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A systematic approach to the surgical treatment of gynaecomastia

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SUMMARY. Numerous techniques have been described for the correction of gynaecomastia, and the surgeon is faced with a wide range of excisional and liposuction procedures. There is a paucity of literature describing an integrated approach to the management of this condition and the roles of the different treatment modalities. A review of all gynaecomastia patients operated on by one surgeon over a 2-year period was undertaken. Patient satisfaction was assessed using a linear analogue scale with a maximum score of 10. In total, 48 breasts in 29 patients were treated— 31 breasts by liposuction alone (19 by conventional liposuction, 12 by ultrasound-assisted liposuction), eight breasts by liposuction and open excision, and nine breasts by liposuction, open excision and skin reduction (concentric or Lejour mastopexy). There were no early postoperative complications, such as haematoma, seroma or infection, and 91% of patients were very satisfied (score: 8–10) with their cosmetic outcome. The most frequently encountered complication was a residual subareolar lump (five breasts), all in patients treated by conventional liposuction alone. In order to avoid the common complication of an uncomfortable residual subareolar nodule, the threshold for open excision in patients undergoing conventional liposuction should be low. Ultrasound-assisted liposuction extends the role of liposuction in gynaecomastia patients. Although skin excess remains a challenge, it can be satisfactorily managed without excessive scarring. A practical approach to the surgical management of gynaecomastia, which takes into account breast size, consistency, skin excess and skin quality, is proposed. © 2003 The British Association of Plastic Surgeons. Published by Elsevier Science Ltd. All rights reserved.

Gynaecomastia is defined as a benign enlargement of the male breast. It is a common condition, with a prevalence in young patients as high as 38%.[1,2] The condition may be caused by an increase in the effective oestrogen–testosterone ratio, which can be either physiological or pathological. In most cases of physiological gynaecomastia reassurance is all that is needed. Treatment of any underlying cause is important, but may fail to resolve the breast development, especially if it has been present for some time.[3] Specific treatment of the enlarged breast is indicated if the gynaecomastia causes sufficient pain, embarrassment or emotional discomfort to interfere with the patient's daily life. The two treatment options are medical therapy and surgical removal. Medical therapy is probably most effective during the active proliferative phase of gynaecomastia. Danazol, clomiphene, testolactone and tamoxifen have been used. If a trial period of medical therapy is unsuccessful or if the gynaecomastia has been present for several years and is bothersome to the patient, then the breast glandular tissue should be removed surgically.[4]

The first reported surgical treatment of gynaecomastia was by Paulus Aegineta (625–690 AD), who used a lunate incision below the breast or, for larger breasts, two converging lunate incisions to enable the excision of excess skin.[5] Such extra-areolar skin incisions with their unsightly scars continued to be used until Webster, in 1946, described an operation with a semicircular intra-areolar incision,[6] which has become the standard operation for excision of gynaecomastia. This technique, however, is of limited use in larger breasts, notably those with skin excess. Over the following years, numerous approaches to resect the excess skin were described. Skin has been removed as an ellipse, and the nipple transposed on a pedicle[7,8] or repositioned as a full-thickness graft.[9] To avoid extra-areolar scars the redundant skin has also been excised concentrically around the nipple, leaving it on a superior[10,11] or central[12] pedicle.

The introduction of suction-assisted lipectomy by Illouz in the late 1970s[13] improved the treatment of gynaecomastia because it enabled the contouring of diffusely enlarged breasts, creating only small scars. In the late 1980s Zocchi developed ultrasound-assisted liposuction, a technique that allows selective destruction of adipose tissue.[14]

The surgeon is faced with a wide range of excisional and liposuction procedures, but no single technique is suitable for all forms of gynaecomastia. There is a paucity of literature describing an integrated approach to the surgical management of this condition and the roles of the different treatment modalities. Despite the

advances in surgical knowledge and technology, techniques that lead to unacceptable cosmetic results continue to be widely used (Fig. 1).[15] Therefore, a review of all gynaecomastia patients who underwent surgery during the preceding 2 years was conducted with a view to formulating a simple and practical guide to the surgical treatment of gynaecomastia.

Patients and methods

All patients who were operated on for gynaecomastia by the senior author between September 1999 and November 2001 were included in the study. The grade of gynaecomastia was assessed from the patients' preoperative photographs and case notes. Following surgery, patients were reviewed in the outpatient clinic between September 2001 and January 2002. Patients who had already been discharged from follow-up were invited to attend the outpatient clinic for a further review. The patients were examined by one of the authors, and postoperative photographs were taken. Each patient completed an assessment sheet evaluating their satisfaction with surgery, recording overall satisfaction, appearance of scars and improvement in chest shape and self-confidence, with a linear score out of a maximum of 10. The results and overall satisfaction of patients who failed to attend the outpatient clinic during the evaluation period were assessed from records of previous clinic visits and postoperative photographs.

Operative techniques

Preoperatively all patients were marked in the upright sitting position. All surgery was performed under general anaesthesia. The breast tissue was infiltrated, via a single stab incision in the lateral inframammary crease, with a solution of Ringer's lactate, 1 l of which contained 30 ml of 1% lignocaine and 1 ml of 1:1000 adrenaline, using a superwet/tumescent technique. Intraoperatively, the patient received one dose of intravenous broad-spectrum antibiotic, which was continued orally for 5

Figure 1—Patient previously treated by a general surgeon for gynaecomastia. Note the prominent extra-areolar scars and the persistent diffuse enlargement.

days. Drains were not routinely used. Following the procedure, a pressure dressing consisting of fluffed-up gauze or Reston foam (3M Healthcare System, Borken, Germany) was applied and held in place with microfoam tape. The patient was instructed to wear a pressure garment day and night for 4 weeks. The following surgical techniques were used singly or in combination.

Conventional liposuction. After infiltration, a suction cannula was inserted through the same incision, and occasionally a second incision was made over the anterior axillary fold superiorly. A 4.6 mm or 5.2 mm Mercedes cannula was used for the initial suction by the palm down and pinch techniques. The final contouring was performed with a 3.7 mm Mercedes cannula. During suction, contour changes were constantly assessed by direct observation, while the thickness of the breast was evaluated intermittently with the flat contralateral hand. A close watch was also kept on the colour and volume of the aspirate. Once a satisfactory contour was obtained, the surrounding fat was feathered to avoid a noticeable saucer deformity and the inframammary fold was disrupted.

Ultrasound-assisted liposuction. Ultrasonic liposuction, which was available only in the private sector, was performed with the Contour Genesis machine (Mentor Medical Systems, Oxfordshire, UK) at an amplitude of 85% (Fig. 2). A hollow cannula with a protective sheath was inserted through the same stab incisions as those used for conventional liposuction. Routine safety measures to avoid thermal injuries included continuous saline irrigation through the sheath system, the use of a skin protector, wet towels around the entry site and avoidance of 'end hits'. The cannula was continuously moved in fanlike long strokes, starting deep and working superficially. The strokes went beyond the marked boundaries of the breast enlargement, and a special effort was made to disrupt the inframammary fold where this was well formed. The endpoint for ultrasound-assisted liposuction was determined by loss of tissue resistance, aspiration volume, appearance of the aspirate and treatment time. The final evacuation and contouring was performed using conventional liposuction.

Open excision. A semicircular incision was made along the inferior margin of the nipple–areolar complex. Dissection with Bostwick scissors commenced inferiorly to the border of the breast, then proceeded in a deep plane to the upper limit of the breast (Fig. 3). Dissection was continued superiorly to the incision leaving a 1 cm disc of breast tissue on the undersurface of the areola to prevent a saucer deformity. Subsequently, the breast tissue was excised through the semicircular incision.

Skin reduction. The skin around the nipple was marked in a concentric or LeJour pattern (Figs 4–6) and de-epithelialised. If the position of the nipple needed to be elevated, the concentric pattern was changed to a
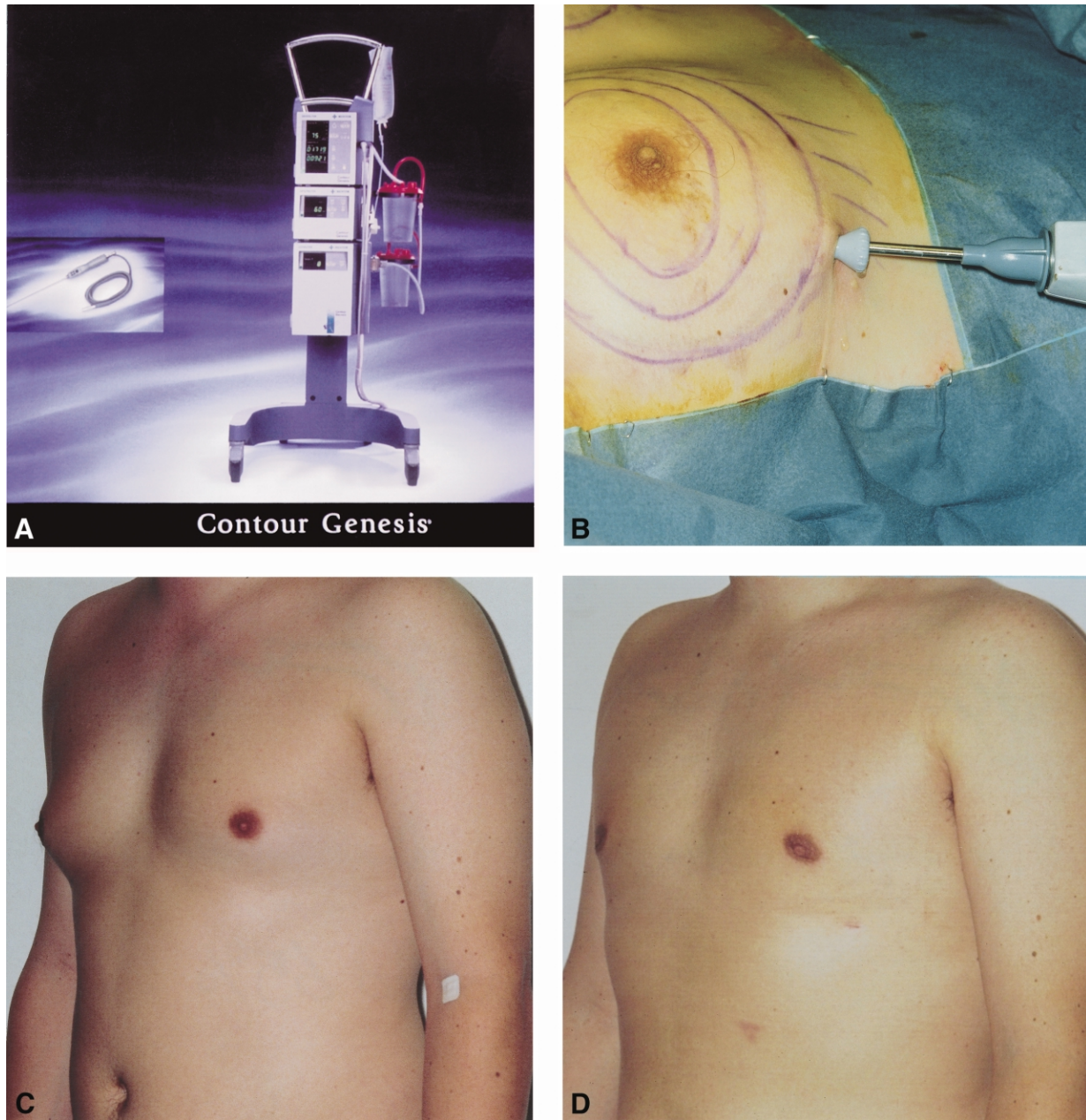
Figure 2—(A) Contour Genesis machine. (B) Intraoperative view of the probe in situ with skin protector. (C) Preoperative view of a 20-year-old patient treated with ultrasound-assisted liposuction. (D) Postoperative result 1 month later.

more eccentric one. In cases of concentric or eccentric mastopexy, a 2/0 Ethibond purse-string suture was used to concertina the external margin to the areola. This reduces tension and prevents outward stretching of the circular scar. With the Lejour reduction pattern, the breast tissue including the skin in the vertical limb was resected, leaving the two Lejour pillars, which were then approximated.

Results

Overall, 29 patients underwent surgery for gynaecomastia over the 27 month period. Their ages ranged from 13 years to 57 years (mean: 25 years), and 19 patients presented with bilateral and 10 patients with unilateral
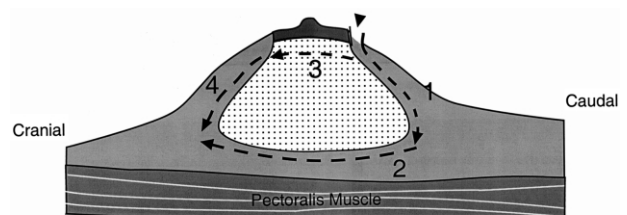
Figure 3—Schematic diagram of dissection plan for open excision.
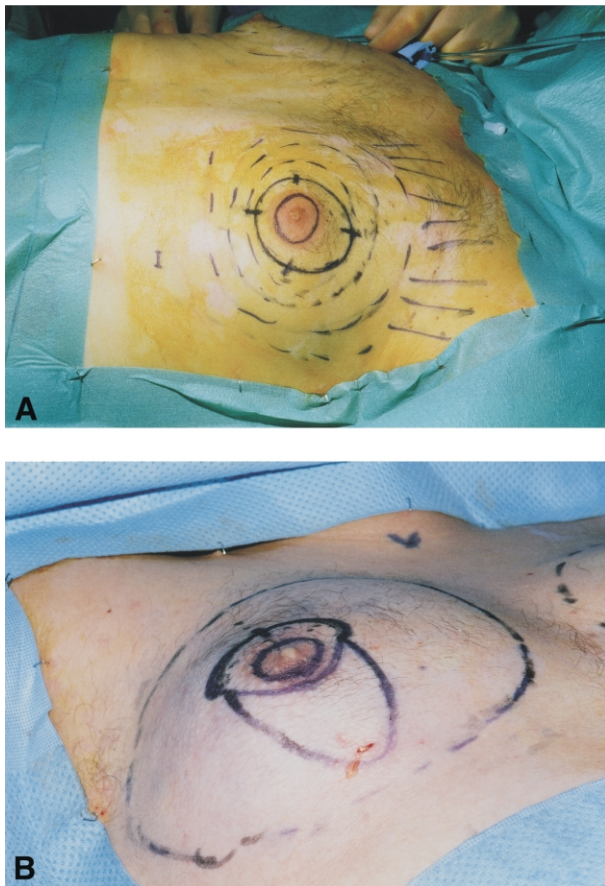
Figure 4—Skin-reduction patterns: (A) concentric mastopexy; and (B) Lejour mastopexy.

gynaecomastia. In total, 48 breasts were surgically treated. The majority of the breasts treated were assessed as small to moderate (Table 1).

Nearly all the breasts were treated by liposuction, alone or as an adjunct (Table 2). One breast was treated by open excision alone, because the liposuction equipment was not available on that day. Skin reduction was performed in nine out of the 17 breasts that were graded as moderate to large, using the concentric mastopexy pattern in six breasts and the Lejour skin resection pattern in three breasts. The mean infiltration volume per breast in suction-assisted liposuction was 358 ml (range: 100–600 ml) and the mean aspiration volume per breast was 416 ml (range: 125–900 ml). The mean infiltration volume per breast in ultrasound-assisted liposuction was 530 ml (range: 413–700 ml) and the mean aspiration volume per breast was 602 ml (range: 485–800 ml). The mean application time per breast for ultrasound-assisted liposuction was 7.4 min (range: 5–10.5 min). The mean weight of the resected specimens was 77 g (range: 9–169 g).

The mean follow-up time was 4 months (range: 1–22 months). There were no haematomas, seromas, infections or other early postoperative complications, apart from moderate bruising in two patients. Late complications included slowly resolving hypaesthesia in one patient, residual lumps in five breasts following suction-

assisted liposuction alone, and under-correction in three breasts—two breasts in the first patient treated by ultrasound-assisted liposuction and one breast treated by suction-assisted liposuction. One of these patients underwent further surgical correction by liposuction and open excision. During the study period, one patient with a residual lump requested further surgery. Patients who underwent skin reduction tended to have less-optimal scars with varying degrees of hypertrophy. In one breast treated by circumareolar skin reduction the skin around the nipple–areolar complex was mildly wrinkled. Two moderate-to-large breasts treated by suction-assisted liposuction without skin reduction showed a mild degree of redundant skin in the nipple–areolar complex, which was not noticed by the patient.

In total, 24 patients with 39 breasts filled in the assessment sheet (Fig. 7). The breasts were divided into three groups: breasts treated by liposuction only ($n = 25$), breasts treated by open excision without skin reduction ($n = 7$) and breasts treated additionally by skin reduction ($n = 7$). We found that 22 patients (92%) were very satisfied (score: 8–10) with their cosmetic outcome. Two liposuction-only patients returned overall-satisfaction scores of less than eight. These patients were also less satisfied with the improvements in their chest shapes and self-confidence. The scars of all breasts treated by open excision were scored between 9 and 10, and those treated by skin reduction were scored between 7 and 10.

Discussion

Surgery is the mainstay of treatment for gynaecomastia. Although a wide range of surgical techniques have been described, surgeons often find it difficult to choose the technique that will achieve the best results for a given patient.

In all patients, liposuction was planned as part of the procedure. The majority of breasts were treated by liposuction only. In 17 breasts, further correction by open excision and/or skin reduction was performed. Conventional liposuction combined with open excision was first described as a treatment for gynaecomastia by Teimourian and Perlman in 1983,[16] and has become a widely accepted method, because of the frequent difficulty of removing breast parenchyma by suction alone.[17–20] Rosenberg, however, contends that all degrees of enlargement and all consistencies can be corrected by liposuction. For this he recommends a special 2.3 mm cannula, which removes breast tissue more easily.[21,22] Others have used special cutting gynaecomastia cannulas, such as a cut cannula with a sharp opening[23] or a biopsy punch.[24] These cannulas, however, are traumatic and

Table 1 Degree of gynaecomastia

Degree	Number of breasts
small-to-moderate	31
moderate-to-large	17
total	48
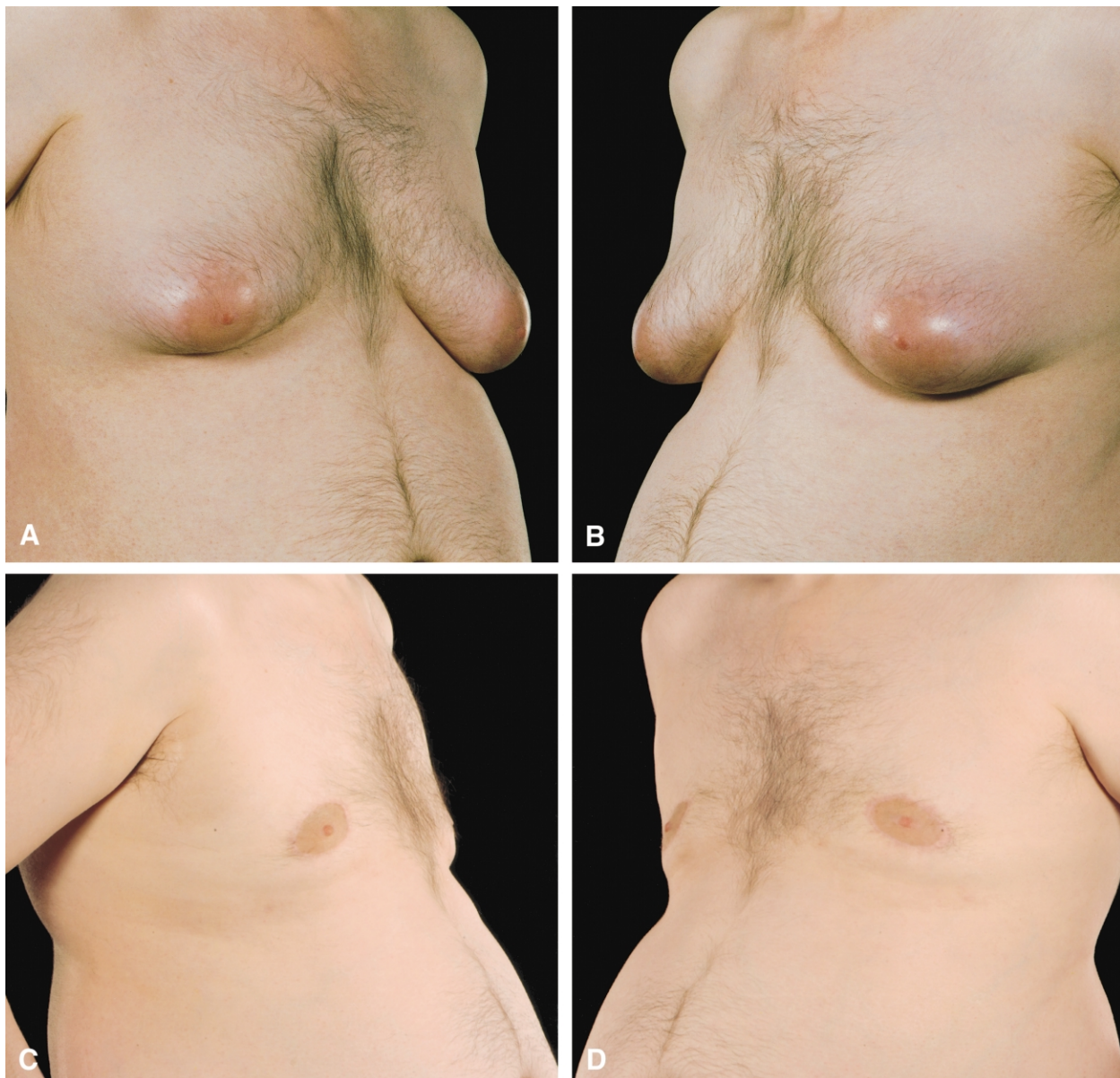
Figure 5—A 47-year-old patient with moderate-to-large breasts treated by suction-assisted liposuction and concentric mastopexy. (A,B) Preoperative appearance, and (C,D) postoperative result 8 months later.

make damage to blood vessels and nerves more likely. A clear advantage over open excision is doubtful.

The most common complication in this series was a residual lump in patients treated by conventional liposuction alone, which was often associated with a degree of discomfort. In these cases, some patients were not satisfied with the result, even if the contour of the chest was improved and satisfactory. In contrast, patients who also underwent open excision were very satisfied with their results, returning the highest scores for overall satisfaction, improvement of self-confidence and the shape of the chest. The longer semicircular scar at the periareolar margin was well accepted and usually faded with time (Fig. 8). Therefore, during correction of gynaecomastia by liposuction, the threshold for conversion to an open procedure should be low, because it is not associated with a significant disadvantage for the patient,

but rather leads to a high degree of satisfaction. It is important that the incision is exactly on the margin between the skin and the areola, which usually leaves the patient with a minimal almost invisible scar. The

Table 2 Treatment modalities used to correct gynaecomastia

| Treatment modality	Number of breasts
conventional liposuction alone	19
ultrasonic-assisted liposuction	12
conventional liposuction and open excision	7
conventional liposuction, open excision and skin reduction	7
conventional liposuction and skin reduction	2
open excision	1
total	48
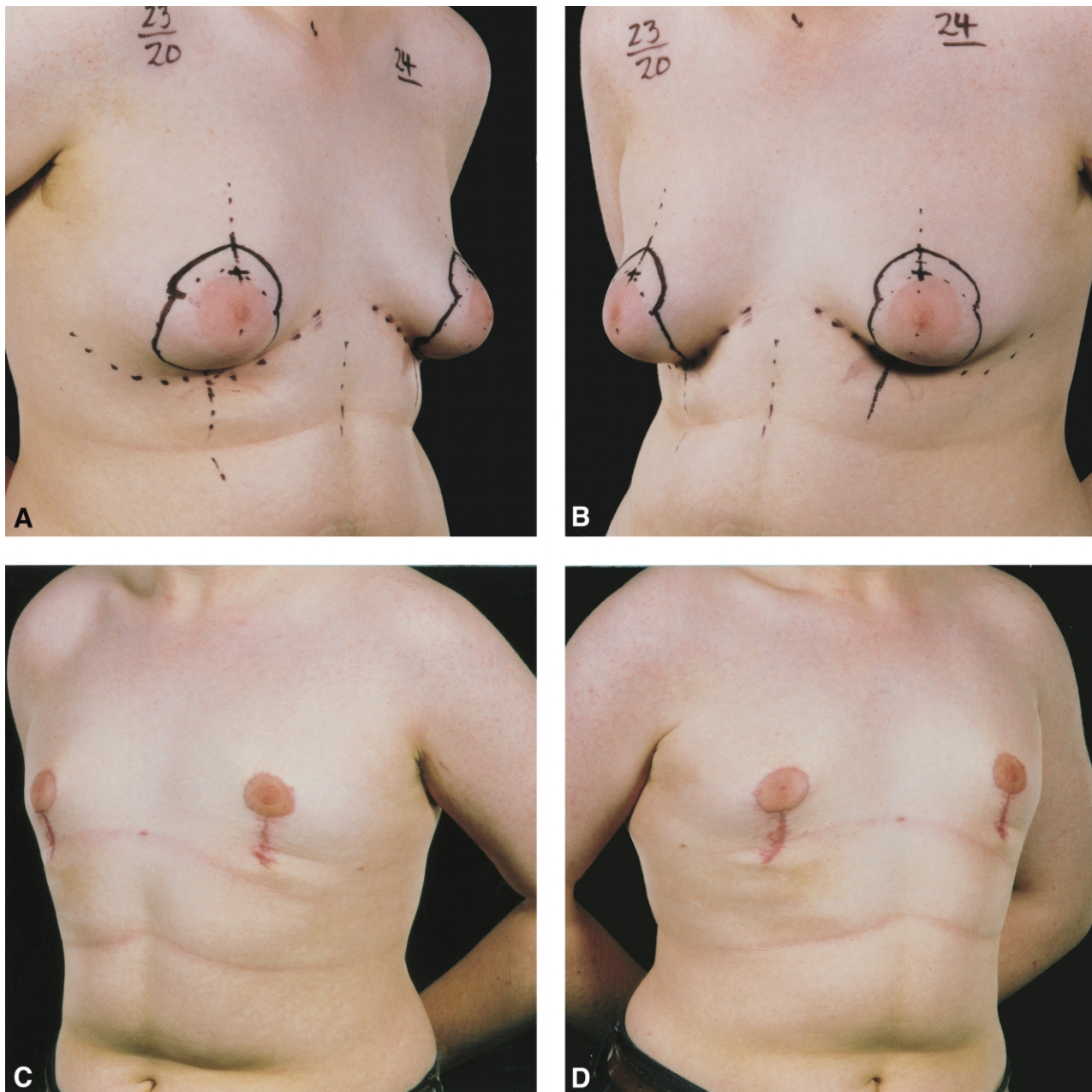
Figure 6—A 17-year-old patient with moderate-to-large breasts treated by suction-assisted liposuction, open excision and Lejour mastopexy. (A,B) Preoperative appearance, and (C,D) postoperative result 2 months later.

decision to convert to an open procedure can only be made intraoperatively, because clinical examination usually cannot predict whether the breast contains fat that can be suctioned.[19,25] Therefore, all patients undergoing liposuction need to consent for open excision as well.

If well performed, open excision can give excellent results in smaller breast enlargements with distinct subareolar nodules. In more diffuse enlargements and larger breasts it is more difficult to achieve a good result without liposuction. The pre-tunnelling and suction achieved with liposuction prior to open excision are beneficial, because they help to taper the peripheral contour, define the glandular tissue and make the excision easier.[19]

In the private sector, ultrasound-assisted liposuction, a relatively new technique, was available. In this technique, electrical energy is transmitted from the power console to a hand piece containing a piezoelectric crystal and transformed into mechanical vibrations, which are transmitted via a metal probe to the tissue. The main biological effects of ultrasonic energy on adipose tissue can be divided into three types: micromechanical effects, effects connected with the cavitation phenomenon and thermal effects.[14] No general agreement has been reached on what the mechanisms of action are.[26] It is, however, generally accepted that ultrasound-assisted liposuction selectively destroys adipose tissue.[27,28] Fodor and Watson performed a
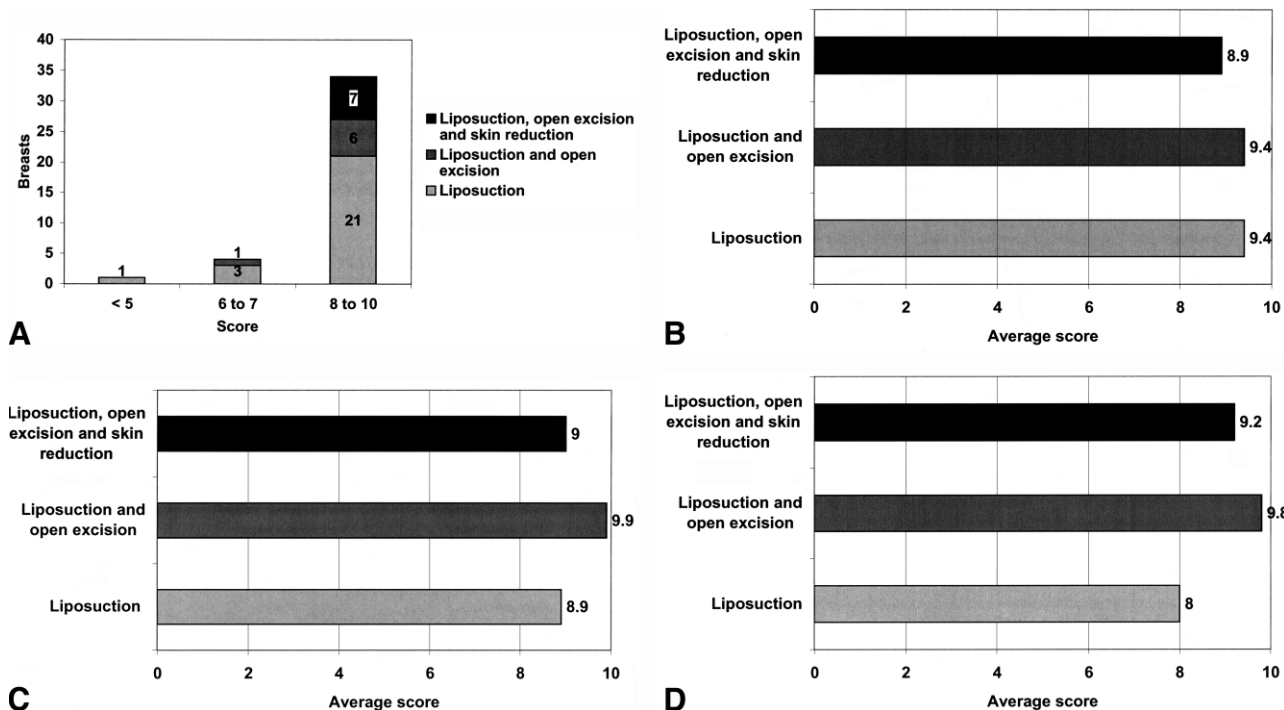
Figure 7—Patient satisfaction: (A) overall satisfaction; (B) scars by treatment type; (C) shape of chest by treatment type; and (D) self-confidence by treatment type.

prospective study comparing conventional and ultrasound-assisted liposuction, and found no difference in patient satisfaction, postoperative ecchymosis, swelling, complication rate or skin contracture.[29] Although the numbers in our series are too small to make valid comparisons, we feel that ultrasound-assisted liposuction resulted in less bruising and swelling and was associated with better skin contraction postoperatively than suction-assisted liposuction. Ultrasound-assisted liposuction has certain benefits over traditional liposuction in some locations, such as fibrous areas, gynaecomastia and secondary cases.[29–31] It reduces the surgeon's mechanical effort, allowing more focused energy for contouring and sculpting.[30] No long-term complications have been reported so far.[26]

The first patient treated by ultrasound-assisted liposuction had insufficient reduction of both breasts and required a second operation to achieve a level of contour correction acceptable to the patient. This was attributed to caution during the procedure. All the subsequent patients had excellent results. We found liposuction of gynaecomastia easier and less strenuous with ultrasound-assisted liposuction. It was felt that in some cases open excision was avoided because of the good response in the fibrous areas. Therefore, we believe that, when available, ultrasound-assisted liposuction should be used preferentially to suction-assisted liposuction in the treatment of gynaecomastia.

In several patients with moderate-to-large breasts it was felt intraoperatively that the skin elasticity was sufficient, and thus no skin reduction was performed. One patient was left with a mild degree of redundant skin in the nipple–areolar complex. This did not affect the overall result, and extra-areolar scars were avoided (Fig. 9).

In larger breasts with marked skin redundancy, excision of skin was required. Many skin-reduction techniques have been described, but they can be divided into two main groups: extra-areolar[7–9] and circumferential[10–12] excisions. Extra-areolar skin excisions are, however, associated with hypertrophic scarring and unacceptable results.[6,8,15] The concentric-circle technique permits skin reduction while limiting the final scar to a circle at the periphery of the areola. The appearance of the scar is inferior to the semicircular periareolar scar, but it is well accepted by the patients. The skin surrounding the nipple–areolar complex was wrinkled in one patient, because the width of the circle of skin excised was too large. Therefore, this procedure is limited to a certain amount of skin excess. If the diameters of the areolar and external margins are too different, an extension to extra-areolar skin needs to be considered.


Figure 8—Well-settled scar 2 years after semicircular incision.

LeJour has popularised a vertical mammaplasty technique without submammary scar for mastopexy and reduction of the female breast.[25] Apart from the circumferential scar, the breast is left with only a small vertical scar. This technique was applied to three breasts. The resulting scars are certainly more obvious, but are accepted in exchange for a flatter chest contour. The LeJour technique obviates the need for the non-absorbable purse-string suture, which can be palpable and associated with periareolar skin puckering, especially in very large breasts. The puckering of skin is limited to the vertical part of the scar, where it may be less obvious to the patient. A very large amount of excess skin should lead one to choose the LeJour technique over concentric skin reduction.

Simon et al classified gynaecomastia according to the size of the breast and the amount of redundant skin.[32]

They described four categories: small enlargement with no skin redundancy, moderate enlargement with no skin redundancy, moderate enlargement with skin redundancy and marked enlargement with marked skin redundancy. The boundaries between the categories are not well defined, leading to subjectivity and inter-observer variability. Therefore, we have simplified the classification to two categories with practical application, namely, small-to-moderate size with no or minimal skin excess, and moderate-to-large size with moderate-to-marked skin excess.

Surgical treatment of gynaecomastia consists of three basic steps: liposuction, open excision and skin reduction (Fig. 10). The surgeon needs to retain flexibility, because often a final assessment of consistency, skin excess and quality is possible only during surgery. In moderate-to-large breasts the markings for skin excision should be made preoperatively, if the
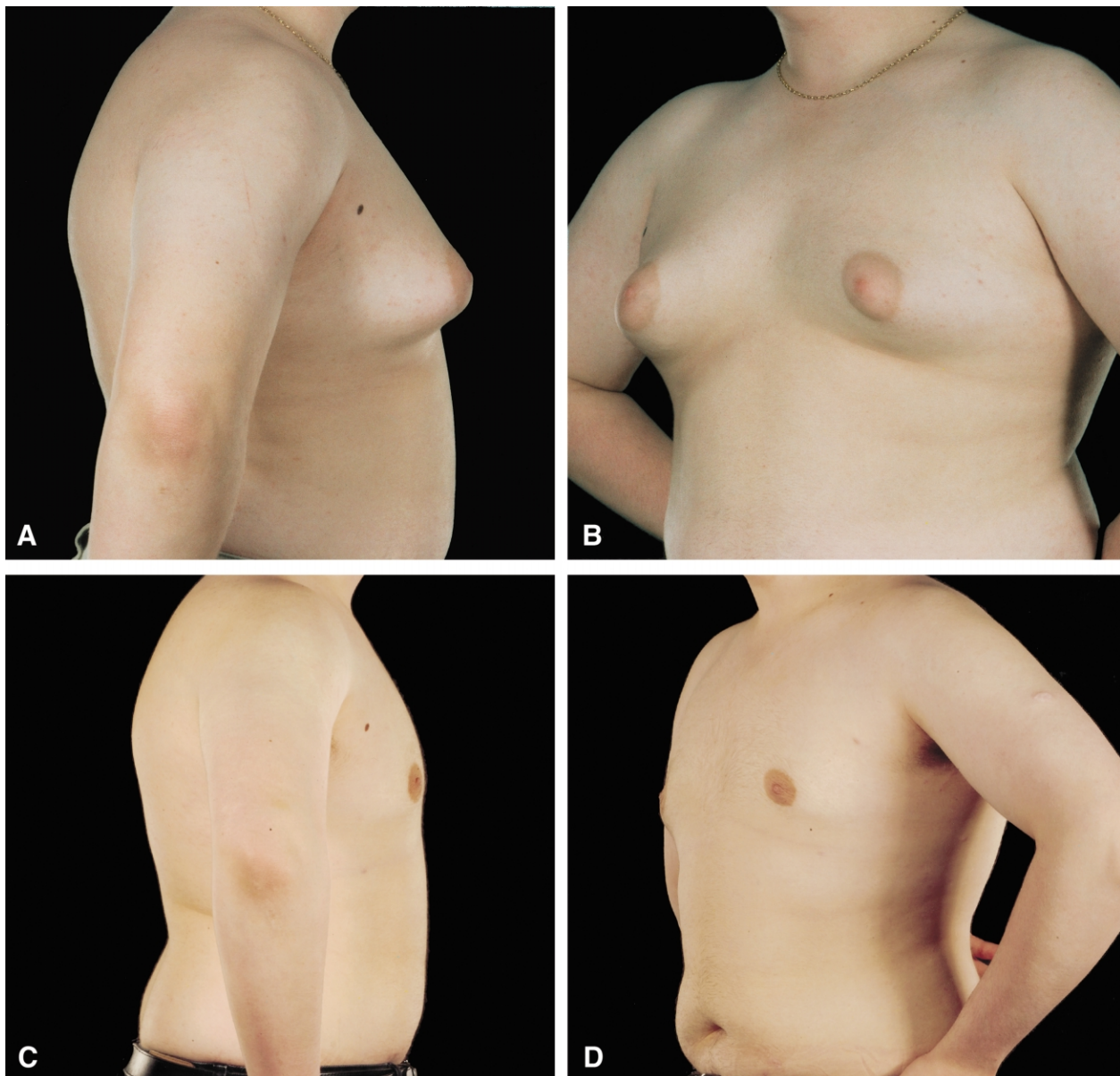
Figure 9—A 16-year-old patient with moderate-to-large breasts treated by suction-assisted liposuction only. (A,B) Preoperative appearance, and (C,D) postoperative result 6 months later.
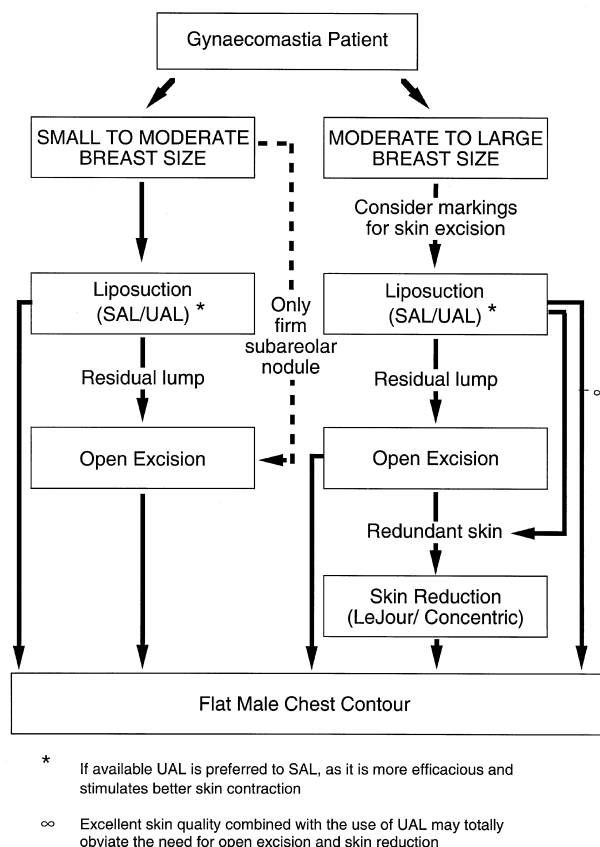
Figure 10—Diagrammatic algorithm for a practical approach to the surgical management of gynaecomastia.

surgeon assumes that the skin elasticity is insufficient. Liposuction should always be used in diffuse or large breast enlargements. It is optional in small breasts with firm subareolar nodules, but facilitates the subsequent excision by pre-tunnelling. Ultrasound-assisted liposuction is preferred. This is often sufficient and, therefore, the only step required.

Following liposuction, the consistency of the breast is reassessed, and open excision is performed if a residual lump or firmness is present. The threshold for conversion to open excision should be low, as it is not associated with a significant disadvantage. Following liposuction and open excision, the skin excess settles to some degree depending on the skin quality. Skin excision is indicated if there is still noticeable skin excess, as occurs in very large breasts or those with poor skin quality. The choice of concentric or Lejour mastopexy depends on the amount of skin excess. The larger the skin excess, the more likely it is that a Lejour-pattern skin resection will be needed. In these cases, the conceptually separate steps of open excision and skin reduction can be undertaken simultaneously.

Acknowledgements

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