Breast Disorders

27

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27.1 Introduction

Breast anomalies in the pediatric population are not uncommon [1]. Until a short time ago, patients usually presented at the end of puberty, but in the current cultural environment, they address earlier to the surgery. These physical deformities are often a significant source of psychological distress for adolescent male and female patients, who feel alienated from their peers [2]. For this reason we should ideally correct these disorders before they become a significant psychosocial problem for the patient.

Breast deformities in the pediatric population represent a significant challenge for the reconstructive surgeon, who must respect the physiology and normal growth of the mammary gland, providing at the same time a satisfactory esthetic and functional outcome. Accurate diagnosis and counseling should be provided and the timing of surgery planned to optimize functional, psychological and esthetic outcomes, thereby alleviating the sense of deformity and unattractiveness that is often present.

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27.2 Embryology and Anatomy

Development of the breast begins during the seventh week of gestation from ectodermal cells along the "milk lines" or primitive mammary ridges, extending along both sides of the body, from the axilla to the groin. By the tenth week of gestation, the main part of the mammary line disappears. However, a small part invaginates in mesenchymal tissue at the level of the fourth interspace. It forms 16–24 sprouts, evolving into solid buds. The epithelial sprouts are canalized and form the lactiferous ducts, whereas the buds form the small ducts and alveoli of the gland. Initially, the lactiferous ducts open into a small epithelial pit that, shortly after birth, evolves into the nipple [3]. The nipple is located at the fourth intercostal space in men and women before puberty. At the onset of puberty, hormonal influence results in breast-tissue growth. Puberty begins at 10–12 years as a result of hypothalamic gonadotropin-releasing hormones secreted into the hypothalamic–pituitary portal venous system. The anterior pituitary secretes follicle-stimulating hormone (FSH) and luteinizing hormone (LH). FSH causes ovarian follicles to mature and secrete estrogens. Estrogens stimulate the longitudinal growth of the breast ductal epithelium. As ovarian follicles become mature and ovulate, the corpus luteum releases progesterone

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which, in conjunction with estrogen, leads to complete development of the mammary glands [4].

Tanner describes five stages of breast development [5]:

- stage 1: pre-adolescent elevation of the nipple, but no palpable glandular tissue or areolar pigmentation;
- stage 2: glandular tissue in the infra-areolar region; nipple and breast project as a single mound;
- stage 3: further increase in glandular tissue with enlargement of the breast and nipple but a continued contour of the nipple and breast in a single plane;
- stage 4: enlargement of the areola and increased areolar pigmentation with secondary mound formed by the nipple and areola above the level of the breast;
- stage 5: final adolescent development of a smooth contour with no projection of areola and nipple.

27.3 Clinical Features

A multidisciplinary team (including a pediatrician, psychologist and endocrinologist) should evaluate any child for general and sexual development to exclude instances of precocious puberty or delayed appearance of secondary sexual characteristics. The plastic surgeon must also define the involved anatomy: musculature of the chest wall and breast position on the chest wall; size, shape, proportion, consistency, definition, symmetry and skin features of the breast [6].

27.4 Classification

Several classifications for breast anomalies have been proposed. Sadove and van Aalst identified three categories: hyperplastic, hypoplastic and deformational [1]. Pryor and Lehman added a further category: acquired anomalies [7]. We propose a simpler and more practical classification that identifies two categories of breast anomalies: congenital and acquired.

27.4.1 Congenital Anomalies

27.4.1.1 Supernumerary Nipples (Polythelia)

Polythelia is the most frequent breast disorder in the male and female pediatric breast. The prevalence is 0.22–5.6% and is dependent upon sex, ethnic group and geographical area [8, 9]. This condition can be associated with nephro-urologic defects [10, 11]. Accessory nipples can occur more frequently in the axillary region and inframammary region, but also anywhere along the mammary line (Fig. 27.1). The differential diagnosis is with pigmented lesions. Treatment is resection.

27.4.1.2 Supernumerary Breasts (Polymastia)

This condition occurs if a residual original mammary line develops into a complete breast. The presence of a supernumerary mammary gland can occur anywhere along the embryologic milk line [3] (Fig. 27.1). An inframammary breast is often confluent with the lower pole of the primary breast, with or without an associated nipple–areola complex. This condition can occur as an isolated finding or be associated with congenital renal anomalies. It can appear sporadically or with a familial recurrence [12]. The diagnosis is made by clinical evaluation. Treatment is excision of the ectopic tissue because of the possibility of breast cancer. Extreme caution should be taken when excising ectopic tissue in this region in patients with developing breasts to avoid a breast deformity (especially at the lower pole).

27.4.1.3 Inverted Nipple

An inverted nipple is a congenital or acquired anomaly in which the nipple, instead of pointing outward, is retracted into the breast. It is a relatively common esthetic problem present-

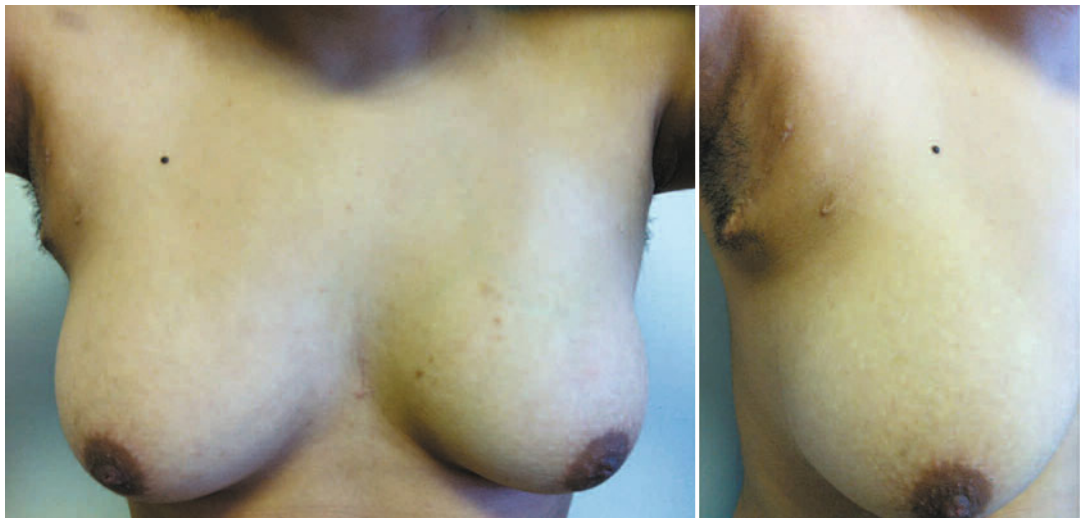

Fig. 27.1 This patient presented with bilateral polymastia and polythelia. She underwent surgery but was concerned about the superior scar and wanted excision of the polythelia

ing to a plastic surgeon (1.77–3.26%) [13]. After a few months of life, the nipple cannot evert because of the failed proliferation of mesenchymal tissue around the lactiferous ducts. This breast anomaly is classified into grades 1, 2, and 3 based on the following parameters: feasibility of keeping the nipple everted after traction; degree of fibrosis; damage caused to the lactiferous ducts. It causes three types of problems: esthetic; hygienic (due to repeated irritation and inflammation); functional (difficulty in breast feeding). Nevertheless most patients seek intervention because of the abnormal appearance.

Several surgical procedures have been described, suggesting that no procedure is universally successful. They can be divided into two main groups based on invasiveness. The first (less invasive) includes some procedures that: preserve the lactiferous ducts; do not require special postoperative care; leave minimal scars; do not affect the sensitivity and function of the nipple. For these reasons they are bettered suit to young patients. In this group, one procedure involves releasing the fibrous tissue around the lactiferous ducts and keeping the nipple in the everted position with a bolster suture and milk-suction pump [14] (Fig. 27.2). The other procedures employ local dermal flaps of different shapes: triangular [15], rhomboid [16] V–Y [17] and star-shaped [18].

In more severe cases (second group), to avoid recurrence and to obtain the perfect shape of the nipple, it is necessary to section the galactophorous ducts and surrounding fibrous tissue through a periareolar incision. These techniques lead to a lack of nipple function and are better suited to older patients [19, 20].

27.4.1.4 Poland Syndrome (PS)

PS is a congenital unilateral anomaly of the thoracic wall characterized by a variable degree of hypoplasia or agenesis of the pectoralis major muscle (particularly the sternocostal head), pectoralis minor muscle, breast, nipple, subcutaneous fat, axillary hair, with or without rib and upper-limb anomalies [21, 22]. The epidemiology, etiology and pathogenesis are reviewed in Chapter 26. S presents a wide spectrum of anomalies and severity varies greatly among individuals (Fig. 27.3). In female patients, a certain degree of breast anomaly is always described, ranging from a mild breast asymmetry to complete agenesis with absence of breast and nipple. An association with tuberous breast may be present. The diagnosis is based on the

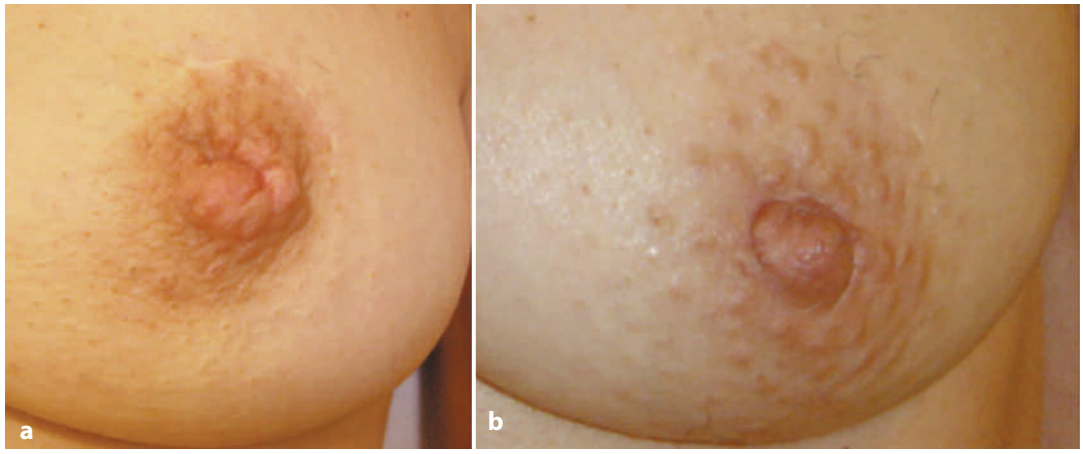

Fig. 27.2 Inverted nipple before surgery (**a**). Same patient 2 years after surgery with a less invasive procedure (**b**) (courtesy of Dr Maria Stella Leone)

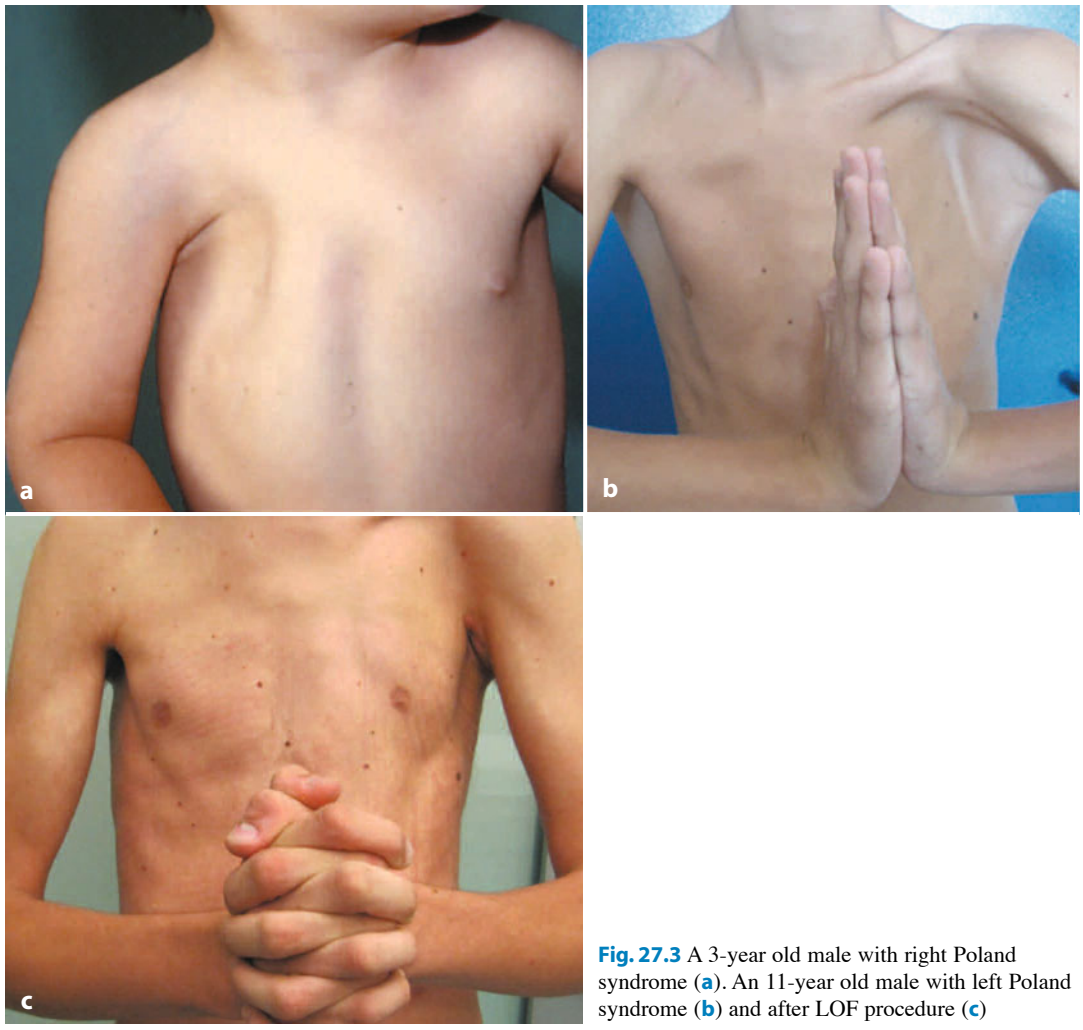

Fig. 27.3 A 3-year old male with right Poland syndrome (**a**). An 11-year old male with left Poland syndrome (**b**) and after LOF procedure (**c**)

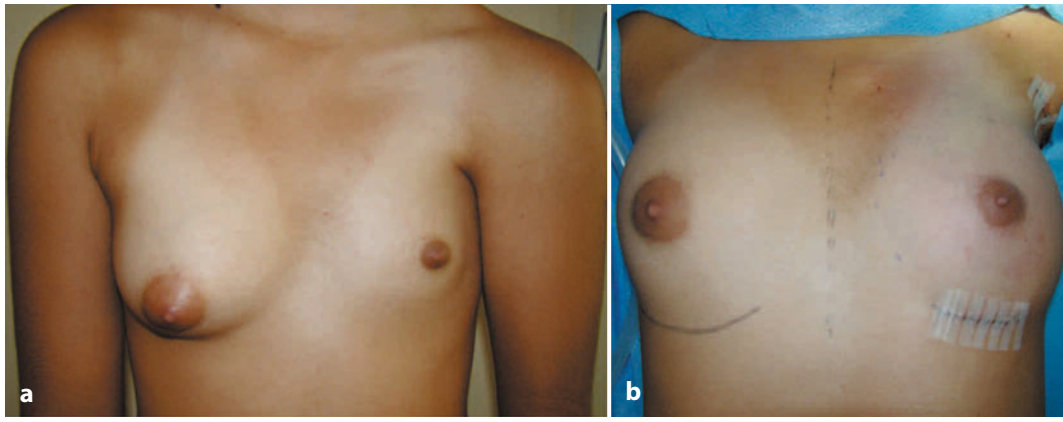

Fig. 27.4 A 15-year-old patient with PS before surgery (**a**). Same patient immediately after surgery with a LOF (**b**)

hypoplasia or absence of the pectoralis major muscle as revealed clinically and by imaging (ultrasonography, computed tomography (CT) of the thorax).

In the case of rib agenesis, chest reconstruction is described elsewhere within this book. Breast reconstruction in PS is particularly challenging for the plastic surgeon, who must tackle the paucity of fat and skin tissue as well as the absence of a muscular plane giving support to the implant. For this reason the use of prosthesis alone in most cases does not guarantee an optimal result. Many procedures have been utilized for the reconstruction of PS: muscular flaps; pectoral and breast implants; fat transfer; and omentum flap.

Muscular flaps include the latissimus dorsi flap (LDF) or rectal abdominal flaps. Although LDF reconstruction can give satisfactory results, providing muscular, fat and skin tissue to the breast area from the posterolateral thorax, it presents several disadvantages [23]. These include the: invasiveness of the procedure; resulting visible scar; removal of one of the major muscles of the shoulder and arm; possible loss of function of the donor muscle; risk of secondary atrophy. Moreover, the latissimus dorsi muscle is not always well represented in PS [24, 25] so the procedure is not always feasible. In an attempt to improve the esthetic result, some authors have proposed minimally invasive harvesting of the muscular flap using endoscopic methods [26].

Surgical correction in males includes the LDF, pectoral implants and, ultimately, fat transfer (lipofilling and lipostructure) carried out with the Coleman procedure [27]. This procedure, in mild-to-moderate cases, gives very good results after 2–3 sessions of lipofilling and is almost complication-free. Our research team is carrying out two-step surgery: (i) expansion of the skin using a tissue expander and (ii) replacing the tissue expander with fat transfer and pectoral implants when necessary. We have obtained satisfactory results.

In female patients, breast reconstruction is particularly challenging because of a cranial defect of the pectoralis muscles and partial/complete breast agenesis. The therapeutic alternatives include positioning a breast implant (generally associated with a rotational LDF to fill the infraclavicular defect) or a fat transfer in the pectoral region alone or associated with an implant. Recently, a laparoscopically harvested omental flap (LOF) has been described by two surgical teams [28, 29]. The first research team described breast reconstruction in adults with PS [28]. However, Morovic, in cooperation with our research team, also showed the feasibility of this procedure in teenagers [29]. Our indication for using a LOF is breast hypopla-

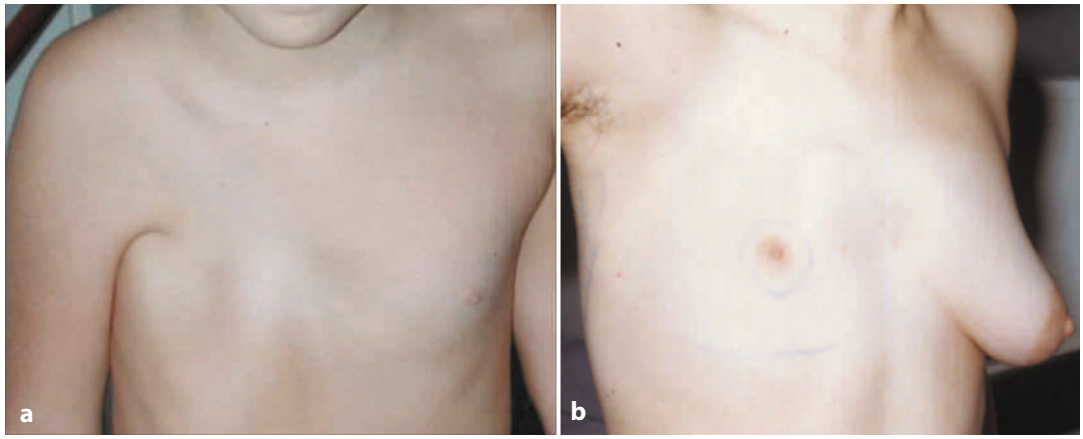

Fig. 27.5 Amastia in a 7-year-old patient with PS (**a**). Amazia in a 15-year-old patient with PS (**b**)

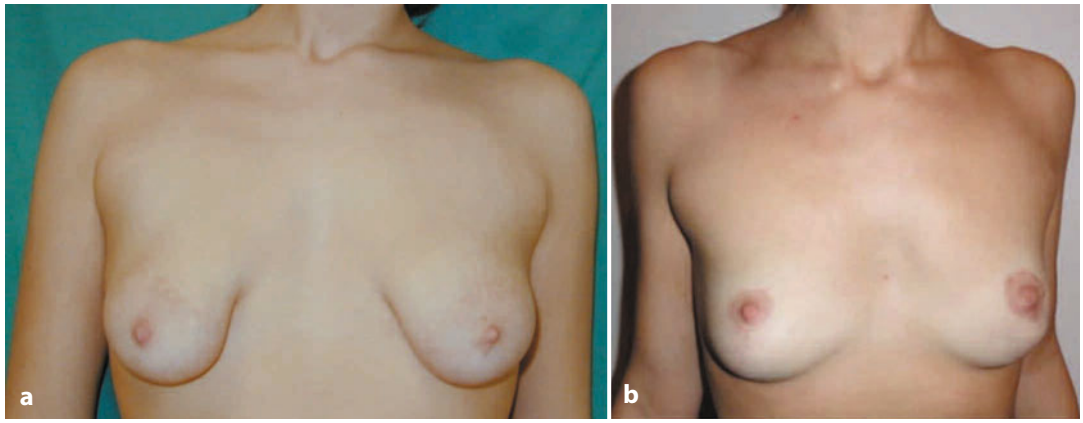

Fig. 27.6 A 17-year-old patient with a tuberous breast before surgery (**a**). Same patient 5 years after the Muti procedure without a breast implant (**b**)

sia without rib anomalies in patients with contralateral breasts reaching Tanner grade 4 or 5 (Fig. 27.4).

27.4.1.5 Amastia

Amastia is the absence of the breast and nipple–areola complex. It is a rare condition, wherein in normal growth of the breast and nipple does not occur because of a complete failure of mammary line development at 6 weeks of life. It has a male to female ratio of 1:5.

Amastia is usually unilateral and often associated with PS (Fig. 27.5a). Bilateral cases have been described making part of several syndromes [30–32]. The differential diagnosis is with amazia (absence of the breast but the nipple–areola complex (NAC) is present; Fig. 27.5b). The diagnosis is clinical at birth and at puberty.

Three-stage surgery is usually employed: At first, a gentle expansion of the skin using a tissue expander is carried out. Then a breast implant or fat transfer can replace the tissue expander. Finally the NAC is reconstructed with skin grafts or local flaps [33].

27.4.1.6 Athelia

Athelia is the absence of a nipple. It can be associated with breast hypoplasia or unilateral amastia in PS (Fig. 27.5a) or bilaterally in

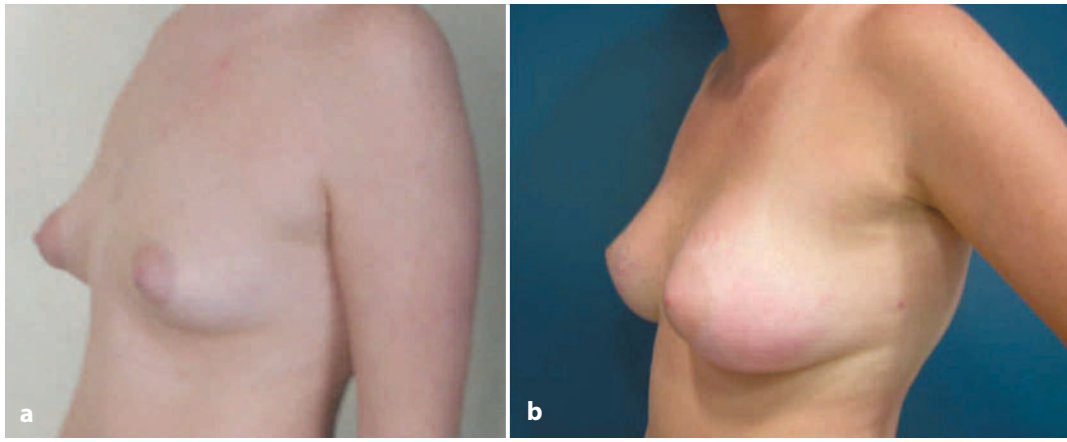

Fig. 27.7 A 16-year-old patient with a tuberous breast before surgery (**a**). See the alteration of the breast profile, which is typical of a tuberous breast. Same patient 1 year after the Muti procedure with a breast implant (**b**). The corrected breast profile is anatomical

association with abnormal development of the skin, teeth, nails and sweat glands like an ectodermal dysplasia [30, 34]. Treatment is reconstruction of NAC using skin grafts from the contralateral complex or a local flap.

27.4.1.7 Tuberous Breast

The term "tuberous breast" was first used by Rees and Aston in 1976. They described a congenital defect featured by the absence of a superficial layer of Camper's fascia in the area below the areola; however the superficial fascia was very thick in the lower pole of the breast. As a result, a ring around the NAC is formed that impairs normal development of the breast. The absence of the fascial layer results in a "zone of least resistance" so that the breast can herniate towards the NAC. The Muti classification [35] distinguishes three categories of defect:

- type I: the mammary parenchyma is herniated into an expanded areola containing the small ptosic breast; a cranial inframammary crease, tight and defined by a fibrotic ring surrounding a small base gland in a lateral position in the chest wall (Fig. 27.6);
- type II: An extreme breast ipoplasia with "solid skin", small areola; retro-areolar and sub-areolar gland protrusion that creates a typical deformity of the breast profile (Fig. 27.7); a flat lower pole with an almost non-existent inframammary crease;
- type III: Usually these are breasts of a morphological "tubular" type, the NAC points downward and there is a reduced NAC–inframammary crease distance; the position of the breast is not excessively lateral.

A tuberous breast may appear during puberty. It can be unilateral or bilateral and can affect the two breasts with different types. It is one of most serious breast deformities, causing profound psychological distress. Previously, surgical treatment was at an adult age, when development of the glandular tissues was complete, but now surgeons operate earlier [35]. The deformity is one of the most challenging congenital breast anomalies, and surgery should correct the multiple breast defects. Placement of an implant does not improve the appearance of a tuberous breast. To correct it, the surgeon must transform the hypoplasic tuberous breast into simple hypoplasia. That is: releasing the NAC from its constrictive envelope; replacing it in the right place in the chest; relocating the inframammary crease; and reducing the areolar diameter significantly without discarding gland tissue.

Two surgical methods appear to be sufficiently flexible to correct the various defects of this deformity. One method, described by

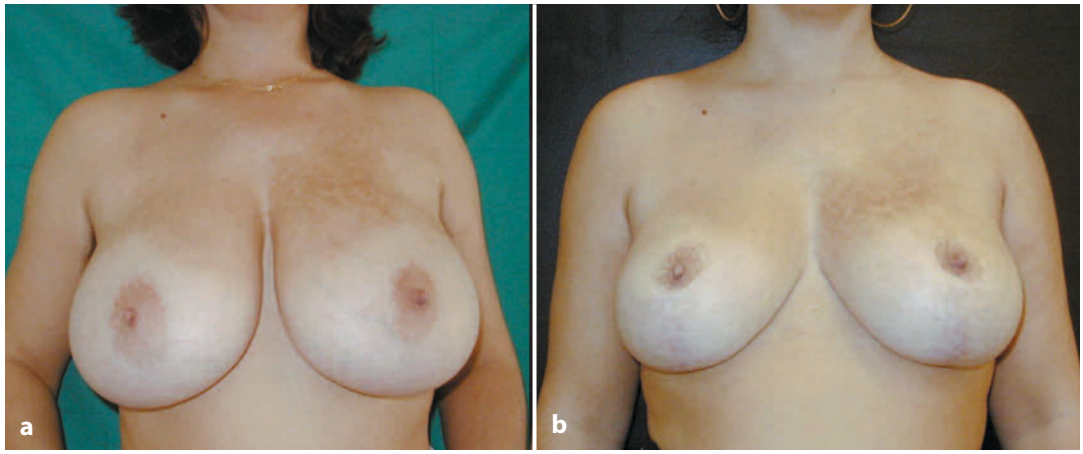

Fig. 27.8 An 18-year-old patient before surgery (**a**). Same patient 4 years after bilateral reduction mammaplasty (800 g for each side) (**b**)

Botti [36], proposes partial removal of the periareolar skin, the undermining of the lower portion of the breast from the skin as well as from the chest and the incision on the deep surface of the gland so that the gland can be freed and widened towards lower quadrants. A prosthesis, usually anatomically shaped, is placed in the suprapectoral space.

Another method, by Muti [35, 37], contemplates the use of a rhomboid glandular flap whose apex is above the nipple, carved in the middle of the lower pole of the gland and inferiorly tilted. The flap shape allows simultaneous reduction of areolar diameter. In this case too, surgery ends with placement of a breast implant (Fig. 27.7) anatomical or round-shaped. The latter versatile method has allowed us, in selected cases, to correct the deformity without the use of breast prostheses (Fig. 27.6b).

27.4.2 Acquired Anomalies

27.4.2.1 Juvenile Hypertrophy

Juvenile gigantomastia is a benign disorder of the breast which is rare. It is characterized by massive enlargement of one or both breasts in otherwise healthy adolescent girls. The etiology of this disorder remains unclear. To establish the diagnosis, all the other causes of gigantomastia must be excluded. Drug-induced gigantomastia (due to D-penicillamine, neothetazone, cycloprosin or protease inhibitors) must be ruled out. Pregnancy tests and serum levels of estrogen, progesterone, prolactin, and gonadotropins should be normal, as should urinary levels of 17-keto- and 17-hydroxysteroids (which are related to adrenal dysfunction). Juvenile gigantomastia is not associated with hormonal disorders. Imaging studies can rule out tumors such as fibroadenoma, juvenile cystosarcoma phyllodes, and malignant breast carcinoma (including lymphoma and sarcoma).

Endocrine therapy alone is rarely successful. Sometimes, after reduction mammaplasty, it is possible to observe recurrent hypertrophy. Indeed, juvenile gigantomastia is prone to recurrence, and several studies suggest that subcutaneous mastectomy provides definitive treatment. Other authors advocate the association of tamoxifen and reduction mammaplasty (Fig. 27.8) to obtain stable results. The age to treat these patients is very variable (13–14 years to 17–18 years) and is dependent on psychological discomfort. However, some authors suggest that only older patients can be treated definitively with reduction surgery alone [38].

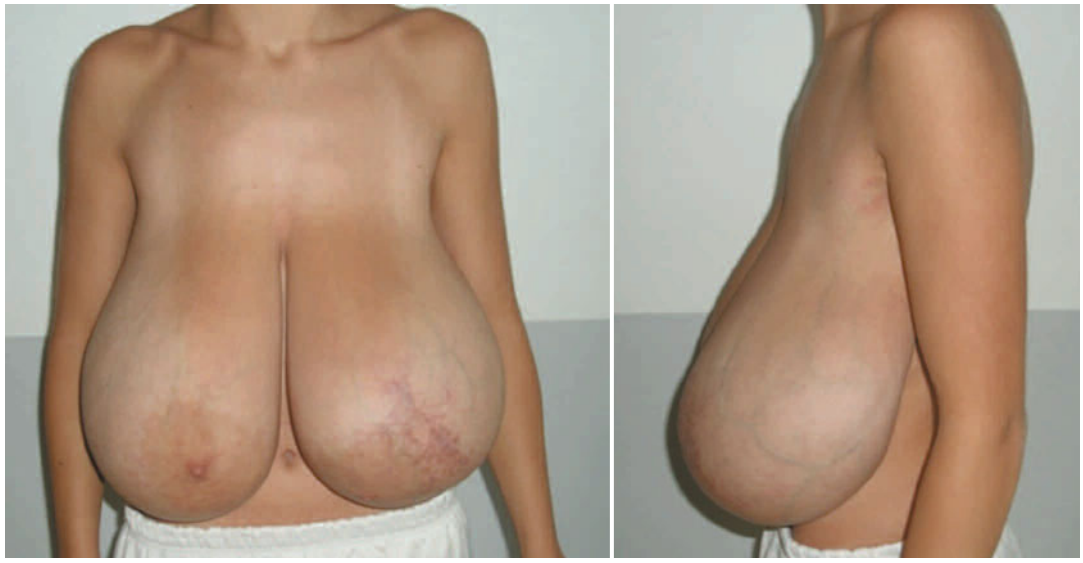

Fig. 27.9 A 17-year-old patient with gigantomastia. Almost all the breast tissue was replaced with fibroadenomas

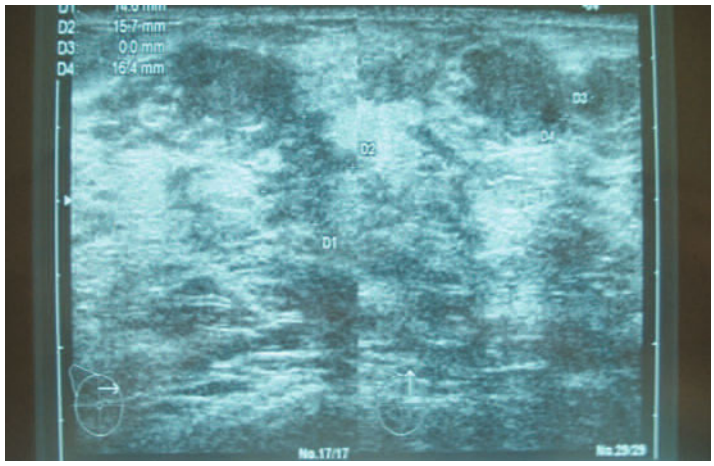

Fig. 27.10 Ultrasonography of the breast showing multiple hypoechoic masses with smooth margins and partially lobulated margins

27.4.2.2 Gigantomastia (Fig. 27.9)

The causes of macromastia in pubertal and para-pubertal females vary. They include endocrine changes and childhood obesity; sometimes idiopathic forms are possible. It is important to know the etiologies and pathophysiology to make a precise diagnosis and consider the true surgical indication *versus* medical treatment. The body mass index (BMI) should be recorded every time a patient is applying for breast reduction; the BMI is >30 in most cases. These patients should be referred to a dietician before surgery to avoid the recurrence. The main symptoms are: pain in the neck, back, and/or shoulder; intertrigo, shoulder grooving. Many patients complain of difficulty in finding brassieres and participating in sports activities; social distress is also a problem. Preoperative evaluation with ultrasonography is essential to assess glandular tissue (Fig. 27.10).

Gigantomastia is often associated with

Table 27.1 Etiologic factors for gynecomastia

• Idiopathic (most common);
• Physiological (neonatal): circulating maternal estrogens *via* placenta
• Pubertal: relative excess of plasma estradiol *versus* testosterone
• Age: decrease in circulating testosterone, peripheral aromatization of testosterone to estrogen
• Pathological: cirrhosis, adrenal tumors, hyperthyroidism, adrenal hyperplasia, congenital or acquired hypogonadism, testicular tumors
• Pharmacological: marijuana, calcium-channel blockers, spironolactone, cimetidine, ketoconazole, anabolic steroids

severe breast ptosis. We evaluate the distance between the sternal notch and NAC before implementing the chosen breast reduction procedure. The vitality of the NAC is dependent upon its vascular supply. Our first choice is the superior pedicle because of its reliability and long-term results.

If the amount of breast tissue to be removed is >500 g for each side, we can use inferior pedicled reduction mammaplasty. In some selected cases (especially if the normal parenchyma is replaced partially or completely with benign neoplasms such as fibroadenomas) the amputation–graft procedure can be used after careful explanation of the disadvantages to the patient and parents.

27.4.2.3 Gynecomastia

Gynecomastia is benign, excessive development of the male breast. The overall incidence is 32–36% (≤40% in autopsy series). Up to 65% of adolescent boys are affected. It usually develops during mid-puberty (14 years) and is self-limiting, with an average duration of 1–2 years. During middle age, approximately 30–36% of men develop gynecomastia, with the prevalence gradually increasing to >70% in the seventh decade. It is bilateral in 75% of cases. In unilateral cases, the right side is affected more often that the left side. Sometimes, it is the symptom of other, more severe disorders such as hermaphroditism, testicular tumors and Klinefelter's syndrome.

The etiology of gynecomastia is multifactorial and is most commonly idiopathic. However, the pathophysiological mechanism involves a relative or absolute excess estrogen action, decreased levels of circulating androgens, or a defect in androgen receptors [39]. The potential causes of gynecomastia are detailed in Table 27.1 [40].

The histological classification of gynecomastia is according to the degree of stromal and ductal proliferation [41]:

- florid: increased budding ducts and cellular stroma;
- intermediate: overlapping florid and fibrous patterns;
- fibrous: extensive fibrosis of the stroma with little ductal proliferation.

The proliferation of ductal and stromal tissues leads to increased breast volume. If this lasts >1 year, fibrosis and hyalinization prevail over epithelial growth. In these cases, surgery can become an irrevocable option. The risk of malignant transformation is real only in patients with Klinefelter's syndrome (1:1,000 cases to 1:400).

The classification of gynecomastia by Simon and colleagues [42] distinguishes three degrees of illness. In our opinion, it is a very useful clinical classification that supports treatment planning. In the first degree, a minimal increase in breast volume is evident. In the second degree, breast volume is increased significantly with cutaneous excess. In the third degree, a significant increase in breast volume leads to a variable degree of ptosis.

With regard to the diagnosis, initial evaluation involves differentiation between fatty tissue, increased mammary tissue and tumor. Pseudogynecomastia is a bilateral increase in

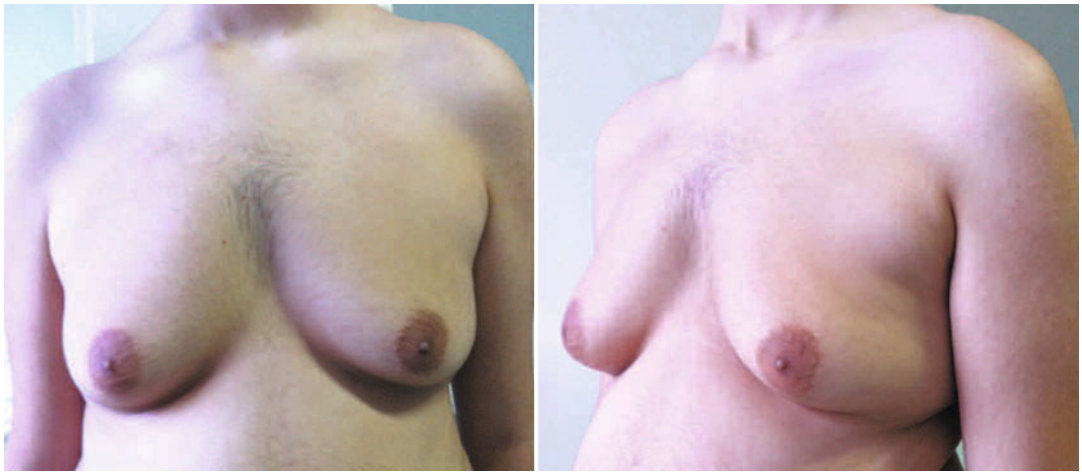

Fig. 27.11 A 14-year-old patient with Klinefelter's syndrome and severe gynecomastia

male breast size resulting from fat tissue. There is no hyperplasia of breast tissue. A complete physical examination must investigate: breast ptosis; skin excess; lack of male hair distribution; and feminizing characteristics. Testicular palpation is vital in patients with gynecomastia to rule out testicular tumors. Imaging studies such as mammography and/or ultrasonography, are useful. Biopsy may be applied in some cases (especially in Klinefelter's syndrome). Endocrine evaluation must be carried out before surgical treatment.

During adolescence, treatment should be postponed because gynecomastia can regress spontaneously. The choice between surgical approaches must be made with the help of clinical classification. Several procedures have been advocated to correct the different clinical aspects depending on the severity, ptosis and amount of fat tissue in the pectoral region. That is, periareolar or intra-aerolar incisions; all types of dermal and glandular pedicles for nipple relocation; free nipple grafting; and conventional and ultrasonography-assisted liposuction.

In mild and moderate cases, we usually carry out a mastectomy with a hemi-periareolar incision. In severe cases (Fig. 27.11) a mastectomy with a periconcentrical procedure or free nipple grafting is employed. The most frequently reported complications are: under-resection, over-resection, poor scarring and seromas [39, 43].

27.4.2.4 Synmastia

Synmastia is aberrant communication of the breasts (Fig. 27.12). It is usually a result of (i) technical complications after breast-augmentation surgery caused by over-dissection at the medial side of the pocket, over the sternum, in the subglandular plane or (ii) over-division of the insertion of the major pectoralis muscle along the sternum in the submuscular plane [44]. The most important rules to prevent synmastia are: accurate surgical planning, correct choice of implant size, and appropriate surgical technique. It is difficult to correct synmastia: additional procedures expose the patient to risks, cost, and dissatisfaction.

27.4.2.5 Asymmetry

Breast asymmetry can affect the wellbeing of young females. It is associated in 69% of cases with tuberous breast, whereas the remaining percentage can be due to PS, pectus excavatum, pectus carinatum iatrogenic factors (chest tissue biopsy) and scoliosis; sometimes asymmetry is idiopathic (Fig. 27.13). Correction of breast asymmetry may present a reconstructive challenge, especially in tuberous breasts. Tho-

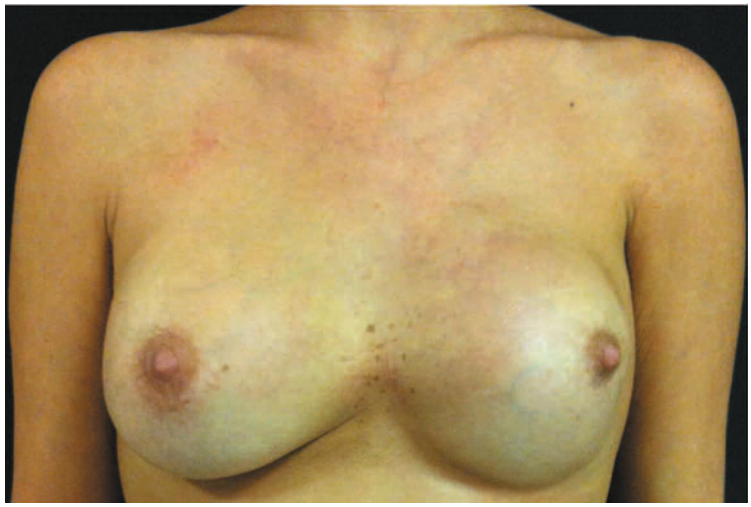

Fig. 27.12 Synmastia. Note the lack of separation or cleavage between the breasts

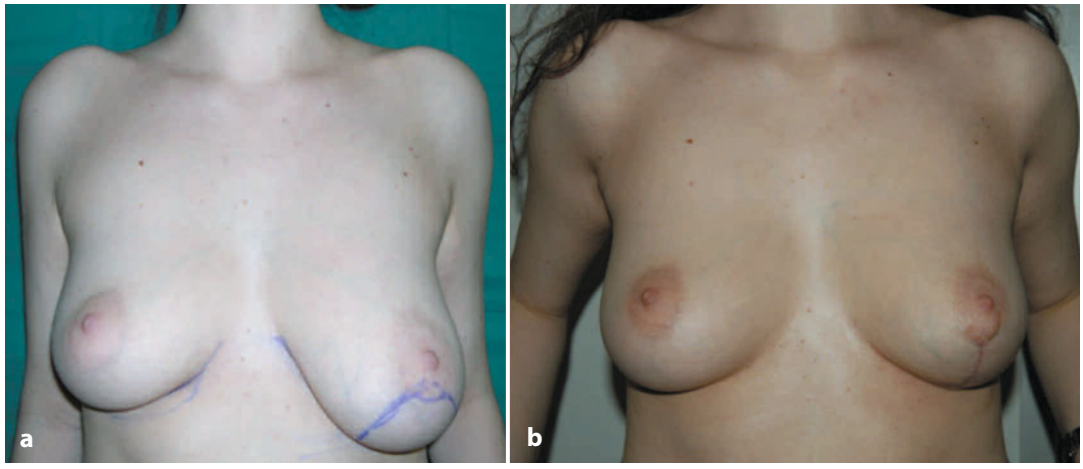

Fig. 27.13 Preoperative view of a 16-year-old patient with moderate asymmetry (**a**). Same patient 5 years after left reduction mammaplasty (**b**). The right breast did not undergo surgery

racic symmetry is the aim. The surgical modalities used include augmentation mammaplasty with or without tissue expansion, parenchymal scoring, NAC reduction, reduction mammaplasty and/or mastopexy.

27.4.2.6 Tumoral Lesions

Other minor diseases include breast atrophy, dysplasia, fibroadenoma, giant fibroadenoma, cystosarcoma phyllodes, intraductal breast papilloma, adenocarcinoma, mastitis, traumatic breast disorders, benign breast disease, fibrocystic change, mastalgia and galactorrhea.

27.4.2.7 Other Defects

Patients with a history of thoracotomy or tumor excision (Fig. 27.14) can present with breast deformities. Surgical procedures should be undertaken with great care in the vicinity of the breast bud. Inadvertent (and even apparently minor) trauma to the bud can result in profound disturbances in the growth and develop-

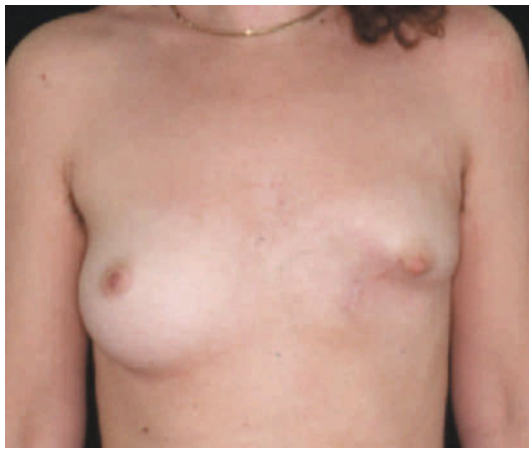

Fig. 27.14 A 16-year-old patient with an iatrogenic sequela of tumor excision at 4 years of age. Note the defect of the lower half of the breast

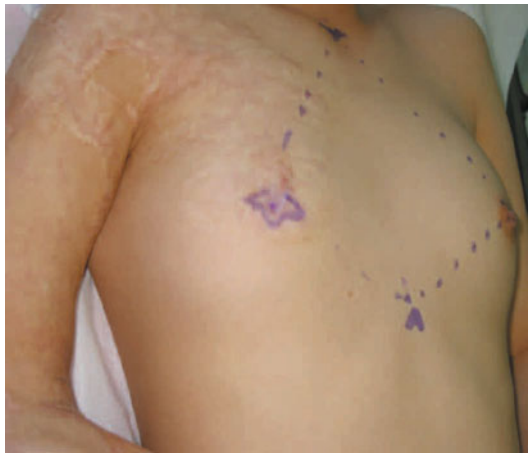

Fig. 27.15 A 12-year-old patient with burn sequelae in the right breast and ipsilateral arm. Reconstruction of the nipple is planned (preoperative design)

ment of the breast. Burns (Fig. 27.15) and traumatic injury can damage the breast bud and interrupt the normal development. All these patients may require breast reconstruction.

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