

## **A Safe, Effective and Low Cost Lipoplasty**

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### **ABSTRACT**

Liposuction has become a major therapeutic tool for body sculpting by plastic surgeons. As the technique has continued to advance, safety has remained a primary concern. The purpose of this study was to evaluate the results of a certain management protocol for liposuction. A retrospective review was conducted on 52 patients who underwent liposuction by the same protocol between January 2005 and December 2006. The studied cases were carried out in a dermatology and cosmetic surgery center in Riyadh, Saudi Arabia. All the patients had localized fat accumulations for which liposuction was indicated. Nineteen cases had only one region to be treated, 33 cases did more than one region. All the patients were subjected to the same treatment protocol, the aim of which was to produce the best results, to reduce the rate of complications, and to minimize the cost. Proper patient selection was essential. All cases were done as day case procedures. Local infiltration anesthesia by the superwet technique combined with deep intravenous sedation was used. The amount to be aspirated was limited to 5 litres of aspirate at maximum. The technique of external ultrasound assisted liposuction was applied in all cases. Postoperative perfect compression was essential. Early ambulation was mandatory. The study concluded that external ultrasound lipoplasty under properly monitored deep intravenous sedation is a safe, effective, and low-cost method of removal of localized fat.

### **INTRODUCTION**

Liposuction is one of the techniques of aesthetic surgery that is very gratifying to the doctor and the patient [1]. In the last two decades, since its inception; there have been many technological advances in lipoplasty [2].

Illouz first introduced suction-assisted lipoplasty two decades ago as a procedure to remove localized areas of excess adipose tissue [3]. Since then it has evolved into a procedure to sculpt large areas of subcutaneous fat and is often referred to as body contouring. Early liposuction techniques used large cannulae, with little or no subcutaneous infiltrate; consequently, blood loss in these early series could be considerably large.

The introduction of the tumescent technique by Klein [4] and the “superwet” technique by Fodor [5] in the late 1980s, dramatically improved the safety of liposuction [6]. Infiltrating large volumes of dilute lidocaine and epinephrine into subcutaneous fat, has been shown to significantly decrease blood loss in the fat aspirate and allow for larger volumes of liposuction [7]. The technique has been associated with limited morbidity and rare mortality. It does not only decrease postoperative haematoma and seroma, but also decrease infection rate [8]. This significant innovation has popularized liposuction worldwide. It allowed surgeons to remove large volumes of fat safely without general anesthesia [9].

Recent advances in the technique of lipoplasty involve the use of ultrasonic energy combined with tumescent technique [10]. Currently, there are two types of ultrasound assisted liposuction (UAL); internal UAL and external UAL [11].

Internal UAL was first introduced in late 1980s by Michele Zocchi [12,13]. The ultrasound energy from the ultrasound-assisted liposuction probe induces preferential lipid cavitation and emulsification of fat. This leads to a more selective and complete evacuation of fat, resulting in greater volume reduction and more effective skin retraction [14,15]. The safety and efficiency of this technique was proven in several articles [16-21]. This technique permits the removal of fat from fibrous areas such as the upper abdomen, back, and flanks with greater ease, especially during secondary procedures [22].

External UAL is a new technique that requires traditional aspirative liposuction after the application of high frequency ultrasonic fields delivered through the skin into a wetted tissue [23]. It was first described in late 1990s [10,24,25]. The use of external ultrasound before liposuction has been reported to enhance the ease of fat extraction,

increase the amount of fat extracted, and decrease patient discomfort during and after liposuction [10,23,26]. External UAL is safer, simpler and less costly than internal UAL [26].

Recent techniques for liposuction also include the power assisted liposuction which uses a small mechanical handle that moves the cannula at high speeds to decrease surgeon fatigue [27,28,29], and laser assisted liposuction using a laser device provoking a breakdown of the membranes of the adipocytes transforming them into an oily substance [30,31].

Various types of anesthesia or anesthesia combinations are appropriate for liposuction, depending on the overall health of the patient, the estimated volume of the aspirate to be removed, and the postoperative discharge plan. In smaller-volume liposuction cases, anesthetic infiltrate solutions alone may provide adequate pain relief. However, in larger-volume liposuction cases, the superwet and tumescent techniques are often accompanied by sedation, general anesthesia, or epidural anesthesia to ensure adequate patient comfort. The patient or the surgeon may prefer the use of sedation or general anesthesia even with small volumes of liposuction [22].

As the technique of liposuction has continued to advance, safety has remained a primary concern [7]. A prerequisite for safe suctioning is a skillful knowledge of suction technique, subcutaneous fat anatomy and vascularization, and a realm of possible, although rare, complications [32]. Liposuction is generally safe, with low risks of major morbidity. As the volume of aspirate increases, however, so does the potential for extremes in fluid shifts, which may lead to hypovolaemia or, more commonly, pulmonary edema and congestive heart failure [33].

Large-volume liposuction is defined as the removal of 5000cc or greater of total aspirate during a single procedure. The risk of complications is unavoidably higher as the volume of aspirate and the number of anatomic sites treated increase. In some instances, it may be best to perform larger-volume aspirations as separate, serial procedures and avoid combining additional procedures with large-volume liposuction [22].

The aim of this study was to evaluate safety, effectiveness and cost of external ultrasound assisted lipoplasty under deep sedation in cases of low volume liposuctions.

## PATIENTS AND METHODS

This work was a retrospective review of all lipodystrophy patients treated with external ultrasound-assisted liposuction by a single surgeon at "Specialized Clinics Center" in Riyadh, Saudi Arabia, over a 2 year period from January 2005 to December 2006.

### *Patient selection:*

Candidates for liposuction should be young with good skin tone, close to their ideal body weight, and should have tried a proper diet and exercise to help achieve their desired appearance. Obese patients or those seeking for weight reduction were excluded. Patients with over expectations were not included.

Selected candidates were carefully screened preoperatively for cardiovascular and coagulation disorders, before liposuction was undertaken. All the selected fit patients were treated by the same management protocol.

### *Management protocol:*

#### *Preoperative preparation:*

All patients were instructed to be fasting 8 hours before the scheduled time of operation. Patients were marked in the upright position in the holding area before entering the surgical suite. Preoperative measures were taken for the circumference at the level of desired area at its most prominent point. In addition, medical-quality preoperative photographs were taken. A preoperative antibiotic (1gm of zinacef) was to be given 2hrs prior to surgery. IV dormicum (tranquilizer) was given to reduce or eliminate recall of the operation.

#### *Operating room:*

The theatre used in this study for liposuction was fully equipped with monitors for pulse, blood pressure, oxygen saturation, and ECG. It should be also equipped for endotracheal intubation. The instruments needed for the surgery included; the liposuction machine, Rich-mar external ultrasound machine, infusate pump machine and liposuction cannulae.

#### *Anesthesia:*

Anesthesia in all the patients was in the form of local infiltration anesthesia (superwet technique) combined with intravenous deep sedation. A combination of ketamine (analgesic dose) and propofol (sedative dose) was given as IV drip. Metoclopramide was added to prevent nausea and vomiting. Hydrocortisone was also added to minimize post-

operative oedema. The sedation was given by a qualified anesthesiologist. Sedation was maintained at a level that keeps the patient asleep but could be aroused by repeated or painful stimulation.

#### *Technique:*

Patients were positioned either prone, supine or lateral decubitus, depending on the areas in need of liposuction. If both anterior and posterior areas were to be suctioned, the patient was placed in the prone position first, and that portion of the operation was completed initially. In case of prone position, all pressure points are adequately padded with pillows and bolsters. A large roll is placed under the patient's abdomen to "flex" the trunk, which affords better access to the truncal regions. This position provides access to the back; posterior and lateral hip rolls; posterior thighs; and gluteal region. Surgical technique adopted in all the patients consisted of three stages.

#### *1- Infiltration:*

Small puncture incisions that are just large enough to accommodate the infiltration catheter were made in the traditional inconspicuous places by means of scalpel 11. Only one incision was initially made per area. That way, when the infusion cannula is inserted through the hole, it prevents leakage from multiple sites. A wetting solution was then infused into the desired areas using an infusion pump (Byron Variflow Infusate Pump). This solution consisted of isotonic saline solution containing 1mg of epinephrine (1ml of 1:1000 epinephrine) and 500mg of lidocaine (50ml of lidocaine 1%) per litre. A superwet technique was used (1-1.5cc of infusate for each 1cc of expected fat aspirate). The endpoint should be a smooth, uniform, tense area with tough skin. The maximum volume to be infused was controlled by the total lidocaine dose which was limited to a maximum of 35mg/kg. The total volume of infiltrate was recorded.

#### *2- External ultrasound:*

Immediately after infiltration of the desired area was complete, the transcutaneous application of ultrasound was executed for 10 minutes. The ultrasound (Rich-Mar 510, George Tiemann & Co.) (Fig. 1) was applied with frequencies of 1MHz and a capacity of 3W/cm<sup>2</sup> in direct mode. Sterility of the ultrasonic transducer was maintained by using a disposable sterile sheath. Sterile surgical lubricant was used as the skin transmission medium. The transducer was moved in a continuous, slow, circular even manner. Moderate pressure was used to help deliver energy to the deeper fat.

#### *3- Suction:*

Once the application of the ultrasound was completed, tiny incisions (3 to 4mm) were made. Two stab incisions were usually made for each area, one above and the other below the desired area to allow cross-cross suctioning. Suction was carried in the standard way using two Mercedes liposuction cannulae (sizes 3 and 4mm) connected to a standard liposuction machine (Byron Medical Psi-Tech Aspirator) (Fig. 2). Liposuction was performed in superficial and deep levels. The degree of tissue resistance was observed.

A careful assessment of skin thickness was performed to determine when the end point had been achieved. Once the appropriate skin thickness was obtained, the other areas are evacuated, and a pinch test was used to verify that all areas were of uniform thickness. Visual symmetry comparisons and side-to-side aspirate volume comparisons were also helpful. When a satisfactory end point was reached, most of the remaining emulsified fat, wetting solution, and blood were expressed from the access sites. This was performed with a rolling device (Byron Medical CG Roller).

The upper wounds were closed with 5-0 prolene sutures while the lower stabs were left open for remaining fluid to drain out. A thick layer of cotton was placed over the treated area to absorb the drained fluid and to decrease the discomfort of the garment. Two layers of support garments were then placed on the patient.

The lipoplasty aspirate was collected in 2-litre canisters (Fig. 2). The canisters were set aside for at least 2 to 3 hours to allow the lipoplasty aspirate to separate by gravitational sedimentation. The total volume of aspirate and total fat were recorded. A small part of aspirated fat was cleaned and stored.

#### *Intraoperative monitoring:*

All the patients were connected to monitors for continuous recording of pulse, oxygen saturation, and cardiac rhythm. Intermittent reading of blood pressure was also taken. These machines as well as the patient's respiration and vitality were closely observed by an attendant qualified anesthesiologist.

#### *Fluid management:*

Intravenous fluids should account for maintenance requirements, preexisting deficits, and intraoperative losses of aspirated tissue and third-space. The intake and output of all fluids utilized in the operative and postoperative periods should be accurately monitored.





Fig. (1): Rich-Mar external ultrasound machine, model 510 (George Tiemann & Co).

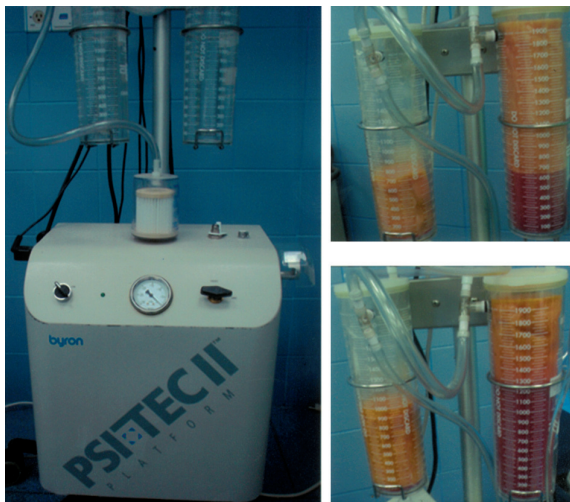


Fig. (2): (Left) Byron Medical Psi-Tech Aspirator. (Right) Aspirated fat collected in two canisters, each is 2 litre.



Fig. (3): A 35 years old female who underwent liposuction of anterior and lateral thighs. (Left) Preoperative views. (Right) Postoperative views.

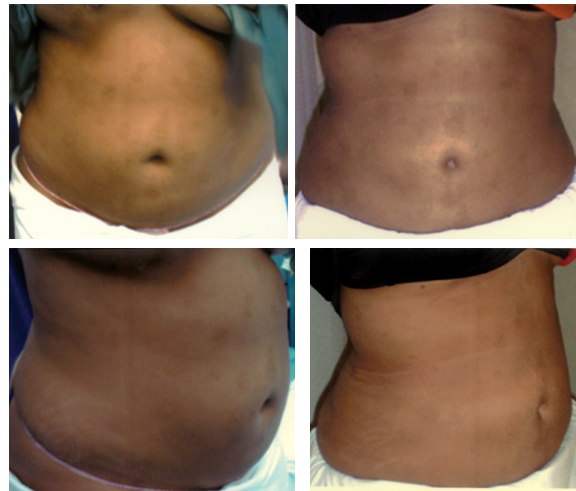


Fig. (4): A 28 years old female who underwent full abdominal liposuction (upper, lower and flanks). (Left) Preoperative views. (Right) Postoperative views.



Fig. (5): A 26 year old female who underwent liposuction of trochanteric region. (Right) Preoperative views. (Left) Postoperative views.

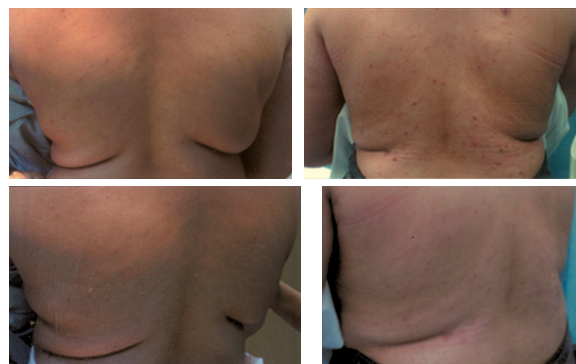


Fig. (6): A 21 year old female who underwent liposuction of scapular region. (Right) Preoperative views. (Left) Postoperative views.

*Postoperative care:*

After completing the operation, the patient was transferred to a recovery room to stay observed until full consciousness was returned, then to be allowed to leave walking but attended. Before a patient was discharged, he/she should be alert and oriented and all vital signs must be stable. The duration of recovery room stay was recorded. Broad spectrum antibiotic (Augmentin 625mg/12hrs) for one week and a mild analgesic (Paracetamol) were prescribed. Before leaving the center, all patients were advised to ambulate at home and not to stay confined to bed. They were also instructed to keep the garment on constantly, for the first 7 days, and then to continue wearing it, except for when bathing, for a total of 6 weeks.

A qualified nurse used to telephone call the patient in the same evening and next morning to assure that he/she is in good health and for reassurance.

*Follow-up:*

Patients were seen in clinic after two days to check for soaking of the dressing and its change if soaked. After that, the patient was seen twice weekly for one week then every week in the first month then monthly for 6 months. Any complication was recorded. Measurements of body weight and of circumference of the treated area were taken after 3 and six months. All patients were instructed to practice a healthy lifestyle, eat a proper diet, and exercise regularly.

Patients were photographed 1, 3 and 6 months postoperatively. The esthetic result of the operation was determined according to patient and physician satisfaction. It was evaluated 3 and 6 months postoperative. The result was classified as excellent, good, fair, or poor.

All the results were tabulated and statistically analyzed. The total cost of the procedure was also calculated and recorded in these tables.

**RESULTS**

A total of 52 patients, 41 females and 11 males, underwent this procedure. The average patient age was 27.5 years, with a range of 22 to 37 years. A total of 98 areas were treated in these patients. 19 patients presented with single area to be contoured, the others needed liposuction of multiple areas (Table 1).

Total volume of superwet fluid infiltrated ranged between 300 and 4000cc with an average of 1727cc. Total volume of fluid aspirated ranged between

400 and 2500cc with an average of 1627cc. Total volume of fat aspirated ranged between 300 and 2500cc with an average of 1144cc. The average percentage of fat in the aspirated fluid was 70.5%, and ranged between 33% and 94.4%.

Duration of stay in recovery room varied between 2 and 3 hours with an average of 2.15 hours. Only 2 patients required analgesia during this period, in the form of IM voltaren injection. All patients were discharged fully alert with stable vital signs, walking, comfortable and not in pain.

The cost of the procedure ranged between 220 \$ and 330 \$ with an average of 265 \$ per procedure. The cost was inclusive of all intra and post operative expended materials.

During the first few days after the operation, mild to moderate pain was experienced by almost all the patients which was well controlled by paracetamol tablets. Only 3 patients (11.5%) needed analgesia (1-2 tablets per day) after the third post-operative day.

Almost all patients felt a varying degree of discomfort due to the compression of the garment. They used to ask for removing it, but this was prohibited for the first 6 weeks. However, this sense decreased with time and with assurance of the high necessity of this garment. They were only allowed to take it off during bathing, after the first week.

During early visits after the operation, mild to moderate swelling was observed in the treated area in almost all cases. Oedema was noticed to decrease gradually over the next few weeks. Cutaneous bruises were seen in 5 cases and resolved spontaneously.

In 42 cases (80.7%), some weight loss was observed 3 months after the operation, ranging between 0.8-7.1Kg, with an average of 3.3Kg. It was proportionate to the amount of aspirated fat.

An average decrease of 8cm in circumference around the area treated was found 6 months after liposuction, ranging between 6 and 14cm.

The esthetic results in the studied patients were excellent in 39 patients (75%), good in 9 patients (17.3%) and fair in 4 patients (7.7%). One patient asked for secondary liposuction (gluteal region). Figs (3-6) show some of the studied cases.

*Complications (Table 2):*

Major complications like adverse anesthetic reactions, deep vein thrombosis, pulmonary or fat

embolism, vital organ perforation, thermal injuries, skin sloughing or major contour irregularities, were not encountered in this series. Only minor complications were reported in the form of:

- 1- One case of small seroma which resolved by repeated aspiration over two sessions.
- 2- Four cases of minor contour irregularities.
- 3- Four cases of unequal contour in paired areas, with mild difference.
- 3- Three cases of bruises.

Table (1): Treated areas in the studied 52 cases.

Area	No. of cases
Upper abdomen	14 cases
Lower abdomen	15 cases
Flanks	13 cases
Male breasts	11 cases
Hips	10 cases
Trochanteric	9 cases
Lumbosacral	2 cases
Gluteal	11 cases
Lower scapular	4 cases
Submental	2 cases
Anterior thighs	3 cases
Posterior thighs	3 cases
Calves	1 case

Table (2): Complications.

	No.	%
Major complications	0	0
Seroma	1	1.9
Minor contour irregularities	4	7.7
Minor unequal contours	4	7.7
Cutaneous bruises	5	9.6
Number of complicated patients	7	13.4

## DISCUSSION

The evolution of liposuction has added a powerful dimension to body contouring procedures [34]. Liposuction is the most commonly performed aesthetic procedure in the United States [33]. Appropriately, along with its popularity comes the continued evolution in technique and technology as this procedure is refined and improved [35].

Proper patient selection and education are paramount elements for long-term success of liposuction. Patients need to have realistic expectations and be committed to healthy lifestyle changes [36].

Candidates for liposuction are younger with good skin tone, close to their ideal body weight, and should have tried a proper diet and exercise to help achieve their desired appearance [37].

As for anesthesia in liposuction, some surgeons favor local tumescent anesthesia alone [38-42]; others prefer general anesthesia in addition to local infiltration especially in large volume liposuction [6,7,15,43,44]. Recently, many plastic surgeons favor local tumescent anesthesia combined with sedation, especially in low volume liposuctions [22,45,46,47]. Epidural anesthesia combined with the infusion of anesthetic infiltrate provides patients with a consistent intraoperative comfort level [48]. The avoidance of general anesthesia removes a number of potential anesthetic complications and reduces the likelihood for the development of deep vein thrombosis and subsequent pulmonary embolus [45].

Improvements in suction techniques and surgical suction instruments rendered liposuction a standard procedure in plastic surgery during the past two decades [32]. The one that has been most widely adopted is the superwet or tumescent technique [49]. The superwet technique utilizes infusing 1cc of solution for each 1cc of fat to be removed. Blood loss decreases to less than 1 percent of the aspirate volume. The tumescent technique involves infusing 3 to 4cc of the infiltrate solution for each planned milliliter of aspirate. Estimated blood loss with the tumescent technique is approximately 1 percent of the aspirate. The safety of liposuction has greatly improved with the advent of wetting solution [22].

Drug concentrations in the wetting infiltrate solution vary in literature, but typically they consist of a range of 0.025% to 0.1% lidocaine and epinephrine 1:1,000,000 in a Ringer's lactate or normal saline solution [22]. Doses of lidocaine below 35mg/kg body weight are safe [21,47,50,51]. Epinephrine dosing up to 10mg is safe [7]. Only few authors add sodium bicarbonate to the infiltrate, for decreasing the sting of infiltration [10,21,51].

Suction assisted lipoplasty combined with the tumescence or super-wet technique is a very popular method of liposuction recommended by many studies [51-58]. Many authors refer to it nowadays as conventional or traditional or classic tumescent liposuction [57-60].

The use of internal or external ultrasonic energy has been recently high-lighted to facilitate the extraction of fat [1]. The application of internal ultrasound for lipoplasty was first introduced in the late 1980s [12,13]. In this technique, the adipose



tissue is destroyed through cavitation while still preserving the surrounding vasculature and connective tissues [21]. Many plastic surgeons currently use internal UAL in combination with the classic tumescent technique, especially for larger-volume lipoplasty procedures [14,15,18-21,61,62] and in the difficult fibrous areas as the back and male breast and secondary liposuction cases [15,63-66].

Internal UAL has become the most frequently performed plastic surgery procedure in the United States [62]. However, many authors dislike it due to its disadvantages. A byproduct of the ultrasound waves is heat; cutaneous burns are a potential complication. Demyelination-type injury is a known side effect [15]. One of the most devastating complications is the possibility of skin slough [18,67]. Cardenas et al. [58] found that internal ultrasound generally produced greater tissue damage and bleeding than the classic tumescent technique.

Other disadvantages include the very high purchase cost of the equipment, users must regularly replace the ultrasonic cannulae, the needs for large incisions and the use of skin protectors. Also, the incisions must be placed at specific locations to allow these wide-diameter cannulae to access the areas to be treated. Difficulty of treatment around curves and body prominences adds to the increased incidence of skin burns and end hits [26].

External ultrasonic lipoplasty is an effective method for the removal of localized fat and the fat due to moderate obesity. The ultrasound is externally applied and transmitted through the skin surface. The acoustic waves are selectively absorbed by previously injected tumescent fluid and fat. It is the combination of this acoustic wave and ultrasound-induced fluid streaming that facilitates fat removal [26].

Many investigators advocate the use of external ultrasound to assist liposuction due to its multiple advantages including diminished bleeding during surgery, facilitation of surgical procedures, more tissue retraction, and less postoperative discomfort improving the results substantially compared with the classic tumescent technique [10,23-26,68]. A major advantage of this procedure is that superficial subdermal liposuction can be used safely [26]. Because in external ultrasonic lipoplasty the ultrasound is applied externally, small incisions can be placed almost anywhere. Standard, thin suction cannulas are used. Skin burns and end hits are avoided [26]. Clinical recovery is also enhanced by the external ultrasound [23].

On the other hand, some researchers have found no significant clinical benefits to external ultrasound and recommended further study [57,58,60,69]. This technique remains under investigation [22].

This study was done to evaluate safety, effectiveness and cost of a certain protocol for liposuction. The principles of this protocol are; 1) Proper selection of patients, 2) Adequately equipped theatre, 3) IV sedation by a qualified anesthesiologist, 4) Close per-operative monitoring, 5) Local infiltration anesthesia by the superwet technique, 6) External ultrasound assisted liposuction, 7) Low-moderate volume liposuction (less than 5 litres total aspirate), 8) Day case procedure, 8) Early ambulation, and 9) Proper postoperative garment compression.

The study included 52 patients who were managed by the same protocol over a period of two years. Patients were selected young, not obese, with no cardiovascular or coagulation disorders, not hypertensive or anaemic, and with realistic expectations. 98 sites were treated. Most common areas were the abdomen and gluteal regions. Next common were the trochanteric areas, hips and male breasts.

In this study, anesthesia was in the form of IV sedation in addition to the local superwet anesthesia. General endotracheal anesthesia was avoided due to its complications and delayed recovery. Deep sedation was preferred to conscious sedation because it gives more analgesia to the patient and it keeps him asleep. Sedation was maintained at a level that keeps the patient asleep but could be aroused by repeated or painful stimulation. Very deep sedation was not recommended for fear of respiratory depression. Actually in the early cases of this series conscious anesthesia was used but it was not tolerated well by the patients, they were feeling pain and were moving a lot. When the patient is comfortably asleep, the surgeon is allowed to focus full attention on the procedure without the distraction of inadvertent patient movement [22]. Sedation was given and monitored by a specialized qualified anesthesiologist. It was found a safe effective method, with very rapid smooth recovery, and with lower cost than general anesthesia.

To avoid complications of fluid overload, intra-operative fluid management followed the recommendations of recent studies on this issue [22,33,70].

Tumescence has been recommended by some studies on external UAL [10,26], based on that injecting too much fluid over-whelms the effect

of the ultrasound [10]. In this series, a superwet technique was used to infiltrate the areas to be recontoured. Superwet was favored to Tumescence technique in this article due to many reasons. First, It was not found necessary to instill too much fluid to attain a tense firm state of the area to be contoured. Also, superwet technique is sufficient to facilitate efficient emulsification [44]. Nevertheless, for safety issue, superwet technique is generally favored than tumescence due to the smaller volume of infiltrations and thus decreased likelihood of lidocaine toxicity and fluid overload [22]. The concentration of lidocaine (0.05%) was preferred as no general anesthesia was given to the patients in addition to the better local anesthetic effect and longer postoperative pain relief. No sodium bicarbonate was added since the commencement of infiltration was after the patient had been sedated.

In this work, it was observed that external ultrasound-assisted lipoplasty had the following intraoperative advantages over conventional suction assisted liposuction: (1) More fat can be removed in a significantly shorter period of time; (2) The fat is whiter and has a looser consistency; (3) There is less resistance to movement of the cannula, and thus less effort was needed by the surgeon. The same was observed by many authors [10,26]. Also, no skin complications were recorded from the use of external ultrasound in patients of this study.

Most of the patients in this series had mild-moderate postoperative pain in the first few days which was adequately treated by paracetamol tablets alone. There was some discomfort in most of the patients due to the compression garments. However, all the patients returned actively to their work after 2-3 days.

Adequate double layered garment compression was very essential in liposuction patients of this series in the first 6 weeks after the operation, and could only be taken off during bathing. The aim of this was to minimize oedema, and to prevent seroma, and haematoma, as well as to allow the skin to adhere to the underlying tissues.

Although liposuction is not a method of weight reduction, especially in this study of low volume liposuction, still some weight loss was noticed in most of the patients few months after operation with an average loss of 3.3Kg. The loss varied according to the amount of aspirated fat, and according to the lifestyle of patient and his dietary habits.

In this work, esthetic results were excellent in 39 patients (75%), good in 9 patients (17.3%) and

fair in 4 patients (7.7%). Only one patient asked for secondary liposuction. No major local or general complications were encountered. Only minor complications were seen in 7 cases (13.4%) mostly in the form of minor irregularities and bruises. Injection of some of the stored fat can help management of localized depressions. Also, recent non-invasive modalities like subcutaneous fillers and mesotherapy can help refinements of post liposuction minor contour irregularities.

In order to have successful long term results, patients of this study were postoperatively advised to have a healthy lifestyle, eat a proper diet, and exercise regularly. The same was recommended by Rohrich et al. [69].

The safety of the protocol mentioned lied in 1) Proper patient selection & preoperative preparation, 2) IV sedation rather than general anesthesia, 3) Proper per operative monitoring, 4) Superwet technique rather than tumescence, and 5) Low volume rather than high volume liposuction.

The management protocol mentioned in this study is not only safe and effective but also cost effective because 1) It is a day case procedure, 2) IV deep sedation is more economic than general endotracheal anesthesia, 3) The use of sedation produces rapid recovery and early discharge, 4) The use of external ultrasound reduces operation time.

#### *Conclusions and recommendations:*

- 1- Proper patient selection is essential for the success of liposuction.
- 2- IV deep sedation combined with local superwet lidocaine infiltration is a very effective combination.
- 3- IV deep sedation is safe provided it is given and monitored by a qualified anesthesiologist, in a properly equipped theatre.
- 4- Superwet technique is quite effective and even safer, less time consuming, and less costly than tumescence.
- 5- The use of external ultrasound is safe and makes the procedure of liposuction easier for the surgeon, with more fat in less time.
- 6- External UAL combined with superwet technique is effective and yields excellent cosmetic results.
- 7- Strict application of double layer garment compression for 6 weeks is mandatory.
- 8- Proper education of the patient is essential to have a successful long term result.



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