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Immediate Breast Reconstructions after Mastectomy due to Breast Cancers with the use of Serasynth and Seragyn BR Synthetic Meshes. Single-Oncological Center Experience, Analysis of Complications

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Abstract

Purpose: Mastectomies with immediate reconstruction are the standard of treatment method in patients with breast cancer who cannot be treated with conserving breast surgery. The use of meshes in reconstructive breast surgery has become a gold standard. The purpose of the study was to analyze the complications and own experience after mastectomies with immediate breast reconstruction with the use of Serasynth and Seragyn BR synthetic meshes.

Methods: In the period from December 2017 to July 2020, 118 reconstructive surgeries of the breast were performed in the department of breast cancer and reconstructive surgery in Maria Sklodowska-Curie memorial cancer center and institute of oncology in Warsaw, Poland with the use of Seragyn BR and Serasynth meshes in 93 patients operated for breast cancer. 78 Serasynth meshes (Group I) and 40 Seragyn BR meshes (Group II) were implanted.

Results: The most common complication was persistent seroma collection, which was reported in 17.9% of cases in group I and 25% in group II. Skin inflammation was reported in 7.6% and 17.5%, while infections in 2.5% and 5% of the surgically treated breasts of Group I and Group II patients. Reoperation was required in 5.1% and 5% of the patients in group I and group II. The percentage of complications was lower when Serasynth rather than Seragyn BR meshes were implanted. The frequent incidence of the seroma collection did not contribute in any significant way to serious complications such as the need of removal of mesh/implant or infection. The complications, which developed following the implantation of both mesh types, were similar to those presented in other publications concerning mastectomy with a simultaneous breast reconstruction with synthetic meshes. The percentage of implant losses/explanations in the discussed group of patients was lower than that reported in literature.

Conclusion: Despite of the complications, both types of meshes can be considered as safe additions to reconstructive breast surgeries.

Keywords: Breast implants; Breast neoplasms; Mammoplasty; Mastectomy; Surgical mesh

Introduction

Mastectomies with immediate reconstruction are the standard of treatment method in patients with breast cancer who cannot be treated with concervating breast surgery. Breast reconstructive surgery has evolved from sub pectoral surgeries, which for many years have been considered as a classic way of breast reconstruction procedure to prepectoral breast reconstruction. In recent years, prepectoral breast reconstruction has dominated operating rooms [1]. For breast reconstruction after mastectomy, in many cases, meshes are used to stabilize the implant, strength the subcutaneous tissues around the implants or protection against implant rotation, both in sub pectoral and prepectoral surgery. There are many meshes available on the market used in breast reconstructive surgery. They can be divided into absorbable, partially absorbable and non-absorbable meshes, a s well as biological and synthetic [2,3].

All commercially available meshes designed for breast reconstruction have their advantages and disadvantages. There is no ideal mesh for breast reconstruction surgery; any solution may cause certain complications to be taken in consideration. The most common complication, regardless of the type of mesh used, is the accumulation of the seroma around the implant [4]. Other complications include inflammation of the skin and subcutaneous tissue, infections, fistulas, skin necrosis or the need to remove the implants [5]. Despite of the complications associated with the use of surgical meshes for breast reconstruction, it can be said that their use is safe, and the benefits outweigh the potential problems associated with their implantation.

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In the following article, the authors present their experience with the use of two types of synthetic meshes, one completely absorbable-Serasynth and the other partially absorbable Seragyn BR, both produced by SERAG-WIESSNER GmbH and Co. S. KG used for breast reconstruction in both sub pectoral and prepectoral methods in patients after subcutaneous mastectomies performed due to breast cancer.

Materials and Methods

The medical and health research ethics committee of Maria Sklodowska-Curie memorial cancer center and institute of oncology in Warsaw, Poland approved this study (ref no. 88/2021. Written informed consent was obtained from all the patients to access their medical data.

A retrospective analysis of the results of immediate breast reconstruction surgeries after subcutaneous mastectomy performed in the department of breast cancer and reconstructive surgery in Maria Sklodowska-Curie memorial cancer center and institute of oncology in Warsaw, Poland, was made in the period from December 2017 to July 2020. The period of post-operative follow-up amounted to a mean of 20 months (10 to 36 months. The qualification for treatment in the author's department was performed in compliance with the standards specified in the 2nd consensus of the polish society of surgical oncology 'surgical treatment of neoplastic breast changes'. Qualified for subcutaneous mastectomy with nipple areola complex sparing (NSM nipple and skin sparing mastectomy or without nipple areola complex sparing (SSM skin sparing mastectomy or with nipple removal (ASM alveolar skin sparing mastectomy with immediate breast reconstruction were both patients with diagnosed breast cancer primarily treated surgically and patients after neoadjuvant chemotherapy.

Indications for NSM or SSM included: Breast cancer not qualifying for breast conserving surgery (including multifocal/multicenter cancers, with extensive micro calcifications, diagnosed BRCA1/2 mutations, with mastectomy chosen as a form of surgical treatment by the patient, mastectomy rather than breast conserving treatment as a patient's decision.

The main disqualification criteria for NSM, SSM and ASM included primary local advanced stage of breast cancer (T4 and N3 features; for NSM less than 2 cm from the nipple cancer location, unstable diabetes, BMI ≥ 35, active cigarette smoking, negative psycho-oncological consultation.

Particular caution was applied in the qualification for surgery of patients with diagnosed cT3N1, cT3N2 stage tumors, which were preoperatively systemically treated as well as patients after the prior thoracic cavity area radiation therapy. The patients with originally planned adjuvant post-operative radiation therapy were informed in detail about possible post-operative complications. Possible complications and the postoperative course were discussed with all the patients. They also had a routine consultation with a psycho-oncologist prior to the final qualification for the surgery.

Two synthetic types of meshes manufactured by SERAG-WIESSNER GmbH and Co. KG were used for the reconstruction. One of them, Serasynth, is a fully absorbable mesh while the other, Seragyn BR, is a partly absorbable mesh. Operations with the use of Seragyn BR were performed in the department in the period from the end of 2017 to mid-2019. Since the end of 2018, Serasynth meshes were also available in our department. Seragyn BR meshes were used primarily in operations performed with the sub pectoral method while Serasynth meshes were used in prepectoral operations.

NSMs were usually performed through an inframammary fold incision, with the whole mammary gland, together with the fascia of pectoralis major, being removed. Where the neoplasm was located at a distance closer than 2 cm from the nipple, the nipple areola complex was removed through an ellipsoid skin incision and it was from this incision that SSM was performed or only the nipple was removed and the areola left and ASM was performed. In the case of large, pendulous breasts, skin reducing mastectomy was performed from an inverted T incision. The epidermal flap left provided an additional protection of the lower pole of the implant. A sample from under the nipple was collected for histopathological examination, whenever the nipple was spared on mastectomy.

In the case of breast reconstruction with the use of the sub pectoral method, the inferior attachment of the pectoral muscle and partly also its attachment to the sternum were cut off. Seragyn BR mesh was sutured to the cut off margin with Vicryl 2.0 (Figure 1).

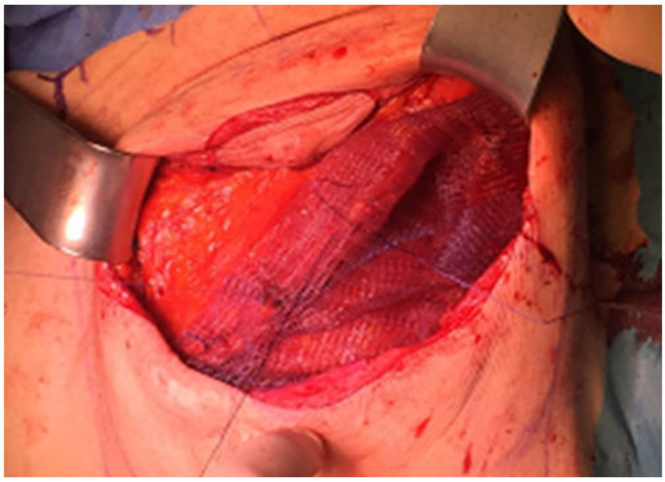

Figure 1: Seragyn BR mesh sutured to the cut off margin of pectoralis major muscle-sub pectoral reconstruction.

Its other end was folded under the implant and sutured to the inframammary fold so as to cover the inferior or medial pole of the implant (Figure 2).

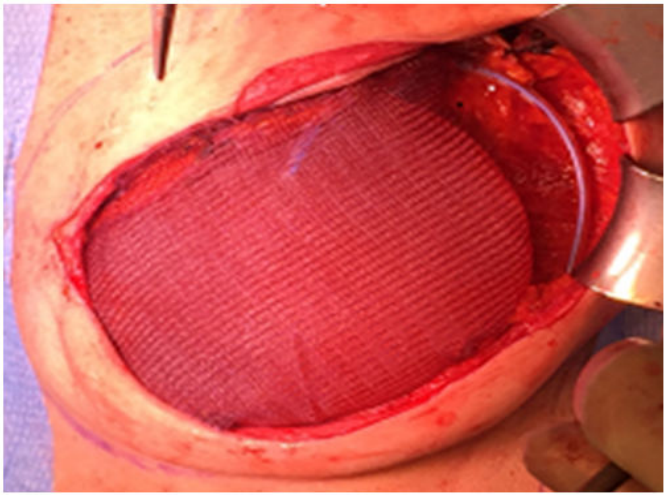

Figure 2: Lower pole of implant covered by Seragyn BR mesh-sub pectoral reconstruction.

For breast reconstructions, Serathyn meshes and Sebbin anatomical implants manufactured by Groupe Sebbin or MENTOR® anatomical implants manufactured by Johnson and Johnson were used. In cases of prepectoral reconstruction the implants were enveloped in the mesh ("ravioli method") (Figures 3 and 4) which was subsequently sutured with single Vicryl 2.0 sutures. The excess mesh was cut off so that it would not form excessive folds particularly on the margins of the implant. A properly prepared implant enveloped in the mesh was placed in the skin pocket after mastectomy and the mesh was sutured to the infra-mammary fold and to the pectoralis major with at least three PDS 2.0 sutures. This form of attachment allowed for adequate protection of the implant against rotation in the postoperative period. To reduce the risk of infection, prior to the placement of the implant, the surgical wound was rinsed with saline while gloves and surgical draping were changed.

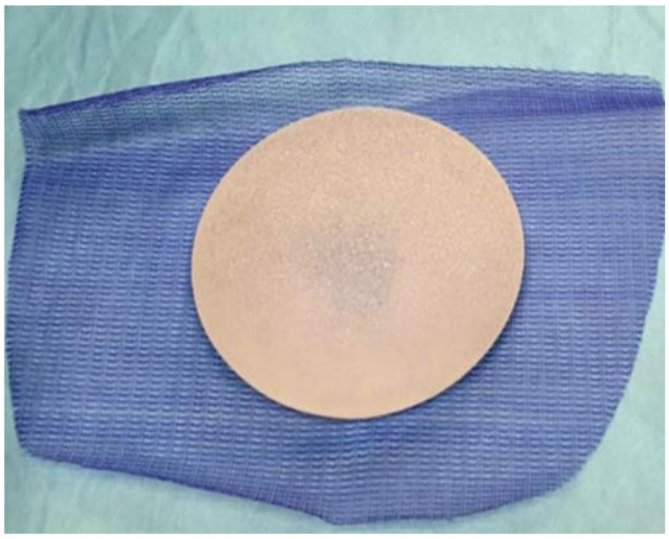

Figure 3: Implant prepared for being covered with Serasynth mesh.

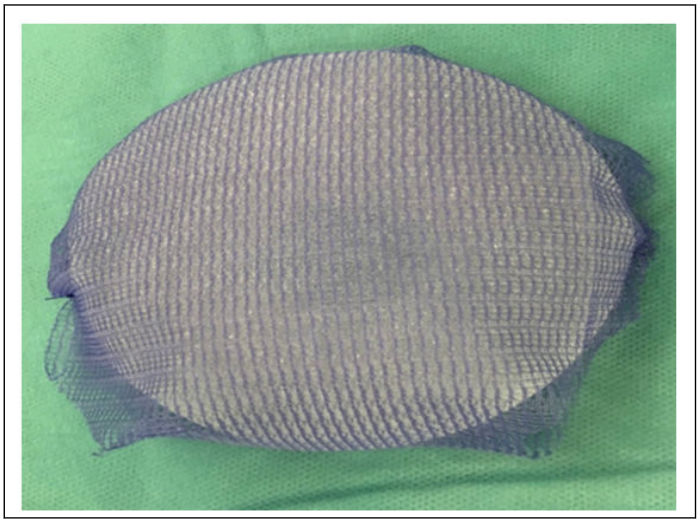

Figure 4: Anatomical implant covered with Serasynth mesh-prepectoral reconstruction.

Biopsies of the sentinel node were made from a separate incision in the axillary fossa or if the node was localized in a low position, in the first layer of the axillary fossa, from an access through the mastectomy incision. Axillary lymphadenectomies were performed through a separate incision in the axillary fossa to separate the surgical field of mastectomy from that of lymphadenectomy. In all the cases, one or two Redon drains were left inserted.

Redon drain was left till the daily drainage of the serum content amounted to ca. 20-30 ml. Until the moment of the drain removal, the patients received cephalosporin 2 × 500 mg, which is recommended in other publications.

Statistical analysis: Differences in the distribution of variables between group I (patients in whom Serasynth mesh was used) and group II (patients in whom Seragyn BR mesh was used) were analyzed with the t-student test for numeric variables or *chi-square* tests and fisher tests for categorical variables.

Results

In the period from December 2017 to July 2020, 93 patients underwent mastectomy surgeries (NSSM, ASM and SSM) with immediate breast reconstruction with an implant, with the use of synthetic meshes, in the author's Department. In 91 (97.8%) of the patients the indication for mastectomy was breast cancer. In 89 (95.6%) of the patients, unilateral therapeutic mastectomies and in 2 (2.1%) bilateral therapeutic mastectomies were performed. In 19 (20.4%) of the patients, unilateral therapeutic mastectomy was accompanied by a simultaneous breast cancer Risk Reducing Mastectomy (RRM) in the other breast.

The mean age of the patients operated on was 45.63 years in the group of patients in whom Serasynth mesh was used for the reconstruction (Group I-G I) and 46.54 years in the group in which Seragyn BR mesh was used (Group II-G II). The mean Body Mass Index (BMI) was 23.8 kg/m^2 in G I and 22.4 kg/m^2 in G II, respectively. 12 SSM operations, 62 NSM operations and 4 ASM operations were performed. In most cases, the prepectoral approach was applied in breast reconstruction.

Seragyn BR mesh (G II) was used for breast reconstruction in 37 patients, including bilateral breast reconstruction in 3 patients; 3 SSM and 37 NSM operations were performed. In this group of patients, dual-plane technique was mostly used.

In total, 118 breast reconstructions were made, 78 breasts were reconstructed with the use of Serasynth mesh and 40 with Seragyn BR mesh. Originally, 92 surgeries were done within the lymph node drainage area. Biopsies of sentinel lymph nodes were performed in 52 cases (66.6%) in G I and in 37 cases (92.5%) in G II.

Lymphadenectomy (LND) was performed only in G I in 3 cases (3.8%) lymphatic drainages due to primary metastases to the lymph nodes of the axillary fossa.

In one patient in G I and in two in G II, the biopsy of the sentinel lymph node was made during an earlier operation, in one patient there were no indications for SLNB because Phyllodes Tumour (PT) was the indication for mastectomy.

Lymphadenectomy for metastases to sentinel lymph nodes was performed at the second stage in 12 patients, in 10 (12.8%) of patients from G I and 2 (5%) from G II.

Removal of drains had place, on average, on the 13th (GI) or 14th (G2) postoperative day (from 4 to 21 days). A specification of the surgical procedures performed is shown Table 1.

Mesh type used	**Group 1**	**Group 2**	**p value**
No of patients	56	37	NS
Age (mean)	45.63 years (26 to 64)	46.54 years (33 to 67)	0.6387
BMI (mean)	23.8 kg/m^2 (16 to 33)	22.4 kg/m^2 (17 to 29)	0.0660
No of operated breasts	78	40	NS
Therapeutic mastectomy			
Unilateral	52 patients (52 breasts)	37 patients (37 breasts)	0.002
Bilateral	2 patients (4 breasts)	0	
RRM			
Unilateral	2 patients (2 breasts)	0	
Conversion from sub-to prepectoral	1 patient (1 breast)		
RRM together with therapeutic mastectomies	19 patients (19 breasts)	3patients (3 breasts)	
Bilateral surgeries (patients)	22(88.0%)	3(12.0%)	<0.001
Types of mastectomies (no of breasts):			
SSM	12 (15.4%)	3 (7.5%)	0.190
NSSM	62 (79.5%)	37 (92.5%)	
ASM	4 (5.1%)	0 (0%)	
Implant location (No of breasts):			
Prepectoral	76 (97.4%)	2 (7.3%)	<0.001
Sub pectoral	2 (2.6%)	38 (92.7%)	
Removal of the drain	Day 13.6 (6 to 21)	Day 12.1 (4 to 19)	0.0419
Surgery within the lymph drainage region	N=78	N=40	0.002
SLNB, without LND	42 (53.9%)	35(87.5%)	NS
SLNB, with later LND (pN+)	10 (12.8%)	2 (5%)	NS

Primary LND (cN+/pN+)	3 (3.9%)	0 (0%)	NS
No indications*	23 (29.5%)	3 (7.5%)	NS
Radical R0	74 (94.8%) breasts	36 (90%) breasts	0.441
Radical R1	4 (5.2%) breasts	4 (10%) breasts	NS
Adjuvant RT	10 (12.8%) breasts	3 (7.5%) breasts	0.539
NAC**	24 (42.8%)	12 (32.4%)	0.386
*RRM, tumor phylodes ** Neoadjuvant chemotherapy			

Table 1: Specification of the surgical procedures performed.

Three of the operated patients reported current cigarette smoking, 2 (3.5%) from G I and 1 (2.7%) from G II. Diabetes was diagnosed only in 1 (2.7%) patient from G II. Since the number of the patients involved was small, they were not included in the analysis of possible complications entailed.

Due to the advanced stage and/or the biological subtype of the cancer, qualified for Neoadjuvant Chemotherapy (NAC) were 24 (42.8%) of the patients from G1, 15 of which underwent bilateral operations. In G II, 12 (32.4%) of the patients received preoperative treatment.

In G I, pT2 breast cancer dominated (37.1%) while in G II pTis (DCIS-Ductal Carcinoma In-Situ-35%) and invasive pT1 breast cancer (30%), according to TNM.

Clinically changed regional lymph nodes -cN0 were not found in the majority of the patients (G I-66.6% and G II-92.5%). Poorly differentiated cancers G3 prevailed among the invasive neoplasms diagnosed in the patients (in G I-52.3% and in G II-50% of the operated patients, respectively). Specification of the cancers histopathology is shown in Table 2.

	Group I	**Group** II	**p value**
Type of tumour	n-78	n-40	0.011
Invasive breast cancer	42 (53.9%)	22 (55.0%)	
carcinoma *in situ*	13 (16.7%)	14 (35.0%)	
Other neoplasms and benign lesions	1 (1.3%)	1 (2.5%)	
Absence of tumour-RRM, conversion from sub to prepectoral	22 (28.2%)	3 (7.5%)	
Subtypes of *in situ* breast cancer	N=13	N=14	0.481
DCIS	12 (92.3%)	14 (100%)	
LCIS	1 (7.7%)	0	
Other neoplasms and benign changes	1	1	NS
Phyllodes tumour	1	0	
Dysplasia	0	1	
Subtypes of invasive breast cancer	N=42	N=22	0.536
NST cancer	37 (88.1%)	19 (86.4%)	
Lobular carcinoma	2 (4.8%)	2 (9.1%)	
Mucinous cancer	2 (4.8%)	0 (0%)	
Tubular cancer	1 (2.4%)	0 (0%)	
Metaplastic cancer	0 (0%)	1 (4.6%)	
Biological subtypes of breast cancer	n-42	n-22	0.298

Luminal A	8 (19.1%)	8 (36.4%)	
Luminal B	13 (31.0%)	4 (18.2%)	
TNBC	15 (35.7%)	9 (40.9%)	
Her2(+)	6 (14.3%)	1 (4.6%)	
Histological grading G feature	n-42	n-22	0.682
G1	6 (14.3%)	5 (22.7%)	
G2	14 (33.3%)	6 (27.3%)	
G3	22 (52.4%)	11 (50%)	
Tumour size acc. to pTNM-(breast)	n-78	n-40	0.006
TIS	13 (16.6%)	14 (35%)	
pT1	12 (15.3%)	12 (30%)	
pT2	29 (37.1%)	11 (27.5%)	
pT3	2 (2.5%)	0	
pT4	0	0	
T0*	22 (28.2%)	3 (7.5%)	
Lymph nodes classification cN	n-78	n-40	0,004
cN0	52 (66.6%)	37 (92.5%)	
cN1	3(3.8%)	0	
cN2	0	0	
cNx*	23 (29.5%)	3(7.5%)	
Lymph nodes classification pN	n-78	n-40	0.001
pN0	42 (53.8%)	35 (87.5%)	
pN1	13 (16.6%)	2 (5%)	
pN2	0	0	
pNx*	23 (29.5%)	3(7.5%)	
* Refers to breast cancer risk reducing mastectomies.			

Table 2: Specification of the cancers histopathology.

Seroma collection, which persisted after the removal of the drain, was the most common complication. The drain was removed, on average, on the 13 postoperative days when the drained quantity of the serum did not exceed 30 ml per day. Extended antibiotic therapy was continued until the removal of the drain. Seroma collection developed in 14 (17.9%) breasts operated with the use of Serasynth mesh and in 10 (25%) breasts operated with the use of Seragyn BR. Seroma punctures were performed mainly in patients who were primarily treated surgically (in G I-50%, in G II-80%).

Therapeutic seroma punctures were performed when the thickness of the liquid over the implant exceeded 5 mm. In cases of this kind, additional rehabilitation procedures were applied. Where the lymph accumulation persisted, lymph cultures were made to exclude infection. In none of the patients was repeated drainage applied to evacuate lymph.

In 3 operated breasts, apart from the lymph accumulation, inflammation developed in the skin and in the subcutaneous tissue. In these cases, the lymph culture performed revealed bacterial infection requiring an additional, prolonged and modified antibiotic therapy. In G I, in one of the patients, improvement of the local condition and effective treatment of bacteria *Klebsiella oxytoca* infection was obtained with conservative treatment. In another patient, in spite of antibiotic treatment of *Aerococcus viridans* infection, cutaneous fistulae formed in both breasts, which required excision as well as removal of the implants and implantation of smaller volume expanders 5 months after the surgical procedure. This particular patient had a history of radiation therapy for Hodgkin's lymphoma.

In G II, in one patient, the accumulating lymph and *Staphylococcus aureus* infection caused a prolonged inflammation of the skin and development of an abscess in the first week of the radiation therapy. In that patient, the implant was removed in the course of radiotherapy. In

GI, the inflammation of the skin and the infection in one patient were linked to a self-absorbing hematoma without seroma collection. The patient was diagnosed with *Escherichia coli*, ESBL strain, infection, which was successfully treated with an antibiotic. Lymphocele were accompanied by ischemia of the skin flap in 3, G1 patients, one of whom had a history of radiation therapy.

In the remaining 9 patients, local inflammatory conditions of the skin and the subcutaneous tissue, without infections, were successfully treated in a conservative way and the effect of the operation was assessed by the authors as good or very good. Specification of complications and reoperations is shown in Table 3.

Complications	**Group 1**	**Group 2**	**p value**
No of breasts operated on	n-78	n-40	
Prolonged seroma collection (breasts)	14 (17.9%)	10 (25%)	0.479
Haematoma	1 (1.2%)	1 (2.5%)	1.00
Inflammation	6 (7.6%)	7 (17.5%)	0.216
Infection (+ culture results)	2 (2.5%)	2 (5%)	0.611
Skin ischaemia (breasts)	7 (8.9%)	8 (20%)	0.148
• superficial	4 (5.1%)	7 (17.5%)	NS
• full-thickness	3 (3.8%)	1 (2.5%)	NS
Reoperations due to complications	4 (5.1%) breasts	2(5%)breasts	1.00
Within 30 days from surgery (breasts)	1-haematoma (1.3%)	1-skin necrosis 2.5%)	NS
Over 30 days from surgery (breasts)	3 (3.8%) breasts	1 (2.5%)breast	NS
	2-skin fistula with infection (exchange of the implant with an expander)	(1 (2,5%) breast-abscess-removal of the implant)	NS
	1-skin fistula without infection (fistula excised)		
Procedure in the case of R1	N=4	N=4	
Reoperations performed due to R1	3 (3.8%)	3 (7,5%)	NS
Adjuvant radiation therapy due to R1	1 (1.2%)	1 (2.5%)	NS
Implant removal (breasts)	2 (2.5%)	1 (2.5%)	NS

Table 3: Specification of complications and reoperations.

The inflammation of the skin and the subcutaneous tissue constitutes the second of the most common complications after reconstructive surgeries with the use of the meshes referred to. It developed in 6 (7.6%) of the operated breasts in G I and 7 (17.5%) in G II. Once patients with a culture-confirmed bacterial infection which developed in two patients in each group (2.5% in and 5% of the operated breasts in G I and in G II, respectively) are added to inflammatory and infectious complications developed in 8 (10.2%) of patients in the group with fully absorbable meshes against 9 (22.5%) patients in the group with partly absorbable meshes.

Another group of complications involves skin ischemia. The later was observed in 8.9% (7 breasts) of breast surgeries performed with the use of Serasynth mesh and 20% (8 breasts) of breast surgeries with the use of Seragyn BR mesh. However, only in 4 breasts, skin necrosis required reoperation. In G I, reoperation was necessary in 3 breasts (3.8%) because of fistulae which developed as a late effect of ischemia and skin inflammation. In one case, excision of the skin fistula with repeated suturing of the wound were possible (wound infection did not develop in that patient), while in another patient fistulae in both breasts were excised and implants replaced with smaller-size expanders to reduce skin tension. In G II, one patient (1 breast-2.5%) required reoperation due to ischemia. Necrosis affected the full thickness of one "inverted T" flap. The excised skin fragment was covered by moving a pedunculated dermo-adipose flap from the epigastrium to the excised necrotic tissue area in the third week after the surgery. The remaining cases of skin ischemia involved marginal skin necrosis or superficial ischemia and did not require surgical intervention. This concerned 4 breasts (5.1%) in G I and 7 breasts (17.5%) in G II, respectively. In all the cases, conservative treatment was successful.

Ischemic complications in G1 were most common in patients after non-adjuvant chemotherapy (6 breasts-7.6%) while in G II skin ischemia developed in patients after primary surgical treatment (6 patients-15%). Reoperations due to complications in the perioperative period (within 30 days from the operation) in both study groups were necessary, in total, in two out of the 118 breasts operated on (1.6%). In G I patients, postoperative bleeding, which required repeated hemostasis occurred on the day of the surgery, while in G II there was skin necrosis which required excision and coverage with a dermo-adipose flap in one case.

In the period of over 30 days from the surgery, reoperation was required in 3 patients (4 breasts). In G1, it concerned skin fistulae in three breasts, which had to be excised (3.8%) while in G II one patient (2.5%) was operated on for an abscess in the course of Radiation Therapy (RT).

Another group of patients in which a repeated surgery was necessary, there were patients, which required re-resection of the surgical margin after R1 resection. That was necessary in case of 6 patients (6 breasts), 3 cases in each of the study groups-3.8% and 7.5% in G1 and G II, respectively. In 5 patients, the nipple areola complex was removed. In one patient, it was possible to additionally cut out a part of the skin and subcutaneous tissue on the site of the original tumor location. As no neoplastic cells were found in the additionally resected tissues, the surgeries were deemed to be oncologically radical.

Two patients (2 breasts-1.6%), one in each group, underwent adjuvant Radiation Therapy (RT) due to R1 resection. In both of those cases, the surgical margin could not be broadened. Postoperative radiation therapy was administered to a total of 13 reconstructed breasts (11%)-10 breasts (12.8%) of G1 patients and 3 breasts (7.5%) of G II patients.

Axillary lymphadenectomies which were performed concurrently with mastectomy, with immediate breast reconstruction (only in G1), did not contribute to the development of complications while the radiation therapy undergone by one patient in G II made implant removal necessary due to an abscess.

Discussion

The use of meshes in reconstructive breast surgery has become a gold standard. There is a variety of meshes synthetic and biological, partly and fully absorbable available on the market. Seragyn BR mesh is partly absorbable and made from bio component fibers-a polypropylene core covered with a layer of polyglycolic acid and caprolactone. Serasynth mesh is a fully absorbable synthetic mesh made of monofilament polydioxanone fibres. The complete absorption for this mesh is 180-210 days.

The above analysis compares complications developing after mastectomy with immediate breast reconstruction, with the use of meshes of both types dedicated for reconstructive breast surgeries, manufactured by SERAG-WIESSNER GmbH and Co. KG. This is the first study comparing these two types of meshes.

The study group covered 56 patients who underwent breast reconstruction with the use of Serasynth meshes and 37 in which Seragyn BR mesh was used. In total, 118 breast reconstructions were made. There were 78 breasts reconstructed with the use of Serasynth mesh and 40 breasts with the use of Seragyn BR. Over the past three years, the department in which the operators work, the sub pectoral method of breast reconstruction with the use of Seragyn BR was gradually replaced with the prepectoral method in which absorbable Serathynth meshes is used.

In the opinion of the authors of this article, and others [6,7] prepectoral operations are technically simpler and allow to obtain a better appearance of the breast already on the operation table, even in patients with a thin layer of subcutaneous tissue. Serasynth mesh is sufficiently soft and plastic to envelope the implant in a simple and fast way and subsequently place it and fix it in the skin pocket after mastectomy.

In case of reconstructions with the use of Seragyn BR, and thus mainly retro pectoral reconstruction, what constitutes an obvious difficulty is the need to cut off the inferior attachment of the pectoral major muscle and to suture the mesh along the whole cut off length, which can involve an increased risk of bleeding in the perioperative period and intense pain after the surgery, which is also emphasized by other authors [8]. Yet, work with this mesh was as simple during the surgical procedure, as it was in the case of Serasynth meshes.

Both meshes are simple to use, plastic and do not require special preparation as it is, for instance, in the case of ADM mesh. They can be cut in any way, folded around the implant and are not palpable through the skin.

In Poland, the cost of Serasynth mesh of the largest size, *i.e.* 28.5 × 17.5 cm, is approximately €800. Seragyn BR meshes are less expensive; the largest size mesh is approximately €350. In comparison with other synthetic absorbable meshes or ADM, described products are less expensive [9,10].

The most common complication in the study groups was seroma collection, which was observed in 17.9% of the breasts reconstructed with the use of Serasynth mesh and in 25% of breasts reconstructed with the use of Seragyn BR mesh.

This is rather a high percentage of complications when compared with what is reported in other publications but it may result from the fact that the authors adopted the concept of faster and more frequent puncture of the lymphocele instead of delaying this procedure. The aspiration of accumulated seroma, after drain removal, in the clinic was performed on its detection by palpation in the subcutaneous tissue of the operated breast or detection of a 5 mm or thicker lymph layer on an ultrasound examination [11]. It is hard to define clearly, whether lymphoceles are a postoperative complication or a natural side effect of the surgical procedure with the use of synthetic meshes. The percentage of lymphoceles reported in literature is assessed at a relatively high range of 3 to even 85% after mastectomies or surgeries in the region of the axillary fossa [12].

Seroma does not develop solely after operations with the use of meshes. It's occurs commonly in the postoperative course after mastectomies and operations in the region of the axillary fossa. High BMI, use of electrocoagulation, low suction pressure, and early removal of drains or delayed physiotherapy are known to be factors affecting the quantity of lymph leaking. Numerous other factors responsible for the accumulation of lymph are still unconfirmed and lymph punctures remain the only effective form of treatment.

The presence of lymphocele in three of the patients operated on accompanied skin ischemia and this can be seen as the cause of lymph accumulation in such cases.

Very similar findings with regards to the occurrence of seroma in patients in which Seragyn BR mesh was used for reconstruction were reported by Machleidt who analyzed 148 breasts operated on in 119 patients [13]. The material describes seroma in 25% of cases and hematoma and infections in ca. 14% of the cases. In our material, these complications accounted for a significantly lower percentage in both analyzed groups. The percentage of reoperations and cases in which the mesh had to be removed, reported by Machleidt was also higher and amounted to 11.5%. In our material, in the group of patients in whom Seragyn BR mesh was implanted, two breasts (5%) required repeated surgery and in one of those cases the mesh and the implant were removed (2.5%). In G1, three patients (4 breasts)

required reoperation (5.1%). In one case, the indication for reoperation was hematoma (1.3%) while in three operated breasts surgery requiring fistulae developed (3.8%). In one of those patients, implants were additionally replaced with expanders when skin fistulae were excised to reduce skin tension.

In both groups of patients, the mean duration of the drain insertion was ca. 13 days and was similar as reported in other publications [14]. Yet, it was a rather long period, which may indicate that implant and mesh placements can constitute an important element which contributes to prolonging lymph accumulation. Chatterjee and Nahabedian in their meta-analysis covering 14 publications and assessing 654 operated breasts, show that the most common complications of prepectoral surgeries with the use of meshes include seroma collection (6.7%) and skin flaps necrosis (7.8%) followed by infections (4.2%), hematomas and wound dehiscence, 3.4% and 3.2%, respectively [16]. In our material, the percentage of seromas in G1 amounted to 17.9% while that of skin ischemia to 8.9%. In G II, these complications were even more common-seromas-25%, skin ischemia. In spite of the high percentage of these complications in both groups, only in four cases (3.4%) out of the 118 operated breasts, full-thickness skin ischemia required reoperation-in 3 breasts (3.8%) due to a fistula in the group with Serasynth mesh and in one patient (1 breast-2.5%) in the group with Seragyn BR mesh due to full-thickness skin necrosis. In the opinion of the authors, complications such as ischemia and necrosis of skin flaps or wound margins are not linked to the type of mesh used for the reconstruction or to the type of reconstruction but rather to the operation technique, the experience of the operator and individual anatomical conditions as well as the anatomy of the mammary gland.

In one patient (1 breast, 2.5%), after a sub pectoral reconstruction with Seragyn BR mesh, a lymphocele and infection led in the course of the adjuvant radiation therapy to the need for the removal of the implant. In the remaining patients, lymphocele and superficial skin ischemia were effectively treated and had no impact on the final outcome of the reconstruction.

In our clinic, the assessment of the blood supply and thickness of skin flaps in the described patients was made based on a clinical evaluation by a surgeon. In other studies, their authors also based their decision as to the selection of the sub pectoral versus prepectoral method on the clinical evaluation of the flaps. The objective ways of the evaluation of the blood flow in the skin include, for instance, cameras for the detection of indocyanine green. This way of assessing skin flaps perfusion is suggested by Jones and Anthony band others [15-17]. This is a very effective method of the evaluation of the normal perfusion of the skin after the removal of the gland and can have a significant influence on the choice of the reconstruction method as well as prevent potential complications in the form of skin ischemia.

Inflammation of the skin and subcutaneous tissue developed in 7.6% (6 breasts) in group I and in 17.5% (7 breasts) in group II. The majority of them subsided spontaneously or after prolonged antibiotic therapy. Infection confirmed by an antibiogram developed in 4 patients who make up 2.5% (2 breasts) in G I and 5% (2 breasts) in G II, respectively. More inflammatory complications and infections occurred in the group with the use of Seragyn BR meshes. In the opinion of the authors, this can be linked to the more extensive field of the surgical procedure and consequently operation trauma as well as lymphedema in the region of subcutaneous tissue and the cut off pectoral muscle in the case of sub pectoral operations. In publications dealing with immediate reconstructions, the percentage of infections is similar [18] or even higher as reported by Potter [19] where infections developed in 26% of operations with synthetic meshes and 22% of cases with the use of biological meshes. In the article by Jeevan, this percentage amounted to 24.1% in the case of mastectomy with immediate breast reconstruction [20].

A higher percentage of infections (12%) were also described by Casella in a two-stage mastectomy with a prepectoral breast reconstruction with an expander and Tiloop bra meshes [21].

The removal of implants was necessary in two patients (3 breasts). In both analyzed groups, the percentage of the operated breasts was 2.5%. In both cases, prolonged lymph accumulation is reported in the operated breasts. This percentage is consistent with other studies [22] and lowers than that given by Jeevan. In the latter, the removal of the implant was necessary in 8.9% of patients. In another publication by Nealon, the percentage of lost implants was higher and amounted to 4.9% after sub pectoral reconstructions and 3.5% after prepectoral reconstructions. In these patients, biological meshes were used. Similar percentages of implant losses (6.5%) after breast reconstructions with the use of ADM were reported by Cumo. In the prospective study by Potter, the mean percentage of implant losses in patients after immediate reconstructions was at the level of 10% for synthetic meshes and 8% for biological meshes.

In turn, Hansson [23] compared complications in patients after reconstructive breast surgeries with the use of biological mesh, on the one hand and synthetic mesh, on the other. The percentage of implant losses after breast reconstructions with a synthetic mesh was similar to the findings presented by the authors of this study and amounted to 2%, in comparison to 8.5% of the 8.5% of implant losses after breast reconstruction with the use of ADM mesh, which is consistent with other publications. The frequency of seroma collection in this material was also higher after the use of ADM (38%), in comparison with breast reconstruction with synthetic meshes (3.8%). In our material, the percentage of this kind of postoperative complication was 17.9% in G1 and 25% in G II.

What deserves an attention is a growing number of patients requiring neo-adjuvant chemotherapy or adjuvant radiation therapy after surgical treatment which results from changes in the qualification for treatment in recent years. This concerns in particular to patients with neoplasms of unfavorable biology, *i.e.* TNBC and HER 2 positive. In the analyzed groups, this concerned, respectively, 42.8% and 32.4% of patients who received neo-adjuvant chemotherapy. What is very important in these groups of patients is careful qualification for surgical treatment and good communication with patients as regards possible influence of a surgery with reconstruction on potential delay of the oncological treatment with a potentially higher percentage of complications. This concerns both the qualification for adjuvant chemotherapy and adjuvant radiation therapy. This is also emphasized by other authors. In our material, one patient (1 breast-2.4%) from group II had interrupted radiation therapy because of an abscess in the operated breast and the need to remove the implant. In patients after neo-adjuvant chemotherapy in group I, more frequent seroma collection and skin ischemia were observed, these complications were, in contrast, higher in group II patients without chemotherapy.

In our material, there were only three patients who were active smokers and one patient with diabetes, but, in these patients, we did not observe any complications. Another important factor of significant influence on the development of complications is high BMI>30 [24].

In our group of patients only one patient had BMI of over 30 (BMI-32) and developed superficial skin ischemia and lymphorrhea. Seven patients with BMI of 27-30 developed superficial skin ischemia and three prolonged lymph accumulation which can confirm the dependence of the occurrence of these complications on BMI [25].

What is the unquestionable advantage of prepectoral operations in which absorbable Serasynth meshes were used is the placement of implants in the anatomical location in the subcutaneous pocket created by mastectomy, which gives a very good aesthetic as well as functional effect after the operation [26]. Neither is there a need to cut off the pectoral muscle attachment, which can generate an increased risk of bleeding and pain in the postoperative period and in the long-run animation of the pectoral muscle. Animation of the pectoral muscle can be of a significant importance particularly in patients active in sport and also make everyday life more difficult. This complication was described, among others, by Spears in 2009 in patients after sub pectoral breast augmentation and also after sub pectoral reconstructions [27].

Where the animation of the pectoral muscle makes everyday life significantly more difficult, conversion to the prepectoral method can be made through the dissection of the pectoral muscle from the subcutaneous tissue and its placement in the natural location followed by the placement of the implant in the prepectoral position. In the assessed group, one patient had an operation of this kind made with the use of Serasynth mesh with a very good aesthetic and functional effect.

In the opinion of the authors of this analysis, the aesthetic effects were better in case of prepectoral operations and implantation of Serasynth meshes. In patients, in whom Seragyn BR mesh was used for the reconstruction, in particular, when the thickness of the subcutaneous tissue was meagre, the margin of the cut off pectoralis major muscle was occasionally visible. As a rule, this levelled off only after some time and with compressive underwear worn. According to the authors of this analysis, this is not connected directly with the type of mesh used but rather with the very type of the sub pectoral reconstruction applied. The assessment of the aesthetic effects and quality of life was not the subject of this study.

Conclusion

The authors assessed complications developing in patients operated on with the use of two types of meshes-partly absorbable Seragyn BR and fully absorbable Serasynth. The most common complication in both assessed groups was the occurrence of prolonged seroma collection, which, however, did not contribute in any significant way to the development of serious complications such as removal of the implant or infection. Fewer complications were reported in the group of patients in whom fully-absorbable Serasynth mesh was used for the reconstruction and the percentage of complications in this group was twice lower than in patients after operations with Seragyn BR. Other complications which developed after the placement of the two types of meshes were similar to those presented in other publications on mastectomy with immediate breast reconstruction with the use of synthetic meshes. The percentage of implant losses in the discussed group of patients was lower than that described in literature.

The study had its obvious limitations. It was not prospective and the time of observation averaged 20 months, ranging from 10 to 36 months. That is why it is impossible to assess the long-term effects as well as complications such as the development of the capsular construction.

In spite of the complications, the development of which was not statistically significant, it can be concluded that both types of meshes are safe additions to reconstructive breast surgeries. The group of patients will remain under further observation so that late effects of the operations can be assessed over a longer period.

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