

Thromboembolic Diseases

Biomedical Engineering - URJC

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Understanding Thromboembolic Events: A Comprehensive Overview

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- 2 Etiology
- 3 Pathophysiology
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- 6 Treatment and Management
- 7 Prognosis and Complications

Thromboembolic Events Overview

- Most feared complication of hospitalizations.
- High morbidity and mortality.
- Third leading cardiovascular diagnosis after heart attack and stroke.
- Involves **deep vein thrombosis** (DVT) and **pulmonary embolism** (PE).

Etiology of Thromboembolic Events

Multifactorial predisposition

- Patient-related factors: age, obesity, varicose veins, immobility.
- Risk factors: oral contraceptives, smoking, malignancies, surgeries.
- Hematologic disorders leading to hypercoagulability.

Pathophysiology of Thromboembolic Events

According to Virchow's triad, the following are the **main pathophysiological mechanisms** involved in VTE:

Virchow's triad

- 1 Damage to the vessel wall
- 2 Blood flow abnormalities (either turbulence or stasis)
- 3 Hypercoagulability

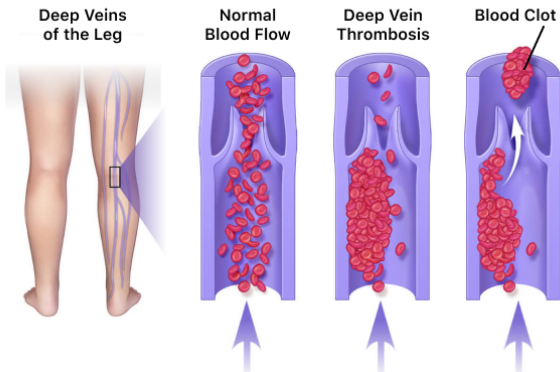
Pathophysiology of Thromboembolic Events

Phase I

- 1 Venous thrombosis refers to the formation of a **platelet and fibrin clot** within the vascular lumen.
- 2 Clinically significant thrombi are formed in vessels (deep vein thrombosis or DVT).
- 3 The clot can then propagate with proximal extension.
- 4 Clinical symptoms of the thrombus are seen when the clot propagates enough to have obstruction of vascular flow.

Pathophysiology of Thromboembolic Events

Deep Vein Thrombosis



Pathophysiology of Thromboembolic Events



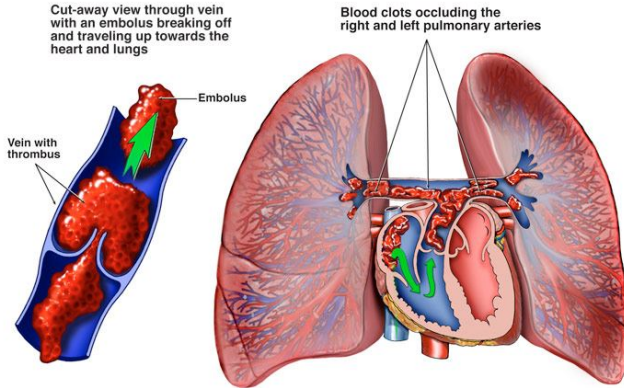
Pathophysiology of Thromboembolic Events

Phase II

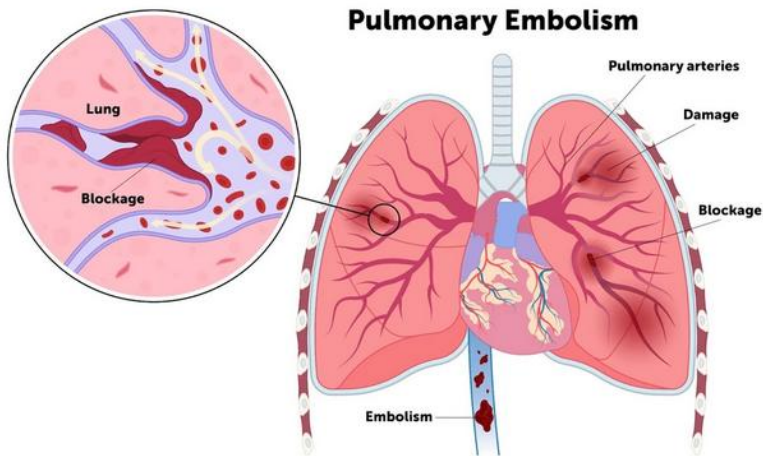
- 1 If the clot dislodges, it can then embolize to a distant site.
- 2 The most common site of embolization for these clots is in the pulmonary vasculature (**pulmonary embolism** or PE).
- 3 Obstruction to pulmonary vascular flow can cause impaired gas-exchange, alveolar edema, or even pulmonary alveolar necrosis.
- 4 Chronic repetitive pulmonary embolization can lead to increased pulmonary vascular resistance and, eventually, pulmonary hypertension.

Pathophysiology of Thromboembolic Events

Mechanism of Pulmonary Embolism



Pathophysiology of Thromboembolic Events



Clinical Presentation

Clinical Presentation

- **DVT symptoms:** pain, swelling, tenderness, redness, fever.
- **PE symptoms:** sudden dyspnea, pleuritic chest pain, dry cough, hemoptysis.
- **Massive PE** may present with syncope, hypotension, and shock.

Evaluation and Diagnosis

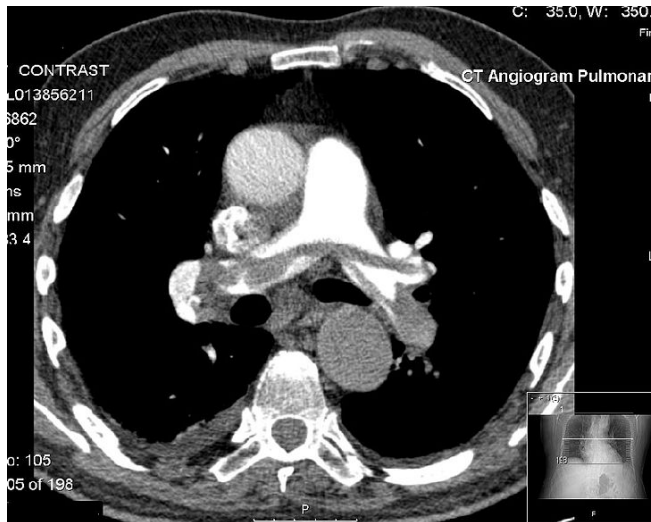
Diagnostics Tests

- Clinical decision-making tools (Modified Well's criteria).
- Definitive testing for VTE:
 - 1 Limb doppler-echography for DVT (ultrasonography)
 - 2 CT with intravenous contrast for PE
- Additional studies: Laboratory tests, Chest X-ray, ECG, Echocardiography.

Evaluation and Diagnosis



Evaluation and Diagnosis



Treatment and Management

- **Anticoagulation** as primary treatment for VTE (DVT and PE).
 - 1 Parenteral heparin therapy
 - 2 Vitamin K antagonists
 - 3 Direct-acting oral anticoagulants.
- Thrombolytic therapy and intravenous filter placement for specialized cases.

Prognosis and Complications

- **Long-term complications:** post-thrombotic syndrome, pulmonary hypertension, cor pulmonale.
- **Complications** of treatment: bleeding, immune-mediated heparin-induced thrombocytopenia, heparin-induced osteopenia, warfarin-induced skin necrosis.