

# Incidence and outcomes of thromboembolic events in plastic surgery infirmary patients

*Incidencia y resultados de eventos tromboembólicos en pacientes de enfermería de cirugía plástica*

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## Abstract

**Introduction:** This study was developed to determine the incidence and outcome of thromboembolic events in a plastic surgery infirmary. **Methods:** In a retrospective study, using the hospital's software of statistics and database, we selected the patients admitted to the plastic surgery infirmary of Hospital São João, Porto- Portugal, from 2006 to the end of 2015. Using software diagnosis codification that is the same as the International Classification of Diseases, Ninth Revision (ICD-9), we selected patients that suffered a deep venous thrombosis or pulmonary embolism and reviewed their medical records – collected the number of patients submitted to abdominoplasty, head and neck cancer patients, and breast cancer patients. **Results:** Of the 10,473 patients of the data set, nine patients were diagnosed with a venous thromboembolism (VTE) event, leading to a rate of 0.09% over the 10 years. During that period, 1728 abdominoplasties were performed, and there were three cases of VTE (0.17%); 338 head and neck cancer patients, three VTE events (0.9%), and one VTE (0.2%) in 506 breast cancer patients. **Conclusion:** This study suggests that in plastic surgery, VTE risk assessment and corresponding prophylaxis cannot be neglected.

**Keywords:** Thromboembolic events. Plastic surgery. Incidence. Thromboembolic prevention. Antithrombotic therapy.

## Resumen

**Introducción:** Este estudio fue desarrollado para determinar la incidencia y el resultado de tromboembólicos eventos (TEV) en una enfermería de cirugía plástica. **Métodos:** En un estudio retrospectivo, utilizando el software del hospital de estadísticas y base de datos, seleccionamos a los pacientes ingresados a la cirugía plástica enfermería del Hospital São João, Portugal, desde 2006 hasta finales de 2015. Usando una codificación de diagnóstico de software que es la misma que la Clasificación Internacional de Enfermedades, Novena Revisión (CIE-9), pacientes seleccionados que sufrieron una trombosis venosa profunda o embolia pulmonar y revisó sus registros médicos, recopilados el número de pacientes sometidos a abdominoplastia, cabeza y cuello pacientes con cáncer y pacientes con cáncer de mama. **Resultados:** De los 10473 pacientes del conjunto de datos, nueve pacientes fueron diagnosticados con un evento de TEV, lo que lleva a una tasa de 0,09% durante los diez años. Durante Eso período, se realizaron 1728 abdominoplasties, y hubo 3 casos de TEV (0,17%); 338 pacientes con cáncer de cabeza y cuello, 3 eventos de TEV (0,9%) y un TEV (0,2%) en 506 pacientes con cáncer de mama. **Conclusión:** Este estudio sugiere que en la cirugía plástica, la evaluación del riesgo de TEV y la profilaxis correspondiente no puede ser descuidada.

**Palabras clave:** Eventos tromboembólicos. Operación plástica. Incidencia. Prevención tromboembólica. Terapia antitrombótica.

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## Introduction

Venous thromboembolism (VTE) is a severe public health reality and a threat to the safety of plastic surgery patients. It is frightening because even though it is estimated that half of all surgery-associated DVT will resolve themselves spontaneously (generally within 3 days [1]), they can strike quickly and be fatal.

A study revealed that among patients who presented symptomatic pulmonary embolism (PE), 10% would die within 60 min, and 5% of patients with PE developed cardiac dysfunction<sup>1</sup>.

The exact incidence of VTE in the plastic surgery population is unknown. Still, relevant data indicates its prevalence. A significantly large study by Grazer and de Jong isolated PE as the single most significant cause of mortality in patients receiving liposuction<sup>2</sup>. Bucknor and Egeler verified that PE was the leading cause of death in over 1 million office-based plastic surgery patients, and that event was most commonly associated with abdominoplasty<sup>3</sup>. Abdominoplasty consistently presented the highest published rates of DVT and PE in plastic surgery, Van Uchelen et al. reported a 1.4% incidence<sup>4</sup>, and Grazer and Goldwyn showed a 1.2% incidence of DVT and 0.8% of PE<sup>5</sup>.

With this in mind, in 2009, the American Society of Plastic Surgeons (ASPS) convened a Venous Thromboembolism Task Force and published its official guidelines in 2012<sup>6</sup>. The American Association of Plastic Surgeons (AAPS) recently performed a systematic review and meta-analysis of VTE risk assessment and the risks and benefits of antithrombotic therapy (AT) specific to the plastic surgery population<sup>7</sup>.

They recommended assessing the risk of VTE to all surgical patients and recorded it in the clinical process.

The 2005 Caprini Risk Factor Thrombosis score<sup>8</sup> has been the most widely used and well-validated individualized risk-stratification tool. Even though it presents its limitations, it is endorsed by the ASPS and the AAPS<sup>9</sup>.

Considering the VTE risk (Caprini score, procedure, and clinical judgment), plastic surgeons should ponder two relevant decisions: delay surgery to reduce risk (stopping medication, lower body weight, and hematologic consultation) and use measures to prevent.

Regarding active prevention, mechanical devices are generally safe, with little to no harm with their use.

The use whenever possible, being sequential compression devices preferred over elastic compression stockings<sup>10</sup>. AT, on the other hand, may increase bleeding. In most cases, it should be done with low molecular weight heparin (LMWH) 40 mg and started 6-12 h after surgery<sup>10</sup>.

Despite many studies demonstrating the importance of VTE, that prevention is the most effective strategy to minimizing morbidity and mortality. Still, plastic surgeons continue to devalue this and underuse AT<sup>11,12</sup>.

This work aims to find information that can help clarify the importance of VTE in plastic surgery and if means of prevention are being employed.

## Methods

In this retrospective study, we collected from the Hospital Database and Statistics (through the hospital codification system) the patients admitted to the Plastic Surgery infirmary of Hospital São João, Porto-Portugal, from 2006 to 2015. Then through the codification (the same as the *International Classification of Diseases, Ninth Revision [ICD-9]*), we selected the patients diagnosed with DVT (453.4 – *Acute venous embolism and thrombosis of deep vessels of lower extremity* Or 453.8 – *Acute venous embolism and thrombosis of other specified veins*) or PE (415.1 – *Pulmonary embolism and infarction*). We discharged those who did not have any medical records, those who had thrombosis following a vascular anastomosis, following vascular injury (traumatic or related to surgery, like thrombosis of a jugular vein following a cervical abscess or hematoma). Specific data were collected from those that met the criteria: age, gender, surgery or primary diagnosis, day of the event, the Caprini score calculated based on the pre-surgery records, and means of prevention were employed.

We, then, collect the total number of patients that had been submitted to: abdominoplasty (diagnosis coded 278.1 *Localized adiposity* and procedures 83.65 *Other suture of muscle or fascia* plus 86.72 *Advancement Of Pedicle Graft*); Head and neck cancer patients (diagnosis coded 140-149 *Malignant Neoplasm Of Lip, Oral Cavity, And Pharynx*, 160 *Malignant neoplasm of nasal cavities middle ear and accessory sinuses*, 161 *Malignant neoplasm of larynx*, 170.0 *Malignant neoplasm of bones of skull and face, except mandible*, 170.1 *Malignant neoplasm of mandible*, 171.0 *Malignant neoplasm of connective and other soft tissue of head, face, and neck*, 172.0 *Malignant melanoma of skin of lip*, 172.1 *Malignant melanoma of*

**Table 1.** Data retrieved from nine patients that suffered a VTE event

Case number	Gender	Age	Diagnosis	Event and days after procedure	Caprini	Prophylaxis
1	F	84	Burn	PE – 53 days after burn (in hospital)	14	LMWH 40 mg
2	F	53	Breast reconstruction (TRAM)	PE – 33 days (home)	11	LMWH 40 mg
3	F	62	Abdominoplasty	PE – 6 days (home)	6	No information
4	F	50	Abdominoplasty	DVT – 3 days (home)	3	LMWH 20 mg
5	F	46	Abdominoplasty	PE – 1 day (in hospital)	4	LMWH 20 mg
6	F	54	Abdominoplasty	PE – 1 day (in hospital)	5	LMWH 40 mg
7	F	59	Head/neck oncological	PE – 5 days (in hospital)	7	None
8	F	58	Head/neck oncological	DVT – just before surgery (in hospital)	3	None

DVT: venous thrombosis; F: female; LMWH: Low-molecular-weight heparin; M: male; PE: pulmonary embolism; TRAM: transverse rectus abdominis musculocutaneous flap; VTE: venous thromboembolism.

*skin of eyelid, including canthus, 172.2 Malignant melanoma of skin of ear and external auditory canal, 172.3 Malignant melanoma of skin of other and unspecified parts of face, 172.4 Malignant melanoma of skin of scalp and neck, 173.0 Oth and unspec malignant neoplasm of skin of lip, 173.1 Oth and unspec malignant neoplasm of eyelid, including canthus, 173.2 Oth and unspec malignant neoplasm of skin of ear and external auditory canal, 173.3 Oth and unspec malignant neoplasm of skin of oth and unspec parts of face, 173.4 Oth and unspec malignant neoplasm of scalp and skin of neck, 190 Malignant neoplasm of eye, 191 Malignant neoplasm of brain) and breast cancer patients (V10.3 Personal history of malignant neoplasm of breast, V51 Aftercare involving the use of plastic surgery, 174 Malignant neoplasm of female breast, 175 Malignant neoplasm of male breast, 198.81 Secondary malignant neoplasm of breast, 233.0 Carcinoma in situ of breast, 238.3 Neoplasm of uncertain behavior of breast, 612 Deformity and disproportion of reconstructed breast).*

The study was conducted according to the principles of the Declaration of Helsinki.

Data were collated in a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA).

## Results

Ten thousand four hundred and seventy-three patients were treated in our department from 2006 to the end of 2015; nine patients had a VTE event (rate of 0.09%) (6 presented PE and three suffered DVT), 1728 abdominoplasties, 338 head and neck cancer patients, and 506 breast cancer patients.

Data for these nine patients were retrieved, with eight being female and one male, with a mean age of 60 (46-84 years). The mean preoperatively Caprini score was 6.89 (Standard deviation [SD]  $\pm$  3.79) (Table 1).

Of the nine selected patients, the VTE event occurred after abdominoplasty in four cases; three of them operated on our Hospital (incidence rate: 0.17%). Three other were related to head and neck cancer patients (incidence rate: 0.9%) and one breast reconstruction case (incidence rate 0.2%). VTE mortality rate was 0% over the following 10 years. All patients survived and are alive with no permanent damage from the VTE.

Regarding VTE assessment and prevention, no patient had a record of the calculated Caprini score, and only three had done the recommended AT (40 mg LMWH).

No documented formal VTE pre-operative assessments were undertaken. In addition, no patient wore compression socks neither sequential compression devices.

## Assessment of case 2

A 53-year-old patient with a personal history of DVT, uterus, and breast cancer, medicated with an aromatase inhibitor, severe bilateral venous insufficiency already waiting for surgical treatment, and using compression stockings.

The patient had deferred breast reconstruction with *Transverse Rectus Abdominis Musculocutaneous Flap* (TRAM). On the 1<sup>st</sup> post-operative day, the patient was found in *syncope*, hypotensive, and

respiratory insufficiency. The symptoms were assumed to be related to acute anemia (dropped from 14.6 grams per deciliter [g/dL] to 9.8/g/dL) and submitted the patient to a blood transfusion. However, 1 month later, the patient was found dyspneic and with thoracic pain. A computed tomography (CT) scan revealed PE on segmental branches of the left-lower-lobe pulmonary artery. An echocardiogram did not show significant alteration. Doppler ultrasound of the inferior, superior members and cervical did not reveal signs of DVT. The patient completed 6 months of AT and shortly after was submitted to venous surgery.

Comment: According to ASPS recommendations<sup>6</sup>, all patients that are to be subject to elective surgery, like deferred breast reconstruction, should address all modifiable risk factors. This patient should have done a venous surgery and completed the treatment with the aromatase inhibitor before surgery. Furthermore, a patient with a very high Caprini score must be clarified about a VTE event and give him adequate time to reflect and decide to follow through or not with surgery.

### **Assessment of abdominoplasty cases (3, 4, 5, and 6)**

Case number 3: A 62-year-old female patient who was a smoker and suffered from chronic respiratory insufficiency, who had a moderated aortic valve stenosis and a 3-month history of lower limb edema from an unknown cause, developed dyspnea thoracic pain 2 days after surgery. A computed tomography (CT) scan revealed a PE on the left pulmonary artery. He was kept in an intermediate care unit for 3 days with oxygen support and heparin perfusion; no DVT was found in the Doppler ultrasound. Neither was cardiac dysfunction on the echocardiogram. The patient was on AT and 3 years later replaced the aortic valve.

The patient corresponding to case number 4 was discharged on a post-operative day one after an abdominoplasty. Three days later, the patient presented sudden pain in her leg. A Doppler ultrasound revealed a DVT. The patient was admitted to the infirmary for surveillance and medicated with low-molecular-weight heparin (LMWH) 60 mg 12/12 h plus compression socks. After 13 days, she was discharged but readmitted 10 days later due to an abdominal hematoma that needed surgery. Patient was submitted to surgery for hematoma drainage and hemostase revision. After this surgery, there were no further complications. She

was kept on AT for 6 months and subsequently submitted to surgery for venous insufficiency.

Case number 5: On the 1<sup>st</sup> day after surgery, the patient was presented with syncope, in shock with type 1 respiratory failure, elevated D-dimers, and a CT scan revealed a massive PE. An echocardiogram revealed enlargement of the right heart and acoustic right ventricular wall. Did not thrombolysis due to the hemorrhagic risk, the patient remained in intensive care with non-invasive ventilation, heparin perfusion, and amine support for 4 days. She recovered and survived with no permanent damage.

Comment: Regarding cases 4 and 5, prevention with 20 mg LMWH only in cases of renal insufficiency, low platelets count, or low weight<sup>13,14</sup>, in which none of the patients presented. Hence, prevention with 40 mg was correct<sup>10</sup>.

Patient number 6 was a 54-year-old female with a body mass index (BMI) of 33 kg/m<sup>2</sup> and chronic obstructive pulmonary disease. On the first post-operative day, the patient was in acute respiratory distress, elevated D-dimers were present, and a CT scan revealed PE on segmented branches of the left-lower-lobe pulmonary artery. The patient stayed in an intermediate care unit with oxygen support and heparin perfusion for 4 days. She completed 6 months of AT and with no permanent damage.

Comment: Again, according to ASPS recommendations<sup>6</sup>, all patients that are to be subject to elective surgery should solve all modifiable risk factors. This patient should have lost weight before surgery.

### **Assessment of head/neck oncological patients cases (7, 8, and 9)**

Case number 8 was related to a patient already at the operating table with an edematous leg, leading to the surgery cancellation. A Doppler ultrasound confirmed a DVT on the left femoral artery. The patient completed 6 months of AT and used compression stockings.

The patient corresponding to case number 9 had an oral epidermoid carcinoma. A tracheostomized patient submitted to segmental mandibulectomy, partial glossectomy, bilateral neck dissection, and reconstruction with a local flap. Soon after starting radiotherapy, an oral cutaneous fistula developed, and the patient was readmitted for reconstruction with a pectoralis major Myocutaneous flap. During recovery, the patient developed a respiratory infection. He was under

prevention with LMWH for 24 days postoperatively; however, it stopped for unknown reasons, then 1 week after, the patient suffered a DVT documented on a Doppler ultrasound. He completed 3 months of AT.

Comment: There are no current standard guidelines for AT duration in plastic surgery patients, but it is advisable that it continues during the inpatient stay, especially when the patient is still recovering and not ambulatory<sup>10</sup>.

## Discussion

This article provides insights on the VTE statistics of a Plastic and Reconstructive Surgery department at a major hospital in Portugal. We believe that it might indicate a similar pattern across other hospitals and possibly Worldwide.

A rate of VTE in the inpatient population of 0.09% is overall sound. A rate of 0.17% in abdominoplasty patients and 0.9% in head and neck cancer is in line with the literature<sup>4,5,15,16</sup>. However, two-thirds of the patients had a potentially preventable event, which is frightening and highlights deficits in VTE risk assessment and prevention. Surgeries that can be considered high-risk for a VTE<sup>10</sup>: abdominoplasty, breast reconstruction, and head/neck oncologic surgery.

The importance of pre-operative VTE risk assessment is well known; however, no pre-operative risk was calculated. Furthermore, the application of prevention modalities is inconsistently made and does not correlate with medical knowledge.

For instance, cases number 2 and 6 had modifiable risk factors not addressed before surgery; in cases 4 and 5, the prevention was done with 20 mg LMWH, the incorrect dosage. In cases 7, 8, and 9 (head and neck oncological surgical patients), all with Caprini score of 3 or above, LMWH should have been considered (a recommendation Grade B evidence by ASPS guidelines). Even though physician judgment determines the final care received by the patient, if the decision is not made accordingly to international recommendations, then there must be a reasonable rationale to that decision in clinical records.

A possible explanation to this data, namely, lack of attention to VTE prevention by plastic surgeons, maybe that these are mainly focused on the surgery; the patient is the surgery, which has steps and techniques to follow. And might sometimes disregard or neglect other aspects of operative care, such as pre-operative antibiotic prevention, the patient's diseases, and medication. Possibly some lay on the anesthesiologist that

responsibility. However, often that is not the case, and plastic surgeons must assess the patient.

Lucky, VTE events are rare in the plastic surgeons' practice, and many cases are asymptomatic, so many surgeons see VTE as a "unicorn," something they never saw and hopefully never will. However, a VTE event can be catastrophic, leading to (maybe, a preventable) death<sup>3</sup>.

Hospital São João had recently implemented changes regarding VTE prevention, including VTE risk assessment using the Caprini score through a computer application. After the score is calculated, prevention methods (including mechanical and LMWH) can be included in the prescription. Furthermore, the safe surgery checklist is currently assessing VTE prevention.

There are some limitations in this study that are important to address. First, it is a retrospective study with a relatively reduced sample size based on only one hospital database. Second, statistics may underestimate VTE incidence, because a VTE event may not have been diagnosed (we believe it to be the case of what happened on the first post-operative day in case number 2) or reported. Furthermore, there were no complete medical records available for all patients and data in the database can be lacking as it is humanly credited, impairing a better comprehensive analysis.

## Conclusion

We believe that this study provides further and improved information suggesting that VTE risk factor assessment and prevention are frequently lacking in plastic surgery. Plastic surgeons need to complete the VTE risk assessment preoperatively and act accordingly in every patient that they treat. Furthermore, it shows that patients going for head and neck cancer procedures, breast reconstruction, or abdominoplasty have one of the highest risks of a VTE event, so it is advisable to implement active preventive measures in these cases.

Plastic surgeons walk a thin line when using chemical prevention: while preventing VTE, it can also increase bleeding complications. Future efforts may involve a better assessment of VTE risk and recording on the patients' medical reports. Nationally compiled data from all hospitals would also increase sample size and make it possible to obtain precious information.

We also hope that this study gives a small contribution to raising awareness for thromboembolic events and the means needed to prevent them.

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## Conflicts of interest

All named authors, hereby, declare that they have no conflicts of interest to disclose.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** Right to privacy and informed consent. The authors have obtained approval from the Ethics Committee for analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

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