Venous Thromboembolism in Aesthetic Surgery: Risk Optimization in the Preoperative, Intraoperative, and Postoperative Settings

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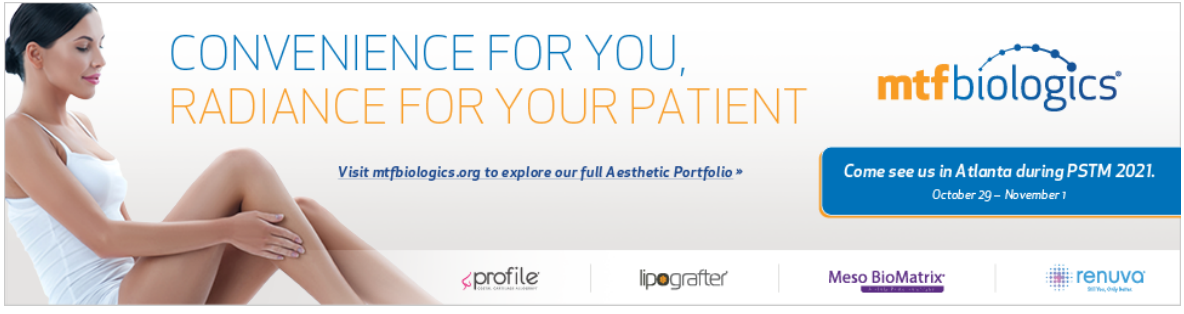

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Continuing Medical Education Article

Venous Thromboembolism in Aesthetic Surgery: Risk Optimization in the Preoperative, Intraoperative, and Postoperative Settings

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Abstract

The purpose of this Continuing Medical Education (CME) article is to provide a framework for practicing surgeons to conceptualize and quantify venous thromboembolism risk among the aesthetic and ambulatory surgery population. The article provides a practical approach to identify and minimize venous thromboembolism risk in the preoperative, intraoperative, and postoperative settings.

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Learning Objectives

After reviewing this article, readers are expected to:

1. Understand the basic concepts of individualized venous thromboembolism risk stratification.
2. Understand how to minimize venous thromboembolism risk in the preoperative, intraoperative, and postoperative settings.
3. Recognize that risk for venous thromboembolism can be minimized, but not necessarily eliminated, in the aesthetic and ambulatory populations.

Physicians may earn 1 hour of *AMA PRA Category 1 Credit*™ by successfully completing the examination based on this article. American Society for Aesthetic Plastic Surgery (ASAPS) members and *Aesthetic Surgery Journal* (*ASJ*) subscribers can complete this CME examination online by logging on to the CME portion of *ASJ*'s website (https://asjcme.oxfordjournals.org/) and then searching for the examination by subject or publication date.

Venous thromboembolism (VTE), which encompasses both deep venous thrombosis (DVT) and pulmonary embolus, is among the most devastating of all complications in aesthetic surgery. The United States Surgeon General[1] has previously identified VTE as a public health crisis. The Plastic Surgery Foundation has funded multiple clinical trials to examine the impact of VTE among plastic surgery patients.[2-5] The American Society of Plastic Surgeons released an evidence-based practice summary for VTE prevention in 2011,[6] and maintains an ongoing public VTE Awareness Campaign. The American Association of Plastic Surgeons recently convened an expert consensus panel and published a systematic review

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and meta-analysis to provide data-driven VTE prevention recommendations.[7] The American Society for Aesthetic Plastic Surgery's Patient Safety Committee has published a "Common Sense" protocol for VTE prevention.[8] The great interest and effort among all plastic surgery societies to identify at-risk patients and prevent VTE is not misguided. Postoperative VTE can be a life- or limb-threatening event that presents suddenly and can be difficult, sometimes impossible, to treat.[1,9-14] Thus, prevention is the dominant initial strategy for VTE risk mitigation.

The majority of aesthetics patients are at low risk for VTE—and fortunately VTE is a rare complication among the overall aesthetic population. However, when these events occur, they can be devastating. Unlike many complex and comorbid plastic surgery inpatients, the elective aesthetic population is typically younger and healthier. While VTE is rare among these individuals, a fatal pulmonary embolus in a 35-year-old mother of three is devastating in multiple paradigms.

The overall rate of 30-day symptomatic VTE among aesthetic surgery patients is 0.09%, based on data from 129,007 CosmetAssure patients.[15] Although rare, VTE remains important: a recent review of American Association for Accreditation of Ambulatory Surgery Facilities data showed that pulmonary embolus (PE) accounted for the majority of unexpected deaths after ambulatory surgical procedures,[16,17] and that patients who died of PE had high rates of inaccurate VTE risk stratification.[17] Certain procedures are known to carry increased or decreased risk when compared to the overall population. This may be due to procedure-specific risk factors, or patient-centric risk factors more common among those patients who elect to have these procedures. Published VTE rates for breast augmentation and facial rhytidectomy are as low as 0.02% and circumferential abdominoplasty as high as 3.4%. Abdominoplasty alone carries a VTE risk of 0.34%, but this nearly doubles (to 0.67%) with concomitant procedures and increases over 6-fold (to 2.1%) when combined with an intraabdominal procedure.[15,18-21] VTE risk quantification using procedure type alone ignores the important contributions of patient-centric factors such as body mass index, personal or family history of VTE, and genetic hypercoagulability.[2,15,22-26] Patient and procedure-centric factors, including increased age, body procedures, and combined procedures, are known to be independent predictors of 30-day VTE risk.[15]

The purpose of this CME article is to provide a framework for practicing surgeons to conceptualize and quantify VTE risk among the aesthetic and ambulatory surgery population. In support of this goal, sections highlight existing knowledge and concepts for preoperative, intraoperative, and postoperative VTE risk identification and modification.

PREOPERATIVE VTE RISK STRATIFICATION

Surgical procedures in the inpatient realm are often time sensitive and cannot be delayed. This means that surgeons must accept a patient's baseline status (eg, actively smoking, taking anti-platelet agents, or not nutritionally optimized) without the opportunity for risk factor modification. In contrast, aesthetic surgery is completely elective. Surgeons will commonly delay a proposed aesthetic procedure to allow patient optimization, and this practice is directly relevant to VTE risk.

Preoperative optimization requires a reliable tool to quantify baseline status, with an expected and demonstrable change after an intervention. Some examples include testing smoking cessation with urine cotinine levels, nutrition with serum prealbumin levels, or cardiac ejection fraction with an echocardiogram. Similarly, perioperative risk for VTE can be conceptualized using individualized VTE risk stratification.

As part of a full preoperative history and physical exam, the author recommends completion of an individualized VTE risk assessment tool such as the 2005 Caprini score (Figure 1).[22] The practice of individualized VTE risk stratification, and specific utilization of the 2005 Caprini score, is explicitly advocated for by the American Society of Plastic Surgeons and American Association of Plastic Surgeons.[6,7] The 2005 Caprini scoring system is a weighted risk assessment tool. This means that individual risk factors receive a different number of points, with point levels related to their relative importance in VTE risk. When summed, the aggregate risk score correlates with a percentage risk for VTE. This tool also acts as a checklist-style guide to promote surgeon inquiry into family history of VTE and history of multiple lost pregnancies (the most commonly missed risk factor[22,27]), personal history of VTE, genetic hypercoagulability, and current estrogen usage, among others.

The 2005 Caprini score has been extensively validated among individual surgical populations, including plastic surgery,[3] general, vascular, and urology surgery,[28] otolaryngology head and neck,[29] gynecology oncology,[30] and surgical ICU patients,[31] to predict postoperative VTE risk among patients who receive no chemical prophylaxis. Data from plastic surgery inpatients who receive no chemoprophylaxis clearly demonstrate that a wide variation in VTE risk is present among the overall population of plastic surgery patients. Specifically, these data showed that 60-day VTE rates for inpatients not provided with chemical prophylaxis included 0.6% in Caprini 3-4 patients, 1.3% in Caprini 5-6 patients, 2.7% in Caprini 7-8 patients, and 11.3% in Caprini >8 patients.[3] These data support that an 18-fold variation in baseline VTE risk exists among plastic surgery patients. Similarly, the score has been validated for surgical patients as a whole,[32] meaning that pooled data for all surgical patients showed similar variation in VTE

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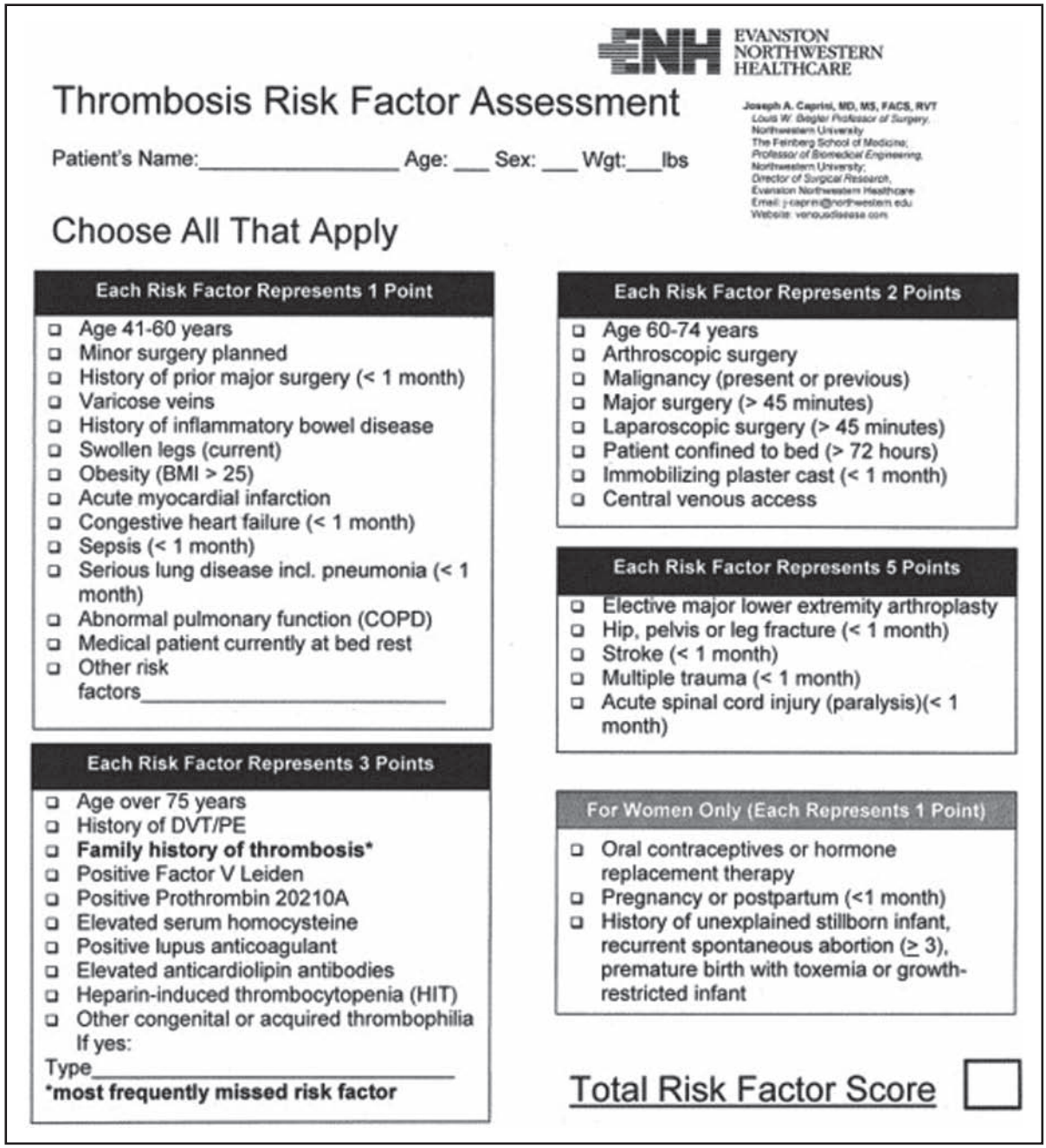

Figure 1. The 2005 Caprini thrombosis risk factor assessment form. Reprinted with permission.[22]

risk without chemical prophylaxis. Individualized VTE risk stratification allows surgeons to conceptualize and quantify this risk.

Using the 2005 Caprini score, one study[33] showed that the minority (2%) of rhinoplasty patients were at high risk for postoperative VTE (Caprini score ≥ 7). A similar study[34] among the overall ambulatory aesthetic population showed that less than 1% were at high risk. These studies demonstrate that the majority of aesthetic surgery patients are at low VTE risk, but also provides evidence that there is a small, nested population of high-risk individuals within the overall low-risk group. Preoperative identification of both of these groups can be performed using individualized VTE risk assessment.

The 2005 Caprini score has been used to identify high-risk populations that specifically benefit from chemical prophylaxis in plastic surgery[2] and urologic surgery.[35] Similarly, a meta-analysis using data from the overall surgical population clearly demonstrates that surgical patients with Caprini scores of 7-8 or >8 have significant VTE risk

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reduction when postoperative chemical prophylaxis is provided.[32] To date, no study has shown that ambulatory or outpatient surgery patients classified as high risk using the 2005 Caprini score benefit from chemical prophylaxis. This study is unlikely to be performed, due to unreasonable sample size. If we assume that 2% of the aesthetics population is at high VTE risk (Caprini score ≥ 7),[33] that the postoperative VTE risk among Caprini ≥ 7 patients is 3%, and that chemical prophylaxis will decrease VTE risk by 50%,[2] then a study powered at 90% to identify significant VTE risk reduction with chemical prophylaxis would have to screen 218,400 patients (98% of whom would have a Caprini score ≤ 6) and enroll 4368 patients into 1 of 2 arms (chemical prophylaxis or no chemical prophylaxis). This sample size calculation highlights the importance of considering risk at the individual level, which will allow surgeons to identify high-risk patients and selectively intervene as below. In the absence of data specific to the ambulatory aesthetic population, surgeons are forced to use indirect high-quality evidence, including data from plastic surgery inpatients or surgical patients as a whole.[2,3,32]

The author recommends using the 2005 Caprini score as a "jumping-off" point for surgeons to consider and conceptualize VTE risk among the aesthetic population. The score can identify existing risk factors that are potentially modifiable in the preoperative setting, and can be used in concert with clinical judgment and consideration of other VTE risk factors, such as prolonged operative time, combined procedures, abdominal wall tightening, and anesthesia type, to determine a patient-centric VTE risk reduction plan. This paradigm is extensively discussed below.

PREOPERATIVE VTE RISK OPTIMIZATION

Risk Modification Through Caprini Score Reduction

Individualized VTE risk stratification can be utilized as a jumping off point to conceptualize and quantify perioperative risk for VTE. Review of the individual components that comprise the 2005 Caprini score shows that many patient-level risk factors are potentially modifiable prior to surgery.[22] Some examples of these include patient weight or body mass index,[36] the presence of a central line or chemotherapy port, recent operative procedure, or use of exogenous sources of estrogen, including oral contraceptives[37,38] and vaginal estrogen supplementation.[39,40] Once identified in the elective population, surgeons can encourage patients to lose weight, have a chemotherapy port removed if no longer needed, wait at least 30 days before an additional procedure, and/or hold estrogen products and Tamoxifen for 3 to 4 weeks prior to (and after) surgery—all of these interventions will decrease a patient's Caprini score at the time of surgery.

Existing validation studies of the 2005 Caprini score in plastic surgery patients have shown a rapid decrease in VTE risk as risk score decreases; a 1 to 2 point decrease could decrease patient's VTE risk by 2- to 4-fold.[3] VTE risk reduction through any means is desirable. However, as noted above, individualized VTE risk stratification is a jumping off point for surgeons to begin thinking about VTE risk, and also to begin discussing VTE risk with patients. A common scenario concerns oral contraceptives—cessation of exogenous estrogen would decrease a patient's Caprini score by one point, but might have the unintended side effect of pregnancy. An aesthetics patient with a baseline 2005 Caprini score of 3 has a predicted 60-day VTE risk of 0.32% based on best available data,[3] which could be decreased by a fraction of 1% with oral contraceptive cessation. This knowledge helps surgeons to quantify VTE risk but also initiate a discussion with patients about an individualized VTE prevention strategy that also optimizes other paradigms (such as pregnancy avoidance).

Surgery-Specific Factors

Some surgery-specific factors are poorly characterized by existing risk stratification tools but have been shown to contribute to VTE risk. Studies have associated an increased number of surgical procedures and longer surgical duration with higher risk for VTE.[15,41] The 2 are related, and which is the driving force is unknown. However, with this knowledge, surgeons can consider limiting the number of concurrent procedures, which will by nature limit operative time, in order to decrease VTE risk. Aesthetic surgeons combine procedures frequently due to patient convenience (single recovery), expedited patient gratification, competitive market forces, and a desire to minimize patient costs. The American Society of Plastic Surgeons recommends 6 hours or less as the targeted length of aesthetic surgery, specifically stating that "ideally, office procedures should be completed within six hours….this might involve staging multiple procedures into more than one case."[42] Concurrent procedures are known to increase 30-day VTE risk, as shown by CosmetAssure data demonstrating significant increase in VTE risk with an increased number of procedures,[15,21] and Internet Based Quality Assurance Data that show increased VTE risk with abdominoplasty plus additional procedures.[36] Specifically, 30-day VTE risk among the overall aesthetic population by procedure number included 0.04 % (1), 0.16% (2), 0.26% (3), and 0.53% (4).[15] In the preoperative setting, limiting operative time through reduction in the number of concurrent procedures performed is a potentially modifiable VTE risk factor. A discussion in which the patient is an active

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participant can help to balance desire for concurrent procedures, patient convenience, and VTE risk.

When considering concurrent procedures, the types of procedures combined have an impact as well. For example, abdominoplasty plus intraabdominal procedure has a 6-fold increased VTE risk when compared to abdominoplasty alone (0.34% vs 2.17%). Similarly, abdominoplasty plus a second procedure has a 2-fold increased risk (0.34% vs 0.67%).[20] A prior TOPS and CosmetAssure analysis (2009) shows that the risk of VTE increases 5-fold (from 0.02% to 0.1%) among those having breast augmentation vs breast augmentation plus 1 or more procedures and nearly 3-fold (from 0.1% to 0.27%) for those having an abdominoplasty vs abdominoplasty plus 1 or more procedures.[21] A more recent review of CosmetAssure (2017) confirmed that breast procedures plus a second procedure carried significantly increased VTE risk, when compared to a breast procedure alone.[43]

Plastic Surgery Tourism and Flight-Associated DVT

Plastic surgery tourism is increasingly common, and the act of flying puts patients at risk for DVT. "Coach Class Syndrome," in which a relatively dehydrated person who is immobile for extended periods of time in a cramped airplane seat develops an in-flight DVT, is well known.[44-46] One landmark series of studies (LONFLIT 1 and 2) performed screening duplex ultrasounds on asymptomatic people before and after trans-Pacific flights. This series of studies clearly demonstrated that 4.9% of people develop asymptomatic deep or superficial venous thrombosis during their flight, and in a followup study, that below knee elastic compression stockings worn during flight can significantly decrease the rate of asymptomatic DVT by nearly 20-fold (4.5% to 0.24%).[44] A subsequent systematic review of VTE prevention specific to air travel showed that elastic compression stockings, but not aspirin or low molecular weight heparin, were associated with significant DVT risk reduction.[45] Thus, patients who travel by air to their surgical procedure would benefit from utilization of elastic compression stockings.

Of note, these data highlight the clinical ambiguity of asymptomatic DVT detected by screening ultrasound—using the LONFLIT data as examples, 1 person in 20 does not proceed directly from the airport to the hospital with symptomatic DVT. This is because the clinical relevance of asymptomatic clots is unclear, and the body's existing thrombolytic mechanisms may dissolve a large proportion of these clots before they become symptomatic. In fact, the most recent American College of Chest Physicians guidelines explicitly advocate against screening ultrasound in asymptomatic patients (even high-risk abdominal and pelvic cancer patients and trauma patients),[47] noting that the clinical relevance of asymptomatic DVT is unclear.[48] Screening ultrasound after aesthetic surgery is further discussed below.

Additional Preoperative Considerations

Individualized VTE risk stratification proactively identifies patients at high risk for VTE. Fortunately, existing data support that these patients comprise 1% to 2% or less of the overall aesthetics population.[33,34] Identification of these patients is important because it provides surgeons with the opportunity to preemptively manage VTE risk. Similarly, the informed consent process regarding VTE risk may be more robust when a patient's risk is better quantified and conceptualized. Patients at high risk for VTE, specifically those with Caprini scores of 7-8 or > 8, have significant VTE risk reduction with provision of chemical prophylaxis,[2,32] although this has not been shown explicit to the ambulatory aesthetic population. For high-risk patients, preoperative hematology consultation can be considered (but is by no means mandatory) if patients have family member(s) with VTE or other notable risk factors. When chosen, preoperative consultation is ideal because hypercoagulability testing is best ordered and interpreted by a hematologist—this is because certain facets of hypercoagulability testing can be affected by drugs or clinical circumstances.[49] Test results can be incorporated into current paradigms of individualized risk stratification and existing data, and an individualized plan for VTE prevention can be determined by the plastic surgeon, hematologist, and patient.

Final Opportunity for Preoperative VTE Risk Modification

In the preoperative setting, the surgeon's decision to offer an elective operative procedure represents the final modifiable risk factor—preoperative consideration of VTE risk and the presence of modifiable risk factors (as opposed to non-modifiable factors, such as age, personal or family history of VTE, or genetic hypercoagulability) allows the surgeon to consider whether a patient's VTE risk is too high to safely perform an elective procedure.

INTRAOPERATIVE VTE RISK REDUCTION

Anesthesia type represents a potentially modifiable intraoperative risk factor. Among the abdominoplasty population, Hafezi and colleagues[50] have previously shown a significant decrease in postoperative pulmonary embolism using epidural as opposed to general anesthesia. This relationship was confirmed by pooling additional data[51] in the American Association of Plastic Surgeons meta-analysis, in which non-general anesthesia was protective against

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postoperative VTE, when compared to general anesthesia (OR 0.11, 95% CI 0.03-0.43).[7] For certain procedures and certain patients, a general anesthetic may be unavoidable—thus, avoidance of general anesthesia is a modifiable VTE risk factor only for certain procedures, surgeons, and environments.

Increased operative duration, as discussed above, is known to increase VTE risk.[41] Preoperative consideration of the number of procedures to perform concurrently was discussed above,[15,21] but maintenance of intraoperative efficiency is a second means to decrease operative time. Similarly, surgeons may choose to abort planned additional procedures if the initial planned procedures require more operative time than anticipated.

Mechanical prophylaxis options include elastic compression stockings and intermittent pneumatic compression (IPC). General anesthesia, as well as anesthetics involving paralytics, can cause loss of calf muscle pump function and resultant venous stasis. Increased venous dilation during surgery is associated with later development of DVT,[52] likely through the production of intimal microtears that act as a clot nidus. Elastic compression shunts the blood from the superficial to deep systems in order to minimize venous stasis. Prior studies have shown that use of stockings is more effective than non-use in prevention of VTE.[53] IPCs physically pump blood out of the legs, re-creating the action of the calf muscle pump and minimizing stasis and operative venous dilation. Via a separate mechanism, IPCs also stimulate bloodborne fibrinolytic activity, meaning that IPCs have both a local and systemic effect.[54] Potentially because they impact multiple limbs of Virchow's Triad, IPCs have been shown to be superior to elastic compression for DVT prevention.[55] A meta-analysis performed by the American Association of Plastic Surgeons could not produce data to support whether the combination of elastic compression plus IPCs was superior to IPCs alone. The American Association of Plastic Surgeons makes an explicit recommendation for use of IPCs.[7]

Among aesthetic patients, those having abdominoplasty are known to be at increased VTE risk.[20,21] This population has several distinct risk factors for VTE in the intraoperative and postoperative setting. Increased intraabdominal pressure places pressure on the inferior vena cava and can cause femoral vein stasis with resultant venous dilation, intimal microtears, and DVT formation.[52] Abdominal wall plication, which decreases intraabdominal volume, is known to increase intraabdominal pressure.[56,57] Similarly, fascial harvest and primary closure for abdominal-based breast reconstruction has been associated with common femoral vein dilation and decreased common femoral vein flow that persists for several days after surgery.[58,59] Bed flexion to achieve abdominal closure is also known to increase intraabdominal pressure.[56] These data do not necessitate that surgeons abandon plication (which is a critical component of the abdominoplasty operation). However, surgeons should be aware that plication and bed flexion for abdomen closure promote conditions conducive to lower extremity venous stasis and DVT formation. In addition, plication as a "matter of course" should not be performed—this recommendation would be particularly relevant to the panniculectomy population.

POSTOPERATIVE VTE RISK REDUCTION

Dehydration and immobility promote venous stasis through increased blood viscosity and lack of calf muscle pump action, respectively. As a result, early ambulation and adequate hydration are critical after any surgical procedure.

Common femoral vein stasis as a risk factor for DVT has previously been discussed in relation to abdominal wall plication. However, worth noting is that postoperative abdominal binders and compression garments can externally compress and constrict the common femoral vein in the thigh—these garments may require modification to allow their safe use.[56,60,61]

Mechanical prophylaxis can be used after aesthetic procedures. Elastic compression stockings help to shunt blood between the superficial and deep systems, which will minimize stasis and venous dilation and theoretically decrease intimal microtears as a nidus for clot formation.[52,53] IPCs can be used to mimic the calf muscle pump after surgical procedures, at least until the patient's own calf muscle pump is active.[7,55] For most aesthetic patients, this would involve continuation of IPCs in the recovery area until patients are ambulatory. To the author's knowledge, there are no data specific to the aesthetic population on VTE risk reduction with post-discharge mechanical prophylaxis.

Chemical prophylaxis has been shown to decrease 60-day VTE risk in high-risk plastic surgery inpatients when provided for the duration of inpatient stay. Specifically, enoxaparin prophylaxis at 40 mg once daily provided for the duration of inpatient stay reduced VTE risk among high-risk patients (Caprini scores of 7-8 and >8), but not lower risk patients (Caprini scores of 3-4 and 5-6).[2] This same study demonstrated a non-significant increase in postoperative bleeding (3.4% vs 2.7%, $P = 0.17$) when postoperative enoxaparin prophylaxis was or was not provided to plastic surgery inpatients.[4] There is no recognized association between Caprini score and bleeding risk.[32]

Among the aesthetic population, there are no large controlled studies that examine the impact of chemical prophylaxis as opposed to no chemical prophylaxis for VTE prevention. However, when considered, surgeons must understand that wide areas of dissection coupled with highly vascular regions of the body predispose patients to bleeding—this risk is

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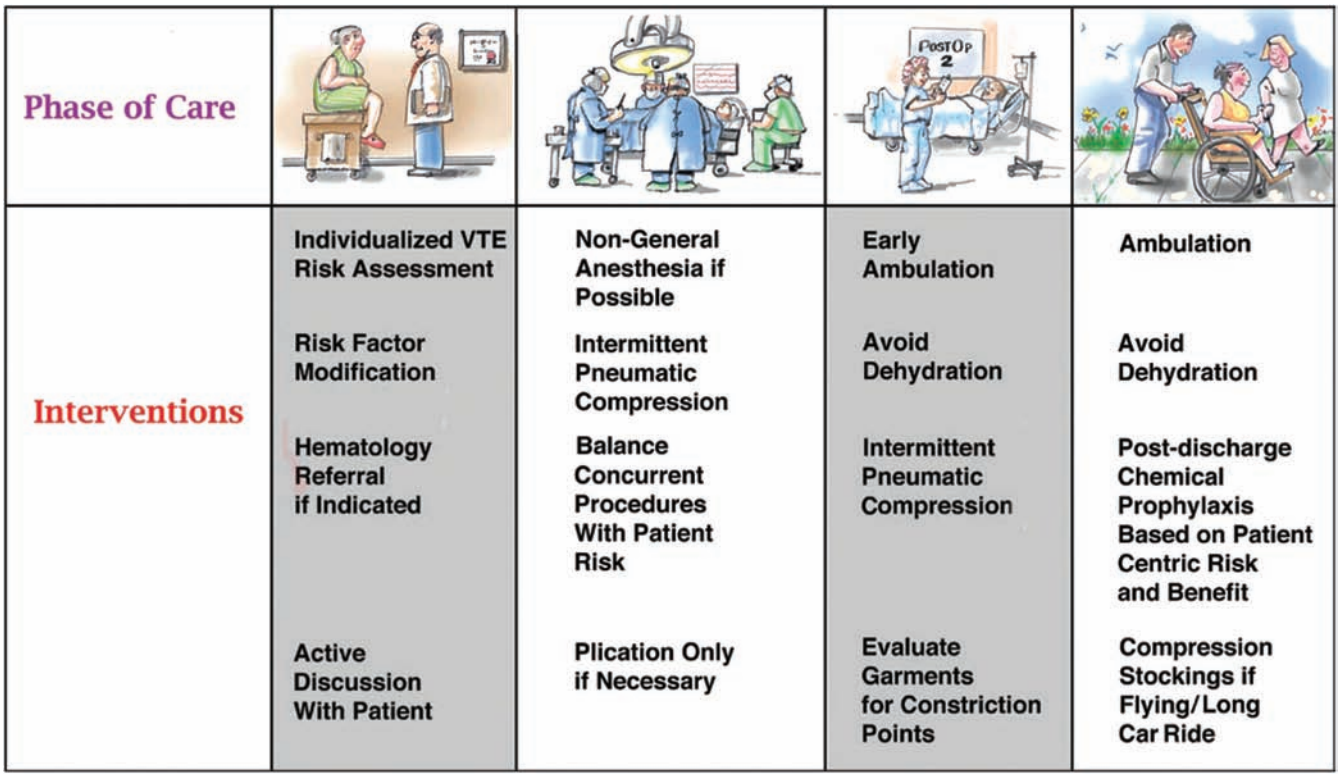

Figure 2. Preoperative, intraoperative, and postoperative opportunities for VTE risk modification.

increased based on the timing of chemical prophylaxis provision. Studies have shown that preoperative or intraoperative initiation of chemical prophylaxis in body contouring[19] or facelift[62] have very high rates of postoperative hemorrhage, up to 7.3% and 16.2%, respectively. Perioperative enoxaparin prophylaxis has been shown in 1 small subgroup analysis (n = 65) to significantly decrease postoperative DVT in circumferential abdominoplasty patients. However, that same series showed significant increase in postoperative bleeding with perioperative enoxaparin.[19] Re-operative hematoma is significantly increased in breast surgery or post-bariatric body contouring surgery patients who receive postoperative enoxaparin prophylaxis.[4] Ultimately, these data provide further support for judicious, as opposed to widespread, use of chemical prophylaxis. The author advocates that the decision to provide chemical prophylaxis be made based on the surgeon's estimate of VTE risk and also the surgeon's estimate of risk for bleeding. Current American College of Chest Physicians guidelines explicitly recommend against aspirin as a single-agent chemical prophylaxis strategy against VTE in non-orthopedic surgical patients.[48]

Abdominoplasty patients routinely prescribed 7 days of rivaroxaban, an oral Factor Xa inhibitor, for postoperative VTE prevention had low rates of re-operative hematoma (2.3%) and symptomatic VTE (0.8%).[63] A retrospective cohort study examined routine postoperative anticoagulation using low molecular weight heparin and oral Factor Xa inhibitors after body contouring procedures and showed no substantial differences in rates of bleeding or VTE between the 2 chemical prophylaxis strategies.[64] There are no data available to examine the role of routine administration of chemical prophylaxis after aesthetic surgical procedures; thus, current data do not support this practice.

In the author's opinion, routine chemical prophylaxis among aesthetic patients would likely have an unfavorable risk/benefit relationship—this opinion is supported by existing knowledge that shows the majority of aesthetics patients are known to be at low VTE risk[33,34] and that low-risk (Caprini ≤ 6) plastic surgery inpatients[2] or surgical patients as a whole[32] do not benefit from chemical prophylaxis. Existing recommendations from the American Association of Plastic Surgeons explicitly recommend against providing chemical prophylaxis to all plastic surgery inpatients, as this practice has an unfavorable risk/benefit relationship.[7] Both the American Society of Plastic Surgeons and the American Association of Plastic Surgeons recommend individualized VTE risk stratification with provision of prophylaxis based on Caprini score, as opposed to explicit reliance on procedure type.[6,7]

Screening Duplex Ultrasound

Current guidelines from the American College of Chest Physicians explicitly recommend against screening duplex ultrasound (eg ultrasound performed in the absence of

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clinical symptoms).[48] This is because the clinical relevance and natural history of asymptomatic DVT is unknown—a fact made clear by the LONFLIT in-flight DVT data discussed above.[44] One study specific to the aesthetic population performed postoperative screening duplex ultrasound on 200 consecutive patients and showed that the rate of asymptomatic DVT was 0.5%.[65] The author disagrees with screening duplex ultrasound for any population because, as noted in the 2012 American College of Chest Physicians guidelines, the clinical significance and appropriate management of asymptomatic VTE remains unclear. The author does not agree with screening duplex ultrasound as a replacement for individualized VTE risk assessment, VTE risk modification strategies, or provision of mechanical or pharmacologic means of VTE prevention.

A visual summary of opportunities for VTE risk identification and modification is provided in Figure 2.

CURRENT GUIDELINES AND RECOMMENDATIONS

The American Society of Plastic Surgeons' "Pathway to Preventing Adverse Events in Ambulatory Surgery" makes explicit recommendations that surgeons 1) consider VTE risk reduction strategies, and 2) consider chemical prophylaxis for patients who have breast reconstruction, body contouring procedures, and abdominoplasty under general anesthesia when the patient's Caprini score is ≥7.[66] Moubayed and colleagues confirm for us that this recommendation likely applies to only a small fraction (approximately 2%) of the aesthetic population.[33] The American Society of Plastic Surgeons published the findings of its VTE Task Force in 2011, and the American Association of Plastic Surgeons published the findings of its meta-analysis driven Consensus Panel in 2016. Both organizations agree upon the following tenets of VTE risk stratification and prevention: 1) individualized VTE risk assessment to understand baseline VTE risk, 2) utilization of the 2005 Caprini score as an individualized VTE risk stratification tool, and 3) incorporation of patient- and procedure-specific VTE risk into the patient-specific VTE prevention plan. These documents are referenced for readers, who are strongly encouraged by the author to review the source literature.[6,7] Direct quotes that are relevant to the aesthetic population are provided here.

American Society of Plastic Surgeons VTE Task Force Recommendations (2011)[6]

1. Risk stratification: "Should consider completing a 2005 Caprini RAM…to stratify patients into a VTE risk category based on their individual risk factors."
2. For elective surgery patients with Caprini scores of ≥7: "Should consider utilizing risk reduction strategies such as limiting OR times, weight reduction, discontinuing hormone replacement therapy and early postoperative mobilization."
3. For body contouring or abdominoplasty under general anesthesia with procedure time >60 minutes:
    a. Caprini score 3-6: "Should consider the option to use postoperative low molecular weight heparin or unfractionated heparin."
    b. Caprini score ≥ 3: "Should consider the option to utilize mechanical prophylaxis…for non-ambulatory patients."
    c. Caprini score ≥ 7: "Should strongly consider the option to use extended [duration] low molecular weight heparin postoperative prophylaxis."

American Association of Plastic Surgeons Consensus Panel (2016)[7]

1. "We recommend using non-general anesthesia when appropriate. When possible, consideration should be given to using monitored anesthesia care, local anesthesia with sedation, or neuraxial anesthesia instead of general anesthesia."
2. "We recommend using intermittent pneumatic compression to prevent perioperative venous thromboembolism events in plastic surgery patients…intermittent pneumatic compression is superior to elastic compression stockings."
3. "We recommend all plastic and reconstructive surgery patients should be risk-stratified for perioperative venous thromboembolism risk using a 2005 Caprini score."
4. "We do not recommend adding chemoprophylaxis to intermittent pneumatic compression for venous thromboembolism prophylaxis in the general non-risk stratified plastic surgery population."
5. "We recommend that surgeons consider chemoprophylaxis on a case-by-case basis in patients with Caprini score greater than 8."
6. "We do not recommend adding routine chemoprophylaxis for venous thromboembolism prophylaxis in non-risk stratified patients undergoing…body contouring."

CONCLUSIONS

Venous thromboembolism is a rare but potentially life- or limb-threatening complication of ambulatory and aesthetic surgery. This review article has outlined the central tenets of VTE risk stratification and VTE risk modification. At present, all VTE events in surgical patients cannot be prevented. VTE risk can be considered and actively

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modified in the preoperative, intraoperative, and postoperative considerations to minimize, but not eliminate, risk for VTE.

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