Sequential Compression Devices

Posted on September 30, 2019

Introduction

Sequential compression devices are mechanical systems used to reduce venous stasis in patients at risk of venous thromboembolism. They are also called intermittent pneumatic compression devices because inflatable sleeves apply and release pressure around the legs in a programmed sequence. The original essay correctly identifies immobility, surgery, trauma, deep vein thrombosis, pulmonary embolism, adherence, and evidence-based nursing as important. It incorrectly calls compression devices the sole preventive measure for trauma patients, concludes that they are broadly safer and more effective than low-molecular-weight heparin, and combines prophylactic pneumatic compression with all forms of compression therapy. Current practice requires individual venous-thromboembolism risk and bleeding-risk assessment. Some patients receive anticoagulant prophylaxis, some receive mechanical prophylaxis when medication is unsuitable, and selected high-risk patients receive both. The nursing contribution is not simply placing sleeves on the legs. It includes assessment, correct fitting, continuous adherence, skin and neurovascular monitoring, patient education, documentation, and rapid escalation when symptoms suggest thrombosis or device-related harm (American Society of Hematology, 2018; American Society of Hematology, 2019).

Venous Thromboembolism

Venous thromboembolism includes deep vein thrombosis and pulmonary embolism. A deep vein thrombosis is a clot in a deep vein, commonly in the leg or pelvis. Part of the clot can detach and travel to the lungs, producing a pulmonary embolism that may cause breathlessness, chest pain, low oxygen, collapse, or death. Hospitalized patients face increased risk because of immobility, surgery, trauma, cancer, inflammation, age, previous thrombosis, pregnancy, estrogen exposure, and other factors. Risk changes during admission, so assessment should occur at entry and after surgery, transfer, bleeding, reduced mobility, or another significant clinical change.

Virchow’s Triad

Thrombosis is commonly explained through Virchow’s triad: venous stasis, endothelial injury, and hypercoagulability. Surgery and trauma can affect all three. Immobility slows venous return, tissue injury activates coagulation, and inflammatory or disease states can increase clotting tendency. Sequential compression primarily addresses stasis. It does not eliminate vessel injury or hypercoagulability and therefore cannot be assumed to provide complete protection. This explains why guidelines may favor pharmacologic prophylaxis, combined prophylaxis, early mobility, or

another plan according to the patient's overall risk.

How the Device Works

A sequential compression system includes a pump, tubing, and inflatable sleeves placed around the calves or the calves and thighs. Chambers inflate in sequence, usually beginning distally and progressing proximally, then deflate. The cycle compresses veins and increases the velocity of venous blood returning toward the heart. Repeated compression may also influence fibrinolytic activity. The device works only when connected, powered, correctly fitted, and worn for the prescribed time. Sleeves resting on the bed or disconnected during most of the day provide no meaningful prophylaxis.

Evidence-Based Decision-Making

Evidence-based practice integrates research evidence, clinical expertise, patient values, feasibility, and individual risk. It does not mean selecting one study and declaring one intervention universally best. Guidelines from the American Society of Hematology and other organizations make conditional recommendations because evidence quality differs by setting. In major surgery, mechanical prophylaxis may be preferred to no prophylaxis, and intermittent pneumatic compression is generally favored over graduated compression stockings when a mechanical method is chosen. Patients at high thrombosis risk and acceptable bleeding risk may benefit from combined mechanical and pharmacologic prevention. The exact plan depends on procedure, diagnosis, mobility, and contraindications.

When Mechanical Prophylaxis Is Especially Useful

Sequential compression is particularly valuable when anticoagulant medication is temporarily contraindicated because of active bleeding, severe bleeding risk, recent high-risk surgery, or another clinical concern. It may also supplement medication in selected surgical or trauma patients. The device does not replace early mobilization, hydration, and active clinical assessment. It should not be applied automatically to every patient without an order or protocol-supported indication. A low-risk ambulatory patient may receive no benefit, while a very high-risk patient may be undertreated if the device is used alone.

Trauma Patients

Trauma patients often have high thrombosis risk and competing bleeding risk. The original essay cites a study showing that adherence to compression was poor and associated with important prophylaxis gaps. Its lesson is not that sequential compression is the sole measure. The lesson is that mechanical prophylaxis cannot work when it is removed, unavailable, or applied inconsistently (Cornwell et al.,

2002). Trauma teams may initiate pneumatic compression while bleeding risk prevents anticoagulation and add medication when safe. Fractures, wounds, external fixators, vascular injury, and repeated procedures may limit placement. The plan should be reviewed frequently rather than left unchanged throughout admission.

Orthopedic Surgery

Total hip and knee arthroplasty carry substantial venous-thromboembolism risk. The cited randomized trial compared a mobile compression device with low-molecular-weight heparin and found fewer major bleeding events with mechanical prophylaxis in that study, with similar observed thromboembolic outcomes (Colwell et al., 2010). One trial does not establish that compression is superior for every orthopedic patient. Event rates, adherence, diagnostic methods, patient selection, and confidence intervals matter. Current practice uses several acceptable strategies, including anticoagulants and mechanical methods, chosen according to guideline, surgeon, patient factors, and bleeding risk. A patient should not stop prescribed anticoagulation because sleeves appear safer.

Medical Inpatients

For acutely ill medical patients, pharmacologic prophylaxis is often used when thrombosis risk is elevated and bleeding risk acceptable. Mechanical devices may be selected when medication is inappropriate, but comfort and adherence can be challenging. Medical patients may have edema, fragile skin, delirium, neuropathy, peripheral vascular disease, or heart failure that require careful assessment. The nurse should not assume that an immobile medical patient automatically qualifies; validated risk assessment and institutional protocols should guide the plan.

Sequential Compression Is Not DVT Treatment

The device is primarily a preventive intervention. It should not be applied over a leg with suspected acute deep vein thrombosis without clinical evaluation. New unilateral swelling, pain, warmth, discoloration, or unexplained respiratory symptoms require prompt escalation and diagnostic assessment. Once a DVT is diagnosed, treatment usually involves anticoagulation or another specialist-directed strategy. Compression may later have roles in symptom management for selected patients, but that is different from routine pneumatic prophylaxis. The nurse should never use the device as a substitute for investigating symptoms.

Pre-Application Assessment

Before application, the nurse verifies the order or protocol, patient identity, indication, sleeve size, skin condition, sensation, pulses or perfusion indicators as appropriate, edema, wounds, devices, and

limb anatomy. The patient's history should be reviewed for suspected thrombosis, severe arterial insufficiency, acute limb ischemia, recent vascular procedures, significant skin disease, or conditions requiring specialist advice. Contraindications differ by device and policy. When safety is uncertain, the correct response is clinical review rather than an improvised universal list.

Correct Sizing and Placement

Sleeves that are too tight can create pressure injury, discomfort, or impaired circulation; sleeves that are too loose may not deliver effective compression. The nurse measures the limb according to manufacturer instructions and aligns the sleeve correctly. Tubing should remain unkinked and positioned to avoid tripping or pulling. The pump settings should match the ordered device mode. Sleeves should not be placed over objects, folds, or damp material that concentrate pressure. After application, the nurse confirms that inflation cycles occur and that the patient can report discomfort.

Adherence

Adherence is one of the largest barriers to effectiveness. Devices are often removed for walking, bathing, therapy, procedures, sleep discomfort, toileting, or because the pump alarms. They may not be reapplied afterward. The prescribed goal is generally to wear them whenever the patient is in bed or seated and not ambulating, subject to the care plan. Nursing workflow should include reapplication after every interruption. Electronic monitoring can identify gaps, but it does not replace human responsibility. Units should measure actual wear time rather than documentation alone.

Patient Education

Patients are more likely to use the device when they understand its purpose. The nurse should explain that the sleeves periodically squeeze the legs to help blood return and reduce clot risk during limited mobility. The patient should know that the device may feel snug but should not cause severe pain, numbness, coldness, burning, or skin injury. Education includes calling for help before walking because tubing and the pump can create a fall hazard. Patients should not be blamed for removing uncomfortable sleeves; discomfort is information requiring assessment, adjustment, or discussion of alternatives.

Skin and Neurovascular Monitoring

Sleeves should be removed at appropriate intervals to inspect the skin and assess comfort and limb condition according to policy and patient risk. Older adults, people with diabetes, neuropathy, edema, poor perfusion, immobility, or fragile skin may need closer monitoring. Findings of persistent redness, blistering, pressure injury, new pain, altered sensation, pallor, coolness, or swelling require

intervention. The nurse documents the finding, stops or adjusts the device when indicated, protects the skin, and notifies the responsible clinician. A preventive device should never be allowed to create an unrecognized injury.

Mobility and Falls

Early and frequent safe mobility is a major component of thrombosis prevention and recovery. Sequential compression should support, not replace, mobilization. The pump and tubing should be disconnected safely before walking, and sleeves may remain on if the design and policy permit. Patients should not climb over tubing or carry an unsecured pump without instruction. Mobility planning includes pain control, footwear, assistive devices, orthostatic assessment, and therapy support. A nurse should not keep a patient in bed merely because the device is running.

Combination With Pharmacologic Prophylaxis

When both anticoagulant medication and sequential compression are ordered, they address different parts of risk. The nurse administers medication at the correct time, monitors bleeding and laboratory considerations as appropriate, and maintains device adherence. The presence of one intervention does not make omission of the other acceptable unless the plan changes. If a dose is held because of bleeding or a procedure, the reason and restart plan should be clear. Mechanical prophylaxis becomes especially important during medication interruption, but it does not guarantee protection.

Compression Stockings and Other Compression Therapies

Graduated compression stockings apply sustained pressure, while sequential devices apply intermittent pneumatic pressure. Compression bandaging and garments also treat selected venous and lymphatic disorders. Evidence and indications differ. A consensus on compression for varicose veins or lymphedema does not prove that sequential compression is the best prophylaxis after every operation. Likewise, current guidelines generally do not recommend routine compression stockings solely to prevent post-thrombotic syndrome after acute DVT. The exact modality must match the clinical objective (National Institute for Health and Care Excellence, 2018, updated 2023).

Documentation

Documentation should include indication, sleeve type and size, limbs treated, skin assessment, application time, interruptions, patient tolerance, education, and escalation of abnormal findings. Repeated charting that a device is “on” while it is disconnected undermines safety and quality

measurement. Shift handoff should identify adherence problems, skin concerns, and whether the patient is now independently mobile. Documentation supports continuity and demonstrates whether the ordered prophylaxis was actually delivered.

Quality Improvement

A unit can audit percentage of eligible patients with appropriate prophylaxis, time from admission or procedure to application, actual wear time, missed reapplication, skin injury, falls related to tubing, and hospital-associated venous thromboembolism. Staff interviews may reveal missing sleeves, incompatible equipment, unclear ownership, or alarms that lead to removal. Improvement may include standard orders, bedside reminders, adequate device supply, patient education, mobility protocols, and accountability during transport. The aim is not merely higher device use; it is correct prophylaxis for the correct patient.

Impact on Nursing Practice

Using sequential compression competently strengthens nursing practice because it combines assessment, technical skill, education, monitoring, interprofessional communication, and prevention. Job satisfaction should come from reliable patient safety rather than from replacing physical therapy or caring for more patients simultaneously. Nurses remain responsible for individualized care, and devices do not reduce the need for mobility support. Training should include manufacturer instructions, VTE prevention principles, contraindication awareness, and response to symptoms. Competence is demonstrated by correct decisions and follow-through, not simply by attaching sleeves.

Conclusion

Sequential compression devices reduce venous stasis through cyclic pneumatic pressure and can be effective components of venous-thromboembolism prophylaxis. They are not the sole preventive measure for trauma patients, universally superior to anticoagulation, or a treatment for suspected acute DVT. Selection depends on thrombosis risk, bleeding risk, surgery, mobility, skin, circulation, and patient preference. The nursing role includes verifying indication, fitting the device correctly, promoting wear, inspecting the skin, preventing falls, supporting mobility, and escalating new symptoms. Evidence-based practice requires matching the device to the patient and combining it with other measures when indicated. The practical lesson from adherence research is clear: a device can prevent harm only when it is appropriate, functioning, and actually worn.

References

American Society of Hematology. (2018). Guidelines for management of venous thromboembolism: Prophylaxis for hospitalized and nonhospitalized medical patients. *Blood Advances, 2*(22), 3198–3225.

American Society of Hematology. (2019). Guidelines for prevention of venous thromboembolism in surgical hospitalized patients. *Blood Advances, 3*(23), 3898–3944.

Colwell, C. W., Jr., et al. (2010). Thrombosis prevention after total hip arthroplasty. *Journal of Bone and Joint Surgery, 92*(3), 527–535.

Cornwell, E. E., III, Chang, D., Velmahos, G., & Jindal, A. (2002). Compliance with sequential compression device prophylaxis in at-risk trauma patients. *American Surgeon, 68*(5), 470–473.

National Institute for Health and Care Excellence. (2018, updated 2023). *Venous thromboembolism in over 16s: Reducing the risk*.