Outpatient cosmetic procedures are becoming increasingly popular. Eighty percent of cosmetic procedures are now performed outside of a hospital setting. Abdominoplasty is consistently one of the five most commonly performed procedures; it increased in frequency by over 300% between 1997 and 2010. In 2010, 144,929 abdominoplasties were performed. Conventionally, abdominoplasties have been performed as inpatient procedures. As the demand for outpatient procedures has increased as a result of patient preference and economic concerns, body contouring is now judiciously being performed in accredited outpatient facilities. Data have been published over the last decade showing that these procedures have complication rates equal to those of the same procedures performed in an inpatient setting.

Abdominoplasties are often cited as the plastic surgery procedure with the highest risk of venous thromboembolism (VTE). However, such reports are limited because of their small patient cohorts; furthermore, they often do not distinguish among different body contouring procedures. Additionally, these reports include patients who were kept overnight or hospitalized for several days. The term outpatient is changing from Medicare’s original definition, which was a patient staying in the hospital less than 24 hours, to a definition that involves a patient being discharged within hours of surgery. To date, there has been no large cohort study of true outpatient abdominoplasty. Stevens et al reviewed 519 patients who underwent full abdominoplasty and were discharged within hours of surgery. The study shows that full abdominoplasty procedures can be safely performed without systemic complications in an outpatient setting. Based on these data, the ever-present sentiment that abdominoplasty is the plastic surgery procedure associated with the highest rate of venous thromboembolism should be carefully evaluated.
miniabdominoplasty, and most of their patients stayed overnight in an aftercare facility. Antonetti and Antonetti\textsuperscript{11} reported on 517 patients, but only 80 of their procedures were exclusively performed in an outpatient setting. As such, there is a dearth in the literature of reports on the safety of immediately discharging patients who have undergone full abdominoplasty in an office-based setting. In this report, we evaluate the senior author’s 18-year experience with office-based full abdominoplasty, including complications and revision rates.

**METHODS**

**Patient Selection and Preoperative Procedure**

The charts of 321 consecutive patients were retrospectively reviewed, 206 of whom had complete electronic medical records (EMR). These patients underwent full abdominoplasty with the senior author (CLM) between January 1992 and May 2010. Demographic, operative, and postoperative data were collected from the charts. Two patients who underwent abdominoplasty as an inpatient procedure were excluded: One had a body mass index (BMI) of 52; the other was undergoing a concomitant procedure by another surgeon. This left a total of 319 patients in the study cohort. These patients all had an American Society of Anesthesiologists (ASA) Physical Status Classification of 1 or 2; otherwise, they would not have been selected for an outpatient procedure.

Patients usually presented with complaints of abdominal lipodystrophy and skin laxity after pregnancy or weight loss. The risks and benefits of abdominoplasty were discussed at length with each patient, and the planned incisions were drawn. If the patient was a smoker, he or she was asked to stop and wait six weeks after cessation for the operation. Patients were seen two weeks preoperatively for any further questions, at which time they signed an informed consent. At this time, patients were asked to stop taking any nonsteroidal anti-inflammatory medications or aspirin. They were also asked not to ingest anything by mouth after midnight the day before surgery. Most important, time was taken to discuss the surgeon’s postoperative expectations, with heavy emphasis on ambulation before discharge and continued ambulation at home.

**Surgical Technique**

All abdominoplasties were conducted in a fully-accredited Class C office-based surgery facility as determined by the American Association for Accreditation of Ambulatory Surgery Facilities. All patients were marked in a standing position before entering the operating room. Once the patient was on the operating room table, pneumatic compression devices were placed on the lower extremities, and antimicrobial prophylaxis was administered intravenously. General anesthesia was commenced with either a laryngeal mask airway or an endotracheal tube. The patients were induced with propofol. Balanced anesthesia was maintained with an inhalational agent (sevoflurane or isoflurane), along with fentanyl for added analgesia. Additionally, a muscle relaxant (rocuronium or mivacurium) was administered to facilitate the rectus plication. Ondansetron, metoclopramide, and, occasionally, dexamethasone (Decadron) were given to prevent postoperative nausea and vomiting. No deep vein thrombosis (DVT) chemoprophylaxis was administered.

In all patients, a full abdominoplasty was carried out with undermining to the xiphoid and subcostal margins. Each patient was then placed in a flexed position, and the excess abdominal tissue was removed. The rectus fascia was plicated from xiphoid to umbilicus and from umbilicus to pubis. One or two 15 French Blake drains were placed immediately below the incision, near the inguinal crease; after which, with the patient still under anesthesia, a 60-mL mixture of 1% lidocaine with epinephrine and 0.5% Marcaine was placed in the drains and allowed to bathe the abdominal wall. The most frequent concurrent procedures were bilateral augmentation mammoplasty and liposuction. Liposuction could be performed in the hips and/or thighs, but no liposuction was performed on the abdominal flap.

Clinical results are shown in Figures 1-3.

**Postoperative Care**

Incisions were dressed, and no abdominal binders were placed. The patient was taken to the recovery room and discharged once he or she could void, tolerate fluid intake, and ambulate. Drainage tubes were placed to bulb suction 30 minutes after arrival in the recovery area, which facilitated ambulation very early in the postoperative period. The ambulation required for discharge included walking to the bathroom and transferring to the vehicle for return home. Instructions for care and recording drain output...
were given to the patient, as well as the adult responsible for caring for the patient over the next 24 hours. Patients were instructed to ambulate with assistance in a position as erect as comfortable, several times that evening. Prescriptions for an antibiotic, a narcotic, and docusate sodium (Colace; 100 mg, twice per day) were given to each patient. Patients were seen in the clinic at two days, one week, two weeks, four weeks, two months, and six months postoperatively, or more frequently if needed. The drains were kept in place until there was less than 30 mL output in a 24-hour period. If a patient noted that the output reached this amount before a subsequent clinic visit, she or he was encouraged to present for drain removal.

**Outcome Measures and Statistical Analysis**

Baseline characteristics were collected for the following: age, sex, BMI, medications, comorbidities, prior abdominal surgeries, smoking habits, and ASA physical status. Information was gathered regarding operative time, recovery time, and length of time until drain removal. The outcomes measured in this study included complications and subsequent treatment. The complications were divided into local and systemic categories. The local complications recorded were seroma, hematoma, flap epidermolysis, wound dehiscence, wound necrosis, umbilical wound dehiscence, hypertrophic scar, contour irregularity, wound infection, suture reaction, and superficial nerve entrapment. Systemic complications included DVT, pulmonary embolism (PE), blood transfusion, intra-abdominal perforation, and death. Any patient who had fluid that could be aspirated from beneath her or his abdominal skin flap was defined as having a seroma. Seromas were identified by palpation or ultrasound. Any patient with ecchymosis and blood that was aspirated or surgically evacuated was defined as having a hematoma. Any scar or skin excess (ie, dog ears or mons ptoisis) that was deemed unfavorable by the patient or the surgeon was counted as hypertrophic

*Figure 2. (A, C) This 50-year-old woman is shown preoperatively. She presented with abdominal wall laxity and excess abdominal skin. She had a BMI of 23 and a prior appendectomy. (B, D) An early result, three months after full abdominoplasty in an outpatient setting.*
scarring or contour deformity, respectively. Data were analyzed with the $\chi^2$ test, Fisher t-test, and two-tailed t-test.

RESULTS

We present two sets of results: one for the entire cohort of 319 patients and another for the 206 patients for whom complete EMR were available.

As record-keeping evolved and EMR were added to the practice in 2009, significantly more data were available for the subset of 206 EMR patients. All but three patients (98.5%) were women. The patients ranged in age from 21 to 69 years (mean, 40 years). The BMI range was 18 to 39 (mean, 25) and 12.1% of the subset cohort had a BMI of greater than 30. All patients had an ASA Classification of 1 or 2. Thirty-seven patients (17.9%) were taking estrogen preoperatively, in the form of oral contraceptives or hormone replacement therapy. Twelve percent (n = 25) continued to smoke at the time of the operation. More than half had undergone prior open abdominal surgeries (56.3%, n = 116). The length of follow-up ranged from two weeks to 9.5 years (mean, 13 months). Only four patients were followed for less than three weeks, because they lived in a city remote from the clinic.

Of the 206 patients in the subset cohort, 88 (42.7%) underwent only an abdominoplasty procedure. The average operative time for these patients was 105 minutes, and the average recovery room time was 86 minutes. The concurrent procedures performed included liposuction of hips and/or thighs (27.7% of the patients who underwent concurrent procedures, n = 57), breast augmentation (17.5%, n = 36), and mastopexy (15.5%, n = 32), as well as hernia repair (n = 4), reduction mammoplasty (n = 3), removal of implants (n = 2), implant exchange (n = 3), brachioplasty (n = 2), blepharoplasty (n = 2), hysterectomy (n = 1), bilateral salpingo-oophorectomy (n = 1), laparoscopic cholecystectomy (n = 1), fat grafts to lips (n = 1), and scar revision (n = 1) (Figure 1). Average operating time for patients undergoing concurrent
The difference closely approached significance at the group that did not have any complications (n = 109). at least one complication (n = 96) was 25.5; it was 24.4 for P = .77). 16.7% (n = four of 24) in smokers (<i>which included underlying fat necrosis</i>), three required surgical debridement and revision. Umbilical wound dehiscence, wound dehiscence, suture reaction, and epidermolysis were all treated with local wound care and healed uneventfully. The patient with superficial nerve entrapment was treated with Xylocaine and steroid injections. None of the complications required hospitalization.

The most common complication seen overall was seroma, at a rate of 19.4%. The amount of fluid aspirated in these cases ranged from 5 mL to a total of 900 mL during serial aspirations. Two of the 40 patients with seromas required surgical excision of the seroma cavity. Six patients required either Penrose drain or seroma catheter placement under local anesthesia. Hypertrophic scarring was the next most common complication (9.2%). Three of the 19 hypertrophic scars (19 patients) were revised operatively; the remainder were treated with either steroid injections or massage and silicone therapy. Of the 15 patients with contour irregularities, 11 underwent operative revision. There were 14 patients with hematoma, four of which required surgical evacuation. The remainder were treated with aspiration or placement of a Penrose drain. All wound infections were successfully treated with oral antibiotics. Of the five patients with wound necrosis (<i>which included underlying fat necrosis</i>), three required surgical debridement and revision. Umbilical wound dehiscence, wound dehiscence, suture reaction, and epidermolysis were all treated with local wound care and healed uneventfully. The patient with superficial nerve entrapment was treated with Xylocaine and steroid injections. A total of 21 patients (10.2%) required a surgical revision.

Until May 2006, the senior author primarily placed only one drain and, occasionally, two drains. After that time, he always placed two drains. The incidence of seroma formation before May 2006 was 25.3% but was reduced to 14.4% after 2006 (P = .05). Overall, the drains were left in place for an average of 11 days. Of the subset cohort, mean BMI was 24.6 ± 3.6 in the patients who did not develop seroma (n = 165) and 26.2 ± 4.6 in those who did (n = 40). (One patient did not have a recorded BMI.) Using a two-tailed t-test, this difference was determined to be significant at P = .01. Additionally, the mean BMI for the group of patients that had at least one complication (n = 96) was 25.5; it was 24.4 for the group that did not have any complications (n = 109). The difference closely approached significance at P = .052.

The incidences of the following wound complications were analyzed separately in patients who were smokers: wound infection, umbilical wound dehiscence, wound necrosis, wound dehiscence, and epidermolysis. The rate of wound complications was 11.5% (n = 20 of 174) in nonsmokers, 12.5% (n = one of eight) in those who ceased smoking in the six weeks prior to surgery, and 16.7% (n = four of 24) in smokers (P = .77).

<table>
<thead>
<tr>
<th>Complications</th>
<th>Patients, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seroma</td>
<td>19.4</td>
</tr>
<tr>
<td>Hypertrophic scar</td>
<td>9.2</td>
</tr>
<tr>
<td>Contour irregularity (dog ear)</td>
<td>7.3</td>
</tr>
<tr>
<td>Hematoma</td>
<td>6.8</td>
</tr>
<tr>
<td>Wound infection</td>
<td>6.8</td>
</tr>
<tr>
<td>Umbilical wound dehiscence</td>
<td>5.3</td>
</tr>
<tr>
<td>Wound necrosis</td>
<td>2.4</td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>1.9</td>
</tr>
<tr>
<td>Suture reaction</td>
<td>1.9</td>
</tr>
<tr>
<td>Epidermolysis</td>
<td>1.5</td>
</tr>
<tr>
<td>Superficial nerve entrapment</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Discussion**

As the trend of performing more abdominoplasties in an outpatient setting continues upward, it is important to selectively examine these patients to better understand their risk of complications. A thorough review of the English literature via PubMed based on the search term abdominoplasty showed that published data are lacking on solely outpatient full abdominoplasty procedures. As we focus more on outcomes-based performance measures, it is imperative that we document the risks pertaining to the procedure being performed. For the purposes of this study, we defined outpatient as procedures after which the patient was discharged from the ambulatory facility within hours of surgery, rather than being kept overnight.

A total of 319 consecutive full abdominoplasty patients from the senior surgeon’s accredited Class C office-based surgery clinic were reviewed retrospectively. All procedures were performed under general anesthesia. The majority were performed concurrently with ancillary procedures, most often liposuction (27.7%). No systemic complications occurred, including VTE. Based on these data, the ever-present sentiment among plastic surgeons that abdominoplasty procedures carry the highest rate of VTE needs to be carefully evaluated.

The incidence of DVT and PE continues to be ill-defined in aesthetic surgery. The most often-cited statistic is from Grazer and Goldwyn,13 who reported a DVT incidence of 1.1% and a PE incidence of 0.8%. Their survey, published in 1975, took place before the advent of sequential compression devices, which are known to decrease the incidence of VTE by 60%. Many surgeons in that survey reported that their abdominoplasty patients remained in

*Table 1. Rates of Local Complications*
Table 2. Rates of Deep Venous Thrombosis and Pulmonary Embolism for Abdominoplasty in the Published Literature

<table>
<thead>
<tr>
<th></th>
<th>Grazer13</th>
<th>van Uchelen15</th>
<th>Matarasso17</th>
<th>Hansen18</th>
<th>Stevens3</th>
<th>Current Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients, No.</td>
<td>10,490</td>
<td>86</td>
<td>11,016</td>
<td>206</td>
<td>519</td>
<td>319</td>
</tr>
<tr>
<td>Thrombosis, %</td>
<td>1.1</td>
<td>1.4</td>
<td>0.04</td>
<td>0.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Embolism, %</td>
<td>0.8</td>
<td>1.4</td>
<td>0.02</td>
<td>0.5</td>
<td>0.02</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note that 17.9% of our patients were taking some form of estrogen and that 12.1% were obese (BMI > 30)—both risk factors for VTE. We did not ask our patients to discontinue use of estrogen preoperatively. Our lack of VTE complications also supports the guidelines that moderate-to-high-risk individuals (depending on the guideline) can receive adequate prophylaxis with intermittent pneumatic compression and early ambulation to prevent these systemic complications. We believe that discussing our expectations of early ambulation with our patients before surgery was important. Furthermore, we had patients ambulate in the recovery room. Also, bathing the abdominal wall with lidocaine and Marcaine before extubation aided greatly in terms of postoperative ambulation comfort (although this is a subjective surgeon observation).

Seroma formation was the most common complication in our series (19.4%), which is in the range of previously-reported rates (1% to 38%). Placing two drains in every operation decreased our rate of seroma formation significantly, from 25.3% to 14.4%. As of June 2010, we have started to place progressive tension sutures on the basis of evidence that the seroma rate can be decreased even further. Like many others, our study supports the fact that obesity is a significant risk factor in complications. Moreover, our comparative data were clinically significant when the mean BMI for the two groups—patients with and without seroma complications—were reviewed. The group without seroma had a mean BMI of 24 (which is considered normal weight), while the group that experienced seroma had a mean BMI of 26 (which is overweight). This is not to say that patients with a BMI of less than 24 did not develop seroma, but they tended toward a lower incidence of seromas. In our study, we did not find an association between smoking and wound complications, but the number of smokers was small. This is likely because we strongly discourage active smokers from having an abdominoplasty if they are unable to quit smoking entirely for six weeks preoperatively.

The majority of seroma cases were treated conservatively, with needle aspiration or Penrose drain placement. Of the 40 patients with recorded seromas of any size, only two patients required operative treatment. Four patients with hematoma required surgical evacuation. All infections resolved with antibiotics. Half the contour deformities and hypertrophic scars were operatively revised. Other studies on outpatient abdominoplasty show similar complication rates. Our overall revision rate was 10.2%, similar to other reported rates.

There is an increasingly strong push for procedures to be performed not only in an outpatient setting but also under conscious sedation. Those that advocate the use of conscious sedation cite decreased risk of DVT, but our study shows that general anesthesia, along with sequential compression devices and early ambulation, can provide comparable results.

CONCLUSIONS

Our study, in which we had a 0% rate of venous thrombotic events in a series of 319 patients, shows that full abdominoplasty can be safely performed in an outpatient setting with same-day postoperative discharge. Patient selection should be rigorous, and attention should be paid to BMI. The optimal method of VTE prophylaxis still needs clarification with a prospective trial that should include mechanical prophylaxis and ambulation as well as pharmaceutical prophylaxis. It is our hope that the current study will add to the literature a significant number of true outpatient abdominoplasties performed without serious morbidity or mortality.

Disclosures

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