

บทบาทพยาบาลในการป้องกันภาวะแทรกซ้อนการเกิดภาวะลิ่มเลือดอุดตัน หลอดเลือดดำส่วนลึกในผู้ป่วยบาดเจ็บรายศาสตร์ส่วนล่าง

Nurse's Role in Preventing Deep Vein Thrombosis-related Complications in Patients with Lower Extremity Injury

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บทคัดย่อ

ภาวะลิ่มเลือดอุดตันในหลอดเลือดดำส่วนลึก (Deep vein thrombosis: DVT) เป็นหนึ่งในภาวะแทรกซ้อนที่พบบ่อยที่สุดในผู้ป่วยที่มีการบาดเจ็บที่รยางค์ส่วนล่าง ส่วนมากจะเป็นที่หลอดเลือดดำส่วนลึกที่ขา และลิ่มเลือดนั้นเคลื่อนที่ไปพร้อมกับ การไหลเวียนของเลือดเกิดการอุดตันในหลอดเลือดดำ (Venous thrombosis) จนมาอุดตันที่ปอด (Pulmonary embolism) อาจเกิดขึ้นที่ตำแหน่งเดียวหรือหลายตำแหน่ง จัดเป็นภาวะอันตรายที่เกิดขึ้นต่อชีวิต เนื่องจากลิ่มเลือดที่อุดตันอาจหลุดไปตาม กระแสเลือด โดยทั่วไปสามารถป้องกันและรักษาผู้ป่วยกลุ่มนี้ได้ ดังนั้นพยาบาลจึงมีบทบาทสำคัญในการประเมินความเสี่ยงและ ปฏิบัติกิจกรรมการพยาบาลเพื่อป้องกันการเกิดภาวะลิ่มเลือดอุดตันในหลอดเลือดดำส่วนลึกที่อาจเป็นอันตรายต่อชีวิต ซึ่งบทความ นี้มีวัตถุประสงค์เพื่อสังเคราะห์หลักฐานเชิงประจักษ์ที่เกี่ยวข้องกับอุบัติการณ์การเกิดภาวะลิ่มเลือดอุดตันในหลอดเลือดดำส่วนลึก พยาธิสภาพ สาเหตุและปัจจัยเสี่ยง การตรวจวินิจฉัย อาการและอาการแสดง วิธีการป้องกัน บทบาทพยาบาลในการป้องกันภาวะ แทรกซ้อนการเกิดภาวะลิ่มเลือดอุดตันในหลอดเลือดดำส่วนลึก นอกจากจะส่งผลให้ผู้ป่วยได้รับการวินิจฉัยและได้รับการรักษาที่ ถูกต้องแล้ว ยังส่งผลให้อัตราการเกิดอุบัติการณ์ซ้ำลดลงอีกด้วย โดยเฉพาะอย่างยิ่งในระยะวิกฤตภายหลังได้รับบาดเจ็บรายศาสตร์ ส่วนล่าง ลดอัตราการเสียชีวิต และลดระยะเวลานอนโรงพยาบาลนาน การจำหน่ายผู้ป่วยได้อย่างมีประสิทธิภาพ

คำสำคัญ : ภาวะลิ่มเลือดอุดตันในหลอดเลือดดำส่วนลึก, ภาวะลิ่มเลือดอุดตันในหลอดเลือดดำ, ภาวะลิ่มเลือดอุดตันในปอด, การบาดเจ็บรายศาสตร์ส่วนล่าง

Abstract

Deep vein thrombosis (DVT) is one of the most commonly found complications in patients with lower extremity injury. Over half of those involve DVT-related complications, and blood clot moves along with the blood flow, causing a blockage in the venous thrombosis, until it become blocked in the lung, It is pulmonary embolism (PE). It may occur at one location or many multiple locations. It is classified as a life-threatening condition. This is because the blocked blood clot may escape through the bloodstream. In general, this group of patients can be prevented and treated. Nurses have a critical role to play in risk assessment and nursing to preventing DVT-related complications is a significant cause of morbidity and mortality in trauma patients. This article aims to summarize and synthesize the current evidence regarding DVT

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วันที่รับ (Received) 27 ม.ค. 2567 วันที่แก้ไขเสร็จ (Revised) 10 มี.ค. 2567 วันที่ตอบรับ (Accepted) 7 เม.ย. 2567

incidence, risk factors, diagnostic tools, and prophylactic methods, and to consolidate the evidence about DVT management. Evidence supporting nurses' role in preventing DVT-related complications in patients with lower extremity injury were investigated as this could support the development of prevention strategies, appropriate nursing management, and DVT monitoring, especially in the acute phase post-injury, to reduce long-term disability, hospital mortality, and prolonged hospitalization.

Keyword : Deep vein thrombosis, Venous thrombosis, Pulmonary embolism, Lower extremity Injury

Introduction

Deep vein thrombosis (DVT) is a potentially life-threatening complication in case of a pulmonary embolism (PE) of the body, most often occurring in patients with lower extremity injury^{1,2} ; although it can also occur in patient with upper extremity injury.³ In general surgical patient without prophylaxis against VTE, The reported incidence of DVT varies with the detection method, mode of prevention, location of the thrombus, and the study sample size, thus resulting in a wide range of numbers reported in the literature. There is a wide variation in the reported incidence of DVT among Asian patients, with one study reporting a 70% incidence,¹ while in Thailand, an 80% incidence has been reported.⁴

Supporting evidence has been generated to help guide DVT prophylaxis in cases of lower extremity injury for orthopedic patient.⁵ in addition, various recommendations are available to help physicians decide which orthopedic trauma patients require prevention and management.^{3,6} The initiation of pharmacologic prophylaxis in a trauma patient must always balance the benefit of therapy with the risk of bleeding,⁷ The advent of more recent anticoagulants has increased the pharmacologic options available to orthopedic surgeons, but in many cases their comparative efficacies remain incompletely evaluated.⁴ A variety of prophylactic treatment are available for perioperative trauma patient. Common prophylactic methods include chemoprophylaxis, such as low molecular weight heparin (LMWH),

unfractionated heparin (UFH) and aspirin have been investigated for their efficacy. Common mechanical prophylaxis includes intermittent pneumatic compression device (IPC). An inferior vena cava (IVC) filter is also a potential prophylactic intervention in patient with severe trauma.⁸ It is generally agreed that thromboprophylaxis should be administered to trauma patient, with careful assessment of the risk of VTE and bleeding.⁹

Many study design factors can affect the reported incidence, such as an increased age^{10,11}, severity of the injury, hospitalization, length of hospital stay, long period of immobilization, family history, chronic venous insufficiency, post-surgery conditions, and obesity, which are common risk factors^{8, 12} among some other factors already described in the literature, and it is further reported that individuals with several factors concomitantly have a greater risk of developing DVT¹³. Considering the various risk factors for DVT among hospitalized patients. nurses, who provide continuous and uninterrupted care, are essential for identifying the risk of DVT¹⁰ and for implementing prophylactic interventions.⁷

An improved understanding of the operative risk factors could permit prophylactic therapy to be better tailored to the individual patient. Therefore, there is a need to monitor DVT cases to determine the appropriate care procedures to apply.⁸ This approach allowed us to indirectly compare the different methods. For a prophylactic method to be

successfully applied, it need to be effective and safe, with consideration of variable factor, such as trauma region, trauma type and patient characteristics.

Deep vein thrombosis

Deep vein thrombosis (DVT) is a condition in which a blood clot develops in the deep veins, usually in the lower extremities. A pulmonary embolism (PE) occurs when a part of the DVT clot breaks off and travels to the lungs, which can be life-threatening. Venous thromboembolism (VTE) refers to DVT, PE, or both. VTE is often recurrent and can lead to long-term complications (e.g., post-thrombotic syndrome after a DVT, chronic thromboembolic pulmonary hypertension after a PE).⁹ Deep vein thrombosis, Venous thromboembolism and pulmonary embolism (PE) are major causes of hospital-related morbidity and mortality, and are recognized as complications in patients with traumatic injury.¹ Despite the significant morbidity and mortality associated with DVTs, prophylaxis and treatment are still not well understood and remain the subject of research and debate.³

Pathophysiology

A blood clot in the body can become dislodged, leading to a pulmonary embolism. Notice that the “thrombus” causes the “embolism.” Indeed, a thrombus is a blood clot that exists in a blood vessel; however, once it dislodges and starts to travel throughout the bloodstream, it is then called an embolus,¹⁴ so an embolus can be thought of as a thrombus on the move. An embolus can be anything that is traveling through the bloodstream. There are air emboli, fat emboli, and even foreign body emboli. However, for this discussion, we just talk about blood clots. These emboli travel along the bloodstream until they get to a vessel too small for them to continue, and that’s where the embolism

occurs, leading to all sorts of problems for the patient.⁹ However, applying the right DVT nursing interventions can help protect the patient. DVT is the single most preventable thromboembolic disorder, even being asymptomatic in many cases.^{3,11} Here, DVT risk assessment tools can provide systematic data upon which to base nursing care plans.^{10,11,15} Additionally, structured patient teaching about how to achieve an optimum safe lifestyle is also paramount. The responsibilities and promotion of self-care strategies are integral in this respect as well as good collaboration among the patients with DVT, their families, and the healthcare professionals who provide hospital and home outreach services.

Risk Factors

To prevent complications from DVT-related risk factors in patients with lower extremity injury, thromboprophylaxis may be applied;⁹ however, here are variations internationally in the use of thromboprophylaxis for such patients.¹³ Therefore, any study that included the measurement of DVT as a patient outcome in adults requiring temporary immobilization, such as a long bone leg cast or brace, applied in an ambulatory setting for an isolated lower extremity injury and that reported the risk factor variables was included in our review.⁴

By developing a uniform set of identifiable risk factors, medical providers can accurately assess patients for their risk of developing DVT and can then make appropriate therapeutic decisions before fatal PE, or other complications, occur. The most common risk factors for DVT in orthopedic trauma patients found across the literature include many study design factors, such as an increased age^{10, 11}, severity of injury, hospitalization, length of hospital stay, long period of immobilization, family history, chronic venous insufficiency, post-surgery conditions, and

obesity.^{2, 12} as follows:

1. Age

Many studies support that there is an association between increasing age and a higher incidence of DVT.^{4, 13} Patients of an older of age are at significantly higher risk compared with younger patients,¹¹ and the risk approximately doubles with each subsequent decade of age. Thus, stratification of risk by a simple dichotomy of age based on years older fails to account for the significantly higher risk among very elderly patients. DVT is rare in children; young patients with venous thrombosis usually have solid predisposing factors, such as multiple injuries, long bone fractures, or indwelling central venous lines. White described the association between DVT and age, and this is presented in greater detail in another section of this supplement.¹²

2. Severity of Injury

Damage that may occur due to the causes and mechanism of injury can affect the functions of many internal organs. The cause and mechanisms of injuries that involve a reduced range of motion have been studied,⁶ and divided up based on the cause of injury with the mechanism of the injury, such as those from traffic accidents or falls from height. Still, the most common accident are traffic accidents,⁷ The most injured person in our studied papers had lower extremity injuries.² to deal with such a crisis, the body is forced to adapt, and this is often expressed by the body's defense mechanism to reduce the body's movement and move less, whereby subsequent motion restriction occurs. Serious injury can also occur from this restriction, resulting in potentially longer-term reduced mobility of the injured person.⁴ However, in appendage injuries where abnormalities of a disability or dysphagia are visible, the ability to move the joints can decrease many complication occurring, such as deep vein thrombosis or venous thrombosis.¹³ In one

study, the prevalence of DVT in less severe trauma patents (injury severity score, ISS <15) was 0.72%, while the prevalence of DVT in primary trauma patients (ISS> 15) increase more than fivefold to 3.9%.⁶

3. Immobilization

Patients immobilized after lower extremity injury are at risk of deep vein thrombosis. There are variations internationally regarding the use of thromboprophylaxis for such patients.^{13, 16} Whereas prolonged bed rest or immobility alone does not provide adequate reason for prescribing prophylactic anticoagulant therapy, prolonged immobility combined with other major risk factors increases the likelihood of a PE.¹⁷

Nielsen found that 64.5% of patients immobilized for 48 hours hospitalization appeared to show some sign of deep vein thrombosis¹⁹. In contrast, Badash found that the incidence of DVT was 80% in patients immobilized for a more extended period.⁵

4. Previous Venous Thrombosis

One of the most critical risk factors for DVT is a history of previous venous thrombosis. Patients with a prior episode of DVT are at a significantly increased risk of recurrence¹⁷, particularly when exposed to high-risk conditions; for example, major surgery, prolonged immobility, or severe illness.⁴ Tan et al. found that patients with fractures below the hip and a previous history of venous thromboembolism (VTE) were five times more likely to have another event.¹³ Another study found that patients with orthopedic surgeries for upper extremity injuries with a personal or family history of VTE had an increased risk of developing DVT in the future. In general, it is believed that an individual or family history of hypercoagulability, as indicated by previous thromboembolic events, is a helpful way to identify at-risk patients.²²

5. Signs and Symptoms

DVT may occur in patients or as a complication of surgery or significant lower extremity injury. Among high-risk hospitalized patients, most DVT occurs in the calf veins⁴, is asymptomatic, and may not be detected. When present, the symptoms and signs of DVT, for example, a vague aching pain, tenderness, and the distribution of the veins, edema, or erythema, are often nonspecific,¹ vary in frequency and severity, and are similar in the arms and legs. Dilated collateral superficial veins may become visible or palpable. Calf discomfort as elicited by ankle dorsiflexion with the knee extended is called Homans sign, and is a sign of DVT.²¹ Occasionally, this also occurs with distal leg DVT, but this is neither sensitive nor specific. Tenderness, swelling of the whole leg, a >3 cm difference in circumference between the calves, pitting edema,¹⁹ and collateral superficial veins may be the most specific signs of DVT. DVT is likely to occur with a combination of ≥ 3 of these signs in the absence of another possible diagnosis.⁹

The knowledge and identification of these risk factors are important not only in the early recognition and treatment of DVTs but also in the prevention of initial and subsequent DVTs. The presence or absence of these risk factors can guide the use of prophylactic measures such as prophylactic anticoagulation therapy in hospitalized patients.¹³ Further, identifying inherited risk factors can be crucial to using appropriate long-term anticoagulation therapy when indicated to prevent future DVTs and complications of DVTs such as PEs.

Nurse's Role

Nurses have a critical role to play in monitoring and preventing DVT-related complications, should be performed upon admission and again during the hospital stay,¹¹ preferably every 24 hours, considering the various stages and change that occur during entry

and with any increase or decrease in the DVT factors. The early post-admission screening of trauma patients with duplex ultrasound for Deep vein thrombosis is supported by our study. A subset of injured patients appears to be at particularly increased risk of developing Deep vein thrombosis within the first 48 hours of admission,⁹ specifically those with hypotension on initial presentation in the trauma bay, patients sustaining lower extremity injury. Larger prospective studies are needed to establish which other patient groups are at high-risk for the development of deep vein thrombosis shortly after hospital admission and may therefore benefit from prompt surveillance.¹²

After that duplex ultrasound for screening Deep vein thrombosis not seen, patient need on Intermittent pneumatic compression (IPC) uses a pump to cyclically inflate and deflate hollow plastic leggings, providing external compression to the lower legs and sometimes thighs. Causes the muscles in the legs to contract and relax rhythmically. According to the pressure from the air released from the leg sleeve of the blood compression machine when the muscles contract. It will compress the veins in the legs. This increases the speed of return of venous blood from the legs to the heart.⁴ Intermittent pneumatic compression may be used instead of or in combination with anticoagulants after surgery.¹⁸ Intermittent pneumatic compression is recommended for patients undergoing surgery associated with a high risk of bleeding in whom anticoagulant use may be contraindicated. Intermittent pneumatic compression is probably more effective for preventing calf DVT than proximal DVT.²²

DVT prophylaxis methods can be generally divided into mechanical and pharmacological methods. The former include advice on foot-ankle pumping exercises and passive foot-ankle pumping exercises at least 15-20 time a day.^{10,11} that can assess

the DVT risk factors in routine nursing care, monitoring the patient's vital signs and oxygen saturation level, and monitoring the patient's leg circumference every 24 hours. Also, patients can be classified as being at very low, low, moderate, high, or very high risk of developing DVT. Depending on the results, the health team would perform the recommended prophylactic measure.²¹

Conclusion

DVT is a life-threatening complication in patients with lower extremity injury.^{13, 19} While the clinical diagnosis of DVT is part of the physician's role, nurses also have a role to play in primary prevention.¹¹ Receiving patients into medical, general, and specialist surgical settings requires formalized DVT patient risk assessments to be undertaken as an integral part of a revised admission assessment by nurse practitioners responsible for DVT cases and for their direct clinical nursing program.¹⁰ Using patient risk assessment tools would enable practitioners to undertake an in-depth patient history to establish the category of DVT risk upon admission.⁹

Within the assessment, planning, implementation, and evaluation of individualized patient care programs,¹⁰ there is a significant opportunity for practitioners to undertake formal and structured patient teaching activities.¹¹ It is the nurse's role to inform, teach, and advise patients about anticoagulant medications, physiotherapy exercises, and the practical availability of anti-embolism stockings.²²

References

1. Bhatt M, Braun C, Patel P, Patel P, Begum H, Wiercioch W, et al. Diagnosis of deep vein thrombosis of the lower extremity: a systematic review and meta-analysis of test accuracy. *Blood advances*. 2020;4(7):1250-64.
2. Alshoabi A. & Mothanna A. Deep venous thrombosis: commonly affected veins in the lower limbs. *Journal of Biosciences and Medicines*. 2019;7:142-9.
3. Scolaro J, Taylor R, Wigner N. Venous thromboembolism in orthopaedic trauma. *The Journal of the American Academy of Orthopaedic Surgeons*. 2015;23(1):1-6.
4. Pongsriroj D, Waewwanjit D, Nimitpan P, Akaraborwoen O. Impact of implementation of clinical nursing practice guidelines in prevention of venous thromboembolism on multiple traumatic injury patients' incidence of venous thromboembolism, length of hospitalisation, and medical expenses. *Journal of Thailand Nursing and Midwifery Council*. 2022;37(2):46-60. (in Thai)
5. Badash I, Pott E, Wu B. Venous thromboembolism in the setting of orthopedic trauma surgery. *Clinical Trials in Orthopedic Disorders*. 2016;1(4):128-37.
6. Bui H, Hung D, Vinh P, Hiep N, Anh L, Dinh T. Frequency and risk factor of lower-limb deep vein thrombosis after major orthopedic surgery in Vietnamese patients. *Open Access Macedonian Journal of Medical Sciences*. 2019;7(24):4250-4.
7. Sriprayoon W, Surakan E, Siriwanitchaphan W. Prevalence of venous thromboembolism in trauma patients in a private tertiary care hospital. *The Bangkok Medical Journal*. 2020; 16(1):13-5.(in Thai)
8. Hamada S, Espina C, Guedj T, Buaron R, Harrois A, Figueiredo S, et al. High level of venous thromboembolism in critically ill trauma patients despite early and well-driven thromboprophylaxis protocol. *Annals of Intensive Care*. 2017;7(1):97-110.

9. Pramnoi T, Danaidutsadeekul S, Chanruangvanich W. Factors predicting traumatic patients readiness for hospital discharge after extremity surgery. *Journal of The Royal Thai Army Nurses*. 2022;23(2):179-87. (in Thai)
10. Norasan S, Gajasen C, Soonthonkit Y, Jaihow R, Sripoom T, Singhatas P. Assessing the risk and incident of deep vein thrombosis in icu trauma patients, Ramathibodi hospital using caprini score. *Journal of Nursing Division*. 2020;47(2): 20-31. (in Thai)
11. Mohamed A, Othman W, Alphy B, Sheble A. Effect of implementing nursing care guidelines on the occurrence of deep vein thrombosis among orthopedic patients. *Journal of Nursing and Health Science*. 2017;6(3):28-36.
12. Barp M, Carneiro V, Amaral K, Pagotto V, Malaquias S. Nursing care in the prevention of venous thromboembolism: an integrative review. *Revista Eletronica de Enfermagem*. 2018; 20(14):1-13.
13. Tan L, Qi B, Yu T, Wang C. Incidence and risk factors for venous thromboembolism following surgical treatment of fractures below the hip: a meta-analysis. *International wound journal*. 2016;13(6):1359-71.
14. Horner D, Pandor A, Goodacre S, Clowes M, Hunt B. Individual risk factors predictive of venous thromboembolism in patients with temporary lower limb immobilization due to injury: a systematic review. *Journal of thrombosis and haemostasis*. 2019;17(1): 329-44.
15. Maeseneer M, Bochanen N, Rooijen G, Neglen P. Analysis of 1,338 patients with acute lower limb deep venous thrombosis (DVT) supports the inadequacy of the term “proximal DVT”. *European journal of vascular and endovascular surgery : the official journal of the European Society for Vascular Surgery*. 2016;1(51):415-20.
16. Herdman H, Kamitsuru S. *Nursing diagnoses definitions and classification*. 11st, editor. Wiley blackwell, 2020.
17. Saket R, Aggarwal S, Kumar V, Kumar P, Patel S. Acute venous thromboembolism in Indian patients of isolated proximal femur fractures. *Journal of clinical orthopaedics and trauma*. 2019;10(5):917-21.
18. Wang P, Li J, Fei C, Li Z, Ke C, Shang K, et al. Deep vein thrombosis in the uninjured limb in patients with lower extremity fractures: a retrospective study. *BioMed research international*. 2020:1-7.
19. Nielsen S, Connor D, Kaul S, Sharma J, Napolitano M, Simonian G, et al. Early detection of deep venous thrombosis in trauma patients. *Cureus*. 2020;12(7):1-8.
20. Min S, Kim Y, Joh J, Kang J, Park U, Kim H, et al. Diagnosis and treatment of lower extremity deep vein thrombosis: Korean practice guidelines. *Vascular specialist international*. 2016;32(3):77-104.
21. Siriraj concurrent trigger tool by MEWs in elective surgery adult hospitalized patient DVT of lower extremity guideline. 2023.
22. Chang W, Wang B, Li Q, Zhang Y, Xie W. Study on the risk factors of preoperative deep vein thrombosis (DVT) in patients with lower extremity fracture. *Clinical and applied thrombosis/hemostasis : official journal of the International Academy of Clinical and Applied Thrombosis/Hemostasis*. 2021;27(1):1-6.