

MODERN CLASSIFICATION AND MODERN VIEWS OF RATIONAL HEMOSTATIC
PHARMACOTHERAPY

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<https://doi.org/10.5281/zenodo.17622365>

Annotation. *This article presents an extensive overview of current approaches to the classification of hemostatic agents and evaluates modern concepts of rational hemostatic pharmacotherapy. It analyzes the mechanisms of action, clinical benefits, and limitations of various groups of hemostatic drugs, considering recent evidence-based guidelines. Special emphasis is placed on individualized therapy, pharmacodynamic characteristics, and safety issues in different clinical situations where bleeding control is required. This study provides an in-depth scientific evaluation of contemporary principles governing the use of hemostatic pharmacotherapy.*

It focuses on advanced drug groups, their functional distinctions, and current clinical directions for managing various bleeding states. Special attention is given to mechanistic diversity, therapeutic precision, and safety-centered decision-making. Modern diagnostic technologies and personalized strategies are also assessed for their contribution to optimizing treatment effects, reducing adverse complications, and improving outcomes.

Keywords: *hemostatic agents, classification, bleeding, coagulation, antifibrinolytics, pharmacotherapy, evidence-based medicine.*

Introduction: Hemostasis is a complex physiological process responsible for maintaining vascular integrity and preventing excessive blood loss. Disorders of hemostasis may lead to clinical conditions such as hemorrhage, surgical bleeding, trauma-related blood loss, and coagulation abnormalities.

The development of hemostatic pharmacotherapy has evolved significantly in recent years, with advancements in understanding coagulation pathways, platelet activity, and fibrinolytic mechanisms. Modern perspectives emphasize precise drug selection based on the etiology of bleeding, patient-specific factors, and pharmacological characteristics of each agent. Current classifications incorporate both traditional and newly introduced hemostatic agents that target different stages of coagulation, platelet aggregation, and fibrinolysis, ensuring a rational and individualized therapeutic approach. Control of hemorrhagic conditions requires a comprehensive understanding of biological mechanisms responsible for achieving vascular stabilization. Recent progress in pharmacological science has enriched treatment options aimed at enhancing coagulation potential, reinforcing platelet activity, and suppressing premature fibrin degradation.

As surgical procedures, trauma incidents, and coagulation disorders continue to rise, updated knowledge of drug categories and their applications has become critical. Current research highlights that therapeutic decisions must be based on clinical context, patient characteristics, and mechanistic targeting. Integrating laboratory monitoring with drug-specific properties ensures accuracy in choosing the most effective intervention.

Materials and Methods: The research is based on a comprehensive review of recent scientific literature, clinical guidelines, randomized controlled trials, and meta-analyses related to hemostatic pharmacotherapy. Analytical methods included structural classification of drugs, comparative evaluation of their mechanisms of action, and assessment of clinical efficacy in various bleeding conditions. Sources were selected from international pharmacology databases, focusing on studies published within the last ten years to ensure contemporary relevance. The methodology included thematic categorization of hemostatic drug classes, evaluation of pharmacodynamic and pharmacokinetic properties, and synthesis of evidence on clinical outcomes and safety profiles.

Results: The modern classification of hemostatic drugs identifies several major categories.

The first group comprises agents that enhance coagulation factor activity, including vitamin K preparations, fibrinogen concentrates, prothrombin complex concentrates, and recombinant clotting factors. The second group includes antifibrinolytic drugs such as tranexamic acid and aminocaproic acid, which stabilize formed clots by inhibiting plasmin activation. The third group consists of local hemostatic agents including collagen sponges, oxidized cellulose, fibrin sealants, and thrombin-based products that achieve rapid bleeding control during surgical interventions. The fourth group encompasses drugs that improve platelet function, such as desmopressin and specific platelet-stimulating agents used in thrombocytopenic states. The fifth group represents novel targeted hemostatic molecules that modulate specific steps in coagulation cascades and have shown promising clinical benefits. Evidence shows that timely and rational selection of these drugs reduces transfusion requirements, improves surgical outcomes, and enhances patient safety. Findings demonstrate that therapeutic efficiency depends largely on the precise selection of drug categories aligned with the underlying pathophysiological pattern.

Concentrates supplying deficient clotting molecules markedly improve correction of coagulation deficits. Agents preventing excessive fibrin breakdown demonstrate outstanding benefit in trauma care, operative fields, and obstetric emergencies. Platelet function enhancers contribute significantly in states characterized by reduced platelet reactivity. Topical formulations achieve rapid bleeding control during surgical exposure, while novel molecular modulators provide new opportunities for patients with rare or complex deficiencies. Data consistently confirm that optimal outcomes arise from early, accurate, and targeted selection of pharmacological tools.

Discussion: Modern views of rational hemostatic pharmacotherapy emphasize individualized treatment strategies grounded in pathophysiology. For example, in patients with coagulopathy, the selection of factor concentrates is preferred over plasma to minimize volume overload and transfusion-related complications. Antifibrinolytics have demonstrated strong efficacy in trauma, postpartum hemorrhage, and surgical bleeding, with a favorable safety profile when administered early. Local hemostatic agents are increasingly used across surgical specialties due to their rapid action and minimal systemic influence. Current debates focus on balancing efficacy against the risk of thrombosis, especially in patients with cardiovascular disease or hypercoagulable states. Recent advances in laboratory diagnostics, such as thromboelastography and rotational thromboelastometry, allow more precise evaluation of hemostatic disturbances and guide targeted pharmacotherapy.

The integration of personalized medicine principles has improved treatment outcomes by aligning the type of hemostatic agent with individual patient factors including age, comorbidities, and bleeding risk. Interpretation of results underscores that modern therapeutic practice requires meticulous differentiation between etiological factors. Choosing plasma substitutes or specific concentrates must be guided by individualized risk assessment, especially concerning thrombogenic potential. Antifibrinolytic agents continue to receive extensive validation for their beneficial impact, although attention to timing and dosing remains central. Topical preparations offer procedural advantages with minimal systemic influence, making them valuable in a broad range of operative settings.

Personalized approaches supported by advanced evaluation techniques help clinicians avoid over- or under-treatment and diminish the likelihood of complications. As research evolves, integration of innovative agents and refined protocols will further enhance clinical effectiveness.

Conclusion: Modern hemostatic pharmacotherapy is characterized by a structured classification of agents that act on different components of the hemostatic system. Rational drug selection requires an understanding of coagulation physiology, mechanisms of action, and clinical indications. Evidence-based strategies highlight the importance of early, targeted, and safe use of hemostatic agents to control bleeding, prevent complications, and improve patient outcomes.

Further studies are needed to explore innovative therapeutic molecules, optimize dosing strategies, and enhance personalized approaches in complex bleeding disorders. Evidence from this comprehensive review indicates that effective management of hemorrhagic events depends on detailed knowledge of drug mechanisms and precise alignment with clinical needs.

Modern pharmacological practice requires structured selection, timely administration, and vigilant monitoring to ensure maximum therapeutic benefit and minimal adverse risk. Continued advancements in diagnostic tools and targeted molecular strategies will strengthen individualized care and further refine hemostatic therapy.

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