Breast surgery: A problem of beauty or health?
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Introduction and aims of this thesis
Introduction

The female breast in culture and art

Throughout the ages, the female body has been revered as a work of art and beauty and as a source of life, from which all people are born. The breast is one of the most predominant features of a woman and stands out as a symbol of womanliness and livelihood\(^1\).

The way how the breast is viewed throughout history is a direct reflection of the views of women of time and life. In European pre-historic societies, sculptures of female figures with pronounced or highly exaggerated breasts were common, symbolising fruitfulness and nourishment. A typical example is the so called *Venus of Willendorf*\(^2\), one of many Paleolithic Venus figurines with ample hips and bosom (fig. 1).

Artefacts such as bowls, rock carvings and sacred statues with breasts have been recorded from 15,000 BC up to late antiquity all across Europe, North Africa and the Middle East.

In Ancient Greece there were several cults worshipping the “Kourotophus”\(^3\), the sucking mother, represented by goddesses such as Hera and Artemis. Nevertheless, the worship of deities symbolised by the female breast in Greece became less common during the first millennium. Classic Greek society praised masculinity and repressed femininity. Woman in art were covered or portrayed in postures that were intended to express shyness or modesty\(^4\). A popular legend at the time was that of the Amazons, a tribe of fierce female warriors who socialised with men only for procreation and even removed one breast to become better warriors (the

*Figure 1: Venus of Willendorf*
idea being that the right breast would interfere with the operation of a bow and arrow).

With the rise of Christianity, the breasts and the flesh in general were discouraged from being exposed. Medieval Christian stories focus on the breast milk of the Virgin Mary as being the most holy and miraculous of fluids. It was not until the fourteenth century and the Renaissance that this began to change. As people became more frivolous, clothing became more revealing, and the neckline lowered to show cleavage. In the seventeenth century, the breast once again became the predominant center of female attractiveness, being a symbol of power and wealth.

After the French Revolution an outpour of emotional awaking occurred and independence and freedom of expression lead to a decade of naturalism where breasts became symbols for emotion and naturalism. This symbolism is well documented in the famous painting of Eugene Delacroix ("La Liberte guidant le peuple" from 1830), in which "Liberty" is symbolised by a bare-breasted robust woman holding the "La Tricolore" (fig 2).

When this Romanticism calmed down the proper display of the breasts and waists through corsets became an important part of fashion society. Nevertheless, due

Figure 2: “La Liberte guidant le peuple”, Eugene Delacroix 1830
to the physical restrictions of women by corsets, there was a growing opposition to
this phenomenon at the turn of the century.

During World War I women’s roles in the work force increased. In 1919 women
acquired the right to vote in the United States and there was a growing belief that
women were able to do almost anything a man could do. Therefore breasts as a
sign of femininity were bided down to emphasise the less gender based roles in
the society⁴.

After the chaos of World War II, people again looked for stability and fertility.
Therefore the female breasts once again became popular as a symbol for prosperity.
During the rise of motion pictures big breasts were viewed as symbol of sexuality
in contrast to small breasts, which were associated with upper class sophistication
and wit.

Based on this a period of rebellion started in the 1960’s and 70’s. One of the best-
known aspects of the early Women’s Liberation Movement those days was the “bra
burning”⁸, a form of liberation to make men face up to the reality of the breast by
freeing it from it’s fantasy underpinnings. This symbolic act was meant as a serious
criticism of the modern beauty culture, of valuing women for their looks instead of
their whole self.

When the hippie era calmed down, perfection of the body became an ideal, which
was reflected by its frequent use in advertising. Large breasts came back in fashion
and woman started to use breast implants to enlarge their breasts⁶. Nowadays large
breasts emphasise gender differences, femininity and womanhood, reflected by a
constantly increasing of number of aesthetic breast surgeries.

**Meaning of the breast**

As history reflects, the cultural significance of the breast revolves around its use
as a symbol both of fertility and sexual pleasure. Many women regard breasts as
an important female secondary sex characteristics, and a factor in the sexual attr-
activeness of a woman⁹.

For Freud, the breast was the first erogenous zone, from which a child should
move on to the anal and genital stages of it’s developing sexuality. The baby’s
complete satisfaction at it’s mother’s breast led to an identification with the mother,
after which the baby needed to develop a sense of itself as a separate being. In
adult life, a person therefore longs for the perfect pleasure of the breast, which has
been taken away¹⁰.

Beside this analytic point of view, the media is obsessed with portraying the
“perfect body”: being thin and having perfectly shaped breasts. Women seeking to
reach this ideal are at risk of feeling uncomfortable to the extend of suffering from low self esteem and therefore disturbed body image. This might induce an impairment in psychological well being, social life and disturbed relationships resulting in a decreased quality of life\textsuperscript{11}.

**Disorders of the breast**

**Anomalies**

1. **Polythelia/Athelia**
   Accessory nipples appear along the natural mammary lines between the axilla and the groin. In contrast in case of athelia the nipples are imperfect or incompletely developed. This developmental breast abnormality affects slightly less than 2\% of women and less than 1\% of men around the world. The absence of the nipple-areola complex is often associated with other anomalies\textsuperscript{12,13,14}.

2. **Polymastia/Amastia**
   Polymastia is a so called accessory breast, supernumerary breasts or mammae erraticae\textsuperscript{12,13}. Athelia as well as amastia might be associated with congenital anhidrotic ectodermal dysplasia, additional musculoskeletal abnormalities or dermoid cysts\textsuperscript{15}. In 1841, Poland described a congenital deficiency of the Pectoralis Major and Minor muscles associated with syndactyly. This syndrome is a spectrum, often involving chest wall and breast deformity as well\textsuperscript{16}.

3. **Gynecomastia**
   Gynecomastia is a benign enlargement of male breast glandular tissue. At least a third of males are affected at some time during their lifetime. Idiopathic causes exceed other aetiologies and relate to an imbalance in the ratio of oestrogen to androgen tissue levels or end-organ responsiveness to these hormones\textsuperscript{17}.

4. **Breast Hypertrophy**
   The hypertrophy of the breast is an abnormal enlargement of the mammary tissue. There are many varieties including gigantomastia\textsuperscript{18}, virginal breast hypertrophy\textsuperscript{19}, juvenile gigantomastia\textsuperscript{20,21} and secondary breast hypertrophy\textsuperscript{22,23}. There are a variety of hypertrophic conditions, which can affect women at various times in their lives. Hypertrophy can affect both breasts equally or only one breast causing asymmetry issues. The condition usually produces psychological and physical effects including: antisocial behaviour, introversion, lack of confidence, insecurity, fear, anxiety, depression, suicidal thoughts, chronic fatigue and mal-posture as well as back pain; among others\textsuperscript{24-26}. No definition exists what size or weight of a female breast is necessary to declare it to be hypertrophic\textsuperscript{27}.
5. Breast Hypoplasia
Micromastia is the post-pubertal underdevelopment of a woman’s breast tissue. Just as it is impossible to define ‘normal’ breast size, there is no objective definition of hypoplasia of the breast. It might be a congenital defect, related to trauma or it may be a more subjective aesthetic description. Self perceived micromastia involves a discrepancy between a person’s body image, and her internalised images of appropriate or desirable breast size and shape.

6. Asymmetrical breasts
Breast asymmetry occurs due to developmental differences, congenital deformities, trauma or surgery.

7. Tuberous breasts
The tuberous breast deformity is described as a result from aplasia of one or more quadrants of the breast as well as skin shortage and herniation of breast tissue through the nipple-areola complex.

Benign breast masses
The most common benign breast conditions include fibrocystic breasts, benign breast tumors, and breast inflammation. Depending on the type of benign breast condition and the patient’s medical situation, treatment may or may not be necessary.

1. Fibrocystic disease
This mammary dysplasia is not a disease, but rather, it describes a variety of changes in the glandular and stromal tissues of the breast. Symptoms of fibrocystic breasts include cysts, fibrosis, lumpiness, areas of thickening, tenderness, or breast pain. Due to the thickening of the tissue fibrocystic conditions can sometimes make breast cancer more difficult to detect with mammography. According to the American Cancer Society, fibrocystic breasts affect at least half of all women and therefore, is the most common cause of breast lumps in women between 30 and 50 years old.

2. Simple cysts
Simple breasts cysts are accumulations of fluid in the breast, which might cause discomfort, and in this case might need fine needle aspiration.

3. Galactoceles
Galactoceles are milk-filled cysts that can occur in women who are pregnant or lactating.
4. Fibroadenomas
Fibroadenomas are one of the most common breast lumps in young women under the age of 30. Treatment may include careful monitoring to detect changes or surgical removal.\textsuperscript{33}

5. Phyllloides tumors
Phyllloides tumors are breast tumors with an overgrowth in fibro-connective tissue, which are much less common than fibroadenomas. On very rare occasions, they may be malignant. Therefore they need to be removed with one inch margin of surrounding breast tissue.\textsuperscript{33}

6. Intraductal papillomas
Intraductal papillomas are non-cancerous wart-like growths with a branching that has grown inside the breast. They often involve the large milk ducts near the nipple, causing bloody nipple discharge.

Papillomas are diagnosed by galactograms and should be removed surgically.\textsuperscript{34}

7. Granular cell tumors
Rarely detected tumors in the breast, which require surgically removal along with a surrounding margin of breast tissue.\textsuperscript{35}

8. Duct ectasia
Duct ectasia, widening and hardening of the duct, is characterised by a thick green or black nipple discharge, typically affecting women in their forties and fifties. The nipple and surrounding tissue may be red and tender. Duct ectasia is a benign condition but can sometimes be mistaken as cancer if a hard lump develops around the abnormal duct. Opalescent (clear) nipple discharge is often due to duct ectasia or cyst. Often, duct ectasia does not need treatment, or improves with the application of heat or antibiotic drugs. Occasionally, the affected duct is surgically removed by an incision at the border of the areola (the pigmented region around the nipple).\textsuperscript{36}

9. Fat necrosis
Fat necrosis, a benign condition where fatty breast tissue swells or becomes tender, can occur spontaneously or as the result of an injury to the breast. Usually symptoms of fat necrosis subside within a month, however the affected area may be sometimes replaced with firm scar tissue. According to the American Cancer Society, some areas of fat necrosis can have a different response to injury. Instead of forming scar tissue an oily cyst might be formed.\textsuperscript{37}
10. Mastitis
Mastitis most commonly affects women while breastfeeding and is treated with antibiotics. If an abscess occurs surgical drainage is needed. All these benign breast masses may require surgical removal and therefore may result in a disfigurement of the breast with subsequent impairment in aesthetic appearance. Regarding the importance of the breasts appearance for women’s body image and self-esteem women might look for plastic surgery corrections.

Breast Cancer
Epidemiology
Worldwide, breast cancer is the most common invasive cancer in women. Breast cancer compromises 22.9% of all invasive cancers in women. The number of cases worldwide has significantly increased since the 1970s, a phenomenon partly attributed to modern lifestyles. In 2008, breast cancer caused 458,503 deaths worldwide (13.7% of cancer deaths in women and 6.0% of all cancer deaths for men and women combined). Breast cancer is more than 100 times more common in women than in men.

The lifetime risk for breast cancer in the United States is given as about 1 in 8 (12%) of women by age 95, with a 1 in 35 (3%) chance of dying from breast cancer.

Table 1: Breast Cancer Incidence Europe 2006

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Rate per 100,000 females
The same numbers are given for the UK according to the data of the UK cancer research institute\textsuperscript{42}.

Prognosis and survival rate varies greatly depending on cancer type, staging and treatment. Five-year relative survival rates vary from 98\% to 23\%, with an overall survival rate of 85\%\textsuperscript{40}. According to the American Cancer Society, more than 230,000 women will be diagnosed with breast cancer annually in the United States, and more than 39,000 will die from the disease each year\textsuperscript{43}.

The highest incidence of breast cancer worldwide is found in Western Europe (85 per 100,000 females) with the highest incident in The Netherlands (121 per 100,000 females in 2006, table 1)\textsuperscript{42}.

**Treatment of breast cancer**

Depending on type and stage of the tumor, six types of standard treatment of breast cancer are being used:

1. Surgery
2. Sentinel lymph node biopsie and/or axillary dissection
3. Radiation therapy
4. Chemotherapy
5. Hormone therapy
6. Targeted therapy (i.e. monoclonal antibodies)

According to tumor stage and breast size, breast-conserving therapy like lumpectomies or partial resections of the breast followed by irradiation as well as mastectomies, are the gold standard in surgical therapy of breast cancer. About two thirds of women diagnosed with breast cancer will undergo breast conserving treatment and one third will elect to undergo mastectomy\textsuperscript{44}.

These interventions may result in alteration of the breast’s shape and aesthetic appearance or even loss of the breast. The functional deficits that occur as a consequence of mastectomy include the inability to breastfeed and loss of sensation of the chest. Loss of the breast mound alters the patient’s personal appearance and can make wearing some types of clothing problematic. The use of external prothesis to address these issues can be inconvenient and uncomfortable, particularly for a woman with large breasts. However, the most important consequence of mastectomy is the psychosocial effect of the physical and aesthetic deformity, which can include anxiety, depression and negative effects on body image and on sexual function\textsuperscript{45}. Therefore reconstructive surgery, to remodel the breast, became an important part in treatment of breast cancer patients\textsuperscript{9,46,47}.
An exception of dealing with the disfigurement was the art-work of the model and artist Matuschka in the early 90s. Her self-portrait “beauty out of damage”, showing herself after amputation of one breast, made the cover of the New York Times magazine in 1993 and subsequently won many prizes all around the world – for creating awareness of a “hidden” problem (fig 3).

**History of breast surgery**

**Reduction mammaplasty**

In comparison with other surgical procedures concerning the breast, the history of reduction mammaplasty is relatively short. Hans Schaller, the so-called “barber” of Augsburg, is considered to be the first surgeon to have performed a reduction mammaplasty by breast amputation in 1561. The patient was a maid whose “breasts assumed such great proportions that she could not support them, neither standing up nor being seated”. Undoubtedly, his intentions were purely functional to relieve her physical symptoms without any further aesthetic considerations. After general anaesthesia was discovered in the 19th century, the indications for breast reduction became more numerous. Till now the most common motivation for breast reduction surgery is to alleviate back and shoulder problems, neck pain and a whole range of other health and emotional problems caused by overlarge breasts. Difficulty in breathing, poor posture and chronic inflammations in the submammary fold are disorders among others that can be minimised or eliminated. However, the growing acceptance of cosmetic and corrective plastic surgery to obtain a bal-
anced and more proportional body has greatly increased the popularity of breast reduction surgery.

Women seeking breast reduction might have no physical needs but the desire to change their aesthetic appearance. Therefore, the medical necessity and, as a consequence the insurance coverage, are questioned by insurers as well as the general public.

Breast augmentation

In 1895, surgeon Vincenz Czerny performed the first reported breast implant emplacement when he used the patient's autologous adipose tissue, harvested from a benign lipoma, to repair the asymmetry of the breast from which he had removed a tumor. In 1899 Robert Gersuny experimented with paraffin injections, with disastrous results.

Many other filling materials were tried with the same fatal results until 1961, when American plastic surgeons Thomas Cronin and Frank Gerow developed the first silicone breast implant. In due course, the first augmentation mammoplasty was performed in 1962.

Since then, further development took place to increase the safety of breast implants. Nevertheless, in the early 1990s, breast implants became the subject of heated controversy as reports of women claiming their implants had seriously damaged their health became widely publicised in the media. As a consequence the FDA issued a ban on the use of silicone-gel filled implants for cosmetic augmentation after stating there was “inadequate information to demonstrate that breast implants were safe and effective”. During this controversy saline filled breast implants continued to be generally available for both breast reconstruction and augmentation.

In the late 1990s, many studies reported no evidence of saline-filled and silicone-gel filled breast implant devices causing systemic health problems; that their use posed no new health or safety risks, and that local complications were “the primary safety issue with silicone breast implants”. They distinguished between routine and local medical complications like capsular contracture and systemic health concerns.

Due to this the FDA lifted its restrictions conditional upon accepting FDA monitoring under study conditions. In other countries, like the UK and Spain, the ban was lifted in 1992 and 1996 respectively.

Since then, the number of breast augmentations or breast reconstructions using silicone breast implants increases continuously and finally silicone gel implants got re-approved by the FDA in 2006.
But, the next implant scandal emerged soon: after receiving reports of potential problems with PIP implants since 2002, The Medicine and Healthcare Products Regulatory Agency (MHRA) in the United Kingdom issued a Medical Device Alert through a press release for clinicians in March 2010, not to use the Poly Implant Prothèse (PIP) implant due to a higher rate of failure and local signs than other implants based on a non-medical grade silicone being used as filler in these substandard implants\(^5\). This safety scare over PIP has again generated heated discussion about cosmetic surgery, private and public responsibilities, and device regulation\(^5\), being the center of global media attention.

The European Union’s Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) was asked to enlighten the question of potential health risks of PIP breast implants and concluded the following; “In the case of PIP implants, when the limited available clinical information is taken together with the findings from tests of the physical and chemical properties of the shell and silicone, and of the in vivo irritancy test, some concerns are raised about the safety of PIP breast implants as the possibility for health effects cannot be ruled out.”\(^5\)

As a result PIP implants were recalled in France and other countries. Subsequent studies not only reaffirmed PIP’s rupture prevalence to be higher than other brands of breast implants, but also recorded the media’s beneficial effect in improving the recall\(^6\).

As a result the need of quality in control for prosthetic material gained importance even more. Effective quality control needs to keep in step with scientific progress as well as technical specifications. Currently obligatory implant registries are being implemented as a tool for bio-monitoring of breast implants, which increases transparency and quality control\(^6\).

As an alternative, techniques of transferring fat using liposuction and lipofilling have evolved and are being developed to augment and reconstruct the breast over the past 25 years\(^6\). In that time the technique has been criticised as it can lead to the fat dying, leaving cysts in the breast or calcification, which can be seen on mammograms and, it was thought, mimic cancer\(^6\)\(-\)\(^4\). This was suspected to compromise breast cancer detection and therefore the American Association of Plastic and Reconstructive Surgery banned this technique in 1987\(^6\). Only recently refinements in techniques and improved understanding of the science behind fat transfer have lead to more predictable results\(^6\). Autologous fat grafting has subsequently become a routine procedure: Its value and indications seem to expand continuously\(^6\)\(-\)\(^8\).
Chapter I

The breast augmentation patient is usually seeking aesthetic improvement, while accepting the potential side effects associated with breast augmentation\textsuperscript{69}. Their personality profile indicates psychological distress about their personal appearance and their body\textsuperscript{70}, with a high incidence of body dysmorphic disorders amongst this population\textsuperscript{71}.

Breast cancer

The earliest reference to the surgical treatment of breast cancer can be found in the “Edwin Smith Surgical Papyrus”, which originates in Egypt between 3000 and 2500 b.c.\textsuperscript{72}. Throughout ancient times there was considerable controversy surrounding the surgical treatment of breast cancer. Hippocrates for instance questioned in 400 b.c. if patients with breast cancer might not live longer without excision of the tumor\textsuperscript{73}.

Not until the rise of surgery in the 16th century European surgeons began to develop different procedures in the surgical treatment of breast cancer. Jean Louis Petit (1674-1750), Director of the French Surgical Academy, is accredited with developing the first unified concept. Petit suggest that “the lymphatic gland should be removed” and “the mammary gland should not be cut into”\textsuperscript{74}. In 1774 the French surgeon Bernard Peyrilhe advocated radical operative surgery. He first formulated this surgical concept, which is now widely connected to the name of the American surgeon William Stewart Halsted (1852-1922). This concept of radical resection has remained influential till now\textsuperscript{73}. Halsted was influenced by the findings of the German pathologist Rudolf Virchow, who noted the invasive anatomy of breast cancer in the mid nineteenth century\textsuperscript{75}. Following Virchow’s findings not only the tumor-containing breast, but also the underlying pectoral muscle and its ipsilateral axillary lymph nodes had to be removed en bloc\textsuperscript{76}. After World War II, simple mastectomy and high-voltage radiotherapy was advocated to treat primary breast cancer. McWhirter was one of the first authors who published about the effectiveness of radiotherapy after mastectomy, laying the foundations for the use of radiotherapy in modern breast-conserving surgery\textsuperscript{77}.

In this context, the effect of Halsted’s radical procedures was questioned again: several large randomised prospective trials tried to answer this question. One of the most important trials was conducted by Veronesi et al. They were able to show that the local recurrence rate was higher after breast conserving therapy when compared to mastectomies, but this had no influence on the overall survival rate\textsuperscript{78}.

Nowadays the treatment of breast cancer is dependent on the stage of the tumor (TNM classification) and includes surgery (either breast conserving surgery or mastectomy), sentinel lymph node extirpation/axillary dissection, radiotherapy,
chemotherapy, hormone therapy and targeted therapy. Further studies are continuously undertaken to improve the outcome of breast cancer therapy\(^79\).

**Breast reconstruction**

Recently, there has been an increased emphasis on improving quality of life for those afflicted by breast cancer. Breast reconstruction became an important tool to reduce the psychological trauma associated with disfigurement of the breast as mentioned above\(^9,46,47,80\).

Therefore, the goal of reconstruction is to restore a breast mound and to maintain the quality of life without affecting the prognosis of recurrence of cancer\(^81-83\).

The first attempt at a true breast reconstruction was in 1895. As mentioned above, Vincent Czerny, a professor of surgery in Heidelberg, is generally credited with the first autogenous breast reconstruction by transplanting a fist-sized lipoma from the patient’s flank into the breast\(^51\). In 1906, the Italian surgeon Tanzini had difficulty closing large wounds after the radical mastectomy. He developed a pedicled flap of skin and underlying Latissimus Dorsi muscle, which was transferred to the mastectomy defect, therefore becoming the first surgeon to use a musculo-cutaneous flap in breast reconstruction. However, due to Halsted’s hypothesis of the negative influence of breast reconstruction on the disease, his technique was soon to be forgotten\(^84\).

Some of the techniques for breast reconstruction used during the first half of the 20th century included bisecting the opposite breast and using half as a pedicle for breast reconstruction. Sir Harold Gilles used a tubed abdominal flap method, which he developed in 1919, to perform his first breast reconstruction in 1942\(^84,85\). Several others followed with excellent reconstructions, but the limiting factor became the need for several staged operations over a minimum of 6 months.

These extensive procedures required multiple delays and transfers and often resulted in many significant scars. Frequently, the flaps would fail, and disappointing results kept these flaps from gaining larger popularity. Neither the surgeon nor patient could recommend these early “reconstructions” to anybody.

In the decades that followed, the Germans continued to lead the way. Hohler and Bohmert\(^86\) performed two-stage reconstructions utilising the thoraco-epigastric flap followed by insertion of prosthesis for routine mastectomies.

**Implant reconstruction**

After Cronin and Gerow introduced silicone gel implants for breast reconstruction in the 1960’s, delayed reconstruction by inserting the implants became the typical method for many years\(^52\). In 1971 Snyderman and Guthrie were the first to report on the use of a silicone breast implant placed under the remaining chest...
wall skin immediately following a mastectomy\textsuperscript{84,87}. This kind of breast reconstruction was limited by the deficit of skin resulting from radical mastectomies. Therefore Radovan introduced the use of tissue expansion in 1982\textsuperscript{88}. The disadvantage of this procedure is, that the tissue expander has to be removed and replaced by a silicone implant, which made further surgery needed. For this reason Becker developed a dual-chamber expander that had a silicone gel outer lumen with an inflatable inner saline lumen. This technique eliminated the need for a second-stage operation.

Despite the difficulties to expand skin and reach a symmetric result, the longterm experience showed several drawbacks. The aesthetic appearance changed by time and long term problems with the implants, like deflation, capsular contracture or rupture occurred and made further surgery necessary\textsuperscript{89}. This forced a rekindled interest in autogenous breast reconstruction.

**Autologous reconstruction**

The first modern description of an autogenous reconstruction of the breast came toward the end of the 1970s. Several authors reintroduced and popularised the use of the Latissimus Dorsi musculocutaneous flap for breast reconstruction in one stage\textsuperscript{90-93}. Due to the limited volume of the Latissimus Dorsi musculocutaneous flap it was - and still often is - used in combination with an implant to reach an appropriate volume. As an alternative though, Hokin and Sifverskiold\textsuperscript{94} introduced an extended Latissimus Dorsi flap without implant in 1987.

Even though the Latissimus Dorsi flap led to satisfactory results, its donor site left large scars with a tendency to contract and was linked to a risk of seroma formation\textsuperscript{94}. Attempts were therefore made to improve breast reconstruction techniques. Holmstrom performed the first abdominal muscle free flap for breast reconstruction in 1979\textsuperscript{101} and Robins subsequently described a vertically oriented skin-muscle flap with the Rectus Abdominis muscle pedicled on the epigastric superior vessels. This allowed for transplantation of larger tissue volumes to recreate a breast mound\textsuperscript{95}. This technique was improved upon by Hartrampf et al.\textsuperscript{96,97} who introduced a Transversely oriented Rectus Abdominis Myocutaneous (TRAM) island flap, which was still pedicled on the superior epigastric vessels. This provided a more aesthetic result, as its direction enabled to close the donorsite like in an abdominoplasty.

Despite disadvantages like an increased risk of abdominal wall herniation due to weakness of the abdominal scar and abdominal discomfort, this flap became the “workhorse” for breast reconstruction for many years\textsuperscript{98}. Another disadvantage of the pedicled TRAM-flap was the high tissue-to-blood supply ratio, which was tried to overcome by using the deep inferior epigastric vessels, being the primary source of circulation to the Rectus Abdominis muscle\textsuperscript{99}. Using the TRAM-flap as a free flap
based on the deep inferior epigastric vessels the blood supply proved to be more reliable with subsequent less tissue necrosis\textsuperscript{100}.

Despite improvement in flap survival, the donor-site morbidity remained a problem, even though just a small part of the muscle had to be sacrificed. To overcome this problem, a new technique of harvesting the abdominal tissue was suggested by Koshima\textsuperscript{102}. He isolated the skin and subcutaneous tissue from the abdomen based upon vessels that perforate the Rectus Abdominal muscle without sacrifice of the muscle.

As an evolution and refinement of breast reconstruction, this flap (Deep-Inferior—Epigastric-Artery-Perforator flap/ DIEAP-flap) was first used by Allen\textsuperscript{103} in 1994. The reduction of risk of abdominal wall herniation or bulging was combined with a unsurpassed freedom of design to give a sufficiently aesthetic as well as long lasting result\textsuperscript{104,105}. Since then, the microsurgical breast reconstruction techniques using perforator flaps have evolved into becoming the state of the art in reconstructive breast surgery after mastectomy.

As a result of this perforator flap concept, all over the body tissue can be taken, for instance not only from the abdomen, but also from the gluteal area (SGAP-flap\textsuperscript{106}) or the upper legs (TMG-flap\textsuperscript{107}). Preserving underlying muscles lessens postoperative discomfort making the recovery easier and shorter, and also enables the patient to maintain muscle strength long term.

Despite various techniques of breast reconstruction with autologous tissue or prosthesis, adipocyte tissue has been used more frequently in recent times\textsuperscript{108,109}. The indications for lipofilling in breastreconstruction are postlumpectomy deformity, postmastectomy deformity, secondary breast reconstruction after flap or prosthesis reconstruction. In combination with vacuum assisted pre-expansion Khouri\textsuperscript{110} et al reported in 2009 about satisfying results in secondary breast reconstructions without previous flap or implant surgery.

The diversity of options for breast reconstruction enables surgeons as well as patients to find the individual treatment for the patients need.

**Number of surgical procedures**

The importance of breast surgery is reflected by the number of surgical procedures per year. According to the American Society of Plastic Surgeons, breast augmentation is the most frequently performed aesthetic procedure\textsuperscript{111}, with 296,000 surgeries performed in 2010. Breast reconstruction is also under the five top reconstructive procedures in 2010 with 93,000 procedures a year. These numbers are constantly
increasing over the course of the last years\textsuperscript{111}. Among breast reconstructions, those with implants are the most performed procedures in 2010. These numbers are shown in table 2, 3 and 4.
Financial impact

In 2010 American women spent $992,432,214 on breast augmentations and another $49,589,719 on implant removals (table 5). Costs for breast surgery with a medical indication, like malformations or after breast cancer, are covered by health insurance. A breast reconstruction costs about $7,000 on average in the United States. This adds up to a total of around $650,000,000 per year in the U.S.. With an average of $7,500 per breast reduction the overall costs per year in the U.S. are $620,000,000. These numbers show the high socioeconomic impact of breast surgery. Unfortunately, from other countries outside the United States, there are no reliable data available.

Breast reduction is generally considered to be a reconstructive procedure and may be covered by the health insurance when it is performed to relieve medical symptoms. Although reduction mammoplasty is defined as being reconstructive in nature, the general public and many medical professionals consider reduction mammoplasty to be more a cosmetic than a functional operation. As a result, insurers do not accept that symptomatic macromastia is a significant health burden. Unfortunately, denials of insurance coverage and policy exclusions for breast reduction are becoming increasingly common in Europe as well as in the United States, and the justification for outright rejection of funding is often unknown. Although previously published longitudinal studies showed that reduction mammoplasty will reliably provide the desired improvement in all symptoms and in the quality of a woman’s life, discussion is ongoing about whether reduction mammoplasty is a cosmetic or reconstructive procedure.

Table 5: 2010 Average surgeons fee per type of cosmetic procedure in the United States

<table>
<thead>
<tr>
<th>COSMETIC SURGICAL PROCEDURES</th>
<th>NATIONAL AVERAGE SURGEON/PHYSICIAN FEE</th>
<th>TOTAL EXPENDITURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast augmentation (Augmentation mammoplasty)</td>
<td>$3,351</td>
<td>$992,432,214</td>
</tr>
<tr>
<td>Breast implant removals (Augmentation patients only)</td>
<td>$2,288</td>
<td>$49,589,719</td>
</tr>
<tr>
<td>Breast lift (Mastopexy)</td>
<td>$4,707</td>
<td>$378,319,268</td>
</tr>
<tr>
<td>Breast reduction in men (Gynecomastia)</td>
<td>$3,013</td>
<td>$55,068,560</td>
</tr>
<tr>
<td>Buttock implants</td>
<td>$4,500</td>
<td>$3,627,000</td>
</tr>
<tr>
<td>Buttock lift</td>
<td>$4,379</td>
<td>$1,402,242</td>
</tr>
<tr>
<td>Calf augmentation</td>
<td>$3,000</td>
<td>$1,630,335</td>
</tr>
<tr>
<td>Cheek implant (Malar augmentation)</td>
<td>$2,799</td>
<td>$22,344,369</td>
</tr>
<tr>
<td>Chin augmentation (Mentoplasty)</td>
<td>$2,000</td>
<td>$24,154,000</td>
</tr>
<tr>
<td>Dermabrasion</td>
<td>$1,200</td>
<td>$82,933,200</td>
</tr>
<tr>
<td>Ear surgery (Otoplasty)</td>
<td>$3,054</td>
<td>$91,165,625</td>
</tr>
<tr>
<td>Eyelid surgery (Blepharoplasty)</td>
<td>$2,628</td>
<td>$500,328,829</td>
</tr>
<tr>
<td>Facelift (Rhytidectomy)</td>
<td>$6,231</td>
<td>$703,695,632</td>
</tr>
<tr>
<td>Forehead lift</td>
<td>$3,161</td>
<td>$134,114,530</td>
</tr>
<tr>
<td>Hair transplantation</td>
<td>$4,676</td>
<td>$88,819,252</td>
</tr>
<tr>
<td>Lipo augmentation (other than injectable materials)</td>
<td>$1,695</td>
<td>$29,849,962</td>
</tr>
<tr>
<td>Liposuction</td>
<td>$2,884</td>
<td>$585,668,787</td>
</tr>
<tr>
<td>Lower body lift</td>
<td>$7,247</td>
<td>$69,752,647</td>
</tr>
<tr>
<td>Nose reshaping (Rhinoplasty)</td>
<td>$4,306</td>
<td>$1,086,142,208</td>
</tr>
<tr>
<td>Pectoral implants</td>
<td>$5,810</td>
<td>$845,811</td>
</tr>
<tr>
<td>Thigh lift</td>
<td>$4,507</td>
<td>$411,917,665</td>
</tr>
<tr>
<td>Tummy tuck (Abdominoplasty)</td>
<td>$5,130</td>
<td>$596,055,062</td>
</tr>
<tr>
<td>Upper arm lift</td>
<td>$3,729</td>
<td>$56,619,969</td>
</tr>
</tbody>
</table>
Definition of Beauty

Beauty is a characteristic of a person, animal, place, object, or idea that provides a perceptual experience of pleasure, meaning, or satisfaction. An “ideal beauty” is an entity, which is admired or possesses features widely attributed to beauty in a particular culture, for perfection. In its most profound sense, beauty may engender a salient experience of positive reflection about the meaning of one’s own existence\textsuperscript{116}.

The characterisation of a person as “beautiful”, whether on an individual basis or by community consensus, is often based on some combination of inner beauty, which includes psychological factors such as personality, intelligence, grace, politeness, charisma, integrity, congruence and elegance, and outer beauty which includes physical attributes which are valued on a subjective basis. Bodily beauty can be defined as the deeply pleasurable experience of someone else’s or one’s body.

The origins of interest in bodily beauty were explained by Sigmund Freud, the founder of modern psychology, as being sexual drives: through a transformation, sexual attraction is moved away from the primary sexual characteristics (reproductive organs) and instead to the secondary sexual characteristics (e.g. women’s more rounded forms and breasts)\textsuperscript{117}. Therefore many women regard breasts as an important female secondary sex characteristic, and a factor in the sexual attractiveness and a woman’s beauty.

Beauty presents a standard of comparison, and it can cause resentment and dissatisfaction when not achieved. People who do not fit the “beauty ideal” may be ostracised within their communities\textsuperscript{109}. The media play an important role in constantly presenting a specific “beauty ideal”. This perpetration of beauty standards has an immense effect on women’s body image and self esteem. Due to the resulting body image dissatisfaction more and more women are seeking plastic surgery to influence their beauty and therefore body image and self esteem.

Definition of Health

According to the WHO\textsuperscript{110} “Health is a state of complete physical, mental, and social well being and not merely the absence of disease or infirmity”.

In case of breast cancer the impairment of health is without doubt. The patients face a potentially life-threatening disease on one hand, on the other hand they have to deal with a resulting disfigurement of their body. Both, their physical, as well as their mental health are impaired.

In other disfigurements of the breast, like hypertrophy of the breast or congenital deformities, the influence on physical health is less clear, while the disturbance of mental health by impairment of body image and self-esteem is more likely.
The question if the indication for breast surgery is of medical or more mental nature is important regarding the insurance coverage of the costs. Medical insurances exclude cosmetic procedures from coverage even though they might have an impact on the patients mental health. While breast augmentations for aesthetic reasons are purely cosmetic, the corrections of i.e. congenital deformities or breast hypertrophy are being discussed.

Another aspect of breast surgery is, that it might also have a negative impact on health. All kinds of surgery have a risk of complications, which might impair the physical as well as the mental health. In contrary a mental health disorder like body dysmorphic disorder might cause a disturbed self-perception. In this case surgery would not cure the disease but might even increase the underlying problem (fig. 4)

Aims and outline of this thesis

Breast surgery might result in improvement of physical and mental health of women. However, in contrary it might also impair physical and mental health due to complications or negative side effects.

Therefore the aim of the study was to illuminate different factors influencing the impact of breast surgery on women with regards to health and beauty.

Summary of the main questions of this thesis

1. What is the impact of breast weight on the psychological and physical morbidity of women?
2. What are the complications after reduction mammoplasty and how much is this influenced by the smoking habit of the patients?
3. What is the impact of breast reconstruction on mental health and social well being of the patients?
4. Does breast reconstruction by use of autologous tissue from the abdomen impair patient’s physical health?
5. Does the choice of breast reconstruction make a difference on postoperative patient satisfaction or physical and mental health?
6. What is the role of MRI in implant rupture detection?
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