

Thrombosis Risk: Mechanisms, Assessment, and Clinical Management

Introduction

Thrombosis, the formation of blood clots within blood vessels, is a major contributor to morbidity and mortality worldwide. The risk of thrombosis is influenced by a complex interplay of genetic, environmental, and acquired factors. Understanding these risk determinants is essential for prevention, timely diagnosis, and effective management of both arterial and venous thromboembolic events.

Mechanisms and Risk Factors

Thrombosis arises from disturbances in Virchow's triad: endothelial injury, stasis of blood flow, and hypercoagulability.

Genetic factors include mutations in coagulation regulators, such as Factor V Leiden, prothrombin G20210A, and deficiencies in protein C, protein S, or antithrombin III.

Acquired conditions encompass malignancy, surgery, prolonged immobilization, pregnancy, and hormonal therapy. Chronic diseases, including obesity, diabetes, and cardiovascular disorders, further increase risk.

Lifestyle and environmental factors like smoking, sedentary behavior, and dehydration can exacerbate thrombotic susceptibility.

Inflammation, endothelial dysfunction, and platelet hyperactivity are central pathophysiological mechanisms linking these risk factors to thrombus formation.

Assessment and Management

Risk assessment combines clinical evaluation, family history, and laboratory testing. Scoring systems, such as the Caprini or Wells scores, help stratify patients for prophylaxis. Biomarkers including D-dimer, coagulation factor levels, and genetic testing can refine risk estimation.

Management strategies include lifestyle modification, pharmacologic prophylaxis with anticoagulants (e.g., heparin, warfarin, direct oral anticoagulants), and surgical interventions when necessary. High-risk patients, such as those undergoing major surgery or with active malignancy, benefit from individualized prophylactic regimens. Emerging therapies targeting specific coagulation pathways offer additional promise for reducing thrombotic complications while minimizing bleeding risk.

Conclusion

Thrombosis risk is multifactorial, encompassing genetic predisposition, acquired conditions, and lifestyle factors. Accurate risk assessment and timely intervention are critical for preventing thrombotic events and improving patient outcomes. Advances in molecular diagnostics and targeted therapies are enhancing personalized approaches to thrombosis prevention and management. Ongoing research and awareness are essential for reducing the global burden of thromboembolic disease.

Samuel Okoye*

Department of Hematology, University of Lagos, Nigeria

***Author for Correspondence:**
samuel.okoye@unilag.edu.ng

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