Sequential Compression Devices for Venous Thromboembolism Prevention

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Introduction

Sequential compression devices, also called intermittent pneumatic compression devices, reduce venous stasis by repeatedly inflating sleeves around the legs and then releasing pressure. They are one component of preventing venous thromboembolism in hospitalized and postoperative patients, not a universal substitute for anticoagulant prophylaxis. Venous thromboembolism includes deep vein thrombosis and pulmonary embolism, and risk rises with factors such as immobility, surgery, trauma, cancer, previous thrombosis, age, and acute illness. Current evidence-based practice requires an individualized assessment of thrombosis risk and bleeding risk. Some patients receive pharmacologic prophylaxis, some receive mechanical prophylaxis because anticoagulants are temporarily unsuitable, and selected high-risk patients receive both (American Society of Hematology, 2018; 2019). The nursing role extends beyond placing sleeves on the legs. Correct indication, fit, adherence, skin and neurovascular assessment, mobility, patient education, documentation, and prompt response to new symptoms determine whether the device is both safe and useful.

How Sequential Compression Prevents Venous Stasis

The physiologic rationale for intermittent pneumatic compression can be understood through Virchow’s triad: venous stasis, endothelial injury, and hypercoagulability. Surgery and trauma may influence all three mechanisms, while sequential compression primarily addresses stasis by increasing the velocity of venous return from the lower extremities. A typical system uses a pump, tubing, and chambers that inflate from distal to proximal before deflating. The device is effective only when the sleeves are the correct size, connected to a functioning pump, and worn for the prescribed period. It does not eliminate tissue injury or systemic hypercoagulability, which is why mechanical prophylaxis alone may be insufficient for some patients. Risk should also be reassessed during hospitalization because mobility, bleeding, procedures, infection, and clinical status change over time. Early ambulation remains important when safe and should not be delayed merely because compression is in use. The purpose of the device is to supplement an evidence-based prevention plan, not to replace movement, assessment, or other prophylactic measures.

Choosing Mechanical and Pharmacologic Prophylaxis

Clinical selection depends strongly on setting and bleeding risk. For major surgical patients, the American Society of Hematology recommends considering mechanical prophylaxis rather than no prophylaxis when mechanical prevention is appropriate, and intermittent pneumatic compression is generally preferred to graduated compression stockings when a mechanical method is selected (American Society of Hematology, 2019). Patients with high thrombosis risk and acceptable bleeding risk may receive combined mechanical and pharmacologic prophylaxis. Trauma patients present a particular challenge because serious injury can simultaneously increase clotting risk and make anticoagulation temporarily unsafe. Mechanical prophylaxis may therefore be used during periods of bleeding concern and combined with medication when it becomes safe. In medical inpatients, pharmacologic prophylaxis is often used when VTE risk is elevated and bleeding risk acceptable, with mechanical methods considered when medication is inappropriate (American Society of Hematology, 2018). No one device strategy is superior for every patient; procedure, diagnosis, mobility, circulation, wounds, and contraindications all influence the plan.

Safe Application and Clinical Assessment

Nursing assessment before application should confirm the order or protocol, indication, correct sleeve size, skin condition, comfort, limb anatomy, and relevant circulation or neurologic findings. The nurse should look for wounds, edema, fragile skin, sensory loss, external devices, or conditions that make placement difficult. Suspected acute deep vein thrombosis requires clinical evaluation rather than automatic application of compression. New unilateral swelling, pain, warmth, discoloration, unexplained shortness of breath, chest pain, hypoxemia, or collapse should prompt urgent escalation because the device is preventive rather than a treatment for an undiagnosed clot. Sleeves that are too tight can contribute to pressure injury or impaired comfort, while loose or misaligned sleeves may not deliver effective compression. Tubing should remain unkinked and arranged to reduce fall risk. Device-specific contraindications and precautions should be checked against manufacturer instructions and institutional policy rather than replaced with a generalized list that ignores differences among systems and patients.

Adherence, Education, and Skin Monitoring

Adherence is one of the most important practical determinants of effectiveness. Devices are frequently removed for walking, bathing, toileting, therapy, procedures, sleep discomfort, transport, or because pumps alarm, and they may not be reapplied afterward. Cornwell et al. (2002) demonstrated substantial gaps in sequential-compression adherence among at-risk trauma patients, illustrating that prescribed prophylaxis is not equivalent to delivered prophylaxis. Nursing workflow

should include reapplication after interruptions and documentation of meaningful wear time rather than repeated charting that the device is “on” when it is disconnected. Patient education can improve cooperation when the purpose is explained in plain language. The patient should understand that periodic leg compression supports venous return during reduced mobility and should report severe pain, numbness, coldness, burning, skin injury, or unusual swelling. Discomfort should lead to reassessment rather than blame. Regular skin inspection is particularly important for older adults and patients with diabetes, neuropathy, edema, fragile skin, or limited ability to report symptoms.

Coordination and Quality Improvement

Sequential compression must also be coordinated with mobility, anticoagulation, and quality-improvement systems. When both pharmacologic and mechanical prophylaxis are ordered, omission of one is not justified merely because the other is present unless the care plan changes. If an anticoagulant dose is withheld for bleeding or a procedure, the reason and restart plan should be clear, while mechanical adherence may become especially important during the interruption. Evidence from orthopedic surgery, including the trial by Colwell et al. (2010), shows that mechanical prophylaxis can reduce bleeding exposure in selected contexts, but one study does not establish universal superiority to low-molecular-weight heparin. Units should monitor appropriate prophylaxis selection, time to application, actual wear time, missed reapplication, skin injury, fall hazards, and hospital-associated VTE. Handoffs should identify adherence problems and changes in mobility or bleeding risk. Quality improvement is therefore broader than increasing device use: it aims to ensure that each patient receives the right combination of prevention measures and that those measures are actually delivered.

Conclusion

Sequential compression devices can reduce venous stasis and make an important contribution to venous-thromboembolism prevention, particularly when anticoagulation is temporarily unsuitable or when combined prophylaxis is appropriate for a high-risk patient. They are not the sole preventive measure for trauma patients, a universal replacement for anticoagulants, or a treatment for suspected acute deep vein thrombosis. Evidence-based use begins with assessment of thrombosis and bleeding risk and continues through correct sizing, application, adherence, skin monitoring, mobility, education, and reassessment (American Society of Hematology, 2018; 2019). The nursing contribution is therefore both technical and clinical. A perfectly functioning pump cannot protect a patient when sleeves are removed for most of the day, and a prevention protocol becomes unsafe when new symptoms are ignored. Competent practice connects the device with pharmacologic prophylaxis when indicated, supports early mobility, responds to patient discomfort, and documents actual delivery. The practical standard is simple: compression prevents harm only when it is appropriate for the patient, correctly applied, functioning, and consistently worn.

References

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