

Surgical treatment of primary gynecomastia in children and adolescents

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Abstract

Purpose Idiopathic gynecomastia is a common diagnosis in children and adolescents. Though medical treatments reveal potentially harmful side effects, surgical interventions are performable in numerous techniques. In children and adolescents, only minimal evidence exists. This retrospective study presents our experiences with two common surgical techniques, namely subcutaneous mastectomy and combination with liposuction.

Patients and methods This retrospective study included all patients <18 years who underwent surgery due to idiopathic gynecomastia. Height, weight and grade of gynecomastia according to Simon's classification before surgery were reviewed in all patients' files. Additionally, duration of surgery, inpatient stay and postoperative complications were documented. Follow-up examinations were performed with assessment of scar formation, numbness and retraction of the nipple region. Furthermore, patients were asked to report on general satisfaction with surgery (satisfactory/not satisfactory) and esthetic outcome on a numeric scale (1 = good, 6 = bad).

Results 37 patients underwent surgery for verified idiopathic gynecomastia. Grade of gynecomastia was I° in 13.5 % ($n = 5$), II° in 40.5 % ($n = 15$) and III° in 46 % ($n = 17$) of cases. Subcutaneous mastectomy was applied in 11 patients (group I, 30 %) and both subcutaneous mastectomy and liposuction in 26 patients (group II, 70.3 %). Postoperative complications occurred in two patients. Long-term follow-up was performed in 32 patients after a median of 34 months (range 6–96 months). Hypertrophic scar formation was seen in one patient (3 %) and nipple retraction in two patients (5 %). Recurrence of gynecomastia occurred in two patients (5 %). Patient rating was satisfactory in 9 % of cases and esthetic outcome was received with a median of 2.0 (1–5). In comparing both surgical techniques, combination of mastectomy and liposuction revealed better results in every measure except for surgical duration (median 73 vs. 90 min).

Conclusion Surgical correction of gynecomastia remains a purely elective intervention. In contrast to adults, skin in children and adolescents provides high retractability. Therefore, open reduction combined with minimally invasive liposuction was proven useful.

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Introduction

Gynecomastia is defined as the benign enlargement of the male mammary gland and reveals a common clinical diagnosis. Depending on study groups and definition, current literature reports the prevalence as being between 36 and 65 % in adults and 4 and 40 % in adolescents [1–5]. Whereas estrogens stimulate and androgens inhibit breast growth, an imbalance of these two factors is mainly

responsible for the development of gynecomastia. In adolescents, it is mostly idiopathic, although many diseases can potentially be associated. To exclude secondary occurrence, endocrinological and urological diagnostics are subsequently required in cases of unexplained patient history or physical examination. Specifically, ultrasound of the breast and testicles should be performed, and in cases of suspected carcinoma, CT scan or MRI are mandatory. Further diagnostics, such as MRI studies of the pituitary gland or genetic analysis with special focus on sex-chromosomes, may also be requisite if the latter are not declarative for mammary gland hypertrophy [6, 7].

In most cases of primary gynecomastia, there is no absolute indication for treatment, as bodily health and function is not compromised. Furthermore, primary gynecomastia is often temporary, with spontaneous remission occurring in up to 75 % of cases [8, 9]. Particularly in children and adolescents, gynecomastia should only be treated if it causes breast pain or psychological distress such as avoidance of social activities, decreased sense of self-worth or deranged sexual development [10]. Fibrotic conversion of breast tissue is a justifiable indication for therapeutic intervention, as pain is often associated and spontaneous remission is no longer expected.

To overcome gynecomastia, both pharmacological and surgical approaches are feasible. Especially in adolescents, drugs are often regarded as first line in therapy. They are considered comparatively safe and low in side effects [11]. Some of these drugs, like Tamoxifen, were initially developed for breast cancer therapy in adults [12]. Due to competitive inhibition of estrogen receptors, Tamoxifen is utilized for adjuvant therapy of hormone-sensitive breast cancer. Fatigue, hot flashes and night sweats are commonly observed and blood clotting and strokes have been documented [13]. Furthermore, some authors raised concerns about its potential effect on skeletal maturation and predicted adult height due to the interference in hormonal balance [14].

In contrast, surgical intervention is often avoided due to fear of wound infection, postoperative numbness and hypertrophic scar formation. Furthermore, some authors observed recurrence of gland hypertrophy, declaring surgery ineffective.

The aim of this study was to evaluate long-term patient satisfaction and outcome after surgical intervention for gynecomastia in children and adolescents. Furthermore, we compared two distinct yet commonly utilized surgical techniques, namely sole mastectomy and a combination of mastectomy and liposuction.

Patients and methods

Data were collected retrospectively by analysis of patients' files, follow-up exams and patient interviews. Patients' files

were reviewed regarding degree of gynecomastia (Simon's classification [15]), operative technique, relapses and complications (wound healing disorders, revisions, numbness). During the follow-up exams, the condition of the scars, sensibility of the nipples and nipple retraction were documented.

Additionally, patients were asked whether surgery was satisfactory and an explanation for their decision. Finally, patients had to evaluate the esthetic outcome on a scale from 1 to 6 (1 = good, 6 = bad).

All outcome measurements were analyzed in relation to the whole study population who underwent surgery and also distinctly for patients treated with sole mastectomy (group I) or in combination with liposuction (group II), respectively.

Statistical analyses were performed with mean values of Student's *t* test for paired samples. Statistical significance was defined as $p < 0.05$.

All patients gave their written consent to publish photographs and patient data according to the declaration of Helsinki.

Indication for surgery

In all patients, surgery was performed after physical examination and exclusion of secondary causes for gynecomastia by both our institution as well as an independent resident pediatrician. Symptoms mandatory to fortify surgical intervention were persistent/progressive enlargement of breast tissue associated with fibrotic alterations, psychological distress or persistent pain.

Operative technique

All procedures were performed under general anesthesia. For liposuction in combination with subcutaneous mastectomy, the skin was incised with a stab incision laterally and medially in the submammary fold. Through these incisions, tumescence solution (containing sodium bicarbonate, mepivacaine and epinephrine) was instilled. After an exposure time of 30 min, liposuction was performed with a 4 mm cannula in epifascial layers. Afterwards, a 3 mm cannula was used for to precisely contour and provoke subsequent retraction of the skin (Fig. 1).

Sole or additional subcutaneous mastectomy was performed through a caudal semi-areolar incision (i.e., from 3 to 9 o'clock). Cooper's ligaments, which connect the dermis with the pectoral fascia, were transected using either a scalpel or scissors under visual control (Fig. 2). The removal of the hypertrophic glandular tissue was performed step by step and en bloc. It was considered crucial to leave enough tissue beneath the nipple-areola complex to guarantee sufficient perfusion and to prevent subsequent



Fig. 1 Intraoperative view before (*right*) and after liposuction (*left*) of gynecomastia



Fig. 2 Intraoperative view of subcutaneous mastectomy through caudal semi-areolar incision and preparation of Cooper ligaments

scary retraction towards the pectoral fascia. Suction drains were inserted. Skin closure was performed with 4x0 Biosyn® absorbable sutures. After applying steri-strips to the wounds, a compression strap was tightened.

Fat removed by suction was measured and resected tissue was weighed and sent for histological examination. In general, drains could be removed on postoperative day two. Two days after surgery, the compression strap was replaced by a compression garment, which was worn for 4–6 weeks.

Results

Between January 1999 and April 2013, 37 patients under the age of 18 received plastic surgical treatment for bilateral primary gynecomastia. Preoperatively, all patients

were urologically and endocrinologically clarified by their resident pediatrician. 15 patients had previously undergone unsuccessful medicative treatment. All patients complained about a progressive and painful enlargement of the breast. 26 patients (70 %) suffered from pain or tenderness. At the time of surgery, the median age was 16 years (11–17 years). Median weight was 82 kg (53–105 kg), and median height was 180 cm (152–188 cm). Surgical treatment was performed by subcutaneous mastectomy through a caudal semi-circular incision along the areola's border (group I, $n = 11$, 29.7 %) or a combination of mastectomy and liposuction (group II, $n = 26$, 70.3 %). In each case, the surgeon determined the surgical technique based on his personal experience. Resected tissue weighed 47.6 gr. (median 38 gr., range 33–77 gr.) on the right and 48.5 g. (median 44 g., range 30–100 g.) on the left. Average volume of liposuction was 231.7 ml (median 250 ml, range 50–500 ml) on the right and 231.1 ml (median 250 ml, 50–500 ml) on the left. All histological examinations were consistent with gynecomastia and none revealed evidence of malignancy. In three patients of group I (27.3 %) and five patients of group II (19.2 %) additional periareolar mastopexy according to Benelli was necessary (group I, $n = 3$, 27.3 %; group II, $n = 5$, 19.2 %). Regarding Simon's classification, 13.5 % ($n = 5$) showed I°, 40.5 % ($n = 15$) II° and 46 % ($n = 17$) III° gynecomastia. Average grade according to Simon was 2.3° in group I and 2.4° in group II. Mean time of surgery was 87.9 min (median 83.5 min, range 40–162 min). Sole mastectomy was shorter than mastectomy with liposuction [73.8 min (41–98 min) vs. 94.2 min (40–162 min)].

Mean inpatient stay was 4.5 days (median 4, range 3–7 days) with no discrepancy between the two techniques (4.5 days vs. 4.5 days). Two patients (5.4 %), one of each group (group I, $n = 1$, 9.1 %; group II, $n = 1$, 3.8 %) required revision within the first three postoperative days due to hematoma.

Follow-up examinations were performed 37.2 months (range 6–96 months, median 36 months) after surgery. 32 patients (86.5 %) were physically examined and the remaining five patients (13.5 %) were contacted by telephone. In total, 5 of 37 (13.5 %) patients developed long-term complications: two recurrences of gynecomastia (5.4 %), two retractions of the nipples (5.4 %) and one hypertrophic scar formation (2.7 %). Long-term complications were more common in the combined mastectomy and liposuction group (group I, $n = 3$, 27 % vs. group II, $n = 2$, 7.7 %). In this group, three of five patients required additional surgery ($n = 3$; 8.1 %). Bilateral hypertrophic scar formation was found in one patient after sole mastectomy (group I, 9.1 vs. group II, 0 %). Two patients, one of each group, developed unilateral nipple retraction (group I, $n = 1$, 9.1 %; group II, $n = 1$, 3.8 %). Since retraction

Fig. 3 Preoperative photographs of gynecomastia III° (*upper row*) and postoperative results after subcutaneous mastectomy and periareolar mastopexy without liposuction (*lower row*)

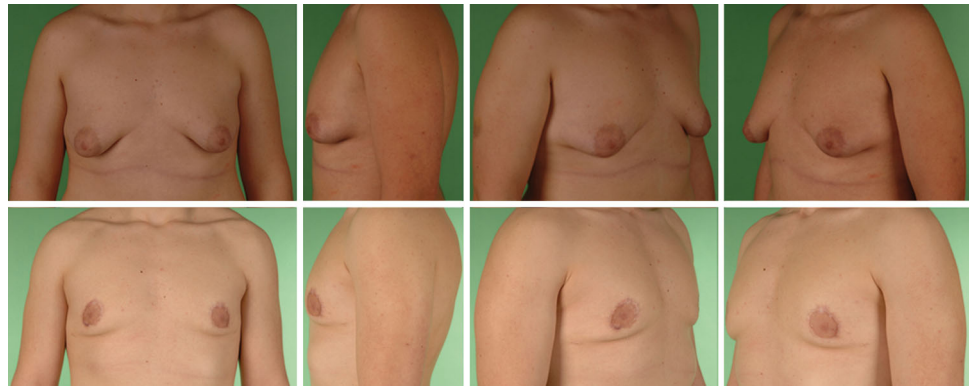


Fig. 4 Preoperative photographs of gynecomastia III° (*upper row*) and postoperative results after subcutaneous mastectomy with liposuction (*lower row*)



did not bother these patients, surgical correction was not necessary. Recurrence of gynecomastia occurred in each group (group I, $n = 1$, 9.1 %; group II, $n = 1$, 3.8 %). For one patient, second intervention was not necessary. The other patient underwent combined liposuction and mastectomy 12 months afterwards and without any complications. None of the patients had sensory deficiencies of the nipple area or pain. Importantly, both postoperative and long-term complications were equally distributed regarding severity of gynecomastia. All patients that suffered from postoperative complications revealed grade 2 gynecomastia and long-term complications occurred in one patient with grade 1, two patients with grade 2 and two patients with grade 3 gynecomastia. Figures 3 and 4 demonstrate pre- and postoperative results of gynecomastia III° after subcutaneous mastectomy with mandatory mastopexy and combination of subcutaneous mastectomy with liposuction, respectively.

With respect to patient satisfaction, four patients (11.1 %) were not satisfied with the surgery in general. One patient complained of hypertrophic scar formation, which was then corrected by serial excision. The remaining three patients were disaffected due to contour deformity, which could not be objectified ($n = 1$) or was the result of persisting fatty tissue ($n = 2$), for which surgical intervention

was not desired by the patient. Interestingly, two of these three disaffected patients belonged to the mastectomy group and two to the combined mastectomy and liposuction group (group I, $n = 2$, 18.2 % vs. group II, $n = 2$, 7.7 %). The esthetic outcome received an average score of 2.0 for both groups. In group I, patients rated esthetic appearance 2.1, while group II rated it 2.0. The esthetic outcome correlated with patient's satisfaction. All patients who were not satisfied with surgery in general, assessed the esthetic outcome with four or worse. None of the results were statistically significant.

Discussion

In general, idiopathic gynecomastia in children and adolescents is a normal phenomenon of puberty, which will disappear within 1–2 years after onset [5]. Therefore, verified idiopathic gynecomastia does not require treatment, but affected children as well as their parents should receive thorough education on the further clinical course. In cases of obesity, children should reduce weight to distinguish the disorder from pseudogynecomastia, which consists mainly of fat as opposed to of hypertrophic glands. Follow-up examinations in 6-month intervals are

recommended, as findings of breast tenderness or pain and psychological stress may indicate a need for therapeutic intervention [10, 16]. Today, there are only few studies on medical therapy of pubertal gynecomastia [11, 17–20]. As treatment aims to restore a non-measurable hormonal imbalance, evidence about the success of medical treatment is difficult to gather and document [6]. For instance, aromatase inhibitors (AI), namely anastrozole or letrozole, inhibit the conversion of androgens to estrogens, and thus are capable of decreasing serum estrogen levels [17]. However, Plourde et al. [20] showed in a randomized, placebo-controlled trial that although testosterone/estrogen ratio significantly increased after AI treatment, breast size was unaffected in 80 adolescent boys.

In contrast, serum estrogen receptor modulators (SERM), for instance Tamoxifen, Raloxifene or Clomiphene, revealed more promising results in recent studies [18]. Initially developed for hormone-sensitive breast cancer therapy, SERMs specifically inhibit estrogen receptors localized in the breast tissue [12]. Side effects are considered low, although fatigue, hot flashes and night sweats are commonly observed and blood clotting and strokes have been documented [13]. Some authors have raised concern about the potential influence on skeletal maturation and predicted adult height due to the interference in hormonal balance [14]. This suspicion is neither proven nor disproven, as randomized controlled trials with adolescents are missing [21]. Most studies had the aim of relieving side effects of anti-androgenic drugs in adults. Thereby, Tamoxifen was recommended in a minimum dosage of 20 mg per day for the whole duration of anti-androgenic therapy until complete regression of breast tissue (approximately 1–4 months) [22]. Compared to radiotherapy, Tamoxifen demonstrated significantly better results, defined as reduction in pain and breast size [23, 24]. Alagaratnam et al. [25] revealed an 80 % regression after 1–4 months of Tamoxifen treatment in 61 adult patients. Side effects were not seen. Derman et al. [18] administered Tamoxifen to 37 adolescent patients with idiopathic gynecomastia. Six patients reported pain and tenderness. After 3–8 months of treatment, reduction in pain and breast size was observed in every patient. Long-term follow-up (mean 4.7 years) of ten patients revealed no side effects except for the recurrence of a palpable breast node in one patient [11]. Even if the previous cases showed promising results, a control group is missing and spontaneous regression of adolescent gynecomastia is feasible during therapy. Considering the scarce evidence lacking placebo-controlled trials and the potential of significant side effects, SERMs are currently not the preferred treatment option for adolescent gynecomastia [26].

In contrast, surgical therapy invites the general risks associated with anesthesia, postoperative complications

and recurrence of breast enlargement. In our study, the postoperative complication rate was 5.4 % due to hematoma in two cases. Recurrence of gynecomastia was observed in two patients (5.4 %), of which one could be successfully treated in a second intervention and the other refused surgery due to lack of psychological strain. Long-term complications occurred in three patients (8.1 %), two with retracted nipples, which were defined by the physician and subjectively irrelevant for the patient, and one with hypertrophic scar formation. The latter especially depends on the type of surgery. Within the last decade, surgical treatment of gynecomastia has evolved considerably. Initially, subcutaneous mastectomy through a trans- or peri-areolar access was the gold standard in treatment of gynecomastia [27]. In 1983, Teimourian et al. [28] introduced minimal-invasive liposuction without skin excision and thus minimized the risk of wound dehiscence numbness and scar formation. This technique was a revolutionary step in case of small amounts of breast tissue [29–32]. Severe gynecomastia, however, could not be treated sufficiently. Therefore, authors recommended liposuction for adipose tissue removal prior to subcutaneous mastectomy or for breast remodeling subsequent to other open procedures [33, 34]. Depending on severity, reduction mammoplasty is also feasible. Laituri et al. [16] demonstrated eight cases of severe gynecomastia in adolescents and successful surgical therapy with reduction mammoplasty in inverted-T technique and inferior pedicle. The inferior pedicle should be favored in male patients, as the thin skin coverage of the male breast would immoderately expose other pedicle locations. Milder grades of gynecomastia, however, can be managed with subcutaneous mastectomy.

The techniques used in our study, namely subcutaneous mastectomy with and without liposuction, do not differ from corresponding techniques in adults and follow the same goal of recreating the male breast shape. There are numerous techniques with different incisional patterns and resulting scar sizes. From a plastic surgeon's point-of-view, the method that leaves the smallest scars should be favored. Thus, liposuction should be the method of choice, because it only requires one or two stab incisions. However, we abandoned the concept of sole liposuction. As it is not feasible to remove glandular tissue and reveals poor long-term outcome due to frequent relapses, which were also demonstrated in other studies [35]. Liposuction alone is only indicated in the rare case of pseudogynecomastia caused by excessive fat deposits minus glandular proliferation.

In this study, we also demonstrated that sole subcutaneous mastectomy reveals no benefits regarding inpatient stay or complication rates. Moreover, a trend towards higher rates of hypertrophic scar formation (9.1 vs. 0 %) and nipple retractions (9.1 vs. 3.8 %) was observable. Consequently, patient satisfaction (72.7 vs. 88.5 %) and

esthetic outcome (2.0 vs. 2.1) were lower compared to combined liposuction. Substantiating our findings, frequency of combined procedures performed in our institution increased over the study period (data not shown).

The combination of both techniques is inevitable as almost all types of gynecomastia consist of both glandular and lipomatous hypertrophy. Typical consequences of the mastectomy, such as depressions in the skin or scarred contractions, can be avoided by radial liposuction. Another advantage of this combined method is that tissue specimens gathered in the open resection can be sent for histopathology. The high retractability of the skin in children and youths after superficial liposuction saved more patients from additional mastopexy procedures (group I, 19.2 % vs. group II, 27.3 %), despite comparable degree of gynecomastia in both groups (Simon's classification; group I, 2.3 vs. group II, 2.4).

Conclusions

Especially in children and youths, most cases of gynecomastia have no absolute indication for therapeutic intervention, as they are temporary and show a high number of spontaneous remissions. Treatment of gynecomastia is reasonable if persisting complaints such as breast tenderness or pain or individual psychological stress on the patient exist. In such cases, a minimally invasive combined approach with open resection and liposuction seems to be the best practice. This milder technique with the integration of liposuction improves the patients' quality of life and decreases the perioperative risk and effort.

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