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ORIGINAL RESEARCH

Venous Thromboembolism Prophylaxis in Plastic Surgery

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Abstract

Background. In 2011, the American Society of Plastic Surgery (ASPS) formed the Venous Thromboembolism Task Force Report, which encouraged the use of the 2005 Caprini score and was amended in 2013. Still, there have been several studies that have questioned the validity of the Caprini score. As a result, the goal of this study is to present our experience with chemoprophylaxis in cosmetic patients compared with the current recommendations for venous thromboembolism **(**VTE) chemoprophylaxis endorsed by the ASPS.

Methods. A retrospective analysis was conducted in all patients operated on by a single surgeon from 2006 to 2016. Exclusion criteria were surgery length >6 hours, patients with known hypercoagulable states, or a personal history of deep vein thrombosis (DVT)/pulmonary embolism (PE). Demographic data were collected and analyzed.

Results. There were 1272 patients from a single institution who met the inclusion criteria. We determined that 71% of patient VTE scores were in the high to highest risk categories (n = 657), median age was 46 years, 79% of the population was Caucasian, 35% of patients had a body mass index of overweight or obese, and the average length of stay was 1 day. The rate of VTE in our patient population was found to be 0.08% (1 patient), which was uncomplicated and resolved with conservative therapy.

Conclusions. This retrospective study found no significant difference in the incidence of VTE by providing chemophrophylaxis to patients without utilizing a scoring system. Our study suggests that the Caprini Scoring system might not be optimal in predicting VTE in patients undergoing aesthetic surgery.

Introduction

Venous thromboembolism (VTE) prophylaxis is a topic of increasing interest in the field of plastic surgery. Due to the lack of consensus and evidence in establishing standard guidelines, the American Society of Plastic Surgeons (ASPS) approved the Venous Thromboembolism Task Force Report, which introduced recommendations for chemoprophylaxis in 2005.[1] The Caprini score at the time was broken down as follows: 0 to 1 (low risk), 2 (moderate risk), 3 to 4 (high risk), and 5+ (highest risk).[2] Currently, the Caprini scoring system is broken down as 1 to 2 (low risk), 3 to 4 (moderate risk), 5 to 8 (high risk), and >9 (highest risk).[3] The Caprini score is composed of the following variables with different weightage: age, sex, recent events [major surgery, congestive heart failure (CHF), sepsis, stroke], venous disease/clotting disorder, mobility, and other past/present history including inflammatory bowel disease (IBD), body mass index (BMI) >25, acute myocardial infarction (MI), COPD, and malignancy.[3] In 2012, the American College of Chest Physicians (ACCP) published new guidelines, which included a paragraph stating that the Caprini scoring system had been validated in a sample of largely reconstructive surgery patients.[4]

Winocour et al published a large study on VTE incidence in patients undergoing cosmetic surgery in an attempt to present a relevant estimate on VTE incidence in this population.[5] The study showed the incidence to be significantly lower than a Caprini score would predict, with a 0.09% incidence compared with 0.3% to 2% in reconstructive plastic surgery and 10% to 50% in other specialties.[6-8] Moreover, comparisons of cohorts stratified by the Caprini score have shown no significant difference in incidence of VTE with or without prophylaxis using enoxaparin. An additional study by Gupta et al found similar results in patients who were undergoing facelifts.[9] In the small fraction of plastic surgery patients who do develop VTE, thromboses are most likely to be distal and hence most likely to spontaneously resolve.[10] Lastly, anticoagulation therapy also has predictable complications such as bleeding and hematomas, which may be far more relevant concerns for patients undergoing cosmetic surgery. Considering these factors, many surgeons opt to focus on evidence-based risk reduction strategies and skip a chemoprophylaxis scoring system altogether.[11]

In addition to the Caprini score, there are several other scoring systems that are useful in predicting VTE risk, including the Geneva score, the Padua prediction score, and the Wells score. Patients who score below a 3 on the Geneva score are noted to be low risk and require no VTE prophylaxis whereas patients who score above a 3 are noted to be high risk and require VTE prophylaxis.[12] On the other hand, according to the Padua prediction score, a score of less than 4 indicates that pharmacological prophylaxis is not indicated and that mechanical prophylaxis should be considered.[13] A recent study by Gatot et al found that, although all the scoring systems are practical and safe to use, the Wells score had better sensitivity, specificity, and accuracy compared with the Caprini score and the Padua score.[14] A study by Zhou et al found that when the Caprini score and Padua score were compared in their patient population, the Caprini score was determined to the be the first choice due to its incorporation of comprehensive risk factors, higher sensitivity, and prediction of mortality.[15]

In this retrospective cohort study, we present our experience with chemoprophylaxis in patients undergoing cosmetic procedures compared with the current recommendations for VTE prophylaxis endorsed by the ASPS. We investigate the incidence of deep vein thrombosis (DVT) and pulmonary embolism (PE) in these patients who did not undergo chemoprophylaxis. We expect to see no significant increase in the incidence of PE or DVT regardless of Caprini score in these patients.

Methods

Patients of a single plastic surgeon underwent cosmetic procedures without DVT chemoprophylaxis between the years 2006 and 2016 as identified from Beaumont Hospital, MI databases (n = 1272). A large sample size was used to establish a generalized basis for comparison in incidence of VTE across all patients without any chemoprophylaxis. Eligibility criteria included surgeries 30 minutes to 6 hours in duration. Patients with known hypercoagulability states or previous history of DVT or PE were excluded to avoid confounding factors for risk of DVT. Lastly, all patients were asked to provide their history relating to obstetrics, cancer, thrombosis, and IBD.

After Institutional Review Board approval was obtained in accordance with the Declaration of Helsinki, data was collected through Epic electronic medical records (EMR). Variables included age, sex, BMI, ASA level, estimated blood loss (EBL), preoperative diagnosis, type of surgery, and length of hospital stay (LOS). Comorbidities included chronic obstructive pulmonary disease (COPD), hypertension (HTN), diabetes(DM), coronary artery disease (CAD), peripheral artery disease (PAD), and hyperlipidemia (HL). Every patient received follow-up visits in intervals of 1 week, 1 month, 3 months, and 6 months, with a maximum of 4 years post operation. Each patient included in the study underwent individual chart review on Epic for the following keywords: *PE*, *VTE*, *embolism*, *pulmonary embolism*, *venous thrombosis*, *deep venous thrombosis*, and *DVT* to ensure all healthcare providers in the system, not only plastic surgeons, were covered. Any cases without adequate follow-up were excluded.

Outcomes and Statistical Analysis

The primary outcome of interest was the incidence rate of symptomatic VTE found in the EMR of all patients who met inclusion criteria. Notes across all specialties were reviewed, not only those from plastic surgeons. The incidence rate of hematoma was also included as a secondary outcome. Descriptive statistics were used to analyze each of the listed variables and comorbidities in the studied population. Since none of the studied patients received chemoprophylaxis, our control group was extracted from historical literatures citing VTE outcome in patients receiving chemoprophylaxis.[16,17]

Patient data was recorded into Microsoft Excel (Microsoft Corporation) and tests for means, standard deviations, and significance levels were calculated utilizing the standard statistical formulas. One-sample Z-tests were then used to evaluate the significance of the difference in the incidence rates of DVT and hematoma, respectively, from the expected rate of 1% for each.[18] Unless otherwise noted, the probability of a type I error of less than 5% ($P < .05$) was used to determine statistical significance. To evaluate additional confounding factors that could influence the risk of hematoma, two-sample tests were

used to stratify patients based on each variable listed. This method could not be applied for the risk of DVT as there was only 1 recorded case of DVT. We did not use any diagnostic tool in order to identify asymptomatic DVT or PE, which could lead to biases as some historical studies includes both symptomatic and asymptomatic VTE.

Results

Participants

Between 2006 and 2016, 1455 patients underwent cosmetic procedures by a single surgeon with a total of 1272 patients meeting all inclusion criteria. No patients were excluded due to family history of thrombosis, obstetric complications, IBD, or cancer.

Table 1. Summary of Patient Demographic Characteristics

Variable	Response	
Age (years)	N	1272
	Mean (SD)	41.68 (23.83)
	Median	46
Race	White or Caucasian	1009 (79.3%)
	Black or African American	36 (2.8%)
	Other race	96 (7.5%)
	Prefer not to answer	131 (10.3%)
Sex	Female	963 (75.7%)
	Male	309 (24.3%)
BMI Categories	Underweight	153 (12.0%)
	Normal weight	585 (46.0%)
	Overweight	292 (23.0%)
	Obese	140 (11.0%)
	Data not recorded	102 (8.0%)
ASA	I - healthy	224 (17.6%)
	II - mild systemic disease	464 (36.4%)
	III - severe systemic disease	77 (6.1%)
	IV - incapacitating disease	2 (0.1%)
	Data not recorded	505 (39.7%)
Estimated blood loss (cc/mL)	N	420
	Mean (SD)	102.4 (100.5)
	Median	50
Time in operating room (hours)	N	1272
	Mean (SD)	1.59 (1.33)
	Median	1.22
Hypertension	Not noted	564 (44.3%)
	Present	63 (5.0%)
	Data not recorded	645 (50.7%)
Diabetes	Not noted	611 (48.0%)
	Present	16 (1.3%)
	Data not recorded	645 (50.7%)
Tobacco use	Never smoker	594 (46.7%)
	Smoker	46 (3.6%)
	Quit smoking	244 (19.2%)
	Data not recorded	388 (30.5%)

ASA, American Society of Anesthesiologist physical status classification system; BMI, body mass index.

Table 2. Venous Thromboembolism Score of Entire Cohort

VTE score	
Low	33 (3.6%)
Moderate	233 (25.2%)
High	530 (57.4%)
Highest	127 (13.8%)

VTE, venous thromboembolism.

Descriptive Data

The cohort descriptive data is listed below (**Table 1**); the overall mean age was 41 ± 23 years, 75.5% were females, and patients were predominantly Caucasian (80%). Patients' BMI was 50% normal and 37% were overweight or obese. Mean operative time, defined as the time from incision to closure, was 97 ± 80 minutes. Patient tobacco use included 67% of patients who never smoked, 28% who quit smoking, and 5% who were current smokers. VTE score was 4% low (n = 33), 25% moderate (n = 233), 57% high (n = 530), and 14% highest (n = 127), equating to 71% VTE score being high to highest (**Table 2**). Risk factors that increased a patient's Caprini score included advancing age, history of malignancy, tobacco use, BMI, and history of cardiovascular disease.

Main Results

All patients received mechanical prophylaxis with intermittent compression devices (ICDs) and were encouraged to ambulate within 2 to 3 hours from surgery with adequate pain control. Overall, only 1 out of 1272 (0.08%) patients developed noncomplicated DVT after having abdominoplasty, diagnosed by clinical symptoms of leg swelling 2 weeks after surgery and resolved with warm compress alone. There was no incidence of PE.

Table 3. Characteristics of Patients Who Developed Hematoma and Those Who Did Not

Variable	No hematoma (N = 1264)	Hematoma (N = 8)	*P* value
Age	41.59 ± 23.86	55.88 ± 13.16	.091
Female	957 (99%)	6 (1%)	.9627
Male	307 (99%)	2 (1%)	
BMI	(n = 1163) 23.77 ± 5.31	(n = 7) 23.63 ± 3.71	.9429
ASA I - healthy	224 (100%)	0 (0%)	.4691
ASA II - mild systemic Disease	462 (100%)	2 (0%)	
ASA III - severe systemic Disease	76 (99%)	1 (1%)	
ASA IV - incapacitating disease	2 (100%)	0 (0%)	
Low VTE	33 (100%)	0 (0%)	.3206
Moderate VTE	233 (100%)	0 (0%)	
High VTE	524 (99%)	6 (1%)	
Highest VTE	125 (98%)	2 (2%)	
Time in operating room (Hours)	1.59 ± 1.32	2.11 ± 1.98	.2708
DVT not noted	1263 (99%)	8 (1%)	.9366
DVT present	1 (100%)	0 (0%)	
Original length of stay	0.57 ± 2.75	0.79 ± 0.66	.3831
Never smoker	590 (99%)	4 (1%)	.8243
Smoker	46 (100%)	0 (0%)	
Quit smoking	242 (99%)	2 (1%)	

There was no statistical significance. ASA, American Society of Anesthesiologist physical status classification system; VTE, venous thromboembolism; DVT, deep venous thrombosis.

Other Analysis

Bleeding, defined as any bleeding requiring readmission or reoperation, occurred in 8 of 1272 patients (0.47%); 6 underwent facelift and 2 mastopexy. Distribution of factors including age, sex, BMI, smoking, ASA, VTE score, operating room time, and hospital LOS, were compared between patients with and without hematoma. There was no statistical different between those in the group who developed hematoma versus those who did not (**Table 3**).

Discussion

The main goal in this retrospective cohort study is to present our experience with chemoprophylaxis in cosmetic patients compared to the current recommendations for DVT prophylaxis endorsed by the ASPS. We believe cosmetic patients, even reconstructive plastic surgery patients, represent a different risk pool from general surgery patients. In cosmetic patients we truly have to weigh the risks versus benefits, and we have the luxury to do so because these are often elective surgeries. The risk of bleeding in cosmetic surgery patients is much higher than our observed risk of DVT, and the morbidity of hematoma may result in second operations or poor aesthetic outcomes. We believe our cohort to be very representative of cosmetic patients in the US, being mainly middle-aged, Caucasian, healthy females.

According to a survey completed by 596 plastic surgeons, the most common reason for not using routine prophylaxis was the concern for bleeding (84%) followed by lack of evidence specific to plastic surgery practice (50%).[3] For those same reasons, we choose to not use chemoprophylaxis for most of our cosmetic patients. Additionally, we do not rely on the Caprini scoring system because it places otherwise healthy individuals in a higher score bracket where chemoprophylaxis is deemed necessary.

In our cohort, 71% of patients had a VTE score falling in the high to highest risk bracket using the 2005 Caprini scale, with 4% low (n = 33), 25% moderate (n = 233), 57% high (n = 530), and 14% highest (n = 127) (**Table 2**). Current recommendations would suggest chemoprophylaxis. The same recommendation was achieved by the Task Force agreement that “surgical cases included in the orthopedic and general surgery literature search were similar enough in their anatomical location, degree of invasiveness, and patient population to make them comparable (from a venous thromboembolism risk perspective) to the following Plastic Surgery cases: major body contouring, abdominoplasty, major breast reconstruction, major lower extremity procedures, and major head/neck cancer procedures.”[1] We believe it is safe to say that head/neck cancer patients are a very different population than middle-aged women undergoing body contouring or any other major cosmetic surgery, and sharing a score system amongst these populations might not be accurate.

A level 2 study conducted at Vanderbilt in 2016 analyzed VTE incidence specifically in cosmetic patients, and the results showed the incidence to be significantly lower than previously cited (0.09% vs. 0.3%-2% in reconstructive plastic surgery), which serves to reassure patient safety when deciding on methods of VTE prophylaxis. The same study also stated abdominoplasty to have the highest rate of VTE incidence in a single procedure, making up 59% of their VTE cases. Our 1 incidence of VTE also underwent abdominoplasty; however due to the small sample size, we cannot rule out type I error. To our purpose, one significant limitation in that specific study is the omission of VTE prophylaxis guidelines. That could be a cofounding factor related to the low incidence, since the study was done between 2008-2013, at which point the Caprini score had already been recommended.

Our study on the other hand does look at chemoprophylaxis, basing our decision on 3 factors: a known hypercoagulability condition, history of DVT/PE, and sedentary lifestyle. Patients’ activity levels help us gauge which 60-year-old needs prophylaxis and which BMI is concerning. Finally, our cohort included all types of procedures, including the often-cited high-risk combined body contouring and breast reconstruction; yet our overall DVT incidence was only 1 (0.08%) with no incidence of PE. Patients were not worked up for DVT or PE without shortness of breath, leg swelling, or unexplained cough. It is critical to note that patients undergoing liposuction or other forms of contouring in the lower extremities tend to report pain and swelling. As a result, patients did not undergo ultrasound or additional forms of testing for VTE unless there were additional unexplained symptoms. Furthermore, it is important to note that we may have underestimated the percentage of patients that had DVT; however, it is highly unlikely given the fact that very few patients presented with any long-term symptoms or subsequent DVTs based on our knowledge.

Hematoma is in general the most common complication following cosmetic surgery. The incidence rate of major hematoma, defined as hematomas necessitating a second operation, is close to 1%, with 0.2% to 12.9% in facelift and facial rejuvenation procedures and 0.6% to 5.7% in breast augmentation surgery.[18-20] Increase in age seems to be a factor in increased bleeding and in our experience the patients who developed hematoma were indeed older although not statistically significant.[8] Although a history of hypertension was cited to be a risk factor for hematoma formation in facelift, this was not the case in our patient population.[8] It is important to note that these results include all patients regardless of chemoprophylaxis use. There are studies that do show chemoprophylaxis to increase the risk of bleeding, with increased rates of reoperative hematoma (OR, 1.86; 95% CI, 1.10-3.14).[21] In our experience, all patients who developed hematoma had a high to highest VTE score, but it was not statistically significant.

The literature is contradictory, often stating that although a score is provided, a surgeon should use their clinical judgment in a case-to-case basis. Furthermore, most studies that support the need for routine chemoprophylaxis include all types of surgical patients including reconstructive and aesthetic plastic surgery patients.[22] As a result, the patient populations are not comparable. Making assumptions based on such findings is not reliable.[23]

Limitations

This study does contain limitations, being a retrospective study limited to data documented in the Epic system and to providers who utilize this system. As a result, it is possible that patients may have presented to a different hospital system or provider that did not share the same EMR, making potential incidence of VTE higher than what is reported in this study. In addition, the majority of our patients were noted to be Caucasian females, making it difficult to generalize the results of this study to other patients. Also, the control group was extracted from historical data and cross-matching was not conducted. Lastly, all patients came from a single surgeon, and the possibility of skill bias cannot be discarded, especially in the high incidence of hematoma with facelift.

After careful data analysis and taking into consideration study limitations, it is not unreasonable to question the validity of the Caprini scoring system to indicate the need for chemoprophylaxis in healthy cosmetic patients. However, more studies are needed to elucidate major risk factors in cosmetic plastic surgery patients, keeping in mind individual combinations of factors might lead to different decision-making regardless of a score.

Conclusions

Although we do understand the importance of VTE prophylaxis, we believe cosmetic plastic surgery patients represent a very specific population where unwarranted routine chemoprophylaxis can cause detrimental effects to cosmetic results. In healthy patients without absolute preoperative indications for chemoprophylaxis and who are able to ambulate within a couple of hours post surgery, the exclusive use of mechanical DVT prophylaxis such as sequential compression devices and early ambulation appeared to be a safe option.

Acknowledgments

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