



Stratification of the risk of thrombosis and prophylaxis: What is the best score to stratify the risk of thrombosis in patients of plastic surgery? What is the best prophylaxis? Evidence Based Medicine

Estratificación del riesgo de trombosis y profilaxis: ¿cuál es la mejor puntuación para estratificar el riesgo de trombosis en los pacientes de cirugía plástica?, ¿cuál es la mejor profilaxis? Medicina basada en evidencia

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Palabras clave:

Trombosis, trombosis venosa profunda, tromboembolia pulmonar, clasificación de riesgo, escalas para calificar riesgo, profilaxis, quimioprofilaxis, cuidados generales.

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ABSTRACT

All patients who undergo surgery, including facial surgery, are at risk of becoming complicated with thrombosis. Thrombosis is the main fatal complication in patients who undergo tummy tucks; the incidence increases, when combined with liposuction or some other type of procedure. We present a systematic review with an MBE trend, to determine the best recommendation to rate the risk of thrombosis and the best prophylactic recommendations in plastic surgery patients. We took a scenario, a common case in plastic surgery, and analyzed the current classifications, rated the patient of the case presented, and compared the results and recommendations. There is a great discrepancy in the stratification of risk of thrombosis among the classifications used; the lowest grade was with the score of Caprini and the highest with IMPROVE and ACCP. There is a marked difference in risk classifications; however, there is an agreement in the recommendation of the use of low molecular weight heparin and in the general care. Current classifications do not include existing thrombogenic factors in plastic surgery patients. As long as there is no effective score adapted to plastic surgery patients, an existing classification should be used and the thrombogenic factors of the specialty procedures must be added, which will increase the scores of the patients and the indication of prophylaxis.

RESUMEN

Todos los pacientes que se someten a una cirugía, incluso cirugía facial, tienen el riesgo de que ésta se complique con una trombosis. La trombosis es la principal complicación mortal en aquellos a los que se realiza abdominoplastia; la incidencia aumenta cuando se combina con liposucción u algún otro tipo de procedimiento. Presentamos una revisión sistemática con tendencia a la Medicina Basada en Evidencia (MBE) para determinar la mejor recomendación que califique el riesgo de trombosis y las mejores recomendaciones profilácticas en los pacientes de cirugía plástica. Tomamos como escenario un caso habitual en cirugía plástica: realizamos un análisis de las clasificaciones actuales, calificamos a la paciente del caso presentado y comparamos los resultados y recomendaciones. Existe gran discrepancia en la estratificación del riesgo de trombosis entre las clasificaciones utilizadas: la calificación más baja fue con la escala de Caprini y la más alta con las de IMPROVE y ACCP. Existe una diferencia notoria en las clasificaciones del riesgo; sin embargo, hay una concordancia en la recomendación del uso de heparina de bajo peso molecular y en los cuidados generales. Las clasificaciones actuales no incluyen factores trombogénicos existentes en los pacientes de cirugía plástica. Mientras no exista una escala efectiva y adaptada a los pacientes de cirugía plástica se deberá utilizar una clasificación existente y agregar los factores trombogénicos de los procedimientos de la especialidad, lo que aumentará la calificación de los pacientes y la indicación de la profilaxis.



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SCENARIO

A 48-year-old woman, weighing 84 kg, 1.60 cm tall; BMI of 33.6; G III, P I, C II. She has been undergoing menopause for 3 years, and has been treated with estrogens and phytoestrogens, as well as other non-specified complements. Three days before being examined by a doctor, she took a 4-hour flight in economy class; her blood pressure increased slightly and had edema in her legs. She denied being hypertensive, although she was checked by a cardiologist who diagnosed reactive hypertension. She was scheduled for an abdominoplasty, flank, back and lower back liposuction; gluteal fat graft and breast implants.

How do I determine thrombosis risk? Which score should I use? What prophylactic care should be taken in order to prevent thrombosis? Should chemoprophylaxis be given? Which medication should be used? When should it be given and for how long?

METHODOLOGY

We carried out a systematic review both, in Spanish and English, in the following websites: PubMed, Embase, Cochrane, Medline, Fisterra, Medigraphic, Google Academic. The keywords that we used were: thrombosis, thromboembolism, assessment, risk, factor, prevention and score, to determine the risk of thrombosis, the grade used when rating thrombosis and thrombosis scale. We performed a comparison between the scores used the most to determine the risk of thrombosis. In order to issue recommendations, we used literature with I, II and III level of evidence.

INTRODUCTION

Thrombosis is one of the main fatal complications in patients hospitalized and operated. It has two presentations: deep vein thrombosis (DVT) and pulmonary embolism (PE). Its asymptomatic presentation has a high incidence and it is difficult to diagnose. Its symptomatic form has been calculated to occur from 1 case/10,000 among young adults to 1 case/100 among the elderly. Mortal thrombosis has an incidence of

0.8%. Findings in different studies carried out in autopsies prove DVT and PE in individuals where this disease wasn't suspected.^{1,2}

Thrombosis is the main fatal complication in patients who undergo tummy tucks. The incidence increases when combined with liposuction or some other type of procedure.³ Abdominal and lower limbs tumescent liposuction associated to a long immobilization may block vein outflow and free pro-thrombotic factors as well as contribute to blood clots.^{2,4-16} Despite the high frequency of thrombosis, the group that provides less prophylactic care are plastic surgeons and the ones that give prophylactic care do it insufficiently.^{2,14-20}

How to determine thrombosis risk? Which score should I use?

There are several instruments, scales or scores to identify thrombosis risk, Caprini/Pannucci, ACCP (CHEST) Improve, Padua and Davison are the most commonly used.

Thrombosis risk classification, Caprini score

The Caprini score is more commonly used for thrombosis risk stratification. It is used for surgical and non-surgical patients. It has contributed to establish prophylactic care and to decrease incidence of deep vein thrombosis and pulmonary embolism.^{21,22}

Pannucci et al, have carried out studies in order to validate this instrument and to apply it to plastic surgery patients. The scale is comprised of 40 variables distributed in 5 groups. Each group adds punctuation and the final score is the result of all positive factors. The most important factors for this score are age and surgery time. Pannucci et al found an incidence of 0.61% for VTE (venous thromboembolism) in 3-4 group; 1.27% in 5-6 group; 2.69% in 7-8 group and 11.32 in > 8 group. Patients with a score higher than 8 points had up to 20.9 times more possibilities of developing VTE compared to those patients with a 3-4 score. The higher punctuation, the higher risk of thrombosis. The ASAPS and ASPS adopted Caprini score modified by Pannucci and have issued prophylactic recommendations (*Table 1*).²¹⁻²⁴

Considerations for Caprini/Pannucci score related to plastic surgery patients undergoing esthetic procedures

1. Includes many factors, which in common conditions are not found in patients undergoing elective esthetic procedures.
2. The 4 points group does not contain any factor.
3. The Caprini/Pannucci score does not include many factors. Caprini et al in 2013 version state that one point should be added for each one of the following factors: morbid obesity < to 40, smoking, insulin-dependent diabetics, chemotherapy, blood transfusion, HIV/AIDS, surgeries longer than 2 hours (Table 2).²²⁻²⁵
4. It does not include thrombogenic factors present in plastic surgery patients, such as: plane or bus trips before surgery.
5. Patients younger than 35 with the following background should be considered having high risk of thrombosis, even if the Caprini assessment is low: gluteal fat graft; varicose veins; obesity; collagen disorders; abdominoplasty and cesarean section or vaginal delivery in the same surgery; multiple procedures; airplane trips; hormone intake. Risk increases when a patient has more than 2 of these factors (Table 2).²⁷
6. Even if the body mass index is included, it has not been stratified; it does not consider higher BMI, higher risk and; Tummy tucks and abdominal wall surgeries, liposuction and fat graft; combined or multiple surgeries at the same time; mobility and participation; use of medication to improve blood clotting such as tranexamic acid or ethamsylate (used by surgeons in order to prevent bleeding) (Table 2).^{15,18,21,26}

Table 1: Caprini Pannucci score; notice that there are no factors included in the 4-point group.

1 point	2 points	3 points	5 points
Age 41-60 years	Age 60-74 years	Age over 75 years	Hip or pelvic limb fracture
Minor surgery	Minor surgery (45 minutes)	Record of TVP or TEP	Hip or knee replacement
Last month major surgery	Present or previous cancer	Thrombosis family history	Vascular brain event
Varicose veins	Arthroscopic surgery	Leiden V factor	Multiple myeloma
Inflammatory bowel disease	Laparoscopic surgery (45 minutes)	Presence of prothrombin 20210A	Spinal cord injury (pharalasis)
Leg edema		Elevated homocysteine	
BMI greater than 25	Immobilizing plaster in the last month	Lupus anticoagulant	
Acute myocardial infarction	Presence of central venous access	Anticardiolipin antibodies	1 POINT ONLY FOR WOMEN
Congestive heart failure		Heparin-induced thrombocytopenia	Contraceptives or hormone replacement therapy
Sepsis in the last month		Other congenital or acquired thrombophilia	Pregnancy or delivery in the last month
Pulmonary disease			Recurrent spontaneous abortion
Current bed rest	Confinement to bed (72 hours)		

therefore, it should be assessed with a higher punctuation.

7. Surgery time is only assessed in the first 2 groups; 1 point for surgeries shorter than 45 minutes and 2 points for surgeries longer than 45 minutes. Caprini et al,^{22,25} add one extra point for surgeries longer than 2 hours. Time should be stratified and use other groups, the longer surgery time is, the higher thrombosis risk.

Stratification of thrombosis risk and prophylaxis recommendations in accordance with Caprini-Pannucci score Level 2-4 of evidence; recommendation level B, C and D²⁸⁻⁴⁰

In all plastic surgery patients who are hospitalized or outpatients, a stratification of the risk of thrombosis should be carried out. The Caprini/Pannucci score could be useful for this purpose. Preventive recommendations are based on this risk score:

Patients with 3 points. The use of low molecular weight heparin should be considered during the patient's inactivity time.

Patients with 3 to 6 points. Low molecular weight heparin or unfractionated heparin should

be taken into account. Use of chemoprophylaxis after surgery for one week is effective in order to prevent thrombosis and it does not increase the risk of bleeding significantly.

Elective surgery patients with over 7 points. Low molecular weight heparin or unfractionated heparin or fondaparinux should be used in all the patients. Chemoprophylaxis should be 4 to 6 weeks.³⁰⁻⁴² In order to decrease the risk of thrombosis, losing weight before the surgery is recommended and discontinuing hormone replacement therapy. The number of procedures should be limited during the surgery and early mobilization should be carried out in the time after surgery.

ACCP (CHEST) risk classification

For the thrombosis risk classification and prophylaxis, an ACCP work team «American College of CHEST Physicians» also known as CHEST, based on GRADE group criteria should be used in order to determine the strength of recommendations and use as a methodological tool, meta-analysis and consensus of experts, prepared high quality clinical guides, based on simplicity, transparency, explicit methodology and coherence. The recommendations

Table 2: List of factors not included in the Caprini/Pannucci score. A. Factors included in the Caprini 2013 version. B. Thrombogenic factors in patients subject to a cosmetic procedure. C. Risk factors in patients under 35 years old.

A. Factors that should be included in the score according to Caprini and contributors; give 1 extra point individually	B. Thrombogenic factors within specialty patients; they are not weighted yet; 1 point at least must be given for each factor	C. Patients under 35 years old with the following history, a higher grade must be given; they are not weighted yet, but must be greater than 1 point
Morbid obesity BMI > 40	Traveling by plane or bus prior to surgery	Gluteal fat infiltration
Smoking	Abdominoplasty	Varicose veins
Diabetics requiring insulin	Abdominal wall plasty	Obesity
Chemotherapy	Liposuction	Collagenopathies
Blood transfusions	Fat infiltration	Abdominoplasty at the same surgical time of a caesarean section or natural delivery
AIDS	Combined or multiple surgeries	Multiple procedures
Time of major surgery at 2 o'clock	Mobility and participation degree	Traveling by plane
		Hormone intake

issued were prepared based on risk, with a summarized presentation without undermining key information. The experts' recommendations help for clinical judgement, based on preferences and needs. Most of the reference groups have accepted this recommended classification system. Systematic approach helps to prevent biases and misinterpretations.⁴³ Updated results have been published in the 8th and 9th editions (AT8, AT9; antithrombotic therapy and prevention of thrombosis 8th and 9th editions.)^{38-42,44} Some have adapted the ACCO proposal.^{2,18,42}

Thrombosis risk allocation and prophylactic recommendations; evidence level 1-2; recommendation level: 1A, 2A (AT8, AT9)³⁷⁻⁴⁶

I Low risk

- Minor surgery; under 40 years of age; without clinical risk.
- Risk: 2% distal DVT, 0.4% proximal DVT; 0.2% PE, 0.002% fatal PE.
- Recommendations: proper position, from 10 to 15 degrees angle of the knee; feet slightly elevated; early ambulation.

II Moderate risk

- Minor surgery in patients between 40 and 60 years old, without any additional factors. Major surgery in patients under 40 years old, without risk factors.
- 10-20% distal DVT, 2-4% proximal DVT risk; 1-2% PE, 0.1-0.4% fatal PE risk.
- Recommendations: Proper position from 10 to 15 degrees angle of the knee; feet slightly elevated; early ambulation; intermittent pneumatic compression; elastic stockings.

III High risk

- Minor surgery in patients over 60 years of age, with risk factors. Major surgery in patients over 40 years of age or other risk factors.
- Risk 20-40% distal DVT, 4-8% proximal DVT; 2-4% PE, 0.4-1% fatal PE.
- Recommendations: proper position, from 10 to 15 degrees angle of the knee; feet slightly elevated; early ambulation; intermittent

pneumatic compression; elastic stockings; consider low molecular weight heparin.

IV Very high risk

- Major surgery in patients over 40 years of age with several risk factors.
- 10-20% risk; 40-80% distal DVT, 10-20% proximal DVT; 10% PE, 1-5% fatal PE.
- Recommendations: proper position, from 10 to 15 degrees angle of the knee; feet slightly elevated; early ambulation; intermittent pneumatic compression; elastic stockings; low molecular weight heparin; consider warfarin.

Relevant considerations of ACCP 8th and 9th edition (AT8, AT9)^{37-42,44}

- It was considered that the asymptomatic thrombosis identification was very important to assess prophylaxis results.⁴⁴ For the first time, a study about DVT diagnosis was carried out, even in suspicion stage. International search for thrombosis in all surgery patients will increase detection and early treatment. There will be more foundations to understand this disease as well as its prophylaxis. The use of Doppler ultrasound is an inexpensive resource for this purpose.
- It is suggested to adapt the risk stratification scale to the medical specialty or hospital. It is important to classify plastic surgery proceedings in accordance with the risk and establish a formal strategy for thrombosis study and prophylaxis. (8AT)
- Mechanical methods should be used preferably in patients with bleeding risk or contribute with anticoagulants. (8AT, 9AT)
- Having accepted the recommendations, the other part of model of coagulation must be assessed, the bleeding risk.
- Acetylsalicylic acid (ASA) is of little use, combined with other anticoagulants, there is more risk of bleeding, including the digestive tract. (8AT y 9AT)
- For patients who undergo major surgery, use low molecular weight heparin or unfractionated heparin or fondaparinux, along with mechanical methods. (8AT, 9AT)

- Special care must be taken for chemoprophylaxis in patients with regional block anesthesia. (8AT)
 - The length of the chemoprophylaxis in low risk patients is 10 days; for high risk patients with little mobility it should be extended up to 35 days. In the first days, heparins can be used and later, vitamin K antagonists. The time to begin with chemoprophylaxis is not mentioned.
 - All the patients should have a stratification of thrombosis risk. There are scales, but they are not well-founded.
 - There is no conceptual definition of the so-called major surgery and minor surgery.⁴⁷ Plastic surgery procedures should be classified in accordance with the evidence and consensus of experts. The fact that performing several procedures at the same surgical time increases the risk and requires more prophylactic care must be considered.
3. High or major risk, invasive procedure with blood loss (less than 1500 mL). Patients with moderate risk, regardless of the anesthesia. Examples: abdominal opening, such as cholecystectomy, resection or reconstructive surgery of digestive system; orthopedic hip, shoulder or knee surgery like joint replacement surgery; plastic surgery procedures: abdominoplasty, extensive liposuction, combined procedures.^{15,20}
 4. Very high or severe risk, invasive procedures with blood loss (greater than 1500 mL). Examples: cardio-thoracic procedures, open-heart surgery, pulmonary resection; intracranial surgery; head and neck tumor resection; vascular, skeletal or neurological surgery such as aorta aneurysm, scoliosis repair surgery; craniofacial surgery, surgery for deep burns, breast/abdominal reconstruction.^{15,20}

How can we determine if the procedure we performed should be considered major surgery?

There is no uniformity on the use of the term. Some have used it for abdominal or thoracic surgery; others relate it to the surgery duration, the trauma, with the blood loss or the complexity of the procedure. Caprini/Pannucci consider major surgery procedures that last longer than 45 minutes.²¹⁻²³ In accordance with the Caprini criteria, most of the plastic surgery procedures should be considered major surgery.⁴⁴⁻⁴⁷

1. Minor risk surgery, non-invasive procedures with minimal blood loss (< 250 mL). Minimal risk for the patient, regardless of the anesthesia, skin surgery and cellular subcutaneous tissue.
2. Medium or moderate risk, limited procedures regarding their invasive nature, minimal blood loss (less than 500 mL). Lower risk for the patient, regardless of the anesthesia; limited entry to thorax, abdomen, neck or limbs, diagnostic objectives or minor therapy without resection or important alteration of organs. Examples: exploratory laparoscopy or lysis of adhesions; extensive superficial procedures, such as face or limbs plastic surgery.

**Thrombosis risk classification;
Caprini score modified by Davison
evidence level 3, 4;
recommendation C-D^{43,44}**

Davison mentions that all plastic surgery patients are exposed to thrombosis, even those that have undergone face lifting. This refers to a study carried out in 2001 in USA. They found 485 DVT cases and 199 PE cases in patients that had undergone facial lifting. The 83.7% underwent surgery with general anesthesia and 16.3% with sedation and local anesthesia. Therefore, all patients must have risk stratification and apply thrombosis preventive care.

Davison uses the Caprini score as a basis for his classification. He presents a scoring system, easy to use, in order to allocate a risk group. It is a risk evaluation model with specific modifications for plastic surgery. The evaluation risk model is divided into three steps.

The first step refers to the «exposition» to risk factors associated with the clinical context. The second step is related to the evaluation of predisposing risk factors associated to the patient. In the third step, the scores of steps 1 and 2 are added to obtain the global score, to allocate a risk group and specific prophylactic recommendations (*Table 3*).

Davison score considerations. The author tried to simplify the score and present it in a more organized way. He did not use a methodology to validate the modifications; although he mentions that it is intended to qualify thrombosis risk in plastic surgery patients. Just as Caprini, he did not include many thrombogenic factors that exist in plastic surgery patients. Therefore, this classification is not very useful.

Classification of thrombosis risk according to the international medical prevention registry on venous thromboembolism (IMPROVE). Level of evidence 1-3; grade of recommendation A, B, C⁴⁸

IMPROVE is an international body including 52 hospitals and 12 countries. They utilize a user-friendly and easily accessible electronic program. Both the risk of thrombosis and the risk of bleeding are stratified. They consider few factors, which are considered the most important. For thrombosis rating the following is pursued: previous deep vein thrombosis (VTE), thrombophilia, lower limbs paralysis, cancer, prostate problems, equal to or more than 7 days immobilization, age over 60. For bleeding: gastro duodenal ulcer, bleeding 3 months prior to the admission, low production of platelets, hepatic failure, central venous catheter, rheumatic disease, cancer. The diagnostic tests recommended to detect venous thrombosis are: clinical diagnosis, the fibrinogen uptake test (leg examination), the impedance phlebography (GPI), the Doppler ultrasound, the duplex ultrasound and the venography.

The prophylactic recommendations are conducted in accordance with the risk degree of the patients:

Low risk Patients. Patients under 40 years old subject to minor operations need general anesthesia lasting less than 30 minutes. For patient protection, early ambulation is recommended.

Moderate risk patients. Patients over 40 years old subject to significant operations requiring anesthesia that lasts more than 30 minutes, but have no additional risk factors. These patients may be given an adequate protection with graded compression stockings,

unfractionated heparin low doses or low molecular weight heparin and intermittent pneumatic compression.

High risk patients. Patients over 40 years old with risk factors and/or high risk surgeries, such as: abdominal surgery, gynecological surgery, urological operations, especially transvesical prostatectomy. The adequate protection is the use of low-dose unfractionated heparin, low molecular weight heparin and intermittent pneumatic compression. The addition of graded compression stockings to these measures may provide additional protection.

Very high-risk surgery. Orthopedic hip or knee surgery and hip fractures repair; senile patients and additional factors increase the risk of thrombosis. Additional types of very high-risk surgery are the operations to extirpate malignant tumors in the thoracic area. In general, the adequate protection for very high-risk patients may be provided by using low molecular weight heparin or warfarin. The addition of intermittent pneumatic compression and graded compression stockings may provide additional protection.

Considerations for IMPROVE's thrombosis risk classification

- When patient data is entered an electronic score is used, showing the rating risk.
- It receives information from many hospital centers around the world.
- It is a team that works with a clinical methodology and is updated.
- They study thrombosis and bleeding risk, trying to balance these.
- Patients and plastic surgery procedures are not included. To benefit from this thrombosis risk stratification, thrombogenic factors associated to the plastic surgery procedures should be added.

Classification of thrombosis risk according to Padua score, level of evidence 3-4; grade of recommendation C-D⁴⁹

It is an available electronic system that uses 11 factors and calculates the risk as: mild risk, moderate risk or high risk of thrombosis.

Table 3: Davison score; instead of points the name of factors is used.			
Step 1. Determine the exposure to risk factors			
1 factor	2 factors	3 factors	5 factors
Minor surgery	Major surgery Immobilization by plaster casts Patient confined to bed for > 72 hours Central venous access	Previous myocardial infarction Congestive heart failure Severe sepsis Free flap	Hip, pelvis or leg fracture Heart attack Multiple trauma Acute spinal cord injury
Step 2. Determine the predisposing risk factors			
Clinical environment	Inherent	Acquired	
Age 40-60 years; 1 factor Age > 60 years old; 2 factors Thrombosis history; 3 factors Pregnancy or postpartum > 1 month; 1 factor Malignant disease; 2 factors Obesity > 20% IBM; 1 factor Oral contraceptives or hormone replacement therapy: 1 factor	Any hypercoagulation genetic disorder; 3 factors	Lupus anticoagulant; 3 factors Antiphospholipid antibodies; 3 factors Myeloproliferative disorders; 3 factors Induction of thrombocytopenia by heparin; 3 factors Hyperviscosity; 3 factors Homocysteinemia; 3 factors	
Step 3. Prophylactic recommendations according to risk classification:			
Level of risk	Number of factors	Recommendations	
Low	1	Early ambulation	
Moderate	2	Intermittent pneumatic pressure and elastic stockings; until total ambulation	
High	3-4	Intermittent pneumatic pressure and elastic stockings; until total ambulation	
Very high	>4	Intermittent pneumatic pressure and elastic stockings; until total ambulation Low molecular weight heparin; start at 12 o'clock Post Surgery	

Classification of Anderson risk, level of evidence 3-4; CD recommended^{39,41,42,43}

The authors studied the factors related to the thrombosis incidence. They found that not all

factors have the same value. They considered that the risk is mainly subject to two factors: the first one, those related to the patient as their comorbidities and the second, those related to the complexity and aggressiveness of the surgical

procedure. Factors were weighted according to OR value. They did not determine stratification, or specific recommendations according to the type of existing factors. They only mentioned that once a high-risk patient is identified, he/she has to receive prophylactic treatment to avoid thrombosis, until patient ambulation is completed. In moderate risk patients, they recommend a 7 to 10-day prophylaxis. In high risk patients, care is extended to up to 4 weeks (Table 4).

Considerations for Anderson risk classification

- Authors consider that not all factors have the same value in retrospective and prospective clinical studies. They weighted the factors according to OR. It is a useful strategy to develop a score with a higher methodological basis.
- As well as other classifications, thrombogenic factors related to plastic surgery procedures are not included.

Considerations that will help us in the election of the best prophylactic care to prevent thrombosis in our patients

Early ambulation and adequate position: the adequate position for a patient on the operating table is a logical measure to be implemented in all surgery patients, regardless

of the risk. With regard to the position, the technique consists in placing the patient in such a way that the venous flow maximizes through the legs avoiding external pressure. Maximum blood flow through the popliteal vein is produced when the knee is slightly flexed to 10 to 15 degrees. Placing a pillow under the knees helps to achieve this function. Early ambulation is recommended for every risk, regardless of the other therapeutic cares. In the low risk group, these cares are enough to reduce the risk of venous thromboembolism efficiently. In moderate and high-risk patients, when complete ambulation is achieved, anticoagulants may be omitted.^{38-42,44}

Aspirin and vitamin K antagonists: Several studies have shown a lower efficacy of aspirin in the prevention of thrombosis. Greater risk of bleeding from the digestive tract and wounds has also been found. This effect is larger when combined with oral anticoagulants, such as clopidogrel, which is why it is a useless drug in antithrombotic prophylaxis. The use of vitamin K antagonists, such as rivaroxaban or apaxiban has not proven to prevent thrombosis effectively and have been linked to bleeding in surgical patients.^{38-42,44}

Elastic compression stockings: These stockings apply constant compression on the calf, avoid venous stasis and facilitate venous return. These are very useful combined with low molecular weight heparin or intermittent

Table 4: Weighting and classification of factors as per their impact and determination of OR, according to Anderson.^{41,44}

Mild risk OR < 2	Moderate risk OR 2-9	High risk OR > 10
Bed rest lasting more than 3 days	Arthroscopic knee surgery	Hip fracture or pelvic limb
Extended rest	Central venous catheters	Hip or knee replacement
Elder people	Chemotherapy	Major surgery
Obesity	Chronic heart or respiratory failure	Major trauma
Varicose veins	Malignant tumors	Spinal cord injury
Pregnancy/antepartum	Oral contraceptive therapy	
	Paralytic CVD	
	Pregnancy/puerperium	
	Previous embolism	
	Thrombophilia	

pneumatic compression. Studies are needed to prove their effectiveness when used alone or in combination with other care.^{38-42,44,50}

Intermittent pneumatic compression: It acts by two mechanisms. First, reducing blood stagnation and facilitating the recurrence through the deep venous system; second, increasing fibrinolytic activity. It has been used in combination with low molecular weight heparin in the prevention of thrombosis in high and very high-risk patients. It is recommended in patients operated with general anesthesia. It can be combined with elastic stockings. The use should continue until the ambulation of the patient is achieved.^{38-42,44,50} In case of working pelvic members, it is recommended to place these stockings on the patient's arms to stimulate fibrinolytic action. It is recommended to start compression 30 minutes before induction.

Fractional heparin and low molecular weight heparin: Both are recommended by ACCP in patients with moderate to very high risk. Low molecular weight heparin is available. It requires minimal care. It is more expensive, but requires fewer applications. In addition to the appropriate dose, it causes less bleeding. It is recommended to apply it 8 to 12 hours after surgery and continue its use until the patient ambulates completely. There is no evidence that the application during surgery reduces the risk of thrombosis.^{38-42,44,51-55}

Warfarin: It is prescribed in very high risk patients. In these patients, the alternative is the use of low molecular weight heparin. Both drugs should be used in combination with intermittent pneumatic pressure, elastic stockings and early ambulation. It interacts with different substances or drugs. It requires strict laboratory control.³⁹

Rivaroxaban seems to have greater efficacy, but a higher risk of bleeding compared to low molecular weight heparins.⁵⁹

New drugs: New drugs have appeared with more specific action on factor Xa, such as: recombinant hirudin, fondaparinux, dalteparin and others. Some of them are very promising. There are not enough studies to make an evidence-based recommendation.³⁵⁻³⁹

Preventive care combination: The combined use of mechanical means and

chemoprophylaxis have proven to be the best means for preventing thrombosis.^{35-39,46}

Thrombosis risk classification and prophylactic recommendations of the case

In the following figure we present the qualifications obtained with the different classifications. The rating with the Caprini-Pannucci score was a moderate risk, in Davison and IMPROVE the risk was considered very high. There is a significant difference in the risk classification; however, there is consistency in the recommendation of the use of low molecular weight heparin and general care. The patient presents some thrombogenic factors that the current classifications do not include, such as: traveling by plane in tourist class (with limited leg space), limb edema, liposuction and gluteal fat infiltration, performing several procedures in a single surgery. If these factors were included, the rating risk would be higher and would require greater prophylactic care extending its application up to 6 weeks after surgery. In patients who have to travel by plane to go to their surgery, it is important to maintain close perioperative surveillance in the timely detection of thrombosis. The use of Doppler ultrasound has been recommended for this purpose (*Table 5*).^{3,15,56-66}

In this kind of patient, it is highly recommended to:

- Prepare him/her several months before surgery.
- Lose weight.
- Stop estrogen use 4 to 6 weeks before surgery.
- Travel at least 1 week before and 3 to 4 weeks after surgery. Suggest not traveling in tourist class. Recommend doing exercise during the trip; avoiding dehydration, and foods that increase inflammation and alcoholic beverages.
- A comprehensive assessment is required days before surgery, searching for signs of thrombosis. It is recommended to perform a good physical examination, laboratory tests and a study with perioperative Doppler ultrasound.

Table 5: Rating obtained from the given case by using the best-known classifications. A great difference in the risk classification may be seen.

Classification					Total	Risk
Caprini-Pannucci	48 years old = 1 point	BMI 33.6 = 1 point	Hormones = 1 point	Major surgery = 2 points	5 points	Moderate
ACCP (CHEST)	Over 40 years old	Several factors		Major C		High
Davison	From 40 to 60 years old = 1 factor	Obesity = 1 factor	Hormones = 1 factor	Major C = 2 factors	5 factors	Very high
IMPROVE	Over 40 years old	Several factors		Several important procedures		Very high

- Decrease the number of procedures and shorten surgical times.
- Apply low molecular weight heparin 12 hours after surgery. Provide general care, such as: adequate position, knee angle at 10 to 15 degrees, slightly raised feet, early ambulation, intermittent pneumatic compression, elastic stockings, extended prophylaxis from 4 to 6 weeks after surgery and up to several weeks after the patient has been discharged.

DISCUSSION AND CONCLUSIONS

Thromboembolism risk classification and preventive care have significantly decreased thrombosis incidence, including the mortal PTE. All these authors agree on the importance of classifying patients according to the risk of thrombosis and the application of prophylaxis; however, there is no uniformity in the classification, the current scores do not include thrombogenic factors existing in plastic surgery patients. All patients subject to surgery have the risk of complication with thrombosis; even patients subject to facial surgery (facelift), so everyone should have a preoperative assessment and a thrombosis risk rating.^{15,18,21,26,57,67-73} As long as there are no an effective scores and are adapted to plastic surgery patients; an existing classification should be used and the

thrombogenic factors of the procedures of the specialty should be taken into account, which will increase the qualification of the patients and prophylaxis indication. Preventive care is important to avoid this complication. The best results are obtained with the combined use of chemoprophylaxis and the application of general care. When the use of chemoprophylaxis is required, use low molecular weight heparins or unfractionated heparin. There are not enough studies on the use of oral anticoagulants showing their efficacy and safety. The safety committee is conducting clinical studies to determine the risk factors for thrombosis, develop a score with greater sensitivity and specificity adapted to patients in the specialty and to determine the efficacy of prophylaxis. We still require time for completion.

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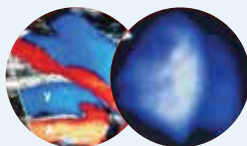
SECURITY RECOMMENDATIONS



Thrombosis and profilaxis Caprini score Risk stratification



Thrombosis
Deep venous thrombosis
Pulmonary thromboembolia



There are many scales for rate the risk of thrombosis



The most used in plastic surgery are:
Caprini/Pannucci
ACCP (CHEST)

Thrombosis is the main fatal complication in abdominoplasty; the incidence increases, when combined with liposuction or some other type of procedure.

1 point	2 points	3 points	5 points
Age 41-60 years	Age 61-74 years	Age 75 years and older	Fracture of the hip or pelvic limb
Minor surgery < 45 minutes	Major surgery (45 minutes)	History of DVT or PE	Hip, pelvis or knee replacement
Major surgery in the last month	Present or previous malignancy	Family history thrombosis	Vascular brain event
Varicose veins visible	Arthroscopic surgery	Leiden factor V	Multiple myeloma
Inflammatory bowel disease	Laparoscopic surgery (45 minutes)	Presence of prothrombin 20210A	Spinal cord injury (paralysis)
Leg edema		Elevated homocysteine	Stroke
BMI greater 25	Immobilizer plaster in the last month	Lupus anticoagulant	
Heart attack	Presence of central venous access	Anticardiolipin antibodies	ONLY FOR WOMEN 1 POINT
Congestive heart failure		Heparin-induced thrombocytopenia	Contraceptives or hormone replacement therapy
Severe infection in the last month		Other congenital or acquired thrombophilia	Pregnancy or childbirth in the last month
Lung disease			Recurring miscarriages
Current confinement in bed	Bed confinement for 72 hours or more		
Other risk factors; 1 point for each			

Scores to stratify the risk of thrombosis



- IMPROVE
- PADUA
- DAVISON
- CAPRINI/PANNUCCI
- ACCP (CHEST)
- BAYTER
- NORTHSHORE UNIVERSITY HEALTH
- ANDERSON

Caprini/Pannucci score



- Abdominoplasty alone or combined with caesarean section
- Multiple procedure surgery
- Liposuction and fat infiltration
- Recent trip by plane
- Hormone intake
- Obesity
- Collagenopathies

Women under 35 years old with more than these factors, have a high risk of thrombosis, must be qualified with a high score

Cuenca-Pardo J, Ramos-Gallardo G, Cárdenas-Camarena L, Contreras-Bulnes L, Leleivier De Alvear G. Searching for the Best Way to Assess the Risk of Thrombosis in Aesthetic Plastic Surgery; The Role of the Caprini/Pannucci Score. Aesthetic Plast Surg 2019; <https://doi.org/10.1007/s00266-019-01428-z>

A. Factors that must be included in the score according to Caprini; give 1 extra point for each one	B. Thrombogenic factors present in patients with aesthetic procedures; they have not yet been weighted. At least 1 point must be given to each factor	C. In patients younger than 35 with the following history, a higher rating should be given; are not yet weighted, but must be greater than 1 point
Morbid obesity BMI > 40	Travel by plane or bus prior to surgery	Infiltration of fat in buttocks
Smoking	Abdominoplasty	Varicose veins
Diabetics that require insulin	Abdominal wall plasty	Obesity
Chemotherapy	Liposuction	Collagenopathies
Blood transfusions	Fat infiltration	Abdominoplasty combined with caesarean section or vaginal delivery
AIDS (HIV)	Combined or multiple surgeries	Multiple procedures
Surgery time greater than 2 hours	Degree of mobility and participation	Air travel
		Hormonal intake

Stratification of the risk of thrombosis and prophylaxis

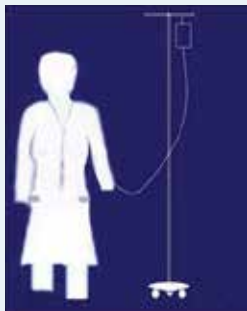
Prophylactic recommendations; Caprini/Pannucci

3 points. Mechanical and chemical prophylaxis, during the time the patient does not walk.

3-6 points. Low molecular weight heparin or unfractionated heparin, for 1 week.

7 or more points. Prepare the patient to decrease the score. Low molecular weight heparin: 4 weeks minimum.

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Early deambulation In the immediate postoperative

1. Improves venous flow
2. Avoids blood stagnation and thrombosis



Low molecular weight heparin Use in patients with Caprini rating > 3 points In high and very high risk surgeries In multiple procedures

1. 8 to 12 hours postoperatively (ACCP)
2. 40 to 60 mg every 24 hours
3. Does not increase bleeding
4. Alternative: unfractionated heparin or warfarin
5. Prophylaxis time depends on the qualification, it can be used for up to 6 weeks



Oral anticoagulants and platelet antiaggregants

1. They may be useful once their efficacy and safety are demonstrated in plastic surgery patients.
2. They could be used in patients who require prolonged chemo-prophylaxis.
3. Combined with aspirin, they increase the risk of bleeding.

Considerations that will help us choose prophylactic care to prevent thrombosis

Position

During surgery and in the immediate postoperative

1. Maximize the venous flow of the legs and avoid external compression
2. Flexion at 10 to 15 degrees of the knee by placing a pillow, achieves this function



Intermittent pneumatic compression

Use 30 minutes prior to surgery

1. Prevents stagnation and facilitates venous return
2. Stimulates fibrinolysis
3. Can be used combined with elastic stockings

Elastic stockings

Put them on before the surgery

1. Improve venous circulation and prevent stagnation

Combined therapy

It is the best prophylaxis in thrombosis prevention!

- Low weight heparin
- Deambulation
- Stockings
- Pneumatic compression
- Position



Recommendations to reduce risk of thrombosis:

1. Increase the degree of mobility and patients' involvement
2. Control comorbidities
3. Reduce surgical time
4. Avoid multiple procedures
5. Timely and adequate antithrombotic prophylaxis