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In Search of Symmetry

Uroš Ahčan

Some diseases can mark people for life, often scarring the body and the soul. Undoubtedly, breast cancer can have horrendous effects: not only can it leave visible marks on the body, it also has the ability to transform a loving wife and mother into a vulnerable victim, and to turn what was once a happy family into a distressed husband and a bundle of terrified children. Today, 330,000 women get breast cancer in the EU every year. And the future of a (so-called) world in development seems to threaten us with the possibility that breast cancer will soon affect the life of every eighth woman, and thus every eighth family out there.

While just a century ago women with breast cancer could only be offered some heroic feat of an operation with a questionable and often daunting aftermath, nowadays we can boast new knowledge in the field of genetics, early disease recognition, advanced imaging diagnostics, novel medication treatment and the new technique

of radiotherapy. Modern medicine doesn't just aim for the survival of the patients, but sets higher goals: a rapid and complete recovery, or even an improvement of the previous health condition. All this is also possible when surgically removing diseased tissue and, through reconstruction, restoring the shape of the breast and the integrity of the female body as well as the complete well-being of the patient.

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Treating breast cancer was once a daring feat, akin to wandering lost in the fog with no sense of direction. It was an unfathomable test of psycho-medical abilities knowing that there was no chance of reaching a defined let alone desirable goal. It was an empiric game of overtreatment and undertreatment with all treatments leading into the unknown. Today the art and science of medicine can offer treatments that are safe and firmly based on scientific principles, a multi-layered system of treatments that have clearly defined goals. The path from being diagnosed to complete healing is predictable. A team of experts from different specialities and subspecialties unite to guide their patient through this journey, with the



guarantee of hope, unbiased information about the treatment options and a realistic appraisal of results. Only then will the journey see a successful conclusion.

Surgical techniques of breast reconstruction

In plastic surgery, too, the patient is not the breast, but a woman with breast cancer, an ill-fated being without a breast or with a deformed, scarred and ugly one. Through reconstruction, we strive to get rid of the aesthetic drawbacks, restore the physical integrity and improve the patient's psychological state and the quality of her life. But reconstruction, whose goal is to achieve breast symmetry, must not influence the course of the oncological treatment (the basic operation, radiotherapy and systemic treatment), so it is always individual and follows the desires of the patient. Breasts with an unnatural appearance will, alongside the disease itself, additionally lower the patient's confidence, diminish her happiness, her creativity and her abilities. A successful reconstruction can prevent or mitigate the psychological effects which emerge because of the bodily change of losing a breast. Patients who have not undergone reconstruction will try to hide their aesthetic disorder with external implants and

clothes. The ugly chest scar, which stays with them for life, reminds them of their difficult trial in life and brings up negative emotions.

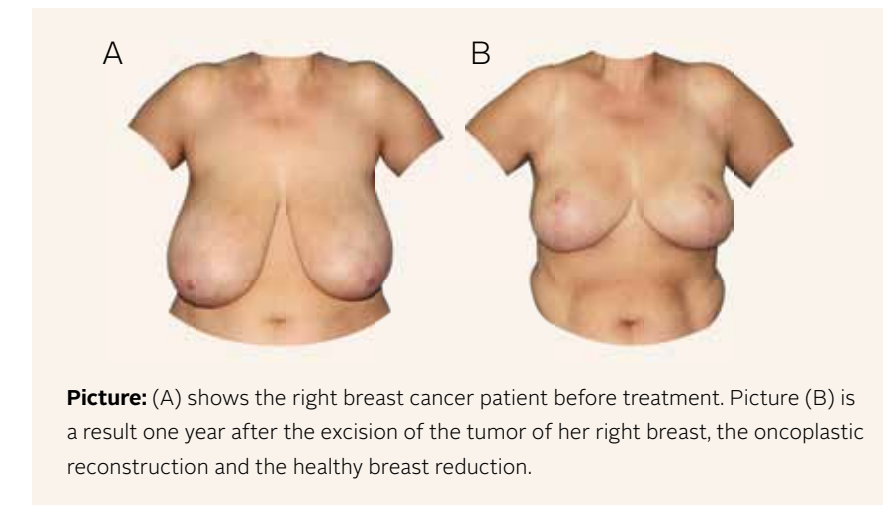
In order to match the newly formed breast the patient's other breast as closely as possible, plastic surgeons can offer the patient an oncoplastic surgical procedure, which is either reconstruction using the body's own tissue (autologous reconstruction) or reconstruction with some other material: tissue expanders or silicone breast implants. Another option is a combination of all of the above.

Oncoplastic surgery

Oncoplastic surgery is the use of plastic surgery techniques for reshaping breasts in breast-conserving surgery. The purpose of oncoplastic operations, suitable for patients with a favourable proportion between the size of the tumour and the breast (individual, small/solitary tumours in large, sagged breasts), is to safely remove the tumour, and simultaneously aesthetically reshape both breasts.

After tumour excision, there are many possible oncoplastic reconstructive approaches. The choice of reconstruction method depends on the amount of tissue to be removed and the amount that can be spared. After an oncologically safe removal of the tumour together with an area of surrounding tissue (the surgical margin), the plastic surgeon has these options available:

- Reshaping and surgically reducing the affected breast (reduction mammoplasty) and simultaneous reshaping of the healthy breast (symmetrising breast reduction);
- Rearranging the local tissue and also using local flaps (in which part of the skin and the subcutaneous fatty tissue is rotated or transposed to the defect);
- Filling up the tissue gaps with implants or autologous adipose tissue (fat grafting, fat remodelling, lipomodelling) after the removal of breast tissue.



Picture: (A) shows the right breast cancer patient before treatment. Picture (B) is a result one year after the excision of the tumor of her right breast, the oncoplastic reconstruction and the healthy breast reduction.

Reconstruction with the patient's own tissue (autologous reconstruction)

If the oncologist removes the entire breast, leaving a large gap on the chest, the patient is frequently suggested to undergo a reconstruction with the body's own tissue, known as autologous reconstruction, which involves removing a part of the tissue (from the donor site), transferring it to the chest (the recipient site) and forming a new breast (or both of them).

In autologous reconstruction, the most frequently used tissues are dermal and

adipose (fatty) tissue in the shape of flaps from various parts of the body. These are named after the area of their origin, their nutritional vessel, or the type of tissue(s) in their composition. The method is chosen considering the bodily properties and preferences of the patient, but in most cases patients are advised to undergo autologous reconstruction which involves taking the required tissue from the lower part of the abdomen (belly), transferring it onto the area of the removed breast,

and shaping it to form the new breast. Such a reconstruction provides long-lasting results, a truly natural shape and structure of the breast, as well as a fair level of symmetry with the healthy breast, requiring no more than one surgical procedure. But it does call for a surgeon that is skilled in microsurgical techniques, and for a patient that possesses enough autologous tissue on the abdomen.

Reconstruction with abdominal tissue (tissue from the belly)

After the age of 40, many patients have excess skin and subcutaneous fat on the lower part of the abdomen. This spare tissue can be used to shape the new breast.

As the tissue is being transferred to a distant area (from the abdomen to the chest), sufficient blood supply needs to be provided to ensure the survival of the tissue (i.e. the flap). And so, along with the 150-1,000 grams of skin and subcutaneous fat, the nutritional vessels that are attached to the flap are also removed, and sometimes a small part of the transverse rectus abdominis muscle as well, which lies directly under the adipose tissue and contains perforating vessels, providing nutrition for the fatty tissue of the flap.

A better option is the DIEP-flap (the deep inferior epigastric perforator flap), which is based on the same vascular system as the TRAM, but does not involve removing the transverse abdominal muscle. Instead, we only remove the skin and the subcutaneous fat on the vascular supply pedicle (the two arteries and the vein), going through the transverse rectus abdominis and providing nutrition for the tissue.

In rare cases, the vascular system on the surface enables us to remove the flap above the muscular fascia. Such a flap is called the SIEA flap (the superficial inferior epigastric artery perforator flap) and is the best option for the patient, as the removal does not damage the muscular fascia and the muscle itself, which improves the speed of post-operative rehabilitation.

Although autologous breast reconstruction is the most difficult and complicated procedure which frequently calls for the knowledge of microsurgery, it is dominant in the best breast reconstructive centres in the world today, and, in my opinion, by far the best choice with regard to the patient. There are fewer operations needed to achieve the final result, there are also fewer possible complications, and the shape of the breast in the end is much more natural, especially in older women. A breast formed from autologous tissue loses and gains weight together with the whole body and keeps its temperature regardless of external factors.

Reconstruction using the patient's own tissue from the belly makes it possible to shape the tissue any way

we want and form reconstructed breasts of various sizes, shapes and degrees of sagging. This is the best way to fulfil the desires of the patient.

The upside of such a procedure is also the simultaneous aesthetic reshaping, tightening and flattening of the abdominal wall (the same procedure known in aesthetic surgery as abdominoplasty or 'tummy tuck').

If the patient has undergone possible previous corrections of the abdominal wall (abdominoplasty), previous abdominal operations, is an active smoker, has a body mass index of over 30, is planning pregnancy, has a poor general health condition or some additional diseases, caution must be applied when deciding on this technique, or it should not be performed at all.

The procedure itself is done under general anaesthesia and will take - with a team approach - 3-5 hours in the best institutions. One of the plastic surgeon teams removes the free flap, composed of skin, subcutaneous fat and the supplying vessels, from the inferior part of the abdomen. Meanwhile, the second team of plastic surgeons will, in most cases, remove a part of the rib next to the sternum and prepare (expose) the recipient vessels which will be the basis for providing nutrition for the flap. The flap is thus reconnected to the blood supply from the chest. In rare cases, the receptor vessels of the armpit are used.

This is followed by the transfer of the flap to the chest. With the help of a microscope and microsurgical techniques, the vessels in the flap are sutured to the recipient vessels. Next, the abdominal tissue is shaped to form the new breast. The abdominal wound is sutured together in the same way as with the aesthetic reshaping of the abdominal wall. The navel also needs to be recreated and repositioned to the same location and shape as before the procedure. Scars will be present on the lower part of the abdomen (the "bikini line") and the area around the navel. They are the same scars as those that result from the aesthetic reshaping of the abdominal wall (performed in cases of overweight patients with excess skin hanging from the belly after a diet or childbirth).

If the patient needs a two-sided (bilateral) reconstruction and there is enough tissue on her abdomen, both breasts, which are usually smaller in such cases, can be reconstructed.

Novelties:

the use of 3-D technology in autologous breast reconstruction

Recreating an aesthetically pleasing breast demands a combination of good measurement, some artistic insight and a significant level of experience on the part of the surgeon. To counter all the challenges that this brings, the latest technology has helped us develop a technique which enables us to plan the procedure better and to further personalize the whole process and its outcome.

Modern technology enables us to scan body parts with a laser and render a 3D model using special computer software. This technology can also be used in autologous breast reconstruction. Before the procedure, we make a laser image of the healthy breast and then, using suitable computer software, render a 3D model of the healthy breast. The model is then simply mirrored over, and a 3D mould of the mirrored healthy breast is fashioned.



Picture: Breast measurement setup and 3D image of the contralateral breast.

The mould, which is a three-dimensional replica of the healthy breast, is used during the procedure to help us shape the new breast quickly, easily, accurately and reliably. The 3D model makes it possible to perform the procedure quicker and to increase the reliability of the result even when less experienced surgeons

are performing; and on top of that, it results in a very high degree of symmetry of both breasts with only one operation needed. This method is especially useful with delayed reconstructions where there is no information about the weight of the removed breast, or when the anatomical properties of the chest have

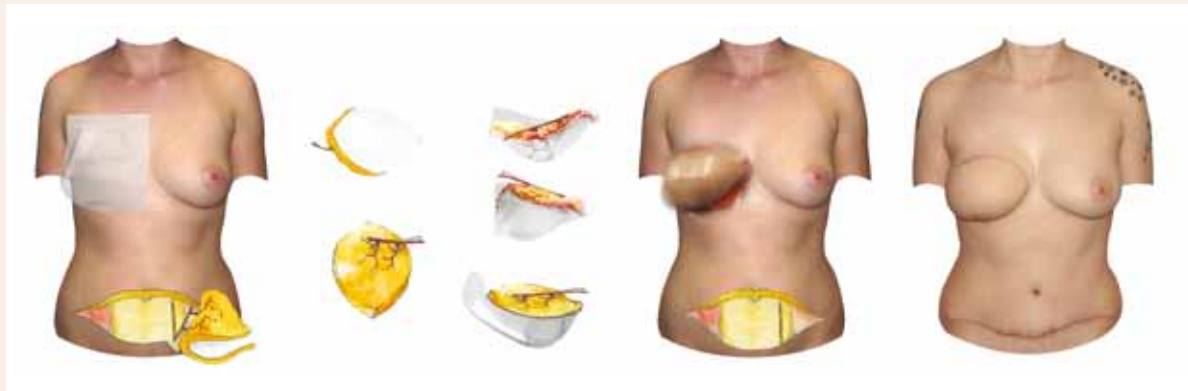


Picture: Before the procedure a laser image of the healthy breast is made and then, using suitable computer software, render a 3-D model of the healthy breast. The model is then simply mirrored over, and a 3-D mold of the mirrored healthy breast is fashioned and plastic new breast replica cast (NBRC) is performed.

been altered (the presence of scars, poor quality of the skin, the footprint, conus, inframammary fold and skin envelope have been damaged dramatically). These are the least desirable conditions for breast reconstruction.

Measurements are usually carried out a few days before the procedure, and then the technicians form a cast from transparent, sterilizable material. Immediately before the procedure, the mould is used to draw the incision lines of the operation, with special attention given to the location of the new breast on the chest. Then the new inframammary fold, the upper edge and

the side edges of the new breast (the footprint of the breast) are drawn on the chest. The mould is then sent to be sterilized and is used during the operation after the removal of the flap. The abdominal tissue is then simply, safely and quickly formed into the new breast in the mould on the table next to the patient, while the abdominal wall (the source area for the flap) is being sutured. It is not necessary to further measure or weigh the tissue, neither to plan how to reshape it. We simply use the mould to shape the new breast, which will in the end be very similar to the healthy one in shape and volume, as it is its exact replica.



Picture: The mold, which is a three-dimensional replica of the healthy breast, is used during the procedure to help us shape the new breast quickly, easily, accurately and reliably. The 3-D model makes it possible to perform the procedure quicker and to increase the reliability of the result even when less experienced surgeons are performing, and on top of that, it warrants a very high degree of symmetry of both breasts with only one operation needed. This method is especially useful with delayed reconstructions, where there is no information about the weight of the removed breast, or when the anatomical properties of the chest have been altered (the presence of scars, poor quality of the skin, the footprint, conus, inframammary fold and skin envelope have been damaged dramatically). These are the least desirable conditions for breast reconstruction. The picture shows the method of work during the procedure and the result 3 weeks after the surgery.



Picture: (A) shows the young patient after oncological treatment and mastectomy of the left breast. The result of a delayed reconstruction with free transfer of tissue from the abdominal wall using a 3D mold can be seen in (B).

Breast reconstruction using an implant and a tissue expander

Implant reconstruction is performed if the patient wants it, if autologous reconstruction is not possible (for various reasons including insufficient tissue, improper donor areas etc.), if the patient is not fit or ready for longer operations, if the patient's breasts are small, if there is no planned radiotherapy, if the patient wishes for a more youthful appearance of her breasts and a simultaneous aesthetic reshaping of the healthy breast, and also with preventive bilateral breast mastectomy in cases of mutated BRCA 1 and 2 genes. Implant reconstruction can also be immediate (primary) or delayed (secondary), one- or two-sided (bilateral) and one- or two-staged. But the characteristic that they all share is the use of foreign, artificial material: the tissue expander and the silicone breast implant.

Two-stage and one-stage implant reconstruction

There are two basic types of implant reconstruction: a two-stage reconstruction and a one-stage reconstruction.

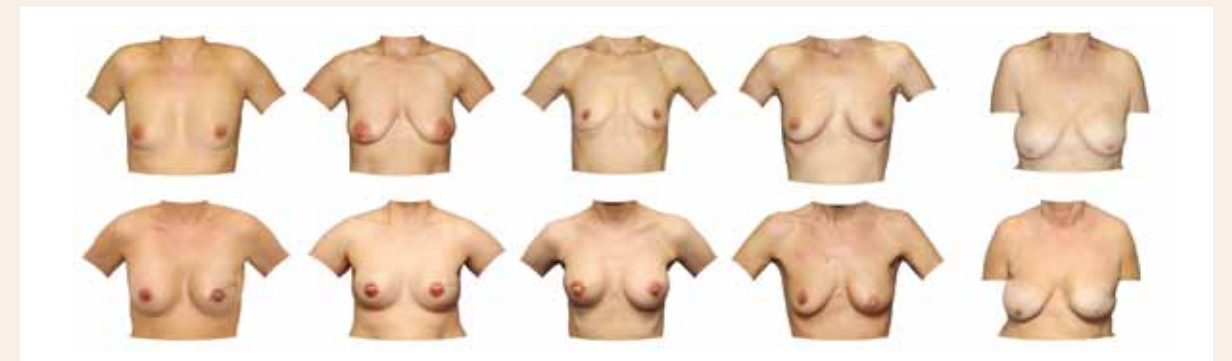
Two-stage implant reconstruction: in the first operation, after the mastectomy, the properly chosen expander is inserted under the pectoral muscle. Then it is filled (expanded) over time in regular intervals, which stretches the surrounding tissues. When a sufficient amount of skin has been acquired on the chest and the proper conditions have been met, the expander is replaced with a permanent silicone implant (which

is similar in size and shape to the healthy breast) during the second operation. This gives us a natural appearance and symmetry of the breast.

The main disadvantage of two-stage reconstruction is the high number of appointments needed at the outpatient clinic (due to the repetitive filling of the expander every 1-2 weeks) and the additional operation under general anaesthesia (during which the expander is replaced with a permanent implant). But compared to one-stage reconstruction, two-stage reconstruction enables us to perform minor corrections of the shape of the breast and control its level of sagging and the position of the inframammary fold, which all play a vital role in achieving symmetry and a nice aesthetic appearance.

One-stage implant reconstruction: in some cases, the permanent silicone implant may be inserted immediately after the removal of the affected tissue (the removed tissue is simply replaced with an anatomical implant of similar shape and volume). This can only be done if the inserted implant is completely covered with soft tissues (the muscles and the skin on the chest).

One of the novelties in breast reconstruction is the use of skin meshes. Surgeons may use artificial tissue substitutes - a natural skin mesh like Strattice® and others (AlloDerm®, Neoform™). The substitute is an acellular tissue matrix which is attached to the chest (pectoral) muscle and supports the implant. The mesh grows into the tissue as an additional layer that cover and protect the anatomical shape silicon implant of the new breast.



Picture: With the proper use of silicone implants and tissue expanders after the removal of breast cancer we can achieve a good aesthetic result in unilateral and bilateral reconstructions. The upper row shows patients prior to the reconstruction and the lower row shows patients after the end of cancer treatment and reconstruction of one or both breasts.

Compared to autologous breast reconstruction, reconstructions with implants and expanders have these advantages: there are no additional scars, as there is no need to remove tissue from the abdomen or some other part of the body (the so-called “donor side defect”); and the operation is technically simpler, shorter and does not involve microsurgical procedures. An additional advantage of one-stage reconstruction is also the fact that only one operation is really needed, and that the operation, the hospital treatment and the recovery period are generally short. Some of its main disadvantages include: that the implants may yield a less natural appearance; that they may feel less soft or less warm to the touch compared to an autologously formed breast; the price and the limited lifespan (10-15 years) of the material; occasional complications caused by using material that is foreign to the body; slim women may notice a rippling in their skin, caused by implant creasing or folding; and there may be a certain level of asymmetry in one-sided breast reconstruction due to larger changes in body-weight, or the natural breast may droop more than the reconstructed one years after reconstruction.

Despite the increase in breast reconstruction surgeries, nearly 70 percent of women who are eligible for the procedure are not well informed about their options for reconstruction.

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