

СОВРЕМЕННЫЕ АЛГОРИТМЫ ДИАГНОСТИКИ И ЛЕЧЕНИЯ ТРОМБОЭМБОЛИИ В РЕАНИМАЦИИ

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Аннотация: Тромбоэмболия является распространенным и опасным для жизни осложнением среди критически больных пациентов в отделениях интенсивной терапии (ОИТ). Быстрая и надежная диагностика с последующим своевременным научно обоснованным лечением значительно улучшает результаты лечения пациентов. Современные клинические алгоритмы объединяют клинические системы оценки, лабораторные маркеры и методы визуализации, в то время как стратегии управления включают антикоагуляцию, тромболитиз и механические вмешательства. В этом обзоре обобщены современные фактические данные и основанные на руководящих принципах подходы к диагностике и лечению тромбоэмболии в отделении интенсивной терапии, выделены практические проблемы и направления на будущее.

Ключевые слова: тромбоэмболия, легочная эмболия, тромбоз глубоких вен, интенсивная терапия, диагностика, лечение.

INTENSIV TERAPIYADA TROMBOEMBOLIYA DIAGNOSTIKASI VA DAVOLASHNING ZAMONAVIY ALGORITMLARI

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Annotatsiya: Tromboemboliya - reanimatsiya bo'limidagi og'ir ahvoldagi bemorlar orasida keng tarqalgan va hayot uchun xavfli asoratdir. Tezkor va ishonchli diagnostika, shuningdek, o'z vaqtida dalillarga asoslangan davolash bemorlarning hayotiy natijalarini sezilarli darajada yaxshilaydi. Hozirgi klinik algoritmlar klinik baholash tizimlari, laborator markerlar va tasvirlash usullarini o'z ichiga oladi, davolash strategiyalari esa antikoagulyatsiya, tromboliz va mexanik aralashuvlarni qamrab oladi. Ushbu sharh intensiv terapiyada tromboemboliyani tashxislash va davolash bo'yicha zamonaviy dalillar hamda klinik ko'rsatmalarga asoslangan yondashuvlarni tahlil qiladi hamda amaliy muammolar va kelajakdagi yo'nalishlarni yoritadi.

Kalit so'zlar: tromboemboliya, o'pka arteriyasi tromboemboliyasi, chuqur vena trombozi, intensiv terapiya, diagnostika, davolash.

MODERN ALGORITHMS FOR THE DIAGNOSIS AND MANAGEMENT OF THROMBOEMBOLISM IN INTENSIVE CARE

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Abstract: Thromboembolism is a common and life-threatening complication among critically ill patients in intensive care units (ICUs). Rapid and reliable diagnosis followed by timely evidence-based treatment significantly improves patient outcomes. Current clinical algorithms integrate clinical scoring systems, laboratory markers, and imaging modalities, while management strategies include anticoagulation, thrombolysis, and mechanical interventions. This review synthesizes contemporary evidence and guideline-based approaches for thromboembolism diagnosis and management in the ICU, highlighting practical challenges and future directions.

Keywords: thromboembolism, pulmonary embolism, deep vein thrombosis, intensive care, diagnosis.

Introduction: Thromboembolic disease, encompassing pulmonary embolism (PE) and deep vein thrombosis (DVT), continues to pose a significant threat to patients in critical care. Global epidemiological data suggest that venous thromboembolism (VTE) affects 1–2 per 1000 individuals annually, with even higher incidence among hospitalized and critically ill populations [1]. The intensive care setting carries specific risks due to patient immobility, systemic inflammation, sedation, central venous catheters, and surgical interventions [2]. Mortality rates remain unacceptably high, particularly for massive PE, which can exceed 25–30% in the absence of immediate therapy [3]. The challenge in intensive care lies not only in early recognition but also in selecting appropriate diagnostic tools and treatments, given the complexity of comorbidities. This article provides an updated review of diagnostic and therapeutic algorithms for thromboembolism in intensive care medicine, drawing from recent evidence and clinical guidelines.

Methods: A narrative review approach was used. Literature was identified via PubMed, Embase, and Cochrane Library databases from January 2014 to June 2024. Search terms included pulmonary embolism, deep vein thrombosis, intensive care, diagnosis, management, anticoagulation, and treatment algorithms. Only English-language publications were included. Guidelines from the European Society of Cardiology (ESC), the American College of Chest Physicians (ACCP), and critical care societies were prioritized.

In total, 126 articles were initially identified. After screening titles and abstracts, 47 papers were considered relevant, and 15 were used as the principal references due to their high citation rates and direct clinical relevance. Results: Diagnostic Algorithms in Intensive

Clinical Assessment: Prediction models such as the Wells score and revised Geneva score are widely validated [4]. However, in ICU patients, their accuracy is limited due to nonspecific presentations and overlapping risk factors [5].

Biomarkers

D-dimer: Highly sensitive but nonspecific in ICU patients [6].

Troponin and BNP: Predict right ventricular strain and poor prognosis [7].

Imaging Modalities

CT Pulmonary Angiography (CTPA): Gold standard for PE diagnosis [8].

Compression Ultrasonography (CUS): Bedside test for DVT [9].

Echocardiography: Useful in unstable patients with suspected PE [10], (Table 1).

Table 1. Diagnostic tools for pulmonary embolism and DVT in the ICU.

Diagnostic tool	Advantages	Limitations
Wells score / Geneva score	Simple, rapid, provides risk stratification	Limited accuracy in ICU patients due to overlapping symptoms
D-dimer	Highly sensitive, useful for ruling out VTE in low-risk patients	Poor specificity in ICU (false positives from infection, trauma, malignancy)
CT Pulmonary Angiography (CTPA)	Gold standard, direct visualization of thrombi, evaluates clot burden	Requires hemodynamic stability, risk of contrast nephropathy
Compression Ultrasonography (CUS)	Bedside, non-invasive, effective for DVT detection	Limited to limb veins, less effective in pelvic/abdominal thrombosis
Echocardiography	Rapidly identifies right ventricular strain in massive PE	Does not directly visualize thrombus, only indirect signs

Management Algorithms in Intensive Care

Anticoagulation: LMWH and UFH remain the mainstay of treatment. DOACs are increasingly used in stable patients but have limitations in ICU settings [11]. *Thrombolysis:* Systemic thrombolysis improves outcomes in massive PE but carries bleeding risks [12]. Catheter-directed thrombolysis offers a safer alternative in selected patients [13].

Mechanical and Surgical Interventions: Options include IVC filters, surgical embolectomy, and percutaneous thrombectomy devices [14,15], (Table 2).

Table 2. Management algorithm for thromboembolism in the ICU.

Risk level / clinical state	Recommended management
Low-risk PE / DVT	Anticoagulation (LMWH, DOAC), clinical monitoring
Intermediate-risk PE	Anticoagulation, close hemodynamic and biomarker monitoring
High-risk/massive PE (shock, hypotension)	IV UFH + systemic thrombolysis (tPA) or catheter-directed thrombolysis; surgical embolectomy if needed
Contraindication to anticoagulation	Inferior vena cava (IVC) filter, mechanical interventions, delayed anticoagulation if feasible

Schematic Treatment Algorithm:

1. Assess hemodynamic status

Stable → Anticoagulation (LMWH / DOAC / UFH)

Unstable (shock, severe hypoxemia) → Systemic or catheter-directed thrombolysis;

Contraindicated for thrombolysis → Surgical embolectomy or mechanical thrombectomy.

2. Contraindication to anticoagulation

Place an IVC Place an IVC filter;

Consider mechanical thrombectomy.

3. Monitoring and follow-up

Cardiac biomarkers (troponin, BNP)

Echocardiography and ECG for right ventricular function. Regular assessment for bleeding complications.

Discussion: Modern management of thromboembolism in intensive care hinges on rapid diagnosis, careful risk stratification, and personalized therapy. Jadvallar (Tables 1 and 2) and schematic algorithms presented in this article summarize the evidence-based steps for intensivists. The integration of imaging, biomarkers, and therapeutic stratification improves survival but requires multidisciplinary collaboration [11–15].

Conclusion: Thromboembolism remains a critical challenge in intensive care medicine. Diagnostic algorithms must integrate imaging, biomarkers, and clinical assessment while recognizing the limitations of each tool in ICU settings. Management requires prompt initiation of anticoagulation, judicious use of thrombolysis, and selected application of mechanical or surgical interventions. Emerging technologies and personalized medicine hold promise for refining future strategies.

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