributes to faster patient mobilization, shorter hospital stay, lower

costs, and an overall positive patient experience. Opioids are often used to achieve the desired pain control. However, the U.S. government has declared opioid abuse a public health emergency; more than 42,000 people died from opioid abuse in 2016 alone (9). Therefore, approaches to minimizing opioid use for postoperative pain control are crucial. Autologous breast reconstruction is associated with a significant postoperative opioid requirement, and numerous opioid-restricting perioperative strategies have been explored to achieve the desired pain control while reducing opioid consumption. Although pain control is typically aimed at postoperative acute pain, the rate of post-mastectomy pain syndrome has been reported to be up to 56%, and approximately 50% of women continue to experience chronic pain seven to 12 years after surgery (10). The mechanism of post-mastectomy pain syndrome is not yet fully understood, but pain experienced during surgery has been implicated as a possible causative factor (11). Therefore, pain-reducing techniques can help solve problems with both early and late postoperative chronic pain.

In our study, PCA duration, morphine dose, and early and late postoperative pain scores were used as target parameters. In Group 2, the early postoperative pain score and the amount of morphine used during the early postoperative period were significantly higher. It is noteworthy that there was no significant difference in the late postoperative pain scores of Group 1 and Group 2. The absence of a significant relationship between PCA duration and late postoperative pain scores is considered a good indicator because patients can self-adjust the amount they use and are motivated to quit when they no longer need analgesia. However, another theory in the cardiothoracic literature is known as internal breast syndrome due to damage to the intercostal nerves during vessel isolation. Therefore, instead of protecting the rib alone, it may depend on leaving the nerves intact, which is responsible for any reduction in postoperative pain derived from protecting the rib (12). In addition, excessive pain prolongs hospital stay, which increases the cost of treatment. Hence, reducing pain is extremely important for the treatment experience of the patient and economically.

Parret et al. report that using the rib-sparing technique for internal mammary vessel isolation while performing breast reconstruction operations with free flaps reduces postoperative pain (13). We did not find many studies on this approach

while conducting the literature review. The biggest disadvantage of the rib-sparing technique is that the area where the anastomoses are to be performed is narrower than with other approaches. This may prolong the anastomosis time and potentially lead to an increase in ischemia, especially for surgeons new to microsurgery. However, no study has reported a statistically significant difference in flap ischemia times (14). Furthermore, for ease of anastomosis, it is desirable that the area to be anastomized is wide, and the vessel stump to be anastomized is long. To suture the posterior wall during anastomosis, it should be possible to rotate the vessel easily using Acland micro clamps. All anastomoses in our study were performed using single micro clamps and a backwall-first technique (an anastomosis technique in which the posterior vessel wall is sutured primarily). Because the posterior wall is sutured primarily, vessel manipulation is minimal, and vessel rotation is not required. Therefore, the narrowness of the field or the shortness of the vascular stump does not constitute a significant impediment. Consistent with previous studies, no difference was observed between the warm ischemia times of the flaps in this study (15).

There are some limitations to our study. One of the weaknesses of this study is that pain is a subjective concept, and objective measurement is difficult, as the response to pain varies from person to person. Consequently, the basis of pain measurement is to believe the pain intensity stated by the patient. In addition, the fact that it is not clear in which part of the patient's use of PCA pump for pain can be considered a limitation in the study. However, during the early postoperative period, especially during the first 4–6 hours, patients may not be able to clearly indicate which part of the pain pump they use for pain relief because they are not fully oriented and cooperative with the effect of anesthesia. Another weakness of the study is the limited number of cases in the study sample. Furthermore, patients who underwent delayed or bilateral autologous reconstruction were not included in the study.

In conclusion, costal sparing surgery significantly reduces pain during the early postoperative period, and we surmise that employing costal sparing surgery during recipient site preparation in autologous breast reconstruction has a positive effect on both patient morbidity and economic considerations. Our study will shed light on future studies.

Conflict of interest: Author declares that there is no conflict of

interest between the authors of the article.

Financial conflict of interest: Author declares that he did not receive any financial support in this study.

Address correspondence to: Burak Sercan Ercin, Bahçeşehir University, Faculty of Medicine, Department of Plastic Surgery, VM Pendik Medicalpark Hospital Plastic Surgery Department, Istanbul, Turkey
e-mail: bsercin@gmail.com

REFERENCES

1. Pusic AL, Matros E, Fine N, et al. Patient-reported outcomes 1 year after immediate breast reconstruction: Results of the mastectomy reconstruction outcomes consortium study. *J Clin Onco* 2017;35(22):2499.
2. Parikh RP, Myckatyn TM. Paravertebral blocks and enhanced recovery after surgery protocols in breast reconstructive surgery: Patient selection and perspectives. *J Pain Res* 2018;11:1567.
3. Berg K, Kjellgren K, Unosson M, et al. Postoperative recovery and its association with health-related quality of life among day surgery patients. *BMC nursing* 2012;11(1):1-10.
4. Wu CL, Richman JM. Postoperative pain and quality of recovery. *Current opinion in anesthesiology* 2004;17(5):455-60.
5. Coley KC, Williams BA, DaPos SV, et al. Retrospective evaluation of unanticipated admissions and readmissions after same day surgery and associated costs. *J Clin Anesth* 2002;14(5):349-53.
6. Hickey OT, Nugent NF, Burke SM, et al. Persistent pain after mastectomy with reconstruction. *J Clin Anesth* 2011;23(6):482-8.
7. Marcusa DP, Mann RA, Cron DC, et al. Prescription opioid use among opioid-naive women undergoing immediate breast reconstruction. *Plast Rec Surg* 2017;140(6):1081-90.
8. Sacks JM, Chang DW. Rib-sparing internal mammary vessel harvest for microvascular breast reconstruction in 100 consecutive cases. *Plast Rec Surg* 2009;123(5):1403-7.
9. Dowell D, Noonan RK, Houry D. Underlying factors in drug overdose deaths. *Jama* 2017;318(23):2295-6.
10. Macdonald L, Bruce J, Scott NW, et al. Long-term follow-up of breast cancer survivors with post-mastectomy pain syndrome. *Br J Cancer* 2005;92(2):225-30.
11. Coderre TJ, Katz J. Peripheral and central hyperexcitability: Differential signs and symptoms in persistent pain. *Behav&Brain Sci* 1997;20(3):404-19.
12. Srivastava A, Tripathi DM, Zaman W, et al. Subcostal versus transcostal mini donor nephrectomy: Is rib resection responsible for pain related donor morbidity. *The J Uro* 2003;170(3):738-40.
13. Parrett BM, Caterson SA, Tobias AM, et al. The rib-sparing technique for internal mammary vessel exposure in microsurgical breast reconstruction. *Ann Plast Surg* 2008;60(3):241-3.
14. Malata CM, Moses M, Mickute Z, et al. Tips for successful microvascular abdominal flap breast reconstruction utilizing the "total rib preservation" technique for internal mammary vessel exposure. *Ann Plast Surg* 2011;66(1):36-42.
15. DiCandia M, Moses M, Mickute Z. Internal mammary vessel exposure with total rib preservation during free flap breast reconstruction-technique and pitfalls. *Br J Surg* 2009;96(S5):67.