

REVIEW ARTICLE

Deep Vein Thrombosis: A Comprehensive Review

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ABSTRACT

Deep vein thrombosis (DVT) is a significant vascular condition characterized by the formation of blood clots within the deep venous system, most commonly affecting the lower extremities. It represents a major public health concern due to its association with morbidity, mortality, and long-term complications such as pulmonary embolism and post-thrombotic syndrome. Nursing professionals play a pivotal role in prevention, early recognition, patient education, and management of DVT. This review provides an in-depth exploration of epidemiology, risk factors, pathophysiology, clinical manifestations, diagnostic approaches, and management strategies, with a particular focus on the implications for nursing education and practice. By synthesizing current evidence and highlighting emerging trends, this article aims to strengthen nursing faculty's knowledge base, support clinical decision-making, and enhance teaching effectiveness in preparing future nurses to manage patients at risk for or affected by DVT.

KEYWORDS

• Nursing Professional • Deep Vein Thrombosis • Blood Clot • Pulmonary embolism • Post-thrombotic syndrome

INTRODUCTION

Venous thromboembolism (VTE), encompassing both deep vein thrombosis (DVT) and pulmonary embolism (PE), constitutes a major cardiovascular disorder worldwide. DVT occurs when a thrombus forms in the

deep venous system, obstructing venous return and potentially dislodging to cause life-threatening pulmonary embolism.¹ According to the World Health Organization (WHO), venous thromboembolic events are among the leading preventable causes of hospital-associated mortality.²

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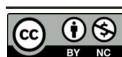
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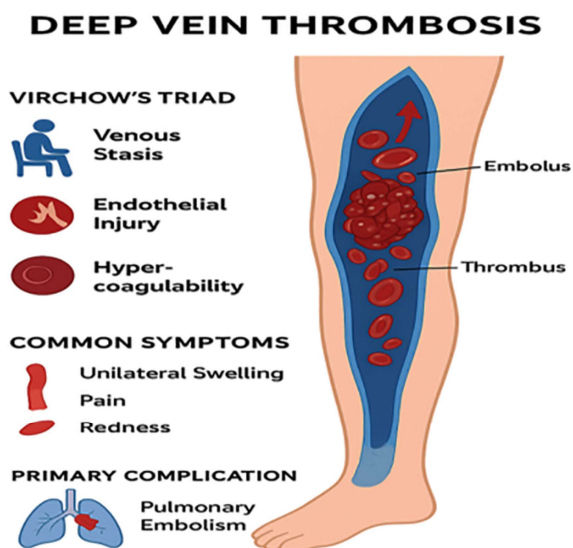
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For nurses, particularly in acute and critical care settings, DVT represents a condition that requires vigilance, evidence-based interventions, and patient education. The role of the nursing faculty extends beyond clinical practice to the preparation of student nurses through teaching, simulation, and research dissemination. Thus, understanding DVT in a comprehensive manner is essential not only for patient safety but also for effective pedagogy.³

This review aims to provide an extensive analysis of DVT, structured to support both clinical practice and nursing education.⁴ It integrates epidemiological evidence, theoretical underpinnings, and clinical guidelines, ensuring that nursing faculty can utilize the information for both professional development and instructional purposes.



Epidemiology

The global burden of DVT is considerable, with estimates suggesting that venous thromboembolism affects 1–2 per 1,000 individuals annually in developed countries. The incidence increases with age, making it a pressing concern in aging populations. Men and women are affected nearly equally, though women may have higher risk during pregnancy, postpartum periods, and when using hormonal contraceptives.⁵

Hospitalized patients represent a particularly vulnerable group. Approximately 50% of hospitalized surgical patients and 10–30% of medical inpatients are at risk of developing DVT if prophylactic measures are not implemented.⁶ Prolonged immobility, such

as that seen in intensive care units, orthopaedic wards, and long-term care facilities, further contributes to risk.

Regional variations in incidence reflect differences in diagnostic practices, awareness levels, and genetic predispositions.⁷ For example, studies in Western populations highlight higher rates of DVT compared to Asian populations; however, this gap is narrowing due to lifestyle changes and better surveillance.

Mortality associated with untreated proximal DVT, particularly when complicated by pulmonary embolism, remains high. Additionally, up to 50% of patients with symptomatic DVT may develop post-thrombotic syndrome, contributing to long-term morbidity.⁸

For nursing professionals, appreciating the epidemiological profile is crucial in risk assessment, resource allocation, and preventive education. Faculty members need to emphasize epidemiology in teaching to ensure students understand both the magnitude of the problem and the importance of proactive measures.

Etiology and Risk Factors

The etiology of DVT is multifactorial, commonly explained by **Virchow's Triad**, which outlines three fundamental mechanisms contributing to thrombus formation:

1. **Venous stasis** – impaired venous return due to immobility, heart failure, obesity, pregnancy, or prolonged travel.
2. **Endothelial injury** – vascular trauma during surgery, fractures, catheterization, or intravenous drug use.
3. **Hypercoagulability** – inherited or acquired conditions such as Factor V Leiden mutation, prothrombin gene mutation, malignancy, dehydration, sepsis, pregnancy, and use of oral contraceptives.

Common risk factors include:

- **Patient-related factors:** advanced age, obesity, smoking, dehydration, chronic diseases (diabetes, cancer, renal or liver disease).
- **Hospital-related factors:** major surgery (especially orthopedic and abdominal), prolonged bed rest, use of central venous catheters, mechanical ventilation.

- **Reproductive health-related factors:** pregnancy, cesarean section, use of hormonal contraceptives or hormone replacement therapy.
- **Lifestyle-related factors:** sedentary lifestyle, long-distance travel ("economy class syndrome"), and poor hydration habits.

Inherited thrombophilia is increasingly recognized as a risk factor, though routine screening is not recommended for all patients. Nursing professionals must understand the spectrum of risk factors to identify high-risk individuals and implement timely interventions.¹⁰

Pathophysiology

The pathophysiology of DVT is a complex interplay of hemodynamic, cellular, and biochemical processes.

1. **Venous stasis** reduces the clearance of activated clotting factors, allowing thrombus formation. Stagnant blood flow creates an environment conducive to clotting, particularly in deep veins of the legs such as the femoral, popliteal, and iliac veins.
2. **Endothelial injury** exposes sub endothelial collagen and tissue factor, initiating platelet adhesion and aggregation. This triggers the coagulation cascade, leading to thrombin generation and fibrin deposition.
3. **Hypercoagulability** results from inherited or acquired conditions that tilt the balance toward clot formation rather than clot breakdown. Elevated levels of pro-coagulant proteins and reduced levels of anticoagulant proteins (e.g., protein C, protein S, ant thrombin) contribute to thrombus development.

Once a thrombus forms, it can either:

- **Organize and adhere** to the vessel wall (leading to chronic venous insufficiency),
- **Propagate proximally**, increasing the risk of embolization,
- **Embolize**, causing pulmonary embolism.

The inflammatory response further complicates pathophysiology, with cytokines and leukocytes contributing to vein wall damage. This explains the clinical sequelae such as post-thrombotic syndrome, characterized by chronic pain, edema, and skin changes.¹¹

For nursing educators, simplifying the complexity of pathophysiology using visual aids and case studies is an effective teaching strategy to promote deeper understanding among students.

Clinical Manifestations

DVT can be clinically silent, with up to 50% of cases asymptomatic. When present, symptoms often result from venous obstruction and inflammation.

Common signs and symptoms include:

- Swelling of the affected limb (usually unilateral).
- Pain or tenderness along the course of the vein, often worsening on standing or walking.
- Warmth and erythema over the affected area.
- Dilated superficial veins due to collateral circulation.
- Low-grade fever in some cases.

Classic clinical signs:

- **Homan's sign:** pain in the calf upon dorsiflexion of the foot (though not specific or reliable).
- **Pratt's sign:** discomfort on squeezing the calf.

Complications manifesting clinically:

- Pulmonary embolism: sudden dyspnea, chest pain, hemoptysis, tachycardia.
- Post-thrombotic syndrome: chronic limb swelling, heaviness, venous ulcers, skin discoloration.

Challenges in clinical recognition:

- Many symptoms are nonspecific and overlap with cellulitis, muscle injury, or lymphedema.
- Reliance solely on clinical features is insufficient; hence, diagnostic testing is necessary.

Nursing staff, often the first to assess patients at the bedside, must be proficient in recognizing subtle changes and escalating care promptly. Faculty can emphasize clinical manifestations through simulation training, case scenarios, and bedside teaching, ensuring that future nurses are competent in early detection.¹²

Diagnostic Evaluation

The accurate diagnosis of DVT is vital, as clinical signs and symptoms alone are insufficient for confirmation. Nurses play an essential role in preparing patients for diagnostic tests, monitoring results, and communicating findings to the healthcare team.¹³

1. Clinical Prediction Rules

- **Wells Score for DVT:** A widely used clinical decision tool that stratifies patients into categories of low, moderate, or high probability based on risk factors and clinical features (e.g., active cancer, recent surgery, immobilization, localized tenderness, swelling, and previous DVT).
- **Nursing implication:** Faculty should teach nursing students how to apply such scores to enhance clinical reasoning in risk assessment.

2. Laboratory Tests

- **D-dimer assay:** Elevated levels indicate active clot formation and breakdown. While sensitive, it is not specific, as levels may be raised in infection, trauma, pregnancy, or cancer.
- **Coagulation profile:** Prothrombin time (PT), activated partial thromboplastin time (aPTT), and INR are important for patients on anticoagulants.
- **Thrombophilia screening:** Considered in recurrent or unprovoked DVT, particularly in younger patients.

3. Imaging Techniques

- **Duplex ultrasonography:** First-line diagnostic tool; noninvasive, widely available, and highly sensitive for proximal DVT.
- **Venography:** Once the gold standard, now rarely used due to invasiveness and contrast-related risks.
- **Magnetic resonance venography (MRV) and CT venography:** Useful in complex cases and pelvic vein thrombosis.

4. Nursing Role in Diagnostics

Nurses are responsible for patient preparation (e.g., explaining procedures, maintaining hydration), post-procedural monitoring, and reinforcing education regarding the significance of diagnostic findings. For faculty,

embedding diagnostic reasoning into nursing curricula enhances student competency in evidence-based practice.¹⁴

Complications

If untreated or poorly managed, DVT can lead to severe acute and chronic complications.

1. Pulmonary Embolism (PE):

- The most feared complication, occurring when part of a thrombus dislodges and travels to the pulmonary arteries.
- Clinical features: sudden chest pain, tachypnea, hemoptysis, cyanosis, and cardiovascular collapse.
- Mortality rates are significant if PE is massive and untreated.

2. Post-Thrombotic Syndrome (PTS):

- Chronic venous insufficiency caused by vein wall damage and valvular incompetence after DVT.
- Symptoms: persistent leg pain, edema, skin changes, venous ulcers.
- Occurs in up to 50% of patients within 2 years.

3. Recurrent DVT:

- Common in patients with persistent risk factors (e.g., cancer, thrombophilia).
- Increases the burden of long-term anticoagulation therapy.

4. Chronic Pulmonary Hypertension:

- Can result from recurrent emboli causing permanent vascular remodeling.
- Associated with poor quality of life and high morbidity.

For nurses, recognition and early intervention in complications are critical to preventing mortality and long-term disability.¹⁵

Implications for Nursing Education and Practice

DVT care requires a strong foundation of theoretical knowledge, clinical skills, and patient-centered education. For nursing faculty, this translates into several educational imperatives:

1. **Curriculum Integration:** DVT should be incorporated into cardiovascular, surgical, and critical care nursing courses.

2. **Simulation Training:** Use of mannequins and case-based learning for recognition of DVT symptoms and complications.
3. **Research Engagement:** Encouraging nursing students to participate in evidence-based projects on VTE prevention and care.
4. **Patient Education Skills:** Teaching students effective communication techniques to counsel patients on lifestyle modifications and medication adherence.
5. **Policy and Advocacy:** Preparing nurses to advocate for thromboprophylaxis protocols in healthcare institutions.

By focusing on these areas, faculty can empower nurses to take proactive roles in reducing DVT-related morbidity and mortality.

Recent Advances and Research Trends

Research in DVT management continues to evolve, with several emerging trends relevant for nursing faculty:

- **Biomarkers:** Ongoing studies explore novel biomarkers for early detection and prognosis of DVT.
- **Pharmacogenomics:** Personalized anticoagulation therapy based on genetic profiles.
- **Artificial Intelligence (AI):** AI-based algorithms are being developed to predict risk and guide clinical decisions.
- **Telehealth:** Increasingly used for monitoring patients on anticoagulation, improving adherence, and reducing hospital visits.
- **Nursing-led interventions:** Evidence supports nurse-led thromboprophylaxis programs in reducing hospital-acquired DVT.

Nursing faculty should remain updated with such innovations, integrating them into teaching and research to prepare students for future practice.¹⁶

CONCLUSION

Deep vein thrombosis is a critical vascular condition with significant implications for patient health, healthcare systems, and nursing practice. Despite being largely preventable, it continues to contribute to substantial morbidity and mortality worldwide.¹⁷ Nursing faculty,

through education, research, and clinical leadership, hold a pivotal role in equipping future nurses with the knowledge and skills necessary to prevent, detect, and manage DVT effectively.

By emphasizing a comprehensive approach that combines evidence-based clinical management, preventive strategies, patient education, and interprofessional collaboration, nurses can significantly reduce the burden of DVT. Faculty members are uniquely positioned to inspire, guide, and empower students, ensuring that the next generation of nurses is competent, compassionate, and prepared to address this important health challenge.

REFERENCES

1. Ageno, W., Becattini, C., Brighton, T., Selby, R., & Kamphuisen, P.W. (2012). Epidemiology and risk factors of venous thromboembolism. *Seminars in Thrombosis and Hemostasis*, 38(6), 614–622. <https://doi.org/10.1055/s-0032-1322663>
2. Anderson, F.A., & Spencer, F.A. (2003). Risk factors for venous thromboembolism. *Circulation*, 107(23 Suppl 1), I9–I16. <https://doi.org/10.1161/01.CIR.0000078469.07362.E6>
3. Becattini, C., Agnelli, G., & Schenone, A. (2012). Aspirin for preventing the recurrence of venous thromboembolism. *The New England Journal of Medicine*, 366(21), 1959–1967. <https://doi.org/10.1056/NEJMoa1114238>
4. Cushman, M. (2007). Epidemiology and risk factors for venous thrombosis. *Seminars in Hematology*, 44(2), 62–69. <https://doi.org/10.1053/j.seminhematol.2007.02.004>
5. Di Nisio, M., van Es, N., & Büller, H.R. (2016). Deep vein thrombosis and pulmonary embolism. *The Lancet*, 388(10063), 3060–3073. [https://doi.org/10.1016/S0140-6736\(16\)30514-1](https://doi.org/10.1016/S0140-6736(16)30514-1)
6. Farge, D., et al. (2019). International clinical practice guidelines for the treatment and prophylaxis of venous thromboembolism in patients with cancer. *The Lancet Oncology*, 20(10), e566–e581. [https://doi.org/10.1016/S1470-2045\(19\)30336-5](https://doi.org/10.1016/S1470-2045(19)30336-5)
7. Galanaud, J. P., et al. (2018). Predictive factors for recurrent venous thromboembolism. *Thrombosis Research*, 163, 6–11. <https://doi.org/10.1016/j.thromres.2017.12.006>
8. Geerts, W.H., et al. (2008). Prevention of venous thromboembolism: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th Edition). *Chest*, 133(6

- Suppl), 381S–453S. <https://doi.org/10.1378/chest.08-0656>.
9. Heit, J.A. (2015). Epidemiology of venous thromboembolism. *Nature Reviews Cardiology*, 12(8), 464–474. <https://doi.org/10.1038/nrcardio.2015.83>
 10. Kahn, S.R., & Lim, W. (2021). Prevention of VTE in nonsurgical patients. *Chest*, 160(6), 2129–2140. <https://doi.org/10.1016/j.chest.2021.07.056>
 11. Kakkos, S.K., *et al.* (2021). European Society for Vascular Surgery (ESVS) 2021 Clinical Practice Guidelines on the management of venous thrombosis. *European Journal of Vascular and Endovascular Surgery*, 61(1), 9–82. <https://doi.org/10.1016/j.ejvs.2020.09.023>
 12. Kesieme, E., Kesieme, C., Jebbin, N., Irekpita, E., & Dongo, A. (2011). Deep vein thrombosis: A clinical review. *Journal of Blood Medicine*, 2, 59–69. <https://doi.org/10.2147/JBM.S19009>
 13. Konstantinides, S.V., *et al.* (2020). 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism. *European Heart Journal*, 41(4), 543–603. <https://doi.org/10.1093/eurheartj/ehz405>
 14. Lyman, G. H., *et al.* (2021). Venous thromboembolism prophylaxis and treatment in patients with cancer: ASCO guideline update. *Journal of Clinical Oncology*, 39(12), 1326–1349. <https://doi.org/10.1200/JCO.20.01461>
 15. Prandoni, P., & Villalta, S. (2011). Venous thromboembolism and the post-thrombotic syndrome: Prevention and treatment. *Vascular Health and Risk Management*, 7, 557–564. <https://doi.org/10.2147/VHRM.S10326>
 16. Raskob, G.E., *et al.* (2018). Thrombosis: A major contributor to global disease burden. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 38(12), 3023–3026. <https://doi.org/10.1161/ATVBAHA.118.311704>
 17. Schünemann, H.J., *et al.* (2018). American Society of Hematology 2018 guidelines for management of venous thromboembolism: Prophylaxis for hospitalized and nonhospitalized medical patients. *Blood Advances*, 2(22), 3198–3225. <https://doi.org/10.1182/bloodadvances.2018022954>
 18. Thaler, J., & Ay, C. (2020). Venous thromboembolism: Epidemiology, risk factors, and genetics. *Hamostaseologie*, 40(6), 366–374. <https://doi.org/10.1055/a-1268-9728>
 19. Wells, P.S., *et al.* (2014). Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. *The New England Journal of Medicine*, 349(13), 1227–1235. <https://doi.org/10.1056/NEJMoa023153>
 20. Wendelboe, A. M., & Raskob, G. E. (2016). Global burden of thrombosis: Epidemiologic aspects. *Circulation Research*, 118(9), 1340–1347. <https://doi.org/10.1161/CIRCRESAHA.115.306841>