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Postmastectomy breast reconstruction. A view from your current perspective

Reconstrucción mamaria postmastectomia. Una visión desde su perspectiva actual

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Resumen

Determining the current advances in post-mastectomy breast reconstruction is a topic of great interest due to the connotations it carries with it. A structured review was carried out for the research; Two research questions were generated focused on the topic: What are the current advances in post-mastectomy breast reconstruction? What are the surgical techniques used for post-mastectomy breast reconstruction? Search terms consisted of mammoplasty, plastic surgery procedures, breast implants, breast neoplasms, breast diseases. The search in databases such as Pubmed, Mendeley, Wiley, Web of Science, Cochrane, Latindex and Google Scholar, with articles published in the last 5 years, and others of more than 5 years that provided relevant data. We chose observational, randomised studies, systematic reviews, case presentations related to the research topic to assess the number of available studies. The current management of breast cancer includes immediate breast reconstruction, which is performed after the initial mastectomy treatment, and breast reconstruction, by placing a prepectoral or subpectoral breast implant to the pectoralis major muscle or by using the patient's own tissue with autologous reconstruction, accompanied by immediate radiotherapy, constituting an advance whose results are still under discussion. Regarding post-mastectomy breast reconstruction, it is important to first determine if the patient with breast cancer is willing to undergo breast reconstructive treatment because this can influence the results. According to the data obtained, patients with autologous fat transfer obtained greater satisfaction, greater physical well-being and better results

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Abstract

Determinar los avances actuales sobre reconstrucción mamaria postmastectomía es un tema de sumo interés por las connotaciones que lleva consigo. Se realizó una revisión estructurada, para la investigación; se generaron dos preguntas de investigación enfocadas al tema ¿Cuáles son los avances actuales sobre reconstrucción mamaria postmastectomía? ¿Cuáles son las técnicas quirúrgicas empleadas para reconstrucción mamaria postmastectomía? Los términos de búsqueda consistieron en mamoplastia, procedimientos de cirugía plástica, implantes mamarios, neoplasias mamarias, enfermedades mamarias. La búsqueda en bases de datos como Pubmed, Mendeley, Wiley, Web of Science, Cochrane, Latindex y Google Scholar, con artículos publicados en los últimos 5 años, y otros de más de 5 años que aportaron datos relevantes. Se eligieron estudios observacionales, aleatorizados, revisiones sistemáticas, presentaciones de casos relacionados con el tema de investigación para evaluar el número de estudios disponibles. El manejo actual del cáncer de mama comprende la reconstrucción mamaria inmediata, se realiza después del tratamiento inicial de mastectomía, y reconstrucción de la mama, mediante la colocación de un implante mamario prepectoral o subpectoral al músculo pectoral mayor o mediante el uso del propio tejido de la paciente con reconstrucción autóloga, acompañado de radioterapia

Palabras clave:

Mamoplastia,
reconstrucción mamaria,
cáncer de mama, linfedema
procedimientos de cirugía plástica,
implantes mamarios,
neoplasias mamarias.

inmediata constituyendo un avance cuyos resultados continúan en discusión. Respecto a la reconstrucción mamaria postmastectomía, es importante primeramente determinar si la paciente con cáncer de mama está dispuesta a someterse a un tratamiento reconstructivo de la mama debido a que esto puede influir en los resultados. Según los datos obtenidos, las pacientes con transferencia de grasa autóloga obtuvieron mayor satisfacción, mayor bienestar físico y mejores resultados

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Introduction

Breast cancer is the most common neoplasm in the female population, its treatment includes chemotherapy, biological treatment, breast surgery, and breast reconstruction is a current issue, because it represents great importance for the aesthetic and psychoemotional part of women, so it will be the object of research.

Breast oncoplastic surgery has established itself as the standard of care in the management of breast cancer, this surgery combines oncological techniques of tumor removal and plastic surgery with reconstruction that improve the psychosocial part of the woman and should be considered in all patients who require breast surgery after their diagnosis. This approach includes therapeutic mammoplasty, partial reconstruction and total reconstruction, either immediate or delayed. However, it remains a clinical and surgical challenge, especially in patients who require mastectomy, radiation therapy, and want breast reconstruction[1,2].

The American Society of Breast Surgeons (ASBrS) defines oncoplastic surgery as "a form of breast-conserving surgery that includes oncological resection with a partial mastectomy, ipsilateral reconstruction using displacement techniques, or volume replacement with possible contralateral symmetry surgery when appropriate"[2]. Fundamentally, oncoplastic surgery involves the removal of the tumor, preservation of the breast tissue, and reconstruction of the defect[2]. Most classifications differentiate oncoplastic surgery into volume displacement and volume replacement techniques, so a level 1 volume displacement oncoplastic operation involves the removal of < 20 % of the breast tissue in partial mastectomy and its subsequent reconstruction with a local tissue rearrangement design. such as a donut mastopexy or a half-moon mastopexy. A Level 2 volume displacement oncoplastic operation involves the removal of 20-50 % of the breast tissue at partial mastectomy, followed by a reconstruction design, which typically uses breast mastopexy or reduction designs and, when more than 50 % of the breast tissue is removed as part of the partial mastectomy followed by reconstruction using local/regional flaps or implants, it is a volume 2 oncoplastic replacement operation.

Radiation therapy is associated with higher complication rates, implant loss, and less favorable cosmetic outcomes in patients undergoing implant-based breast reconstruction. It has been justified that breast reconstruction has a positive effect on quality of life, since mastectomy can negatively impact the physical and emotional well-being of women. For this reason, many patients choose reconstruction in order to reduce pain, recover their self-esteem and improve aspects related to vitality, femininity and sexuality[3-5].

The impact of immediate breast reconstruction with implants (IBBR), a surgical procedure that restores the volume of the breast through the placement of implants, in the execution of radiotherapy plans remains

controversial[4]. The effects of radiotherapy in IBBR allow for a structure that improves the patient's natural contour and psychological function, current evidence on the treatment is limited due to the short follow-up and lack of patient-reported outcomes[5].

The breast reconstruction techniques available today fall into two main categories: implant-based reconstruction (IBR) and autologous flap reconstruction. In the case of autologous flap reconstruction, the tissue is transferred to the breast in the form of a flap, with the deep inferior epigastric artery perforating flap (DIEP) being the gold standard in this type of procedure. Both techniques have been shown to be effective in improving the quality of life of patients with breast cancer[6]. Capsular contracture continues to be one of the most challenging complications of breast reconstruction with implants, mainly in patients undergoing postmastectomy radiotherapy[6]. Autologous fat grafting is a regenerative strategy to reduce radiation damage, but this requires further research[6].

The fat cell harvesting and lipofilling technique is performed using 2 to 3 mm incisions. A saline solution with lidocaine and adrenaline is infiltrated into the area intended for fat grafting. The extraction is carried out with a blunt, three-hole cannula connected to a 60 mL syringe. The fat is then processed using the PureGraft 250 system in unilateral cases and the PureGraft 850 system in bilateral cases, in order to collect and purify the lipoaspirate. After washing the contaminants, the semi-liquid material is transferred to 10 mL syringes. Finally, the fat is injected in microdroplets, distributing the fan graft through different pectoral planes and in the deep and superficial subdermal layers of the breast. Patients attended regular clinical check-ups at 2 and 6 weeks after the procedure[3,7].

Free fat grafting can be considered as an alternative to breast reconstruction procedures[7].

Breast reconstruction algorithms predominantly focus on avoiding the delivery of radiation to definitive reconstruction to avoid late toxic effects. These strategies include staged reconstruction with the placement of a temporary tissue expander at the time of mastectomy, which is associated with high rates of cellulitis and explantation, which can delay radiation therapy, patients can undergo mastectomy without reconstruction. Delayed reconstruction is typically performed approximately 6 to 12 months after premastectomy radiation therapy[8]. The BREAST-Q questionnaire is used to measure quality of life after breast reconstruction and satisfaction after oncoplastic surgery, version 1.0, used to measure quality of life, it consists of several domains: psychosocial well-being, sexual well-being, physical well-being (breast), satisfaction with the breasts and satisfaction with the outcome, so all these factors are important. The questions on the BREAST-Q questionnaire are graded from 0 to 100 (worst to best), with a higher score indicating greater satisfaction or better quality of life, depending on the scale. The questionnaire was administered at the time of inclusion in the study, at 6 months, and at the main endpoint, 12 months after the last reconstruction procedure[3].

Surgery for breast cancer presents important advances that include robotic surgery as a novel approach in the management of patients who have overcome chemotherapy and radiotherapy[9], considering that breast surgery can cause anxiety, depression and sleep disturbances after perioperative reconstruction ($p < 0.001$)[10].

Hence, the objective was to determine the current advances in post-mastectomy breast reconstruction.

Material and methods

A structured review was carried out, for the research, two research questions were generated focused on the topic: What *are the advances in postmastectomy breast reconstruction*? What *are the surgical techniques used for postmastectomy breast reconstruction*?

Search terms consisted of mammoplasty, breast plastic surgery procedures, breast implants, breast neoplasms, breast diseases, and breast reconstruction in databases such as Pubmed, Mendeley, Wiley, Web of Science, Cochrane, Latindex, and Google Scholar with articles published within the last 5 years. Observational studies, randomized studies, systematic reviews and meta-analyses, case presentations related to the research topic, were chosen to assess the number of available studies. Clinical characteristics and positive or negative treatment outcomes were used as the primary outcome, and all review authors freely contributed to the research by proposing, executing or presenting results.

Eligibility criteria. Through the development of inclusion and exclusion criteria, the research was grouped for synthesis.

Inclusion criteria. Most of these articles were published in the last 5 years and others of more than 5 years that provided relevant data on post-mastectomy breast reconstruction techniques. Articles published on complications of postmastectomy breast reconstruction. Articles on advances in post-mastectomy breast reconstruction.

Exclusion criteria. Articles that do not address the topic of research. Articles with results not available.

Sources of information. Articles published on post mastectomy breast reconstruction were reviewed using information from databases such as PubMed, Mendeley, Wiley, Web of Science, Cochrane, Latindex, and Google Scholar.

Search strategy. Manual randomization focused on the research topic on post-mastectomy breast reconstruction was used, deleting articles that did not address the specific topic, Boolean operators and search words were: mammoplasty, plastic surgery procedures, breast implants, breast neoplasms, breast diseases.

Study selection process. Articles that met the objective and met the inclusion criteria were selected.

Data extraction process. For data extraction, manual stratified randomization was used according to the date of the research, the types of studies and the intervention used, to ensure transparency the results were extracted and analyzed together by a working group to avoid selection and randomization biases.

Assessment of risk of bias in publication. The studies used different tools and metrics, as well as population heterogeneity bias.

Measures of effect. The p-value was used to assess statistical inference; other measures evaluated were relative risk, confidence interval, absolute risk, odds ratio, median.

Assessing the certainty of the evidence. Randomized and nonrandomized population-based studies were obtained, as well as publications on post-mastectomy breast reconstruction. The evidence was derived from highly relevant research. We assessed the certainty of the evidence using the *Grading of Recommendations Assessment, Development and Evaluation* (GRADE) methodology with the aim of obtaining high-level evidence.

Results

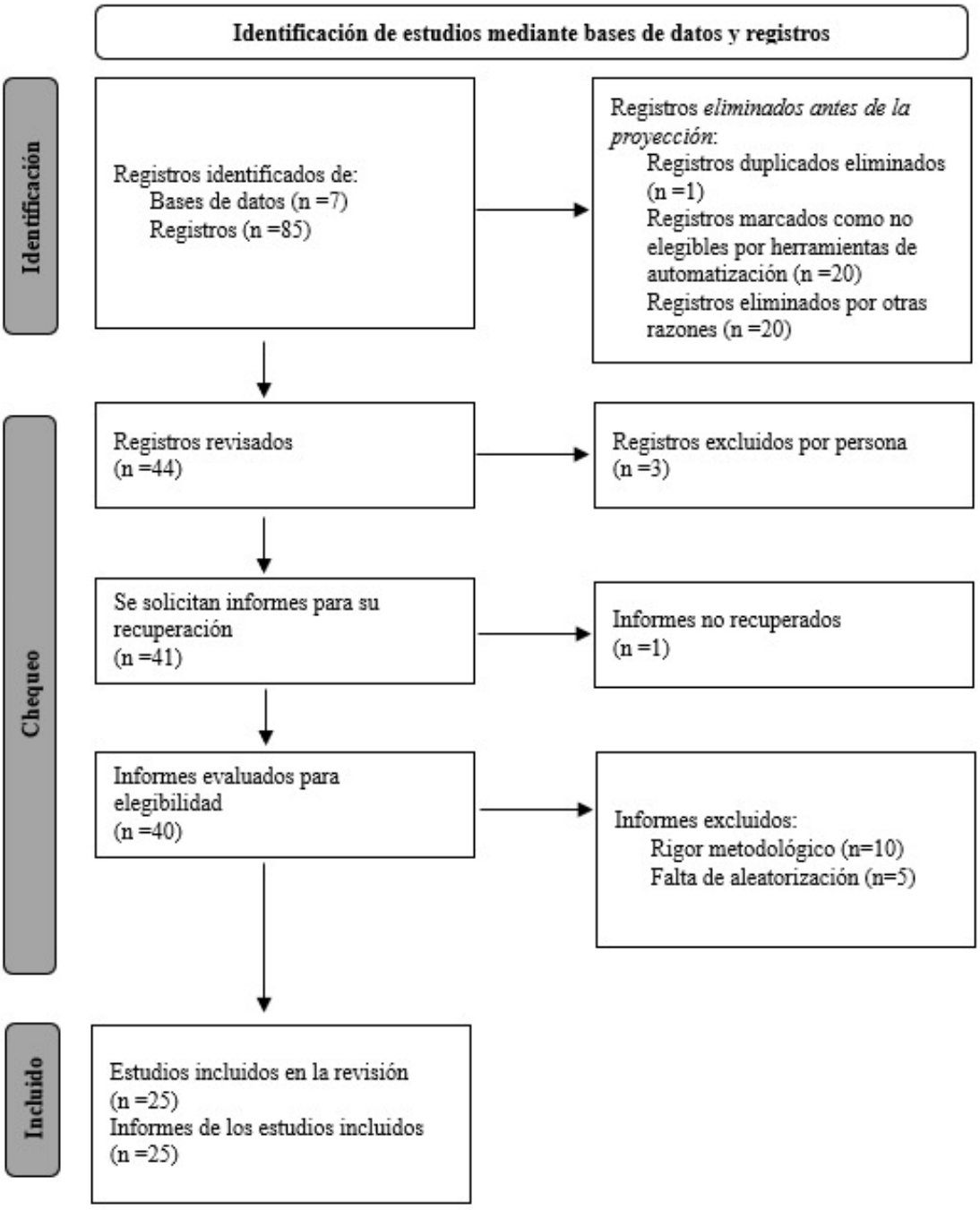


Figure 1 PRISMA 2020 flowchart for new systematic reviews including database and registry searches

Selection of studies. Using the PRISMA 2020 flowchart (Figure 1) for systematic reviews, database searches and registries were included, and a total of 6 randomized clinical trials with a high level of evidence according to GRADE that complied with inclusion were obtained.

Table 1 Advances in the surgical management of breast cancer, summary of clinical trials, high level of evidence

Reference	Population	Intervention	Results	Assessment of bias/recurrence/complications
Piatkowski et al.[3]	193 breast cancer patients (mean age, 49.2 ± 10.6 years) aged 18 years or older undergoing breast reconstruction technique, 91 patients from the autologous fat transfer group (mean age, 49.3 ± 10.3 years) and 80 from the implant-based group (mean age, 49.1 ± 11.0 years).	Total breast reconstruction with autologous fat transfer compared to implants.	Patients who underwent mastectomy and then underwent breast reconstruction, breast satisfaction increased (p = 0.002), physical well-being was higher (p = 0.007), and satisfaction with outcome improved (p = 0.04).	18 patients dropped out mainly due to their aversion to the use of implants, while in the autologous fat transfer group, 6 patients ended their treatment prematurely due to the load.
Schaverien et al.[8]	48 patients underwent mastectomy with immediate breast reconstruction, with a median of 23 days (IQR, 20-28.5 days) after radiation therapy. 41 patients underwent autologous microvascular flap reconstruction, 5 underwent latissimus dorsi pedicled flap reconstruction, and 2 underwent tissue expander placement.	Pre-mastectomy radiation therapy and immediate breast reconstruction.	There was no complete loss of autologous flap and 1 patient underwent explantation with a tissue expander. Eight of 48 patients (17 %) had skin flap necrosis of the treated breast, of whom 1 underwent reoperation. During follow-up (median, 29.7 months [range, 10.1-65.2 months]), there were no regional recurrences or distant metastases.	
Wong et al.[13]	400 women (201 in the conventional fractionation (CF) group and 199 in the hypofractionation (HF) group; median age, 47 [23-79] years) undergoing mastectomy and immediate breast cancer expander or implant reconstruction (Tis, TX, or T1-3) with RT after unilateral mastectomy compared with conventional fractionation.	Post-fractionated versus conventional fractionated versus fractionated postmastectomy radiation after implant reconstruction.	Women < 45 years had absolute physical well-being scores after 6 months were higher if treated with FH rather than CF regimens (23.6 [95% CI, 22.7-24.6] vs. 22.0 [95% CI, 20.7-23.3]; p = 0.047) and reported being less bothered by adverse effects (mean [SD], 3.0 [0.9] in the HF group and 2.6 [1.2] in the CF group; p = 0.02) or nausea (mean [SD], 3.8 [0.4] in the FH group and 3.6 [0.8] in the CF group; p = 0.04).	23 distant recurrences (11 in the FH group and 12 in the CF group) and 2 local-regional recurrences (1 in the FH group and 1 in the CF group). Chest wall toxicities occurred in 39 patients (20 in the FH group and 19 in the CF group).
Khan et al.[14]	119 women were registered. Cohort 1 included 45 patients and cohort 1 and 74 in cohort 2.	Effect of Intensity-Modulated Postmastectomy Radiation Therapy on Implant Failure Rates in Breast Cancer Patients.	External radiotherapy (RT-TE) and intensity-modulated radiotherapy have similar results.	Among the complications, they observed wall contracture, infection, exposure, and others that required extraction, replacement, or new reconstruction.
Park et al.[15]	Surgical and oncological results of robotic and conventional mastectomy with nipple sparing and immediate reconstruction, a total of 659 women (609 with breast cancer and 50 undergoing mastectomy to reduce risk.	Surgical and oncological outcomes of nipple-sparing robotic mastectomy (MRCP) with immediate breast reconstruction (MRI) compared to conventional nipple-sparing mastectomy (MCCP).	The teat necrosis rate was 2.2% and 7.8 % for MRCP and MCCP, respectively (p = 0.002).	Grade III postoperative complications were equivalent with no differences between the two groups (all p < 0.05).

Study characteristics. A nonrandomized clinical trial determined that premastectomy radiation therapy and regional lymph node irradiation, followed by mastectomy and autologous microvascular flap, are feasible and safe[11].

A randomized study conducted in China, a large percentage of patients do not accept immediate breast reconstruction after mastectomy, in a population of 100 newly admitted breast carcinoma patients received modified radical mastectomy and were randomly assigned into two groups (A and B) to receive preoperative information of breast reconstruction, 18 patients did not accept breast reconstruction in Group

A, while 24 patients agreed to receive breast reconstruction and 26 patients did not accept breast reconstruction in Group B. There was statistical significance ($p < 0.05$) between the two groups mentioned, non-acceptance of treatment may influence the results for the treatment or prevention of breast cancer during the same operation[12]. Table 1 describes randomized clinical trials that studied the usefulness of reconstructive mammoplasty.

Risk of bias of individual studies. The bias of the included studies was low and intermediate as the RoB 2 analysis is described in Table 1.

Results of individual studies. By means of descriptive analysis and (Table 1), the results of the individual studies are described according to the *Patient/Population, Intervention, Comparison, Outcome* (PICO) methodology and the studies that included population, intervention, comparison and results were analyzed in order to issue high-quality recommendations.

Results of the synthesis

The (Table 1) summarises the treatment of breast cancer includes new surgical approaches such as immediate reconstructive surgery, immediate radiotherapy at different doses than usual, use of implants in reconstruction, surgical complications include distant metastasis, necrosis, infection, flap loss and the need for reconstruction.

In a study that aimed to compare differences in radiation therapy dosimetry, complications of radiation therapy, and quality of life in patients undergoing modified radical mastectomy combined with or without IBBR impact, it was found that the IBBR group was associated with higher planning target volumes, compared to the group without reconstruction ($p < 0.05$). The IBBR group also had lower dosimetric radiation therapy parameters in the ipsilateral lung and heart of patients with left breast cancer[4].

In a study that aimed to determine long-term surgical outcomes and patient-reported outcomes regarding the effects of radiation therapy following IBBR, they concluded that although radiation therapy was significantly associated with higher rates of implant removal, results from surveys conducted between 2012 and 2020 using the BREAST-Q questionnaire (a questionnaire that measures benefits, was developed and rigorously designed to evaluate the results of different types of breast surgery) remained stable for 8 years despite irradiation[5].

Fat grafting is a safe and effective adjunct to maintain implant-based breast reconstruction after radiation therapy. In a retrospective review carried out in women who underwent two-stage implant-based breast reconstruction followed by post-mastectomy radiotherapy (50 G and in 25 fractions) between 2010 and 2021, they found that lipofilling was associated with a lower incidence of capsular contracture, absence of severe contracture and absence of oncological events. Fat grafting may represent a valuable strategy for preserving implant viability, improving tissue quality, and reducing the need for salvage procedures in patients who are not candidates for autologous reconstruction[6].

Publication biases. The bias assessment observed a high percentage of treatment dropouts, recurrences and postoperative complications that hindered long-term follow-up.

Certainty of evidence. The assessment was high-level for outcome on the effect of breast reconstruction on breast cancer management.

Discussion

Current management of breast cancer includes immediate breast reconstruction, performed after the initial mastectomy. This can be carried out by placing a breast implant, either prepectoral or subpectoral to the pectoralis major muscle, or by autologous reconstruction using the patient's own tissue. In some cases, this procedure is accompanied by immediate radiotherapy, which is a significant advance, although its results continue to be debated in the scientific literature[16].

Reconstruction can be performed using two techniques: autologous reconstruction with fat transplantation known as Brava expansion which is a fat breast reconstruction or augmentation procedure and another technique that uses expanders or implants after mastectomy to improve cosmetic outcomes (8.66, 95 % CI 0.46 to 16.86; $p = 0.041$)[17-19].

Another approach is based on breast-conserving surgery with the performance of local transposition flap followed by radiotherapy, it is used for the treatment of early-stage breast cancer, the decision of breast reconstruction surgery can generate anxiety in the patient[11], the results of a clinical trial indicated that patients with anxiety are more likely to experience (OR = 1.03, $p = 0.01$) clinically significant decisional conflict (OR = 1.03, $p = 0.01$), so adequate information management is necessary[20].

The complications of breast reconstruction are varied, from necrosis; seroma is the most frequent complication and can reach the total loss of the implant or the need for a new surgery. A randomized study observed that there is a higher frequency of total implant loss in the biological mesh group (8.5 vs. 2 %), although it was not statistically significant ($p = 0.083$)[21].

Regarding robotic surgery, a meta-analysis conducted in 1674 patients, grade III complications in nipple-sparing robotic mastectomy were lower without statistical significance. Nipple necrosis was significantly lower in robotic mastectomy; however, they observed an increase in surgical time but shorter hospitalization time[22].

Another study in 2166 patients, minimally invasive surgery significantly reduces overall complications (OR = 0.74; 95 % CI [0.58, 0.94]; $p = 0.01$) and grade III complications (OR = 0.47; 95 % CI [0.31, 0.71]; $p = 0.0003$)[23].

Immediate breast reconstruction at the time of mastectomy has many advantages compared to delayed reconstruction, reduced treatment costs, superior cosmetic outcomes, and improved psychosocial outcomes[24,25].

A randomized study conducted a Body Image Scale to assess perception and satisfaction in patients undergoing robotic mastectomy or open surgery with greater satisfaction with robotic surgery ($p < 0.0001$), through a follow-up of 28.6 months[9].

Conclusion

Regarding post-mastectomy breast reconstruction, it is important to first determine if the patient with breast cancer is willing to undergo breast reconstructive treatment because this can influence the results. According to the data obtained, patients with autologous fat transfer obtained greater satisfaction, greater physical well-being and better outcome.

Among the complications of receiving radiotherapy, prior to mastectomy and immediate breast reconstruction, the presence of flap necrosis can be highlighted, in addition to wall contracture, infection, need for extraction or replacement.

To perform a breast reconstruction, the type of patient, the age and the decision to want to undergo reconstruction surgery must be determined to determine the technique to be used, since all this will influence the prognosis and results.

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Conflicts of interest

The authors declare that there are no conflicts of interest in the present research.

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Ethical considerations

As it is a review, it does not need ethical approval for publication, all authors contributed and read the manuscript, the data were analyzed together to avoid manipulation or direction of the research.

Limitations in research

The limitation was dependent on population heterogeneity, more research on the subject is suggested.

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All participants as authors of the review contributed to the research freely to propose, execute or present the results of the research and accept that the article be published.

Contribution of the authors in the article

María Calderón, conceptualization and resources. *Omar Rodríguez*, methodology. *Sonia Díaz*, software and formal analysis. *María Calderón*, data curation. *Liz Mendoza*, writing the original draft. *María Calderón*, revision and editing of the original draft. *Alfredo Chong*, visualization. *Omar Rodríguez*, research. *María Calderón*, supervision. *Sonia Díaz*, project management. *Liz Mendoza*, writing the final draft. *María Calderón*, revision of the final manuscript. *Alfredo Chong*, final reception. *María Calderón*, acquisition of funds and translation.

Use of artificial intelligence

No artificial intelligence was used in the development of the manuscript.

Availability of data, codes, and other materials

The data and protocol are available from the correspondent.

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