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ERAS-protocol in Breast Reconstruction Post-Mastectomy

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ABSTRACT

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This study aimed to assess the impact of the Enhanced Recovery After Surgery (ERAS) protocol on patients undergoing breast reconstruction, by conducting a descriptive literature review of nine peer-reviewed scientific articles relevant to the subject.

Data collection involved a systematic search across various databases, applying search limitations to retrieve the most pertinent information. All selected articles, published in English and peer-reviewed, have been issued within the time frame of 2013 to 2023.

The findings from the nine articles suggest that the implementation of the ERAS protocol led to a reduction in the length of hospital stays, and a decrease in opioid usage and postoperative nausea, along with a decrease of the complications. It's worth noting that specific patient criteria for inclusion in the ERAS protocol were identified in most of the articles, potentially influencing the outcomes.

However, further research is warranted, particularly investigating the effects of the ERAS protocol on various breast reconstruction techniques, given the limited number of available articles and the relatively understudied nature of this subject.

Keywords: mastectomy, breast reconstruction, ERAS-protocol

CONTENTS

ABBREVIATIONS AND TERMS

ERAS	Enhanced recovery after surgery
FLAP	Autologous tissue reconstruction
IV	Intravenous
LOS	Length of stay
NSAID	Non-steroidal anti-inflammatory drugs
POD	Postoperative day
POVN	Postoperative nausea and vomiting
RCR	Responsible conduct of research
TENK	Finnish National Board on Research Integrity
VTE	Venous thromboembolism

1 INTRODUCTION

A mastectomy is a procedure women with breast cancer undergo to eliminate and prevent the growth of cancerous cells (What is a Mastectomy? 2021). However, despite the large number of patients receiving a mastectomy, many studies confirm that less than half of mastectomy cases are followed by breast reconstruction. Sometimes due to the lack of information about the overall benefit or the high cost of the procedure. Breast reconstruction is considered a major surgery due to the number of days the patient might need to spend in the hospital and the possibility of needing other operations to fully complete the breast reconstruction (National Cancer Institute 2017).

Enhanced Recovery After Surgery (ERAS) protocols have brought significant improvements in various aspects of surgical care, including breast reconstruction. Breast reconstruction overall can be a very exhausting process for a patient who has recently gone through a mastectomy (Cortina, Patten, Adamson, & Doren 2020). Therefore, ERAS can be a new alternative to improve the experience. ERAS is a perioperative protocol associated with reduced surgical trauma that influences the recovery period.

Moreover, it's often assumed that minor procedures have less impact on the body compared to major surgeries. However, recent studies have shed light on the crucial role of controlling inflammatory responses in the recovery process, something that ERAS crucially focuses on. This aspect holds equal importance for patients, particularly those with compromised immune systems or multiple chronic conditions, such as cancer patients or older individuals (Ljungqvist & Hubner 2018). Understanding and managing inflammation can significantly influence the outcomes of various surgical interventions.

In a study conducted in January 2019, patients' impression of ERAS was positive. Breast reconstruction patients appreciate the emphasis on a more forward pre-operative education and quick discharge. (Zychowicz, Pisarska, Laskawska, Czyz, Witowski, Kisielewski, Kulawik, Buzynski & Pedziwiatr 2019). Additionally, evidence has shown that ERAS reduces morbidity and

hospital length of stay (LOS). Therefore, reducing patient stress levels, as well as high financial charge for the hospital.

THEORETICAL STARTING POINTS

2.1 Mastectomy

A mastectomy is a surgical procedure done to remove the breast. Also, it might be considered a treatment option for women who have been diagnosed with breast cancer (What is a Mastectomy? 2021). There are several reasons for choosing a mastectomy and they depend on the patient's personal decision to have their breast(s) removed surgically. Reasons affecting the patients might be that breast-conserving surgery is not possible, or that the chances of breast cancer recurrence are high and therefore it would be safer to remove the breast(s) completely. Different types of mastectomies vary according to how much of the breast needs to be removed and if the lymph nodes underarms need to be taken as well (What is a Mastectomy? 2021).

2.2 Breast reconstruction

Every patient's experience is unique and if the circumstances are correct, meaning the patient has the correct criteria, breast reconstruction may be performed after a mastectomy. There's a variety of breast reconstruction options to choose from. There are factors that directly affect what type of reconstruction the patient gets. Those factors can be the patient's health and medical history, the size of the cancer, its location and the size of the breast itself (Breast Reconstruction Options 2021). Surveys explain that at least 30% of women undergoing a mastectomy for breast cancer express a preference for obtaining breast reconstruction either concurrently with the mastectomy or following their primary cancer care treatment (Balasubramanian, Buckley, Merrigan & Twormey 2016).

Two major breast reconstructions are Implant-based reconstruction and Autologous Tissue (Flap) Reconstruction. In the implant surgery, tissue expanders are placed and then filled over time with saline or silicone to get the desired size. Another option for implant reconstruction is to replace the breast with an actual implant (Breast Reconstruction Using Implants 2022). In contrast,

the Flap reconstruction takes tissue from other parts of the body to rebuild the breast shape. The tissue commonly used is from the stomach, the thighs or the buttocks (DIEP flap 2021).

Breast-Q is a “patient-reported outcome measure” designed to assess the quality of life and satisfaction of patients who have undergone any type of breast surgery, with a separate model focused on breast cancer reconstruction and research (Liu, Branford & Mehigan 2018). Through the use of this questionnaire, researchers have identified that poor patient education and inadequate preoperative preparation are primary factors contributing to patient dissatisfaction. Specifically, patients often lack a full understanding of the potential impacts on abdominal and chest sensation, physical and sexual well-being, and the time required for completing the breast reconstruction process (Shammas, Fish, Sergesketter, Offodile, Phillips, Oshima, Lee, Hollenbeck & Greenup 2022). However, regardless of the specific type of procedure undertaken, it's important to note that overall patient satisfaction remains relatively high. Either way, it is advisable for every patient undergoing a mastectomy to explore the possibility of breast reconstruction (Balasubramanian et al. 2016).

2.3 ERAS-protocol

Enhanced Recovery after Surgery protocols formerly used in alternative surgical procedures, have recently gained popularity among breast reconstruction post-mastectomy (Breast 2021). Currently, ERAS is being adapted to different breast reconstruction procedures such as Latissimus Dorsi reconstruction, implant-based reconstruction and alloplastic breast reconstruction, to name a few. Their popularity comes from their individualised patient care and shorter length of stay without compromising the practical results of the reconstruction (Soteropulos, Tang & Poore 2019; Breast 2021).

Compared with the traditional protocol, ERAS recommends diminishing insulin resistance by reducing pre-surgical fasting. This helps control hypermetabolic stress that affects postoperative recovery. Studies that examine the levels of systemic inflammatory markers post-surgery, found that individuals participating

in an ERAS had lower levels of interleukin-6 and C-reactive protein compared to individuals receiving a traditional surgical protocol. (Peña 2022; Villamiel, Yao & Sioson 2019).

Table 1. enlists the ERAS protocol in post-mastectomy breast cancer. This list is not for a particular type of breast reconstruction but is more of a general guideline of how the protocol is implemented.

TABLE 1. ERAS-protocol in post-mastectomy breast reconstruction (Cortina, Patten, Adamson & Doren 2020).

Preoperative protocol	WEEKS PRIOR SURGERY	● Preoperative education and counselling ● Alcohol and smoking ceased for about 4 weeks pre-surgery ● Weight loss or weight control ● Glucose control for diabetic patients
Preoperative protocol	DAY OF SURGERY	Pain management: ● Acetaminophen ● Gabapentin ● Celecoxib (Goal is to reduce the use of opioids) ● Regional anaesthesia (based on the procedure) Antiemetics: ● scopolamine patches ● ondansetron ● gabapentin Venous Thromboembolism: ● VTE prophylaxis ● Sequential compression devices

Intraoperative protocol	Cleaning and Antibiotic Prophylaxis	• proper skin preparation to reduce infection • IV antibiotic targeting skin flora within 1h of incision
Intraoperative protocol	Temperature Management	• 36 °C • Warming blankets (Warmed intravenous fluids and humidified air should be considered by the anaesthetic team)
Intraoperative protocol	Intravenous Fluid Management	• maintenance of euvolemia • Warm fluids with balanced crystalloid • vasopressor support • Foley catheters if surgery is longer than 3h (remove post operation or as soon as possible)
Intraoperative protocol	Analgesia and Anaesthetic Management	• IV analgesia (Nitrous oxide and inhalation agents should be avoided) • IV or oral acetaminophen • fentanyl and/or hydromorphone
Postoperative protocol	Pain management	• 1 to 2 weeks of schedule: acetaminophen, gabapentin and NSAID and rarely muscle relaxants. • If necessary, opioids

Postoperative protocol	Diet and POVN	● IV fluid discontinuation ● Regular diet ● Refeeding within 24h
Postoperative protocol	Mobilisation	● Early mobilisation (same day or POD 1) ● Physiotherapy ● Respiratory exercises

2.4 Patient Experience and ERAS

One focus aspect of ERAS is the minimization of opioid usage (Chatterjee, 2020). The use of opioids has proven not to affect patient satisfaction. Nevertheless, they can have harmful effects, in cases causing dependency. In the United States, for example, it is the number one cause of injury-related death (Louie, Kelly, Barth Jr. 2019).

Another important aspect is the reduced length of stay which has several benefits for patients (Chatterjee 2020). A shorter length of stay reduces the risk of infections and deterioration of the mental and physical condition. Patients have better overall conditions when they are discharged earlier. Despite these benefits, many patients spend up to multiple weeks in the hospital due to various reasons such as not clear indications (NHS England 2023). Patient satisfaction also seems to increase with a decrease in the length of stay (Diwaan, Nakonezny & Wells 2020). Patients are more satisfied when they can go home earlier. Not only are there medical reasons for wanting a decreased length of stay but it also improves patients' mental well-being.

2.5 Nurses´ Role in ERAS

Within the realm of ERAS, nurses play a crucial role in improving patient outcomes throughout the perioperative process (Balfour, Burch, Fecher-Jones, & Carter 2019). Their responsibilities extend beyond traditional protocols; ERAS

nurses are tasked with designing innovative care pathways and managing projects, all while offering pre-assessment and post-operative assistance to patients (Peña 2022). In some cases, ERAS patients may require daily visits for data collection. Although not a clinical element of ERAS, data collection is important for monitoring patient experiences, disease management, and the consistency and improvement of ERAS protocols (Peña 2022; Balfour et al. 2019).

Patient education is key for ERAS throughout the patient's pathway. This process needs to be simple, patient-centred, and highlight what to expect during and after the procedure. For example, flap reconstruction patients might become depressed due to the stress of the surgery and the loss of their natural breasts (Nahabedian & Nahabedian 2016). Regardless of the method of reconstruction, patient engagement in co-decision-making about breast reconstruction increases patient satisfaction. Abundant information promotes knowledge and reduces choice regret (Temple-Oberle, Shea-Budgell, Tan, Semple, Schrag, Barreto, Blondeel, Hamming, Dayan & Ljungqvist 2017). Preoperative preparation and information do not only fall to nurses alone but its often complimented by surgeons or other members of the multiplanar ERAS teams to avoid inadequate care and manage time (Balfour et al. 2019).

Another vital role of nurses in ERAS is patient assessment during surgery. Table 2 below highlights the nurse's roles with ERAS during a deep inferior epigastric perforator (Diep) flap (autologous microvascular) breast reconstruction as an example. Diep flap is the most common lap reconstruction, in which the surgeon cuts fat, skin, and blood arteries from the lower abdomen wall and transports them up to your chest to reconstruct the breast (DIEP flap 2023).

TABLE 2. Autologous microvascular breast reconstruction: Postoperative strategies to improve outcomes (Nahabedian & Nahabedian 2016).

MONITOR PATIENTS VITALS	● Assess for hypotension (<90/50) and hypothermia (<36) ● Compare values with

	perioperative values ● This helps prevent flap necrosis ● In case of hypotension, administer fluid resuscitation as prescribed.
PATIENT POSITIONING	● Patient bed head at 30 degrees to minimise stress in the abdomen ● Patient should avoid laying on the surgical site
SECRETION	● Monitor drain output ● Check for edemas ● Apply a surgical waistband as prescribed
FLAP MONITORING (skin colour, elasticity, capillary refill, skin temperature)	● The surgical site should be monitored every 15min in the first 4h postop. ● Then every hour for 20 hours ● PO2 and PO3, the site is checked every 2h to 4h based on surgeon's recommendations ● Usage of Doppler device (arterial flow control)
PATIENT SUPPORT AND EDUCATION	● Mobilisation on the PO1 ● Drainage catheters might be in place for a week ● Follow visit ● Nipple reconstructions are marked 3 months PO if needed ● Education about prescribed medication ● Education about how to review the surgical site ● Limitation on their physical activities for about 4 to 6 weeks

3 RESEARCH TASK, PURPOSE AND OBJECTIVE

The purpose of the thesis was to conduct a literature review of current research articles about the effects of ERAS protocol in patients undergoing breast reconstruction post-mastectomy.

The following question was set for the review. How does the implementation of the ERAS protocol impact the breast reconstruction of a woman who has undergone a mastectomy?.

In light of the fact that many women diagnosed with breast cancer may hesitate to pursue breast reconstruction due to fear or a lack of knowledge about the procedure. Therefore, it is significant to explore new alternatives such as the ERAS protocol, which can influence patients' decisions. While ERAS is a comprehensive perioperative protocol, this thesis narrowed its focus to examine the post-operation to the moment of discharge results and effects.

4 METHODOLOGY

This thesis is a qualitative descriptive literature review which aims to analyse certain literature about the research question, "How does the implementation of the ERAS protocol impact the breast reconstruction of a woman who has undergone a mastectomy?". The descriptive literature review method is used to provide context, identify a possible gap in knowledge or make justifications for future research (Xiao & Watson 2017).

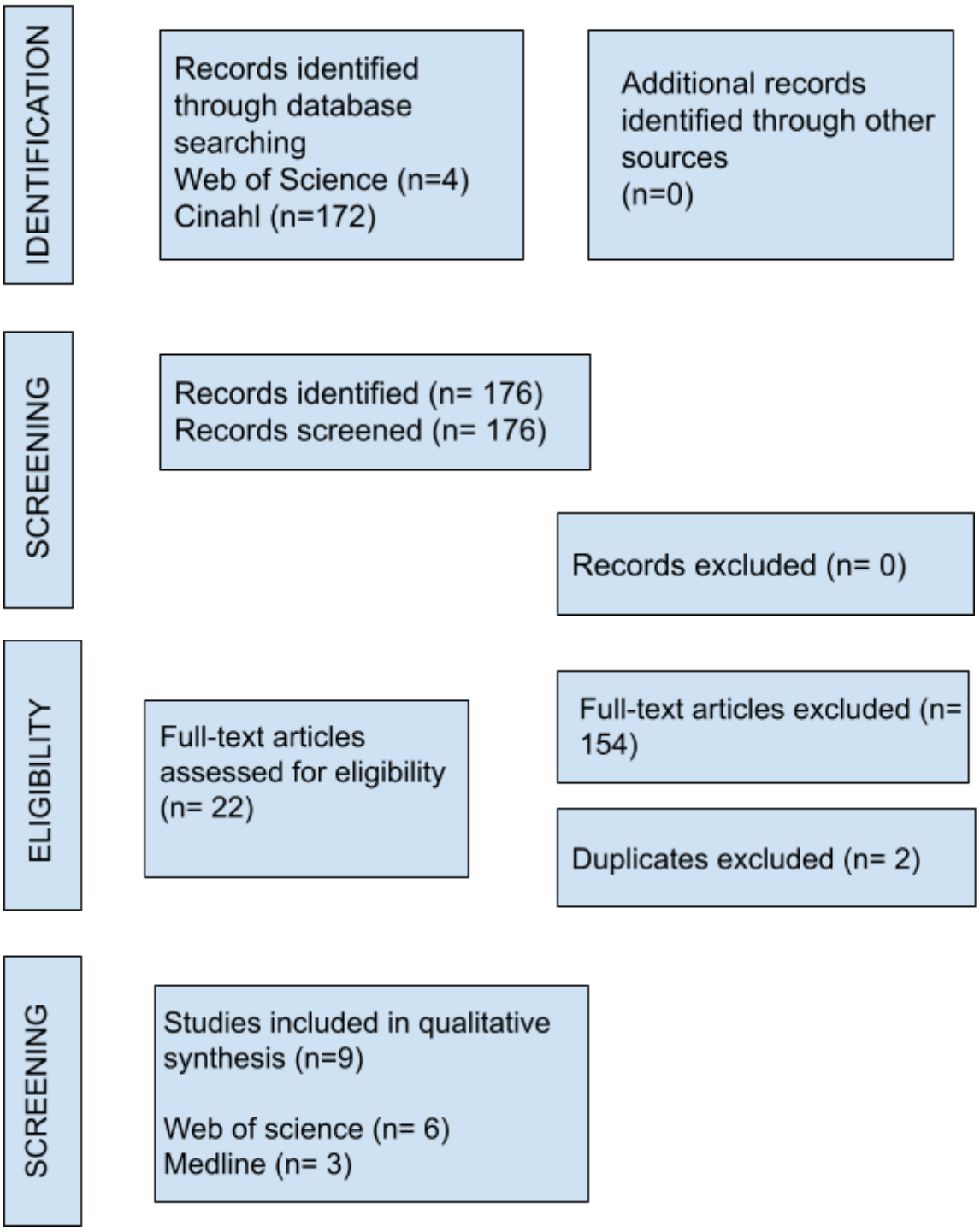
The thesis was conducted using the following scientific databases: MEDLINE's EBSCO and Web of Science. These databases proved to have the most relevant articles to the research. Table 3 shows the search words used to search for the chosen articles, which database it was and how many articles were found.

TABLE 3. Table of how the searches were conducted

Database	**Search Words**	**Articles found**
MEDLINE (EBSCO)	(Eras OR 'enhanced recovery after surgery') AND (breast reconstruction)	172
Web of Science	(ERAS protocol OR fast-track surgery) AND breast reconstruction AND post-mastectomy	4

The search was limited to scientific articles that were published no earlier than 2012. A 10-year time limit was considered crucial since there have been many medical and technological advancements over the period of time. There was no specific location chosen for the conducted research but articles published in English were reviewed to get as much information as possible. For this reason, no distinction was made on the type of breast reconstruction performed. All types were included in the search. For a comprehensive overview of the data collection process, Figure 1 illustrates the steps involved, utilizing the Prisma flow chart to delineate the procedures employed in study selection.

FIGURE 1. Prisma flow diagram (Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. 2021)



After assessing the quality of the articles and removing any possible articles that do not suffice qualitatively, the articles were read through and data extracted. The articles were read through in detail and the data is coded according to the needs of the review. Specific information that is relevant to the

research question is extracted. Similar themes found were grouped to make the process of reviewing easier. Then, the findings were reported clearly for the readers to read easily. After that, the findings of the literature and how they relate to the theoretical starting points were discussed and a conclusion summarising the main points of the thesis was written (Xiao & Watson 2017).

5 FINDINGS

Nine articles were used for the final review. The articles were published between the years 2017 and 2022 with English as the desired language. The selected studies were undertaken in six countries, three in the USA, two in Canada and one each in the following countries: Scotland, Denmark, Switzerland and the Netherlands. More information about the articles is reported in Appendix 1 Table 4.

The main categories of the study are the length of stay, opioid consumption, postoperative nausea and vomiting (PONV) and general complications. The overview of the articles presents that ERAS in breast reconstruction surgery demonstrates potential benefits in terms of shorter hospital stays, reduced opioid usage, and lower rates of postoperative nausea and vomiting. Complication rates remain relatively low, and patient criteria for inclusion in ERAS programs may vary, with factors like age, health status, and comorbidities being taken into account.

5.1 Length of Stay

8 out of 9 articles showed a decrease in length of stay for the ERAS protocol. One study (2) claimed the LOS was due to patient education and pre-emetics. Patient education helped patients set expectations for the course of their recovery and allowed them to meet expectations regarding the healing path. The use of pre-emetics shortened the length of stay since nausea and vomiting are one of the causes of prolonged hospital stays. Another study (4) owed the shortened LOS in the ERAS protocol to the management of drains. The ERAS protocol allowed for the earlier removal of drains compared to the traditional surgical protocols. This allowed patients to go home earlier since there was a lower minimum amount of drain fluid required to remove the drains. For the traditional surgical protocol, many patients stayed due to there being the presence of drains. One study (8) found no significant difference in LOS, however, there was still a difference. They owed this attribute to age, surgical length and facility difference. The ERAS group had younger patients which

equaled faster recovery. The ERAS group had shorter surgery length which meant shorter exposure to general anesthesia. This usually causes delayed ambulation and bowel function which contributes to longer LOS. Since the ERAS protocol group wasn't exposed to general anaesthesia they had faster ambulation and bowel function, which are critical criteria for discharge (1,3,6).

5.2 Opioid usage and PONV

Procedure time is highly linked with the use of opioids (1). Despite the length of the operation, it is found that proper analgesic infusion decreases opioid consumption and improves pain control for a longer period (2). Another alternative found was the usage of local anaesthesia to control surgical pain and avoid the administration of opioids (6). While NSAIDs are rarely recommended due to the risk of bleeding, in ERAS protocol the use of NSAIDs and other modes of analgesia decreases the need for opioids (2). However, for the Latissimus Dorsi flap (4) NSAIDs were exchanged for COX-II inhibitors. COX-II inhibitors work as anti-inflammatory and pain medication with fewer risks of bleeding or gastrointestinal problems.

In an implant-based reconstruction study (5), the usage of opioids was also minimal. However, there was an increase in ibuprofen, acetaminophen and gabapentin as compared to the non-ERAS study group. Another study mentions that the lower use of opioid consumption was also due to the lower pain score post-operation (3)

PONV can lead to discomfort and distress, potentially delaying a patient's recovery and discharge. Reduction of opioids contributes to the reduction of PONV, also leading to a better recovery (2). In implant-based reconstruction (5), common cases of postoperative nausea among the ERAS group were treated with ondansetron. Continuous monitoring of patients in the postoperative period was crucial to identify and prevent PONV.

5.3 Complications

Most of the studies include a post-operative evaluation to determine the safety of the ERAS protocol and patient pathways, these studies focus on overall major complications, readmissions, hematomas and infection (7).

The use of NSAIDs post-surgery can cause bleeding and increase the emergence of hematomas, for this reason in some case studies patients needed to live within an hour of the hospital for quick management in case of hematomas (2) however, the case of hematomas was only 1% out of the all study specimen. In one study case (9) the most common minor complication was a seroma (fluid accumulated near the surgical site), which was treated with oral antibiotics and the most common major complication was infections. The removal of a catheter might help in the rehabilitation of the patient, but if a new catheter is needed the probability of infection increases (8). Overall, ERAS did not lead to a significant rate of complications (3,4,5,7,8,9).

5.4 Patient criteria

Most articles aside from 3 (1,4,6) included only specific patients in the ERAS program. For example, in article 2 the patient criteria consisted of: ASA class 1 or 2, BMI < 35, the presence of an adult at home willing to provide basic post-op care and living within a 1 hour drive from the hospital. In Article 5, patients accepted into the ERAS program were primarily white, with a normal BMI and without significant comorbidities. Age was considered a factor in the inclusion criteria in article 7; only articles with females at least 18 years old were considered in the review. Exclusion criteria from articles 3 and 8 were simultaneous prophylactic ovariectomy at the same time as the breast reconstruction. In Article 9, the only exclusion criteria were any serious medical comorbidities that would prevent safe ambulatory discharge.

6 DISCUSSION

6.1 Research Ethics

This thesis has been made in compliance with the Finnish Responsible Conduct of Research (RCR) written by the Finnish National Board on Research Integrity (TENK) which aims to ensure reliable and ethical research. Researchers are accountable for complying with the conduct to guarantee the validity of their research. The RCR states that one must perform accurate research, be open about the results and to respect other people's works. It is that researchers also are aware of their own rights during the research and any possible conflicts of interest that may arise. Financial aspects must also be made clear to all research members (Responsible Conduct of Research RCR 2021).

6.2 Conclusion

The purpose of this academic work was to find the effects that ERAS has on breast reconstruction in the postoperative phase. The findings highlight that the implementation of the Enhanced Recovery After Surgery (ERAS) protocol in various studies demonstrated a consistent trend of decreased length of stay (LOS) for patients undergoing surgical procedures. This is due to a few key factors such as the length of the operation, patient criteria, drain management and patient education and preparation.

In terms of complications, ERAS maintains a relatively low rate of major issues, with manageable outcomes such as hematomas and infections. The patient selection criteria are an integral part of the ERAS process, ensuring that each patient receives individualized care based on their unique circumstances.

In summary, the implementation of ERAS protocols in the reviewed studies consistently demonstrated benefits in terms of reduced LOS, minimized opioid usage, lower PONV rates, and manageable complications. These results basically emphasize the importance of customizing the ERAS methods to the specific needs and characteristics of the surgical patient. Further research and analysis are essential to refine and optimize the implementation of ERAS

protocols in different breast reconstruction contexts and different types of patients.

REFERENCES

Balasubramanian, I., Buckley, J., Merrigan, A. & Twormey, S. 2016. Cross-sectional study of a single unit's experience with post-mastectomy reconstruction in breast cancer patients. International Journal of Surgery (London, England), 36, S52–S53. https://doi.org/10.1016/j.ijsu.2016.08.112

Balfour, A., Burch, J., Fecher-Jones, I. & Carter, F. J. 2019. Exploring the fundamental aspects of the Enhanced Recovery After Surgery nurse's role. Nursing Standard, 34(12), 70–75. https://doi.org/10.7748/ns.2019.e11437

Breast. 2021. ERAS Society. Read on 14.5.2023 https://erassociety.org/specialty/breast/#:~:text=The%20published%20ERAS%20protocol%20consists,and%20early%20postoperative%20mobilization7.

Breast Reconstruction after Mastectomy. 2017. National Cancer Institute. Read on 26.5.2023. https://www.cancer.gov/types/breast/reconstruction-fact-sheet

Breast Reconstruction Options. 2021. American Cancer Society. Read on 29.1.2023. https://www.cancer.org/cancer/breast-cancer/reconstruction-surgery/breast-reconstruction-options.html

Breast Reconstruction Using Implants. 2022. American Cancer Society. Read on 29.1.2023. https://www.cancer.org/cancer/breast-cancer/reconstruction-surgery/breast-reconstruction-options/breast-reconstruction-using-implants.html

Breast Reconstruction Using Your Own Tissue (Flap Procedures). 2021. American Cancer Society. Read on 29.1.2023. https://www.cancer.org/cancer/breast-cancer/reconstruction-surgery/breast-reconstruction-options/breast-reconstruction-using-your-own-tissues-flap-procedures.html

Chatterjee, A. 2020. Enhanced Recovery after Surgery: Better Value vs Cutting Cost. Journal of the American College of Surgeons 230 (5), 795-797

Cortina, C. S., Patten, C. R., Adamson, K. & Doren, E. L. 2020. Enhanced Recovery After Surgery (ERAS): Protocols in Post-Mastectomy Breast Reconstruction. Current Breast Cancer Reports, 12(4), 398–404. https://doi.org/10.1007/s12609-020-00378-9

DIEP flap. 2023. Breastcancer.org. Read on 28.5.2023 https://www.breastcancer.org/treatment/surgery/breast-reconstruction/types/autologous-flap/diep

Diwaan, W., Nakonezny, P. A. & Wells, J. 2020. The Effect of Length of Hospital Stay and Patient Factors on Patient Satisfaction in an Academic Hospital. Orthopedics 43 (6), 373-379

Gort, N., Van Gaal, B., Tielemans, H., Ulrich, D. & Hummelink, S. 2021. Positive effects of the enhanced recovery after surgery (ERAS) protocol in DIEP flap breast reconstruction, The Breast, Volume 60, 2021, Pages 53-57, ISSN 0960-9776, https://doi.org/10.1016/j.breast.2021.08.010 (Referred as 3)

Højvig, J., Kehlet, H. & Bonde, C. 2021. Enhanced recovery after breast reconstruction with a pedicled Latissimus Dorsi flap—A prospective clinical study, Journal of Plastic, Reconstructive & Aesthetic Surgery, Volume 74, Issue 8, Pages 1725-1730, ISSN 1748-6815, https://doi.org/10.1016/j.bjps.2020.11.047.

Kuhlefelt, C., Homsy, P., Repo, J. P., Jahkola, T. & Kauhanen S. 2022. Health related quality of life after breast reconstruction. World J Surg 46, 2695-2705

Liu, L. Q., Branford, O. A. & Mehigan, S. 2018. BREAST-Q Measurement of the Patient Perspective in Oncoplastic Breast Surgery: A Systematic Review. Plastic and Reconstructive Surgery. Global Open, 6(8), e1904–. https://doi.org/10.1097/GOX.0000000000001904

Ljungqvist, O. & Hubner, M. 2018. Enhanced recovery after surgery—ERAS—principles, practice and feasibility in the elderly. Ageing Clinical and Experimental Research, 30(3), 249–252. https://doi.org/10.1007/s40520-018-0905-1

Louie, C. E., Kelly, J. L. & Barth Jr., R. J. 2019. Association of Decreased Postsurgical Opioid Prescribing with Patients' Satisfaction with Surgeons. JAMA Surgery, 154 (11), 1049-1054

Nahabedian, M. Y. & Nahabedian, A. G. 2016. Autologous microvascular breast reconstruction: Postoperative strategies to improve outcomes. Nursing (Jenkintown, Pa.), 46(12), 26–34. https://doi.org/10.1097/01.NURSE.0000504672.73356.8e

NHS England. Reducing Length of Stay. Read on 28.5.2023. https://www.england.nhs.uk/urgent-emergency-care/reducing-length-of-stay/

Offodile, A., C., Gu, C., Boukovalas, S., Coroneos, C. J., Chatterjee, A., Largo, R. D. & Butler, C. 2019. Enhanced recovery after surgery (ERAS) pathways in breast reconstruction: systematic review and meta-analysis of the literature. Breast Cancer Research and Treatment, 173(1), 65–77. https://doi.org/10.1007/s10549-018-4991-8
(Referred as 7)

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P. & Moher, D. 2021. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. PLOS Medicine. 18(3):e1003583 [15p.]. https://doi.org/10.1371/journal.pmed.1003583

Peña, C. G. 2022. What makes a nurse a good ERAS nurse? Asia Pac J Oncol Nurs. Feb 16;9(7):100034. doi: 10.1016/j.apjon.2022.01.009. PMID: 35607507; PMCID: PMC9123207.

Responsible Conduct of Research RCR. 2021. Finnish National Board on Research Integrity TENK. Read on 19.2.2023. https://tenk.fi/en/research-misconduct/responsible-conduct-research-rcr

Shammas, R. L., Fish, L. J., Sergesketter, A. R., Offodile, A. C., Phillips, B. T., Oshima, S., Lee, C. N., Hollenbeck, S. T. & Greenup, R. A. 2022. Dissatisfaction After Post-Mastectomy Breast Reconstruction: A Mixed-Methods Study. Annals of Surgical Oncology, 29(2), 1109–1119. https://doi.org/10.1245/s10434-021-10720-9

Soteropulos, C. E., Tang, S. Y. Q. & Poore, S. O. 2019. Enhanced Recovery after Surgery in Breast Reconstruction: A Systematic Review. Journal of Reconstructive Microsurgery, 35(9), 695–704. https://doi.org/10.1055/s-0039-1693699

Temple-Oberle, C., Shea-Budgell, M. A., Tan, M., Semple, J. L., Schrag, C., Barreto, M., Blondeel, P., Hamming, J., Dayan, J. & Ljungqvist, O. 2017. Consensus review of optimal perioperative care in breast reconstruction: Enhanced recovery after surgery (ERAS) society recommendations. Plastic and Reconstructive Surgery, 139(5), 1056e–1071e. https://doi.org/10.1097/PRS.0000000000003242

Villamiel, K. M. F., Yao, C. & Sioson, M. 2019. Enhanced recovery after surgery (ERAS) outcomes in patients with prior diagnosis of diabetes. Journal of the ASEAN Federation of Endocrine Societies, 34(1), 73–79. https://doi.org/10.15605/jafes.034.01.11

What is a Mastectomy? 2021. American Cancer Society. Read on 19.1.2023. https://www.cancer.org/cancer/breast-cancer/treatment/surgery-for-breast-cancer/mastectomy.html

Xiao, Y. & Watson, M. 2017. Guidance on Conducting a Systematic Literature Review. Journal of Planning Education and Research 39 (1), 93-112

Zychowicz, A., Pisarska, M., Laskawksa, A., Czyz, M., Witowski, J., Kisielewski, M., Kulawik, J., Budzynski, A. & Pedziwiatr, M. 2019. Patients' Opinions on Enhanced Recovery After Surgery Perioperative Care Principles: A Questionnaire Study. Wideochir Inne Tech Maloinwazyjne 14 (1), 27-37

APPENDICES

Appendix 1. TABLE 4. Description of the eligible studies

Authors, year and country	**Purpose**	**Design and measure**	**Sample**	**Results**
(1) Cho, M.J., Garza, R., Teotitia, S.S. & Haddock, N.T. 2022. USA	To find out the utility of ERAS pathway in breast reconstruction	Retrospective review. Before and after ERAS implementation were performed.	87 Patients who underwent PAP flap reconstruction(58 patients in pre-ERAS and 29 patients in ERAS group).	ERAS group had reduced LOS, surgical time and opioid use. There was no statistical difference in average pain scores between the two groups.
(2) Dumestre, D.O., Redwood, J., Webb, C.E. & Temple-Oberle, C. 2017. CANADA	The difference between conventional and ERAS alloplastic breast reconstruction	Retrospective study	78 ERAS and 78 non-ERAS patients undergoing alloplastic breast reconstruction	ERAS group had a reduced LOS. ERAS patients had significantly more bilateral surgery and immediate reconstructions and had more implants versus expanders placed There were no differences in the number of post-operative emergency department visits and readmission between the groups
(3) Gort, N., van Gaal, B. G. I., Tielemans, H. J. P., Ulrich, D. J. O., & Hummelink, S.	The positive effects of ERAS in patients undergoing DIEP breast	Single-centre patient-control study comparing two	Patients undergoing DIEP breast reconstruction; 73- ERAS and	The ERAS groups had a less amount of LOS, less constipation

2021. SCOTLAND	reconstruction in a single centre	group of patients.	79- pre-ERAS patients	and lower pain score. There were no significant differences between the groups in postoperative complications.
(4) Højvig JH, Kehlet H, & Bonde CT. 2021. Denmark	Optimization of the Latissimus Dorsi reconstruction program using ERAS	Clinical study. 10-year period examination	of 30 patients, plus 135 cases from a previous study. ERAS (n=18) and non-ERAS (n=12)	Drainage were taken earlier in ERAS group, therefore LOS was shorter. There were no significant differences or complications between the groups.
(5) Kennedy, G. T., Huang, C. Y., So, A., Hill, C., Wu, L. C., Fosnot, J., Farrar, J. T., & Tchou, J. C. 2019. USA	Use of ERAS and its relation to the reduction of narcotics in implant-based reconstruction post-mastectomy	Clinical study	23 patients undergoing reconstruction after a mastectomy	ERAS patients needed fewer narcotics and LOS was less. Pain scores were equivalent between groups, as were postoperative complication rates of nausea, hematoma, and infection.
(6)Linder, S., Walle, L., Loucas, M., Loucas, R., Frerichs, O., & Fansa, H. 2022. SWITZERLAND	Compare the outcomes for patients undergoing a DIEP-flap breast reconstruction from two centres with and without ERAS protocol.	Control study	79 patients. ERAS (n=42) and non-ERAS (n=37)	LOS were shorter in ERAS patients. BMI in ERAS group did not affect LOS as compared with the other group. In both groups, no complications were observed.

(7) Offodile II, A.C., Gu, C., Boukovalas, S., Coroneos, C.J., Chatterjee, A., Largo, R.D. & Butler, C. 2019. The Netherlands	The Evidence for ERAS Pathways in breast reconstruction	Meta-analysis/ systematic search	260 articles	ERAS patients used fewer narcotics. No significant differences were found.
(8) Sharif-Askary, B., Hompe, E., Broadwater, G., Anolik, R. & Hollenbeck, S.T. 2019. USA	How ERAS protocol improves the post-operation outcomes	Data Review	Review of 276 consecutive patients who underwent abdominal-based free flap breast reconstruction before and after ERAS implementation	ERAS patients had lower use of narcotics. no significant differences were further found.
(9) Stein, M.J., Frank, S.G., Lui, A., Zhang, T. & Zhang, J. 2019. CANADA	Compare ERAS protocols with non-ERAS protocols in breast reconstruction	Prospective cohort study	Patients undergoing LSD breast reconstruction from 2016-2019	ERAS patients were discharged within 24h. No significant differences between major and minor complications.