

Latissimus dorsi flap (LD-flap) or endoprosthesis for breast reconstruction? Which is optimal for immediate reconstruction after a nipple-sparing mastectomy in breast cancer patients?

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The article analyzes two methods of breast reconstruction: breast reconstruction with an implant or an LD-flap after a subcutaneous nipple-sparing mastectomy in the case of complex treatment of stage I—III breast cancer. In many works, the advantages and disadvantages of different types of reconstruction are indicated and contradictions can often be found, although most prefer reconstruction with implants.

OBJECTIVE — to compare the results of immediate breast reconstruction using an implant or an LD-flap after a subcutaneous nipple-sparing mastectomy in patients with I—III stages of breast cancer.

MATERIALS AND METHODS. We conducted a comparative study of the results of immediate reconstruction of the mammary gland after a subcutaneous nipple-sparing mastectomy using the method of putting a silicone implant (endoprosthesis) or the method of LD-flap reconstruction. Randomization was not carried out. The results of operative interventions were retrospectively and parallelly compared in two groups: reconstruction of the mammary gland with an implant (1) or LD flap (2). In both groups of 30 patients, all patients were diagnosed with stage I—III breast cancer and in most cases (80—83 %) received preoperative chemotherapy for regression and reduction of the stage of the process. The evaluation of the treatment result was carried out according to aesthetic indicators, oncological survival indicators, and the subjective evaluation of the aesthetic result by patients.

RESULTS. During the observation period since 2018, the analysis of the frequency of development in the groups of relapses and metastases during the 4-year observation period (since 2018), the frequency of development of local complications in both groups: hematomas, skin necrosis, implant extrusions, seromas, lymphorrhea, capsular contractures, liponecrosis, lymphostasis of the upper extremity on the side of the operation, the degree and duration of the pain syndrome in the postoperative area, and the possibility of a full course of treatment did not show significant differences during the observation period. The quality of life in both groups, according to the Spitzer scale, was comparable (in the first group, 64 %, and in the second group, it was 63 %). Only the duration of postoperative bed rest was longer in the LD flap reconstruction group.

CONCLUSIONS. The results of the analysis of the study's data showed that there are advantages and disadvantages to both methods. According to the findings, it is difficult to conclude which of the methods is more optimal, but it is necessary to choose the technique based on the constitutional characteristics of the patient and the size and shape of the mammary gland. An individualized and comprehensive approach is important.

KEYWORDS

breast cancer, reconstruction with LD flaps, reconstruction with endoprosthesis, nipple-sparing mastectomy.

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According to current standards and recommendations, surgery remains an essential part of complex therapy for patients with breast cancer [1]. The main methods of surgical treatment of breast cancer are mastectomies, breast conserving surgery, and oncoplastic interventions [2–7]. Mastectomies can be supplemented by immediate or delayed reconstructive interventions, which include the use of mammary gland implants or autologous tissues (LD, TRAM (transversus rectus abdominis mass), SIEP (superficial inferior epigastric perforator)-flaps, etc.). The volume of mastectomies is 40–60 %, despite the improvement in early diagnosis due to screening and the popularization of breast-conserving surgery [2–5]. Some of the most common reasons for performing mastectomies in the early stages or after neoadjuvant chemotherapy are multifocal tumor growth, a common intraductal component of tumor growth that prevents clean resection margins during breast-conserving surgery, and the detection of hereditary gene mutations responsible for hereditary and familial breast cancer (BRCA-1,2; PALB-2, CHEK-2), which is highly likely to indicate a multicentric and bilateral process (synchronous or metachronous).

Since mastectomy in itself is a disabling procedure, reconstructive and plastic surgical interventions have been developed and implemented for the rehabilitation of patients that involve flap reconstruction or endoprosthesis of the mammary gland. In cases where the mammary gland has been completely removed, reconstruction with expanders in delayed breast plastic surgery with an implant or autologous flap is possible. When discussing immediate reconstruction after a nipple-sparing mastectomy, it should be noted that the types of reconstruction will be the same: breast plastic with an implant or an autologous flap, or a combination of both, which is rarely used recently.

In order to determine which method is optimal, breast reconstruction using an implant or an LD flap, it is necessary to note that LD flap breast reconstruction has its limitations, specifically that this technique can only be used for reconstruction and restoration of the shape of the mammary gland of 1–3 sizes, which is determined by the insufficient size and volume of the transplanted (LD flap). In many reports, the advantages and disadvantages of various types of reconstruction are pointed out and contradictions can often be found, although most prefer reconstruction with implants [3–13].

OBJECTIVE — to compare the results of immediate breast reconstruction using an implant or an LD-flap after a subcutaneous nipple-sparing mastectomy in patients with I–III stages of breast cancer.

Materials and methods

We conducted a comparative study of the results of immediate reconstruction of the mammary gland after a subcutaneous nipple-sparing mastectomy using the method of putting a silicone implant (endoprosthesis) or the method of LD-flap reconstruction. Randomization was not carried out. The results of operative interventions were retrospectively and parallelly compared, evaluating the immediate and late results. All patients had a diagnosis of stage I–III breast cancer and in most cases (83 %) they received preoperative chemotherapy for regression and reduction of the stage of the process. The operation was chosen based on the patient's preferences for one or another reconstruction, the availability of a silicone implant and constitutional features that, for example, allowed for reconstruction with LD flaps due to the presence of a sufficient tissue volume to restore the shape of the mammary gland. Preservation of the nipple was carried out only when an intraoperative pathohistological examination of the infranipple zone confirmed R0 or the absence of malignant cells there. A subcutaneous nipple-sparing mastectomy was performed in both groups using the same technique. A submuscular package (under the pectoralis major and serratus anterior muscles) was additionally formed only in the group with implant reconstruction, and in the group with LD flap reconstruction, a skin-muscle graft was additionally mobilized (a section of back skin measuring 12×8 cm with subcutaneous tissue and the mobilized Latissimus dorsi muscle) and moved in the tunnel to the bed of the removed mammary gland to form a breast (Fig. 1).

Table 1 shows the distribution of patients in groups. The 1st group included patients who underwent breast reconstruction with silicone implants, and the 2nd group included patients who underwent breast reconstruction with an LD flap.

The evaluation of the results was carried out according to aesthetic principles, oncological survival data, and the subjective evaluation of the aesthetic result by patients. To do this, we studied and compared cases of development in the groups of relapses and metastases during the observation period of 4 years (since 2018), the frequency of development of local complications in both groups: hematomas, skin necrosis, implant extrusions, seromas, lymphorrhea, capsular contractures, liponecrosis, lymphostasis of the arm on the side of the operation, the degree and duration of the pain syndrome in the postoperative area, and the possibility of conducting a full course of treatment in both groups. In both groups, patients' quality of life was rated on a percentage scale (Spitcer) ranging from 0 to 100 %.

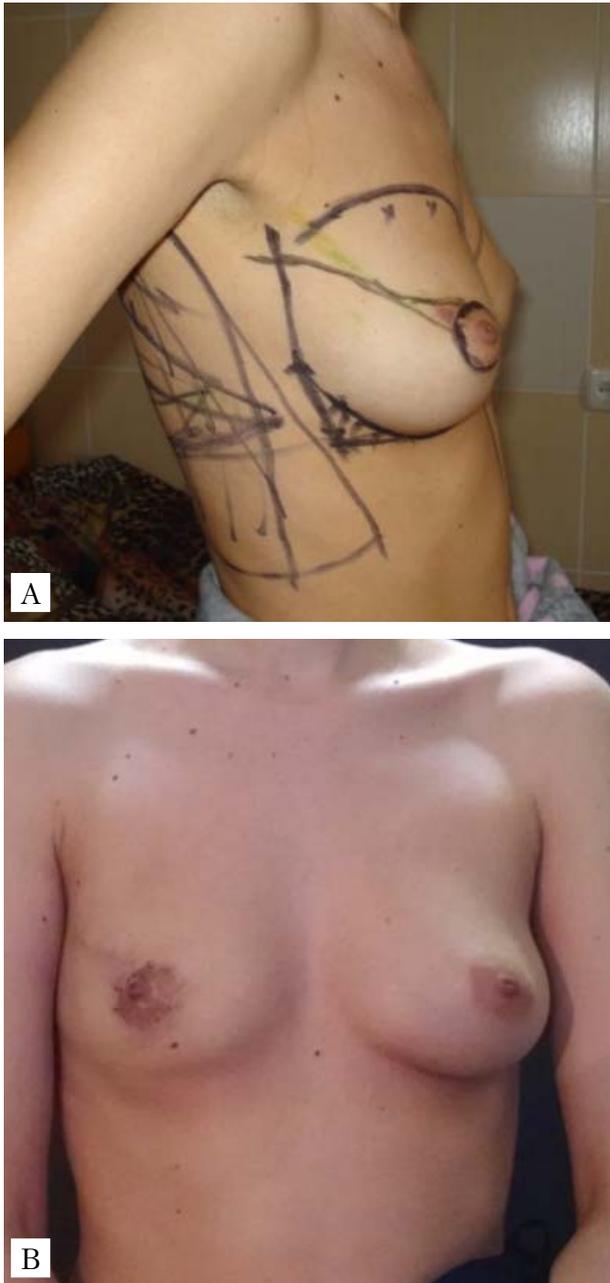


Figure 1. Preoperative marking (A) and surgical outcomes (6 months; B) after LD-flap reconstruction of the right breast after one-stage subcutaneous nipple-sparing mastectomy

Table 1. Distribution of patients in the study groups

Index	1st group (n = 30)	2nd group (n = 30)	p*
Preoperative CT	25 (83 %)	24 (80 %)	> 0.999
Local stage: T ₁ N ₀ M ₀	7 (23 %)	8 (27 %)	> 0.999
Locally advanced stage: T ₁₋₂ N ₁₋₂ M ₀	23 (87 %)	22 (83 %)	

* Fisher's exact test was used for the comparison of two groups.

The statistical package MedCalc® Statistical Software version 20.115 (MedCalc Software Ltd., Ostend, Belgium; <https://www.medcalc.org>; 2022) was used for the analysis. The median and interquartile range were calculated to present quantitative data, and the distributions were different from normal by the Shapiro-Wilk test. Frequency was calculated for qualitative data. For quantitative comparison, the statistical significance of differences between treatment groups was evaluated using the Mann-Whitney test. Fisher's exact test was used to compare frequencies between the two groups. For the comparison between the survival curves, the logrank test was used. The analysis' critical level of significance was set at $\alpha = 0.05$.

Results and discussion

During the follow-up period beginning in 2018, we compared the incidence of various complications, survival, and aesthetic results of reconstruction in both groups.

The development of a hematoma in the early postoperative period was noted in one patient of the first group, and conservative treatment was successful. In the long term, there was no development of capsular contracture in this case. In the second group, there was no development of hematomas in the early postoperative period, but after 4 weeks, a hematoma developed in the donor site on the back, in the place of mobilization of the latissimus dorsi muscle, as a result of excessive physical exertion (carrying a box of things). This complication could not have happened if the patient had followed the recommendations on limiting physical activity for 3 months after the operation.

Seromas developed frequently (60–80 %) in both groups, but there were significant differences. In the first group, they were mainly around the implant; they were punctuated daily, and 3–4 weeks after the operation, seromas were not observed. In one patient, seroma led to the development of inflammation and the extrusion of the implant. The main cause of seroma was the mismatch of the volume and shape of the implant pocket with its size. Sometimes preoperative calculations of the size of the implant for reconstruction give an error in the direction of larger or smaller sizes. In the first case, it can lead to skin necrosis; in the second case, it can induce long-term seroma formation. In the second group, seromas occurred somewhat more often, both in the area of the mammary gland and on the back at the donor site. In the area of the mammary gland, they were not found any more 2 weeks after surgery, and on the back, they were not observed

4 weeks after surgery. Their continuous evacuation, with increasing intervals between procedures, resulted in the disappearance of seroma. The gradual swelling of the skin-muscle graft in the skin cover and its uniform distribution in the mammary gland bed with a significant improvement in the aesthetic result over time (after 1–3 months) should be noted (Fig. 2).

The development of lymphorrhea was not noted in both study groups. Capsular contractures developed in 2 patients of the first group and there were none at all in the second group, which is understandable due to the absence of an implant. In the second group, in contrast to the first, the development of lipogranuloma was noted in one patient, which was caused by a partial deterioration of the blood supply in the skin flap of the back from the branches of the thoracodorsal artery.

When assessing the frequency of development of lymphostasis in both groups, the appearance of first-degree lymphatic edema was noted (an increase in the circumference of the upper limb on the side of the operation up to 3 cm compared to a healthy upper limb). No lymphostasis of the 2nd degree was detected. That is, both groups had the same results: lymphostasis was compensated, and in most cases, it significantly decreased and even disappeared in the morning.

According to the analogue scale of pain assessment, the degree of pain syndrome was maximum (3–4 points) on 1–2 days after the operation and it was mild (1–2 points) on the third day and did not differ significantly in both groups. In the second group, it was larger in area as the operative injury was greater and the duration sometimes reached 3–4 days. Installation of the implant under the muscle

corset (pocket) and stretching of the muscles were the main causes of pain in the first group (Fig. 3).

Recently, analgesia during surgery has been given great importance, and methods of anesthesia have been combined with local (blockades, irrigation of the wound with anesthetic) anesthesia, which contributes to rapid recovery [14–17]. We also implement these approaches.

We studied the effect of reconstruction on adherence to the full special treatment after surgery. Only one patient from the first group could not receive a course of radiation therapy after surgery due to seroma, skin necrosis and implant extrusion, and later this patient also developed a local recurrence, perhaps just because of the lack of radiation therapy in the postoperative period. All other patients of both groups had no deviations or omissions in the use of radiation therapy, chemotherapy or hormone therapy. So, postoperative complications did not affect, in most cases, the initiation of other types of treatment: radiation therapy, chemotherapy, and hormone therapy.

The survival assessment showed that in the first group, one patient (3.3%) had a local recurrence of the disease, and one patient (3.3%) developed brain metastases, from which she died after treatment (radiotherapy and chemotherapy) within a year. Thus, recurrence-free survival was 93.4% in the first group. In the second group, the frequency of local recurrence was also 3.3% (the 1st patient had a recurrence), and as a result of the development of metastases in the lungs, liver, and brain, one patient died during the observation period, and another patient died of thromboembolic complications (PE, acute disorders of cerebral blood flow) without signs of disease progression. Therefore,



Figure 2. Seven months after immediate LD flap reconstruction of the left breast after a subcutaneous nipple-sparing mastectomy

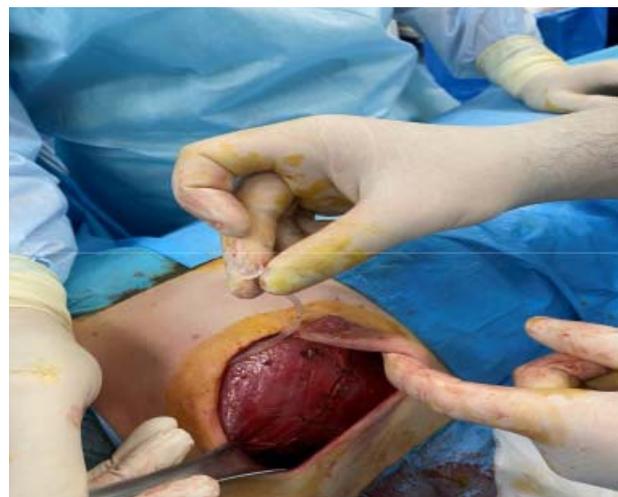


Figure 3. Placement of the implant under the pectoralis major and serratus anterior muscles (in the muscle pocket)

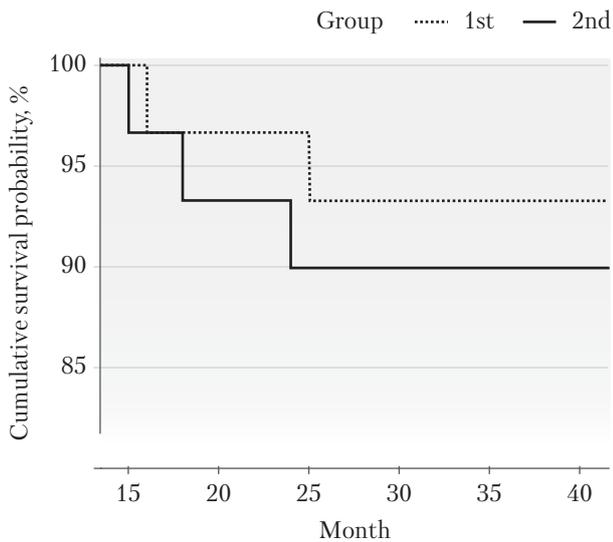


Figure 4. **Recurrence-free survival of two groups**

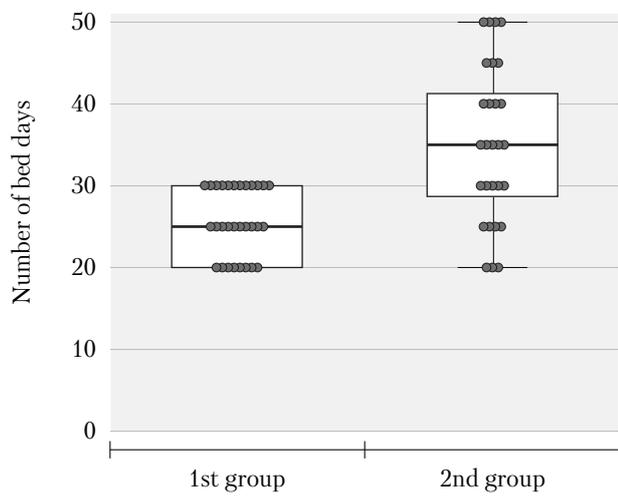


Figure 5. **Bed days of two groups (median, interquartile range, Min, and Max are presented)**

recurrence-free survival was also 93.4% in the second group. In conclusion, there were no differences in survival rates in both groups depending on the type of breast reconstruction (Fig. 4).

There are no differences in the survival probability between the first group and the second group ($p = 0.632$ by logrank test). The first group has a three-year survival rate of $93.3 \pm 4.6\%$, while the second group has a three-year survival rate of $90.0 \pm 5.5\%$.

According to the Spitzer scale, a general analysis of the quality of life of patients in both groups was performed after reconstruction. The evaluation was carried out one month after the operation, when all complications had gradually resolved. According to self-assessment, the quality of life in the first group

Table 2. **Quality of life level (Spitzer scale) and postoperative bed day in the study groups**

Index	1st group (n = 30)	2nd group (n = 30)	p
Spitzer scale level, %	64 (60–68)	63 (59–67)	0.295
Number of postoperative bed days	5 (4–6)	7 (6–8)	0.001

The median and interquartile range are presented. The Mann-Whitney test was used for the comparison of two groups.

was 64% (60–68) and in the second group it was 63% (59–67), which indicates the same level of self-esteem (Table 2). The scale has the form of a line from 0 to 100, and patients conditionally mark their level of well-being on it. There are no differences in the quality of life, % for the two groups ($p = 0.295$). The data are not subject to the normal distribution law, so we present them through the median and interquartile range.

In conclusion, it should be noted that the duration of the postoperative bed day in both study groups (see Table 2) differed significantly and was shorter in the first group – 5 (4–6) bed days and 7 (6–8) bed days in the second group ($p = 0.001$). And the costs of a longer hospital stay already make this economically significant.

The analysis of the research results shows ambiguous data. The second group prevails in terms of trauma and length of stay in the hospital (Fig. 5).

The postoperative bed day for group 1 is less than for group 2 ($p < 0.001$). This simultaneously increases the cost of surgery, but we did not compare costs. As a result, patients who did not want an implant reconstruction and instead preferred to use a mesh or an acellular dermal matrix gladly agreed to the second option of reconstruction. More patients will be inclined to correct with alloplasty if implants are provided at the clinic’s expense [18, 19].

Considering the possibility of breast symmetry after surgery with one-sided intervention, especially when there is ptosis of the mammary glands, the results are better after reconstruction with LD flaps. Here, ptosis is preserved, symmetry is better, and in most cases, it is not necessary to carry out correction on the opposite breast (Fig. 6).

When reconstructing with an implant on one side, there is often a lack of symmetry of the mammary glands, necessitating correction plastic surgery on the opposite mammary gland. Therefore, in these cases, the cost and aesthetics are greater for reconstruction with implants (Fig. 7).

In addition, in those cases where the tumor has spread to the nipple, which was revealed by

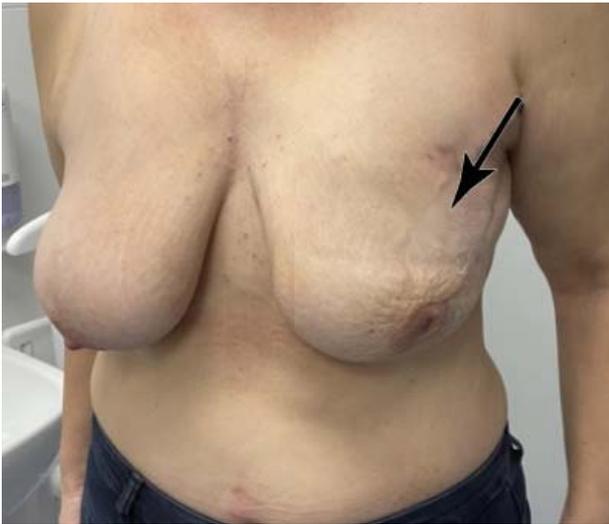


Figure 6. **The result of good symmetry after LD flap reconstruction of the left mammary gland and a single-stage subcutaneous nipple-sparing mastectomy**



Figure 7. **The result of immediate reconstruction with an implant of the right breast after a subcutaneous nipple-sparing mastectomy**

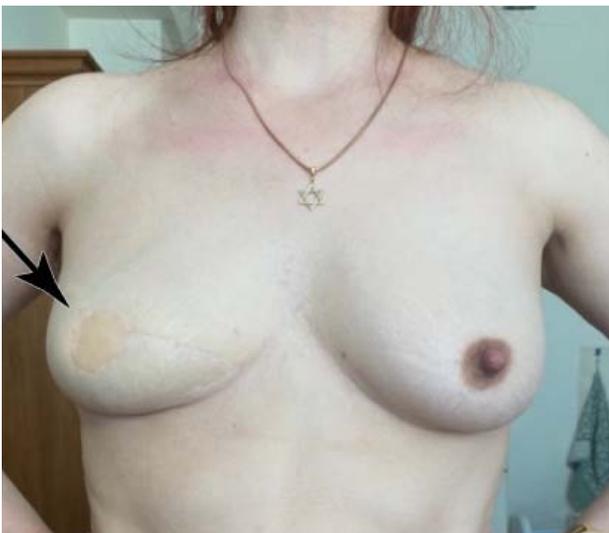


Figure 8. **The result of immediate LD flap reconstruction of the right breast after a subcutaneous skin-sparing mastectomy and skin insertion for the new areola complex**



Figure 9. **10 days after immediate LD flap reconstruction of the left breast after a partial subcutaneous skin-sparing mastectomy**

intraoperative pathohistological examination, the use of LD flap reconstruction is more advantageous because it allows for the insertion of the skin for the areola and the subsequent formation of the nipple (Fig. 8).

In addition, it is impossible to perform immediate breast reconstruction with an implant in cases of tumor growth on the skin of the breast and the requirement to remove part of the skin for various reasons. In such cases, part of the skin from the back during reconstruction with LD flaps will be useful (Fig. 9).

Conclusions

The results of the analysis of the study's data showed that there are advantages and disadvantages to both methods. According to the findings, it is difficult to conclude which of the methods is more optimal, but it is necessary to choose the technique based on the constitutional characteristics of the patient and the size and shape of the mammary gland. An individualized and comprehensive approach is important. The transplant in one case is allogenic material, whereas the transplant in the other is autologous tissue. However, it is always possible to combine

these two methods in the future. In the event of an unsuccessful implant reconstruction (skin necrosis, extrusion of the implant), it can be replaced with an LD flap (with or without an implant), and after an unsuccessful cosmetic result of reconstruction with an LD-flap, the shape can be improved with the additional use of the implant.

DECLARATION OF INTERESTS

Authors declare no conflicts of interest.

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ETHICS APPROVAL AND WRITTEN

INFORMED CONSENTS STATEMENTS

All procedures performed in the study and involving human participants were carried out in accordance with the ethical standards of the institutional and/or national research committee, 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from all individual participants included in the study.

AUTHORS CONTRIBUTIONS

Concept and design of the study: V.E. Cheshuk, M.F. Anikusko; literature review; discussion of the results: V.E. Cheshuk, V.I. Kozina; materials and research methods, research results: V.E. Cheshuk; statistical analyses: V.G. Gurianov.

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Реконструкція молочної залози LD-клаптем чи ендопротезування? Що краще для одномоментної реконструкції у пацієток, хворих на рак молочної залози, після підшкірної сосокзберігаючої мастектомії?

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Проведено аналіз двох методів реконструкції молочної залози: ендопротезування імплантатом та ендопротезування LD-клаптем після підшкірної та сосокзберігаючої мастектомії у разі комплексного лікування раку молочної залози I—III стадії. В багатьох роботах вказується на переваги та недоліки різних видів реконструкції і часто можна зустріти протиріччя, хоч більшість віддають перевагу реконструкції за допомогою імплантатів.

Мета — порівняти результати хірургічного лікування у пацієнтів з I—III стадіями раку молочної залози шляхом підшкірної сосокзберігаючої мастектомії з одномоментною реконструкцією імплантатом або LD-клаптем.

Матеріали та методи. Проведено порівняльне дослідження результатів одномоментної реконструкції молочної залози після підшкірної сосокзберігаючої мастектомії шляхом встановлення силіконового імплантату (ендопротеза) або реконструкції LD-клаптем. Рандомізації не проведено, ретроспективно та паралельно порівняли результати оперативних втручань у двох групах: реконструкція молочної залози імплантатом (1-ша група) або LD-клаптем (2-га група). В обох групах було по 30 пацієток. У всіх пацієток діагностовано рак молочної залози I—III стадії, з них 80—83 % отримали доопераційну хімотерапію для регресування та зниження стадії процесу. Оцінку результату лікування проводили за естетичними показниками, онкологічними показниками виживаності та суб'єктивною оцінкою естетичного результату пацієнтками.

Результати. Аналіз частоти розвитку рецидивів і метастазів за 4 роки (з 2018 р.), місцевих ускладнень (гематоми, некрози шкіри, екструзії імплантатів, сероми, лімфорей, капсулярні контрактури, ліпонекрози, лімфостази верхньої кінцівки на боці операції, ступінь і тривалість больового синдрому в післяопераційній зоні) та можливості проведення повного курсу лікування не виявив суттєвих відмінностей між групами. Якість життя в обох групах за шкалою Спітцера була порівнянною (в 1-й групі — 64 %, у другій групі — 63 %). Лише тривалість післяопераційного ліжко-дня була більшою в групі реконструкції LD-клаптем.

Висновки. Установлено що обидві методики мають переваги і недоліки, але рекомендувати кращий метод для конкретної пацієнтки складно. Це залежить від конституційних особливостей пацієнтки, розмірів і форми молочної залози. Важливе значення має індивідуалізований та комплексний підхід.

Ключові слова: рак молочної залози, реконструкція LD-клаптем, реконструкція ендопротезом, сосокзберігаюча мастектомія.

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