Risk of Adverse Outcomes When Plastic Surgery Procedures Are Combined

Ahmad N. Saad, M.D.
Ralitza Parina, M.P.H.
David Chang, Ph.D., M.P.H., M.B.A.
Amanda A. Gosman, M.D.

San Diego, Calif.

Background: The ability to study population-level outcomes of outpatient cosmetic procedures has been limited by a lack of longitudinal data. This study aimed to describe the rates of adverse events in patients who underwent an isolated cosmetic surgery procedure compared with those who had a combination of two procedures.

Methods: Retrospective longitudinal analysis was performed of the 2005 to 2010 California Office of Statewide Health Planning and Development Ambulatory Surgery Database. Patients were included if they had undergone an abdominoplasty or any other procedure that was identified as frequently performed concurrently with abdominoplasty. Patients' subsequent in-patient admissions and emergency department visits were identified. Outcomes analyzed were the 30-day and 1-year venous thromboembolism rates, 30-day hospital admission rate, 30-day emergency department visit rate, and 30-day mortality rate.

Results: A total of 477,741 patients were analyzed, of whom 16,893 had undergone two concurrent procedures. The 12-month venous thromboembolism rate was 0.57 percent for patients undergoing abdominoplasty, 0.20 percent for liposuction, 0.12 percent for breast procedures, 0.32 percent for hernia repair, 0.28 percent for face procedures, and 0.28 percent for thigh lift/brachioplasty. Greater than additive 30-day and 1-year venous thromboembolism rates were observed among patients who underwent an abdominoplasty and liposuction (0.68 percent and 0.81 percent, respectively) and those who underwent an abdominoplasty and hernia repair (0.93 percent).

Conclusions: Some combinations of elective outpatient procedures conferred an additive, and sometimes more than additive, venous thromboembolism risk. This is an important consideration when informing patients of potential postoperative complications and for venous thromboembolism prophylaxis. (*Plast. Reconstr. Surg.* 134: 1415, 2014.)

The majority of cosmetic procedures are performed on an outpatient basis.[1,2] However, there are limited data on the safety and adverse outcomes after outpatient cosmetic surgery. One reason is that it is challenging to reliably follow patients who have undergone outpatient surgery and track their subsequent complications. As such, most prior studies have relied on self-reported data or single-center or single-surgeon experiences.[3] Furthermore, most studies have reported data from hospital-based outpatient surgery centers, and outcomes from freestanding facilities are unclear.

Despite the paucity of evidence, outcomes after outpatient cosmetic surgery, including subsequent hospital admissions and venous thromboembolism rates, are of particular interest for patients and in the current health care environment with an increasing focus on analyzing and tracking outcomes.[4,5] In addition, recommendations on which plastic surgery patients may benefit from venous thromboembolism prophylaxis remain unclear.[6–8]

Previous data on adverse outcomes after cosmetic surgery have reported a wide range of complication rates, including venous thromboembolism

From the Division of Plastic Surgery and the Department of Surgery, University of California, San Diego.
Received for publication May 2, 2014; accepted May 29, 2014.
Presented at the 82nd Annual Meeting of the American Society of Plastic Surgeons, in San Diego, California, October 11 through 15, 2013.

DOI: 10.1097/PRS.0000000000000738

Disclosure: *None of the authors has any relevant financial support or commercial associations or interests to disclose.*

rates ranging from 0 to 9.4 percent for different procedures.[3,6] A recent review of the American College of Surgeons National Surgical Quality Improvement Program Databases found that elevated body mass index was the most significant predictor of morbidities associated with abdominoplasty.[9,10] Furthermore, there has been contradictory data on whether undergoing multiple procedures concurrently places patients at a higher risk for adverse events. Although duration of anesthesia has previously been linked to increased rates of adverse events, this evidence has been disputed.[11–13]

Administrative databases provide a reliable way of tracking patients and analyzing surgical outcomes, but few databases capture outpatient surgery centers.[4,14] For this study, we used the California Office of Statewide Health Planning and Development Ambulatory Surgery Database, which we linked to the emergency department and inpatient discharge databases by means of a unique patient identifier. This allowed for reliable tracking of patients from the outpatient setting to the inpatient setting without reliance on self-reported data.

The aims of our study were to (1) accurately describe the rates of adverse outcomes for patients undergoing an isolated cosmetic procedure and for those undergoing two concurrent procedures using a large population-based database and (2) determine whether there is an additional risk when procedures are combined. The outcomes studied were 30-day and 1-year venous thromboembolism rates, 30-day hospital admissions, emergency department visits, and mortality rates.

PATIENTS AND METHODS

The 2005 to 2010 California Office of Statewide Health Planning and Development ambulatory surgery database was used to identify patients undergoing outpatient cosmetic surgery. The database uses a unique record linkage number (i.e., encrypted social security number) to identify each patient. This allowed us to track patients' subsequent hospital and emergency department visits anywhere in the state by linking the ambulatory surgery database to the California Office of Statewide Health Planning and Development patient discharge (inpatient) and emergency department databases, respectively. The inpatient and emergency department databases capture all admissions or emergency department visits to any nonmilitary hospital in the state of California. Included in each database is demographic information about the patient in addition to diagnoses and procedure codes. The ambulatory surgery and emergency department databases include Current Procedural Terminology codes, whereas the inpatient discharge database uses *International Classification of Diseases, Ninth Revision* codes.

California has a unique two-track system for regulation of ambulatory surgery centers. Surgery centers may be licensed as surgical clinics by the Department of Public Health or licensed as an "outpatient setting" by the California Medical Board.[14] This distinction is the result of the 2007 *Capen v. Shewry* decision in which the court ruled that physician-owned ambulatory surgery centers are to be regulated by the Medical Board. Accreditation by an independent agency such as the American Association for Accreditation of Ambulatory Surgery Facilities, the Accreditation Association for Ambulatory Health Care, the Joint Commission on Accreditation of Healthcare Organizations, or the Institute for Medical Quality is a process that is independent of licensure for facilities regulated by the Department of Public Health and fulfills licensure requirements for facilities regulated by the Medical Board. Facilities licensed by the Department of Public Health are required to submit data on each patient to the California Office of Statewide Health Planning and Development. Therefore, the California Office of Statewide Health Planning and Development ambulatory surgery database includes all licensed ambulatory surgery centers in the state in 2005 and 2006 and only those centers licensed by the Department of Public Health from 2007 to 2010. We also described whether facilities included in our study are accredited by one of the four aforementioned accreditation agencies based on their current accreditation status.[15–17]

Because abdominoplasty has been previously associated with the highest rates of postoperative complications, including venous thromboembolism, we included all patients who had undergone an abdominoplasty or any procedure that we identified as frequently performed concurrently with abdominoplasty.[4,18–20] Procedures that are frequently performed concurrently with abdominoplasty were determined by categorizing the 100 Current Procedural Terminology codes most frequently associated with abdominoplasty. The procedures identified were liposuction, breast procedures, face procedures, thigh lift, brachioplasty, and hernia repairs (Table 1). Patients who had a prior diagnosis of breast cancer were excluded from the analysis.

Demographics of the patient population were described including age, sex, and ethnoracial

Table 1. Procedure Categories Performed with Abdominoplasty

	Associated CPT Codes
Liposuction	15877, 15879, 15878, 15876
Breast procedure	19316, 19318, 19328, 19371, 19370, 19324, 19499, 19330, 19325, 19340, 19342, 19300
Face procedure	15822, 15820, 15823, 15821, 11950, 15828, 15825, 15829, 15824, 67900, 11954, 15788, 30400, 11951, 15838, 67999, 30410, 15826, 21120, 40799, 11952, 15770, 15780, 15781, 15782, 15783, 15784, 15785, 15786, 15787, 15789, 15792, 15793, 15819
Thigh lift/brachioplasty/ other	15832, 15839, 15836, 15833, 15834, 15835, 15837
Hernia repair	49560, 49585, 49561, 49565, 49505, 49587, 49570

CPT, Current Procedural Terminology.

group. Patients' medical history of obesity, smoking, type 2 diabetes, prior acute myocardial infarction, prior venous thromboembolism, a hospitalization within the past 6 months, previously diagnosed malignancy, oral contraceptive or hormone replacement therapy use, pregnancy or less than 1 month postpartum, and other hypercoagulable states (*International Classification of Diseases, Ninth Revision* diagnosis codes 289.81 to 289.89) were described as well. No risk adjustment was performed based on these characteristics when analyzing adverse outcomes because such outcomes after elective cosmetic procedures may represent poor patient selection that would get masked with risk adjustment. To describe risk factors for venous thromboembolism, a bivariate analysis was performed comparing patients who did and did not have a venous thromboembolism using Pearson chi-square tests to find differences in frequency distribution. The outcomes analyzed were the 30-day and 1-year venous thromboembolism rates, 30-day hospital admission rate, 30-day emergency department visit rate, and 30-day inpatient mortality rate. The rate of adverse outcomes was described in patients who underwent one outpatient procedure and in those who underwent two concurrent procedures. Venous thromboembolisms were identified based on the presence of an *International Classification of Diseases, Ninth Revision* diagnosis code for deep venous thrombosis or pulmonary embolism (415.1, 415.11 to 415.19, 453.2 to 453.4, 453.40 to 453.42, and 453.8) in a subsequent admission or emergency department visit.

Statistical analysis was performed with Stata SE statistical software, version 11.2 (StataCorp LP, College Station, Texas). Statistical significance was defined as $p < 0.05$ and 95 percent confidence intervals excluding 1.0. This study was exempt from review as designated by the University of California, San Diego Human Research Protections Program.

RESULTS

A total of 477,741 patients were included in the study, representing 727 ambulatory surgery centers. Of these, 132 surgery centers (18.2 percent) were also accredited by one of the following: the American Association for Accreditation of Ambulatory Surgery Facilities, the Accreditation Association for Ambulatory Health Care, the Joint Commission on Accreditation of Healthcare Organizations, and the Institute for Medical Quality.

Among patients undergoing cosmetic surgery procedures, most were female (84.6 percent) and non-Hispanic white (67.9 percent), with a median age of 47 years. In terms of comorbidities, 8.2 percent were obese, 5.5 percent were tobacco users, 5.6 percent had a diagnosis of type 2 diabetes, 4.0 percent had been hospitalized within the 6 months preceding their cosmetic procedure, 3.5 percent had a prior diagnosis of a malignancy, 0.7 percent had a prior myocardial infarction, and 0.5 percent had a prior venous thromboembolism (Table 2). When comparing the demographics and comorbidities of cosmetic surgery patients who did and did not have a venous thromboembolism, statistically higher rates of venous thromboembolisms were noted among patients with comorbidities as outlined in Table 2.

On analysis of the outcomes of patients undergoing an isolated cosmetic procedure, abdominoplasty was found to be associated with the highest rates of adverse outcomes—a 0.44 percent 30-day venous thromboembolism rate, a 0.57 percent 1-year venous thromboembolism rate, a 2.3 percent 30-day admission rate, a 4.3 percent emergency department visit rate, and a 0.07 percent 30-day mortality rate. One-year venous thromboembolism rates were 0.2 percent for liposuction, 0.12 percent for breast procedures, 0.28 percent for face procedures, 0.28 percent for thigh lift/brachioplasty, and 0.32 percent for hernia repair. The rest of the adverse outcome rates observed in patients undergoing an isolated procedure are listed in Table 3.

The outcomes for patients who underwent two concurrent procedures are listed in Table 4. We found that patients who underwent an abdominoplasty and liposuction had greater than additive 30-day and 1-year venous thromboembolism rates, at 0.68 percent ($p = 0.08$) and 0.81 percent

Table 2. Characteristics of Cosmetic Surgery Patients*

	Univariate Analysis	Bivariate Analysis		
	Total	Patients without VTE	Patients with VTE	*p*
No. of patients	187,587*	186,907	406	—
No. of ambulatory surgery centers	693	693	193	—
Age, yr				
Median	47	47	59	
IQR	34–60	34–60	46–72	<0.001
Sex, no. (%)				
Male	28,769 (15.4)	28,663 (15.3)	106 (26.1)	
Female	158,544 (84.6)	158,244 (84.7)	300 (73.9)	<0.001
Ethnoracial group, no. (%)				
Non-Hispanic white	109,547 (67.9)	109,287 (67.9)	260 (72.0)	
Hispanic	13,347 (8.3)	13,314 (8.3)	33 (9.1)	
Asian	11,539 (7.2)	11,526 (7.2)	13 (3.6)	
Black	5997 (3.7)	5978 (3.7)	19 (5.3)	
Other/decline to state	20,786 (12.9)	20,750 (12.9)	36 (10.0)	0.015
PMH				
Obesity	15,316 (8.2)	15,237 (8.1)	79 (19.5)	<0.001
Type 2 diabetes	10,448 (5.6)	10,391 (5.6)	57 (14.0)	<0.001
Smoker	10,231 (5.5)	10,181 (5.4)	50 (12.3)	<0.001
Hospitalization in past 6 mo	7487 (4.0)	7435 (4.0)	52 (12.8)	<0.001
Prior malignancy	6536 (3.5)	6493 (3.5)	43 (10.6)	<0.001
Prior AMI	1232 (0.7)	1222 (0.7)	10 (2.5)	<0.001
Prior VTE	940 (0.5)	904 (0.5)	36 (8.9)	<0.001
Oral contraceptive/HRT	583 (0.3)	581 (0.3)	2 (0.5)	0.51
Other hypercoagulable state†	186 (0.1)	176 (0.09)	10 (2.5)	<0.001
Pregnancy/<1 mo postpartum	52 (0.03)	52 (0.03)	0	0.73

IQR, interquartile range; PMH, patient's medical history; AMI, acute myocardial infarction; VTE, venous thromboembolism; HRT, hormone replacement therapy.
*This table describes demographics and comorbidities of patients who underwent at least one cosmetic procedure. Patients who underwent an isolated hernia repair are not represented.
†Including primary or secondary hypercoagulable states, myelofibrosis, and heparin-induced thrombocytopenia.

Table 3. Outcomes of Patients Undergoing an Isolated Procedure

	Abdominoplasty	Liposuction	Breast Procedure	Hernia Repair	Face Procedure	Thigh Lift/ Brachioplasty/ Other
No. of patients	5410	12,653	78,817	290,154	71,665	2115
VTE Rate, % (95 % CI)						
30-day	0.44 (0.30–0.66)	0.08 (0.04–0.15)	0.04 (0.03–0.06)	0.08 (0.07–0.09)	0.03 (0.02–0.05)	0.09 (0.02–0.38)
12-mo	0.57 (0.40–0.81)	0.20 (0.13–0.29)	0.12 (0.10–0.15)	0.32 (0.30–0.34)	0.28 (0.25–0.33)	0.28 (0.13–0.63)
30-day in-hospital mortality rate, no. (%)	4 (0.07)	7 (0.06)	26 (0.03)	196 (0.07)	67 (0.09)	2 (0.09)
30-day readmission rate, no. (%)	126 (2.3)	66 (0.5)	509 (0.7)	4112 (1.4)	451 (0.6)	24 (1.1)
30-day ED visits, no. (%)	230 (4.3)	211 (1.7)	1956 (2.5)	11,930 (4.11)	1375 (1.9)	82 (3.9)

VTE, venous thromboembolism; ED, emergency department.

($p = 0.09$), respectively, compared with those who underwent only one of the procedures. Similarly, patients who underwent an abdominoplasty and hernia repair at the same time had a greater than additive 1-year venous thromboembolism rate at 0.93 percent ($p = 0.10$). However, when analyzing other outcomes in patients who underwent two procedures—the rates of 30-day admission, 30-day emergency department visit, and 30-day mortality—we did not note any increased or additive risk of adverse events.

DISCUSSION

Abdominoplasty, when performed in isolation, had a significantly higher incidence of venous thromboembolism compared with other procedures included in this study. This

Table 4. Outcomes for Patients Undergoing Two Concurrent Procedures

	No.	30-day VTE Rate, % (no.)	1-Year VTE Rate, % (no.)	30-Day Admission Rate, % (no.)	30-Day ED Visit Rate, % (no.)	30-Day Mortality Rate, % (no.)
Abdominoplasty plus						
Liposuction	2945	0.68 (20)*	0.81 (24)*	1.97 (58)	3.26 (96)	0
Breast	1797	0.33 (6)	0.45 (8)	1.78 (32)	3.39 (51)	0.11 (2)
Face	213	0.47 (1)	0.47 (1)	1.41 (3)	2.82 (6)	0
Hernia	428	0.47 (1)	0.93 (4)*	3.04 (13)	5.37 (23)	0
Thigh lift/brachioplasty	343	0	0	2.62 (9)	4.37 (15)	0
Liposuction plus						
Breast	5202	0.08 (1)	0.10 (5)	0.77 (40)	2.31 (120)	0.04 (2)
Face	2816	0.04 (1)	0.04 (1)	0.53 (15)	1.49 (42)	0
Hernia	117	0	0	0.85 (1)	3.42 (4)	0
Thigh lift/brachioplasty	495	0.20 (1)	0.40 (2)	0.61 (3)	1.82 (9)	0
Breast plus						
Face	1660	0.06 (1)	0.06 (1)	0.54 (9)	2.05 (34)	0.06 (1)
Hernia	175	0	0	1.71 (3)	2.86 (5)	0
Thigh lift/brachioplasty	385	0	0	2.34 (9)	2.86 (11)	0
Hernia plus						
Face	28	0	0	0	3.57 (1)	0
Thigh lift/brachioplasty	32	0	0	3.13 (1)	0	0
Face plus						
Thigh lift/brachioplasty	257	0.0	0.39 (1)	1.17 (3)	2.33 (6)	0

VTE, venous thromboembolism; ED, emergency department.
*Denotes that the observed rate is higher than the expected additive rate for the two procedures. The expected additive rate for abdominoplasty and liposuction is 0.52% for 30-day VTE and 0.77% for 1-yr VTE; the expected additive rate for abdominoplasty and hernia repair for 1-yr VTE is 0.89%.

observation correlates with the relatively increased 30-day admission rates and emergency department visits. When compared with prior studies (Table 5),[4,6,21,23–33] this rate is similar to those reported by multiple single-surgeon or single-center studies but significantly higher than the rates reported for multicenter studies.[4,21]

Although combining two procedures did not confer a greater risk of 30-day hospital admission, emergency department visit, or mortality rates, we did find that venous thromboembolism risk is higher when certain cosmetic surgery procedures were combined. Specifically, we report a greater than additive 30-day and 1-year venous thromboembolism risk for patients undergoing concurrent abdominoplasty and liposuction and a greater than additive 1-year venous thromboembolism risk in patients undergoing a concurrent abdominoplasty and hernia repair. Although the supra-additive venous thromboembolism rates when combining these procedures were not significantly different from the venous thromboembolism risk in patients undergoing an isolated abdominoplasty, there was a trend toward statistical significance ($p \leq 0.1$) that would be further augmented with a larger sample size. When compared to previous studies that have reported venous thromboembolism rates for patients undergoing a concurrent abdominoplasty and liposuction (Table 6),[4,6,19,25,29,31,34–36] we note that most prior studies have not noted a higher risk. However, the most recent multicenter study did find a similarly increased risk of pulmonary embolism in patients undergoing procedures concurrently.[4] Interestingly, these increased (more than additive) venous thromboembolism rates were observed when abdominoplasty was combined with another abdominal procedure (liposuction or hernia repair). One possible explanation is that the addition of another abdominal procedure intensifies the insult on the venous system and increases the risk of venous thromboembolism.

Thus far, risk-assessment models have been used to guide recommendations on perioperative thromboprophylaxis.[3,6] Specifically, the Caprini-Davison risk-assessment model has been previously validated for plastic surgery.[36–38] However, the model focuses on patient characteristics and does not account for procedure type or combination of procedures. More studies and risk modeling need to be performed to establish where the findings presented in this study may fit into practice guidelines for venous thromboembolism chemoprophylaxis.

When considering the demographics and comorbidities of patients in the study and the differences between patients who did and did not have a venous thromboembolism, we noted that a significant proportion of the patients in the study had risk factors for thromboembolic events including prior venous thromboembolisms, obesity,

Table 5. Previous Studies on Venous Thromboembolism Rate after Abdominoplasty

Study	No.	Design	VTE Rate
Grazer and Goldwyn, 1977[23]	10,490	Survey of 958 surgeons	1.9% (1 in 53)
Savage, 1982[24]	20	Retrospective analysis in one hospital	0
Hester et al., 1989[25]	117	Retrospective analysis in one hospital	0
Teimourian and Rogers, 1989[26]	16,562	Survey of 935 surgeons	0.54% (1 in 185)
Floros and Davis, 1999[27]	133	Retrospective analysis in one hospital	1.5% (1 in 67)
Chaouat et al., 2000[28]	258	Retrospective analysis in one hospital	1.2% (1 in 83)
Hensel et al., 2001[29]	199	Retrospective analysis of one surgical group	0.50% (1 in 20)
van Uchelen et al., 2001[30]	86	Retrospective analysis in one hospital	2.3% (1 in 43)
Kryger et al., 2004[31]	30	Retrospective analysis of the authors' cases	0
Stewart et al., 2006[32]	278	Retrospective analysis in one hospital	0
Spring and Gutowski, 2006[19]	Unknown	Extrapolation based on survey results of 3797 surgeons	0.0036% (1 in 27,778)
Neaman and Hansen, 2007[33]	206	Retrospective analysis in one hospital	0.97% (1 in 103)
Somogyi et al., 2012[6]	247	Retrospective analysis in one outpatient surgery center	0.4% (1 in 247)
Soltani et al., 2013[4]	462,588	Internet-based system of self-reporting required in all AAAASF-accredited facilities	0.066% (1 in 1502)
This study	5410	Retrospective statewide analysis	0.57% (1 in 175)

VTE, venous thromboembolism; AAAASF, American Association for Accreditation of Ambulatory Surgery Facilities.

Table 6. Previous Studies of Venous Thromboembolism Rate When Combining Abdominoplasty and Liposuction

Reference	No.	Design	Conclusions
Hester et al., 1989[25]	333	Retrospective analysis in one hospital; abdominoplasty compared abdominoplasty and other aesthetic procedure	Increased risk of PE (0% vs. 0.93%); obesity noted to be a confounder
Dillerud, 1990[34]	487	Retrospective analysis of the author's cases; no comparison group	No significant difference
Hensel et al., 2001[29]	35	Retrospective analysis of one surgical group	No difference
Kryger et al., 2004[31]	80	Retrospective analysis of the authors' cases	No difference
Stevens et al., 2005[35]	406	Case series in a single outpatient center	No difference
Spring and Gutowski, 2006[19]	Unknown	Extrapolation based on survey results of 3797 surgeons	No difference
Newall et al., 2006[36]	53	Retrospective analysis of one surgeon's cases; patients received prophylactic enoxaparin	No difference
Somogyi et al., 2012[6]	404	Retrospective analysis in one outpatient surgery center	No difference
Soltani et al., 2013[4]	462,588	Internet-based system of self-reporting required in all AAAASF-accredited facilities	Increased risk of VTE, specifically, PE

PE, pulmonary embolism; VTE, venous thromboembolism; AAAASF, American Association for Accreditation of Ambulatory Surgery Facilities.

tobacco use, and a history of malignancy. This calls into question whether some patients captured in our study were not poor candidates for outpatient surgery at a freestanding ambulatory surgery facility. However, the database does not allow accurate capture of whether patients underwent appropriate thromboprophylaxis in accordance with current practice guidelines. As such, further studies are needed to precisely characterize which combination of procedures or patients may be poor candidates for outpatient surgery.

The uniqueness of the present study is our ability to reliably track patients from the outpatient setting to the inpatient setting without relying on self-reported data. This ensures that we capture all complications after outpatient cosmetic surgery that necessitated hospital admission or emergency department visit to any hospital in the state. Furthermore, we capture a variety of outpatient surgery centers (including freestanding and hospital-based) and those accredited by an independent accreditation organization and those that are not. This is the largest multicenter multisurgeon study that does not rely on self-reported data.[+] Although the use of administrative data sets does allow for a reliable way to track adverse outcomes, we cannot accurately capture some known risk factors

such as type and duration of anesthesia or the use of and type of venous thromboembolism prophylaxis. Also, complications that were diagnosed and treated outside California were not captured.

CONCLUSIONS

Overall, we found a higher rate of adverse outcomes, including hospital admission rates and venous thromboembolism rates, than previous self-reported multicenter data. Furthermore, we noted that a number of patients in our study had significant risk factors for embolic events, which may point to suboptimal patient selection. Most cosmetic procedures did not pose an increased risk of adverse outcomes when performed concurrently with one other procedure. However, the combination of abdominoplasty and liposuction, and abdominoplasty and hernia repair, conferred an additive venous thromboembolism risk. This stresses the importance of adhering to the venous thromboembolism prophylaxis guidelines, especially when abdominoplasty is combined with liposuction or hernia repair.

Amanda A. Gosman, M.D.
Division of Plastic Surgery
University of California, San Diego
200 West Arbor Drive
San Diego, Calif. 92103-8890
agosman@ucsd.edu

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