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Safety of Tumescent Liposuction under Local Anesthesia in a Series of 4,380 Patients

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Key Words
Liposuction · Tumescent liposuction, safety · Local anesthesia

Abstract
Background: Liposuction is increasingly performed under local anesthesia and in an outpatient setting. The term 'tumescent liposuction' has been used in the literature in patients receiving other forms of anesthesia as well, hence the confusion regarding the safety profile of liposuction performed under local anesthesia alone. ***Objective:*** To analyze the safety of tumescent liposuction performed under local anesthesia in a larger group of patients. ***Methods:*** Between 2003 and 2010, 4,380 consecutive patients underwent tumescent liposuction by the same surgeon. The occurrence of complications was recorded in detail. ***Results:*** There were no serious complications requiring hospitalization. There were no injuries, no nerve damage or permanent lymphedema, no deep venous thrombosis or seroma. Seven patients needed closer follow-up due to large hematoma (n = 3; no drainage needed), allergic drug reaction to doxycycline (n = 2), erysipelas (n = 1) and generalized edema (n = 1). ***Conclusions:*** Tumescent liposuction under local anesthesia is a safe method, providing it is performed by an experienced surgeon and the guidelines of care for liposuction are strictly followed.

Introduction

Tumescent local anesthesia refers to a technique that uses large amounts of a very dilute local anesthetic combined with epinephrine that is injected into subcutaneous fat compartments. This method, introduced in 1987 by a dermatologic surgeon, revolutionized the liposuction procedure and eliminated many problems associated with dry liposuction and with liposuction performed under general anesthesia [1]. Tumescent liposuction is not clearly defined and was not only used in the literature when liposuction was performed under local anesthesia, but also when liposuction was performed with other forms of anesthesia, such as general anesthesia, intravenous sedation or spinal anesthesia. This led to a misperception of the rate of complications and side effects of liposuction performed under tumescent local anesthesia, which was erroneously associated with serious complications, including pulmonary embolism, excessive blood loss, hemorrhagic necrosis of fat and even death [2, 3]. In a number of studies it was clearly shown that serious complications increase when liposuction is performed under general anesthesia, when it is combined with other surgical procedures, such as abdominoplasty, or in megaliposuction [4]. It is important to note, however, that not a single death has been recorded after tumescent liposuction under local anesthesia when the guidelines of care

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Table 1. Distribution of the 9,242 body areas treated

Body area	Treated
Neck	281
Arms	76
Female breast	23
Stomach	2,055
Hips or love handles	2,149
Scapular rolls	188
Infra-axillary	153
Buttocks	471
Outer thigh	1,983
Inner thigh	1,608
Anterior thigh	102
Posterior thigh	28
Lower legs	74
Others (lipoma, sacral, pubis, buffalo hump)	51

for liposuction were followed [5, 6]. This study was designed to analyze the side effects in a series of 4,380 patients who consecutively underwent tumescent local anesthesia in an outpatient setting.

Subjects and Methods

Between 2003 and 2010 all patients who underwent tumescent liposuction were included in the study. Our venue is an outpatient setting where exclusively tumescent liposuction is performed. To reduce human error, the procedure has been constantly optimized over the years. A thorough medical history was obtained from all patients prior to liposuction. In several cases, when patients were suffering from systemic diseases, other specialists were consulted. Liposuction was only performed when the patients agreed to the procedure, and in a few cases, patients were excluded from liposuction following the specialist's opinion. Informed consent was obtained from all patients. To reduce the risk of infection, antibiotic prophylaxis was performed with initially 200 mg, then 100 mg doxycyline daily for 7 days. Between 2003 and 2006 we administered doxycycline 1 day prior to surgery. After 2006 doxycycline was given on the day of surgery. In most patients, 10 mg of diazepam was also given to reduce emotional discomfort. A variety of different areas were treated, including the neck, breast, belly and love handles, upper arms, back, inner and outer thighs, the front and the back of thighs, knees, calves and ankles. We included each procedure in the study, regardless of whether only a very small area (i.e. knees, mons pubis) was treated or whether liposuction was performed in multiple areas. The areas to be treated were marked with ink while the patient was in a standing position. The amount of tumescent fluid was calculated according to body weight and was up to 7 liters, with a maximum lidocaine dose of 55 mg/kg body weight, according to the American Society of Dermatologic Surgery guidelines of care for liposuction [6]. Tumescent fluid consisting of lidocaine, epinephrine and sodium bicarbonate was prepared in the operating room. The concentration of lidocaine varied in the tumescent fluid between 400 and 500 mg/l. Instruments were sterilized, and sterile gloves were worn during infiltration and liposuction. Body areas to be treated were disinfected with a spray in a lying position (Softasept, B. Braun, containing 74.1% ethanol). This was repeated each time the patient had to change position. Slit incisions (3 mm) were made, when possible, in inconspicuous places and wherever possible in a slightly asymmetric pattern. Infiltration of the tumescent fluid was performed either with a single, blunt infiltration cannula with a diameter of 18 gauge (1.02 mm; HK Surgical, San Clemente, Calif., USA) or with a sharp needle (21 gauge) using an automated high-flow/high-vacuum system (Vacuson 60LP, Erlangen, Germany). Between 2003 and 2005, thinner infiltration cannulas were used (18 gauge). The tip of a thin infiltration cannula broke during infiltration in 1 patient. Therefore, thicker infiltration cannulas were used from 2005 (10 gauge). Power-assisted liposuction was performed using a variety of different cannulas, depending on the tissue and body parts to be treated. Most often, a Capistrano cannula (HK Surgical) and Becker cannula (Byron Medical) were used. We prefer to perform liposuction partly in a lying, partly in a standing position which enables us to work more precisely. Before liposuction and after each change of position, the area was cleaned with chlorhexidine-alcohol. Reinfiltration was never performed. Liposuction was performed as soon as blanching occurred. Most patients had multiple fat deposits, and here, liposuction could be performed immediately after infiltration in those areas that were infiltrated first, thus allowing the solution to diffuse evenly during the 15–20 min waiting time of a given area. Patients wore a compression garment for 3 weeks. Slit incisions were left open (open drainage technique). Only in a few cases, where handling of fluid would have been difficult, was tissue adhesive used to close the incisions (Histoacryl, Aesculap AG, Tuttlingen, Germany). All patients were provided with an emergency number after their discharge and could reach the physician (R.B.) during 24 h/7 days. They also had scheduled follow-up appointments after 8 weeks. All patients received pain killers (mefenamic acid) that were only taken in case they experienced pain. Most patients opted for external tissue massage (endermology) beginning 1 month after the procedure to smooth out skin irregularities during wound-healing. This was performed once a week for up to 8 weeks.

Results

A total of 4,380 patients aged 16–85 years underwent tumescent liposuction during the 8-year period of this study. There were 3,372 female (77%) and 1,008 male patients (23%). The aspiration volumes were 0–100 ml (n = 302; 7%), 100 ml to 2 liters (n = 3,416; 78%) and 2 liters and more (n = 662; 15%). The distribution of 9,242 body areas treated is given in table 1. In none of the patients was hospitalization required. There were no injuries, no nerve damage or permanent lymphedema, no deep venous thrombosis or seroma. Follow-up appointments were scheduled 8 weeks after surgery. A minority of pa-

tients required closer follow-up appointments. In 3 patients, large painful hematoma had developed, which needed further attention. One hematoma in a female patient was particularly disturbing due to its location in the face after liposuction of the neck. The other hematomas in 2 men were less severe and were located on the breast and on 1 love handle, respectively. Treatment consisted of cooling the areas with cold packs as well as oral anti-inflammatory and pain treatment. No drainage was necessary, and the hematoma receded over a period of several months. Three and 4 days after treatment, 2 patients developed a generalized exanthema, consistent with an allergic drug reaction to doxycycline. Antibiotic treatment was immediately stopped in both patients and the rash receded over a period of several weeks. One female patient complained of tension and pressure pain close to a slit incision 2 days after liposuction. On clinical examination, irregular inflammatory patches were seen in the groin, consistent with beginning erysipelas. There were no chills and no fever. An oral antibiotic treatment was started with amoxicillin clavulanate 2 × 1 g/day for 7 days, which resulted in a rapid response. One patient suffered from generalized edema and was given furosemide orally (table 2). A number of unwanted side effects were seen that could be treated and were of no concern to the patient. These included hyperpigmentation, hypopigmented slit incision sites, erythema, surface irregularities (were treated with touch-up), nausea due to lidocaine and/or antibiotics, transient swollen genital areas due to absorption of tumescent solution, small locally infected incision sites, postliposuction panniculitis, more postoperative pain than expected, and irregular menstrual cycle. Touch-ups were only performed 6 months after the initial surgery (n = 68). A touch-up is defined as lipoaspiration to improve the results in a patient previously treated by the same surgeon.

Table 2. Complications of tumescent liposuction, occurrence in this series and actions needed

Complications	Number in this series	Action needed
Death	0	–
Perforation	0	–
Pulmonary embolism	0	–
Deep venous thrombosis	0	–
Fat embolism	0	–
Fluid overload	0	–
Necrotizing fasciitis	0	–
Skin necrosis	0	–
Generalized edema	1	furosemide
Lidocaine toxicity	0	–
Allergic reaction to antibiotic	2	stop antibiotic
Extensive hematoma	3	anti-inflammatory treatment
Seroma	0	–
Nerve damage	0	–
Permanent lymphedema	0	–
Erysipelas	1	antibiotic treatment

Discussion

In tumescent local anesthesia, dilute lidocaine and dilute epinephrine are delivered by subcutaneous infiltration to provide profound local anesthesia, thus eliminating the need for general anesthesia. The patient will remain pain-free during the procedure, providing a sufficient amount of fluid is injected into the target area. The injected areas must be firm upon palpation. Vasoconstriction due to epinephrine (blanching) will prevent blood loss. A firm area enables a perfect and safe condition to aspirate waterlogged fat cells, and it will provide sufficient pain control within these areas only, forcing the surgeon to stay within the tumescent areas. As long as lipoaspiration using blunt microcannulas is performed within these target areas, which are clearly visible due to vasoconstriction, injuries and extensive blood loss can be prevented [1].

Tumescent liposuction under local anesthesia has been shown to be the safest method of fat removal with the fewest complications. This was substantiated by a number of previous studies comparing the rate of severe complications under local anesthesia alone to liposuction performed under general anesthesia or intravenous sedation. In a study conducted in 1988 with 9,478 and in 1995 with 15,336 patients by the same author, no serious complications were reported [7]. In a survey of over 66,000 patients undergoing liposuction using the tumescent local anesthesia technique, no deaths were reported and the rate of serious adverse events was 0.68/1,000 cases [8].

In the presented study with 4,380 consecutive patients who had undergone tumescent liposuction in an outpatient setting and under local anesthesia alone, no severe complications occurred and no hospitalizations were required. In our series, 7 patients needed further attention due to large hematoma, allergic drug reaction to doxycycline, erysipelas and generalized edema. The complications needed no consultation with other specialists, were treated immediately and left the patient with no perma-

nent damage. The rate of patients needing further attention was 0.16%. This data is comparable to the literature with a rate of 0.27% of patients who needed additional action. In this series with albeit a smaller number of patients compared to this study, no serious complications occurred [9]. Factors lowering the rate of complications include the physician's experience, an organized setting reducing human error and performing the procedure in an outpatient setting. This was substantiated previously by a study which sought to determine whether specialty of the physician and location of the liposuction surgery had an effect on the incidence of malpractice claims [10]. This study showed that less than 1% of the defendants were dermatologic surgeons even though dermatologic surgeons performed about 33% of liposuctions in this study. For hospital-based liposuction the rate of malpractice settlements was 3 times higher compared to office-based liposuction surgery [10]. Our series consisted of a higher percentage of men (male-to-female ratio 1:2.3 vs. 1:9) compared to the recent literature [9]. The differences in the number of female versus male patients may depend on local factors, the surgeon's guidance during the first appointment and exposure to publicity in the lay press or the Internet.

This study demonstrates that liposuction performed under local anesthesia alone by an experienced physician in an outpatient setting has a very low rate of complications. In order to prevent lidocaine toxicity, 55 mg/kg body weight lidocaine should not be exceeded in a single session. If a higher amount of tumescent solution is needed due to multiple body parts to be treated, the procedure needs to be performed in 2 sessions, giving enough time to allow the lidocaine to be metabolized. Knowledge of those drugs that can inhibit the cytochrome p450 system that metabolizes lidocaine and can result in elevated lidocaine blood levels is crucial. Drugs given prior to surgery to reduce emotional discomfort have to be taken into account as well. While we did not experience any unwanted effects of diazepam, it has been shown that midazolam may occasionally precipitate hostility and violence instead of tranquility. These symptoms can be reversed with flumazenil [11]. Guidelines of care for liposuction need to be followed meticulously, and for the few patients needing further attention in an outpatient setting, a response system needs to be put in place where potential complications can be addressed immediately.

Disclosure Statement

There is no direct or indirect financial implication.

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