

# Analysis of the Current Status and Influencing Factors of Deep Vein Thrombosis Knowledge and Prevention Practices among Orthopedic Nurses in Western Guangxi

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**Abstract:** ***Objective:** To investigate the current status of deep vein thrombosis knowledge and prevention practice of orthopedic nurses in western Guangxi, and to analyze its influencing factors, so as to provide reference strategies and empirical evidence for the training and VTE management of nurses in the future. **Methods:** From July to August 2023, a questionnaire survey was conducted on 250 orthopedic nurses in western Guangxi using the Chinese version of the deep vein thrombosis risk knowledge and prevention practice evaluation questionnaire. **Results:** A total of 250 nurses were surveyed, and the total score of DVT knowledge and prevention practice was  $(92.31 \pm 6.33)$ , which was at a medium level overall. The score of deep vein thrombosis knowledge was  $(28.96 \pm 2.17)$ , which was at a good level, and the score of prevention practice was  $(63.35 \pm 4.76)$ , which was at a medium level. Multiple linear regression analysis showed that nursing years, years of work in the current department, nurse professional title and grade, and whether or not they had received VTE specialist training were influencing factors for the knowledge dimension of deep vein thrombosis; nurse professional title, nurse grade, and whether or not they had received VTE specialist training were influencing factors for the practice dimension of deep vein thrombosis prevention. **Conclusion:** The total scores of DVT knowledge and prevention practice of orthopedic nurses in western Guangxi were at a medium level overall, with a good grasp of the DVT knowledge dimension score, and the prevention practice part needed to be improved. It is recommended that nursing managers pay attention to the nurses' knowledge of DVT, attach importance to the knowledge training of nurses with low seniority and low professional titles, provide more opportunities for learning and communication, and combine the training content with clinical work to ensure that nurses can apply theoretical knowledge to actual nursing work.*

**Keywords:** Western Guangxi, Orthopedic nurses, Venous thromboembolism, Deep vein thrombosis, Influencing factors.

## 1. Introduction

Venous thromboembolism (VTE), including deep venous thromboembolism (DVT) and pulmonary thromboembolism (PTE), is one of the common complications in orthopedics. It refers to abnormal coagulation of blood in blood vessels, which blocks the lumen and leads to venous reflux obstruction, causing swelling and pain in the patient's limbs, affecting the patient's treatment effect, and in severe cases, leading to death of the patient [1,2]. Many studies and guidelines [3-6] have proposed that the occurrence of venous thrombosis can be effectively prevented through basic prevention, physical prevention and drug prevention, which helps to improve the patient's health outcomes and reduce the burden on patients and society. Nurses are the best implementers of venous thrombosis risk assessment and prevention measures [7]. The degree of nurses' knowledge of venous thrombosis can affect their compliance with the venous thrombosis prevention guidelines [8]. Understanding the degree of orthopedic nurses' understanding of venous thrombosis and the current status of prevention practices and taking corresponding intervention measures will help implement various preventive measures. Therefore, this study investigated the knowledge level of deep vein thrombosis and the current status of prevention practices of orthopedic nurses in western Guangxi, in order to provide reference strategies and empirical basis for future nurse training and VTE management.

## 2. Objects and Methods

### 2.1 Respondents

The survey subjects were selected using a convenient sampling method and on a voluntary basis. From July to August 2023, orthopedic nurses from secondary and above public general hospitals in western Guangxi, including Baise, Chongzuo, and Hechi, were selected as the research subjects. The sample size was estimated as 5 to 10 times the total number of questionnaire items. The questionnaire had a total of 49 items, and 10 times the number of items was taken. Considering the possibility of invalid questionnaires, the sample size was expanded by 10%. According to the formula:  $49 \times 5 \div 0.9 \approx 272$ , the sample size was determined to be 272. Inclusion criteria: (1) Obtain a nurse's professional qualification certificate; (2) Work in orthopedics for  $\geq 1$  year; (3) Obtain informed consent and voluntarily participate. Exclusion criteria: (1) Nurses who were not on duty during the survey (on vacation, studying abroad, etc.); (2) Intern nurses and continuing education nurses.

### 2.2 Method

#### 2.2.1 Study tools

This study used the Chinese version of the Knowledge and Practices of Nurses on The KPNDVT questionnaire was compiled by Khalid Anwer [9] and his team in 2017 and translated into Chinese by Chu Wei [10] in 2020 for use in my country. The questionnaire consists of 49 items in three parts. The first part is about the general information and training of nurses, with a total of 13 items. The second part is about the basic knowledge of DVT, high-risk factors and prevention

knowledge, with a total of 34 items. This part is a judgment question with the options of "true", "false" and "uncertain". A correct answer is scored as "1 point" and a "false" or "uncertain" answer is scored as "0 point". The third part is about the current status of DVT prevention practice. This part is a multiple-choice question with a total of 15 items. The Likert 5-point scoring method is used, with scores ranging from "1 point" to "5 points" from "never" to "always", and the score range is 15-75 points. The higher the score, the better the implementation of prevention practice. The internal consistency reliability Cronbach's  $\alpha$  of Part 2 of the questionnaire was 0.756, and the test-retest reliability was 0.762; the internal consistency reliability Cronbach's  $\alpha$  of Part 3 was 0.815, and the test-retest reliability was 0.803, which showed strong internal consistency and stability [11].

### 2.2.2 Survey Method

The questionnaire was prepared in the form of a questionnaire star and a QR code and link were generated. Before the formal survey, 30 nurses from the orthopedic department of the researcher's hospital were selected for a preliminary survey. The feedback was easy to understand, the number of items was acceptable, and they were able to cooperate in completing the survey. During the formal survey, the questionnaire was sent to the head nurses of the orthopedic department of the participating hospital via WeChat. The head nurse sent the questionnaire to the WeChat group of the corresponding department, and the nurses participated in the electronic questionnaire survey by scanning the QR code. Quality control: (1) The questionnaire was anonymous to ensure the authenticity of the survey results. (2) Invalid questionnaires were eliminated. The elimination criteria were: the answers to the questionnaire appeared in a certain pattern; the missing values of the questionnaire answers were  $>10\%$ . (3) After the questionnaires were collected, two researchers checked the data and double-entered it to ensure the accuracy of the data.

### 2.2.3 Statistical methods

SPSS 27.0 was used for statistical analysis. Count data were described by frequency and percentage. Measurement data were expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ) if they followed normal distribution, and as median and quartile if they did not follow normal distribution. For inter-group comparison, if the data followed normal distribution,

independent sample t test was used, and one-way analysis of variance was used for comparison between multiple groups; if the data did not follow normal distribution, non-parametric test was used. Multiple linear regression was used for influencing factor analysis, and  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1 Questionnaire Collection

A total of 272 questionnaires were collected in this survey. 22 invalid questionnaires were eliminated when checking the data, leaving a total of 250 valid questionnaires, with a questionnaire recovery rate of 91.91%.

### 3.2 General Data Analysis of Orthopedic Nurses in Western Guangxi

This study finally included 250 orthopedic nurses, mostly female, aged between 23 and 53 years old, mostly 30-39 years old, with an average age of  $(32.64 \pm 6.49)$  years old; most of them had a bachelor's degree, accounting for 66%; most of them had 5-9 years of nursing experience, and most of them had worked in their current departments for less than 5 years; most of them had the title of head nurse, accounting for 46%; most of them had the grade of nurses N3, accounting for 48%; most of the hospitals participating in the survey were secondary hospitals, accounting for 60%; 92% of the nurses had received VTE specialist training, mainly in-hospital training, and the training effect was mostly "average" and "good", and 94% expressed a need for training; 96% of the nurses knew that the hospital had a DVT prevention charter, and 4% of the nurses were still unaware of the hospital's DVT prevention charter. See Table 1 for details.

### 3.3 Current Status of Knowledge and prevention of Deep Vein Thrombosis Among Orthopedic Nurses in Western Guangxi

The knowledge score of deep vein thrombosis was  $(28.96 \pm 2.17)$  points, including  $(4.82 \pm 1.34)$  points for basic knowledge,  $(17.01 \pm 0.75)$  points for risk factors,  $(7.10 \pm 0.75)$  points for preventive measures,  $(64.35 \pm 4.76)$  points for preventive practices, and  $(93.31 \pm 6.33)$  points for the total questionnaire. See Table 2 for details.

**Table 1:** Univariate analysis of general information of the subjects and knowledge and prevention practices of deep vein thrombosis

| variable                                        |                          | constituent ratio<br><i>n</i> (%) | Knowledge of venous thrombosis |                | Prevention practice |                |        |
|-------------------------------------------------|--------------------------|-----------------------------------|--------------------------------|----------------|---------------------|----------------|--------|
|                                                 |                          |                                   | <i>F/t</i>                     | <i>P</i> value | <i>F/t</i>          | <i>P</i> value |        |
| gender                                          | male                     | 10(4)                             | 0.04                           | 0.845          | 0.63                | 0.430          |        |
|                                                 | female                   | 240(96)                           |                                |                |                     |                |        |
| age                                             | <30                      | 90(36)                            | 27.710                         | <0.001         | 78.420              | <0.001         |        |
|                                                 | 30~39                    | 135(54)                           |                                |                |                     |                |        |
|                                                 | ≥40                      | 25(10)                            |                                |                |                     |                |        |
| Educational degree                              | Junior college and below | 75(30)                            | 0.388                          | 0.679          | 0.530               | 0.590          |        |
|                                                 | undergraduate course     | 165(66)                           |                                |                |                     |                |        |
|                                                 | Master's degree or above | 10(4)                             |                                |                |                     |                |        |
| Years of nursing experience                     | <5                       | 60(24)                            | 46.813                         | <0.001         | 74.112              | <0.001         |        |
|                                                 | 5~9                      | 75(30)                            |                                |                |                     |                |        |
|                                                 | 10~14                    | 70(28)                            |                                |                |                     |                |        |
|                                                 | ≥15                      | 45(18)                            |                                |                |                     |                |        |
| Current working years in the department (years) |                          | <5                                | 95(38)                         | 22.009         | <0.001              | 64.003         | <0.001 |

|                                                        |                       |         |        |        |        |        |
|--------------------------------------------------------|-----------------------|---------|--------|--------|--------|--------|
|                                                        | 5~9                   | 55(22)  |        |        |        |        |
|                                                        | 10~14                 | 75(30)  |        |        |        |        |
|                                                        | ≥15                   | 25(10)  |        |        |        |        |
| Professional title                                     | Junior nurse          | 55(22)  | 50.981 | <0.001 | 75.489 | <0.001 |
|                                                        | Junior Nurse          |         |        |        |        |        |
|                                                        | Practitioner          | 50(20)  |        |        |        |        |
|                                                        | Nurse in charge       | 115(46) |        |        |        |        |
| Nurse grade classification                             | Associate chief nurse | 30(12)  |        |        |        |        |
|                                                        | N1                    | 50(20)  | 32.592 | <0.001 | 66.715 | <0.001 |
|                                                        | N2                    | 55(22)  |        |        |        |        |
|                                                        | N3                    | 120(48) |        |        |        |        |
|                                                        | N4                    | 25(10)  |        |        |        |        |
| Grade of hospital                                      | Secondary hospital    | 150(60) | -3.766 | <0.001 | -0.770 | 0.443  |
|                                                        | Tertiary hospitals    | 100(40) |        |        |        |        |
| Prior specialist training in VTE                       | Yes                   | 230(92) | 19.162 | <0.001 | 20.838 | <0.001 |
|                                                        | No                    | 20(8)   |        |        |        |        |
| Pathways to training                                   | School                | 30(12)  | 4.229  | 0.017  | 4.658  | 0.012  |
|                                                        | Hospital training     | 210(84) |        |        |        |        |
|                                                        | othe                  | 10(4)   |        |        |        |        |
| Evaluation of the effect of the VTE training           | Not good              | 30(12)  | 5.567  | <0.001 | 9.498  | <0.001 |
|                                                        | In general            | 85(34)  |        |        |        |        |
|                                                        | good                  | 105(42) |        |        |        |        |
|                                                        | Very good             | 20(8)   |        |        |        |        |
|                                                        | Excellent             | 10(4)   |        |        |        |        |
| Training needs for the DVT                             | Yes                   | 235(94) | 1.717  | 0.089  | 1.161  | 0.248  |
|                                                        | No                    | 15(6)   |        |        |        |        |
| Whether the hospital has a protocol for DVT prevention | Yes                   | 240(96) | 0.197  | 0.845  | -1.467 | 0.146  |
|                                                        | No                    | 10(4)   |        |        |        |        |

**Table 2:** Score of knowledge and prevention practice of deep vein thrombosis among orthopedic nurses in western Guangxi ( $\bar{x} \pm s$ , points)

| Entry items              | Number of items | Score range | score      |
|--------------------------|-----------------|-------------|------------|
| Risk knowledge part      | 34              | 0~34        | 28.96±2.17 |
| elementary knowledge     | 6               | 0~6         | 4.82±1.34  |
| risk factor              | 20              | 0~20        | 17.01±0.75 |
| preventive measure       | 8               | 0~8         | 7.10±0.75  |
| Prevention Practice Part | 15              | 0~75        | 63.35±4.76 |
| total points             | 49              | 0~109       | 92.31±6.33 |

### 3.4 One-way ANOVA of Deep Vein Thrombosis Awareness and Prevention Practices Among Orthopedic Nurses in Western Guangxi

The results of univariate analysis of variance showed that there was a statistically significant correlation between age, nursing experience, years of work in the current department, nurse professional title and grade, hospital grade, whether VTE specialist training was received, training approach, and training effect and deep vein thrombosis knowledge score ( $P < 0.05$ ). There was a statistically significant correlation between age, nursing experience, years of work in the current department, nurse professional title and grade, whether VTE specialist training was received, training approach, and

training effect and deep vein thrombosis prevention practice score ( $P < 0.05$ ). See Table 1 for details.

### 3.5 Multiple Linear Regression Analysis of Deep Vein Thrombosis Awareness and Prevention Practices Among Orthopedic Nurses in Western Guangxi

In order to further explore the impact of general information on nurses' deep vein thrombosis knowledge and prevention practices, deep vein thrombosis knowledge scores and prevention practice scores were used as dependent variables, and the relevant factors with statistical significance in univariate analysis were set as independent variables, and values were assigned one by one, and multivariate linear regression analysis was performed for testing. The results showed that nursing years, years of work in the current department, nurse professional titles and grade classification, and whether or not VTE specialist training has been received were influencing factors in the deep vein thrombosis knowledge dimension (see Table 3 for details); nurse professional titles, nurse grade classification, and whether or not VTE specialist training has been received were influencing factors in the deep vein thrombosis prevention practice dimension. (See Table 4 for details)

**Table 3:** Multiple linear regression analysis of nurses' knowledge of deep vein thrombosis risk

| The DVT knowledge score                         | Coefficient of regression | t      | P value | Tolerance of tolerance | VIF    |
|-------------------------------------------------|---------------------------|--------|---------|------------------------|--------|
| Constant quantity                               | 26.162                    | 24.814 | <0.001  |                        |        |
| age                                             | -0.014                    | -0.023 | 0.981   | 0.154                  | 6.506  |
| Years of nursing experience                     | 1.297                     | 2.474  | 0.015   | 0.116                  | 8.624  |
| Current working years in the department (years) | -0.997                    | -2.326 | 0.022   | 0.142                  | 7.049  |
| Professional title                              | 2.971                     | 3.231  | 0.002   | 0.056                  | 17.821 |
| Nurse grade classification                      | -1.757                    | -2.2   | 0.03    | 0.074                  | 13.489 |
| Grade of hospital                               | 0.513                     | 1.932  | 0.057   | 0.636                  | 1.573  |
| Prior specialist training in VTE                | -0.631                    | 2.293  | 0.024   | 0.656                  | 1.524  |
| Evaluation of the effect of the VTE training    | 0.093                     | 0.489  | 0.626   | 0.641                  | 1.56   |
| Pathways to training                            | -0.508                    | -1.551 | 0.124   | 0.8                    | 1.249  |
| F                                               | 16.908                    |        |         |                        |        |
| Adjusted R squared                              | 0.562                     |        |         |                        |        |
| D-W                                             | 1.849                     |        |         |                        |        |

**Table 4:** Multiple linear regression analysis of nurses' deep vein thrombosis prevention practices

| Practice score                                  | Coefficient of regression | t      | P value | Tolerance of tolerance | VIF    |
|-------------------------------------------------|---------------------------|--------|---------|------------------------|--------|
| Constant quantity                               | 24.933                    | 22.127 | <0.001  |                        |        |
| age                                             | 0.24                      | 0.39   | 0.697   | 0.141                  | 7.083  |
| Years of nursing experience                     | 0.641                     | 1.14   | 0.257   | 0.099                  | 10.123 |
| Current working years in the department (years) | 0.082                     | 1.463  | 0.147   | 0.196                  | 5.091  |
| Professional title                              | -0.875                    | -1.933 | 0.046   | 0.125                  | 8.021  |
| Nurse grade classification                      | 1.144                     | 2.351  | 0.021   | 0.092                  | 10.91  |
| Prior specialist training in VTE                | 0.916                     | 2.559  | 0.012   | 0.656                  | 1.524  |
| Evaluation of the effect of the VTE training    | -0.197                    | -0.615 | 0.54    | 0.822                  | 1.216  |
| Pathways to training                            | -0.528                    | -0.858 | 0.393   | 0.724                  | 1.382  |
| F                                               | 17.501                    |        |         |                        |        |
| Adjusted R squared                              | 0.571                     |        |         |                        |        |
| D-W                                             | 1.745                     |        |         |                        |        |

## 4. Discussion

### 4.1 Current Status of VTE Knowledge Training for Orthopedic Nurses in Western Guangxi

In this study, 92% of nurses had received VTE specialist training, most of which came from in-hospital training, indicating that VTE training for nurses in the region has gradually become popular, covering secondary and tertiary hospitals, but the training effects are uneven. The survey found that nurses generally desire further professional training to make up for the deficiencies in the existing knowledge system and practical ability, and to ensure that they can provide more effective care for patients in the prevention and management of DVT. Therefore, it is recommended that clinical institutions can formulate continuing education plans to ensure that nurses can regularly update their knowledge system, conduct practical operations in training, and closely integrate with clinical work to ensure that nurses can flexibly apply theoretical knowledge to actual nursing work. At the same time, it is possible to consider cooperating with medical associations and educational institutions to provide various training channels such as online courses and on-site seminars, so that nurses can continue to learn without affecting their work. At the government level, corresponding policy support can also be provided to strengthen the investment and training of nursing teams in primary hospitals, ensure that nurses at all levels of hospitals can obtain corresponding educational resources, and provide a more solid guarantee for DVT prevention.

### 4.2 Analysis of the Current Status of Knowledge on Deep Vein Thrombosis Among Orthopedic Nurses in Western Guangxi

Orthopedic patients may suffer damage to the vascular endothelium due to severe trauma, intraoperative tissue traction, and the use of tourniquets. Intraoperative blood loss, fluid loss, and dehydration may lead to hemoconcentration. Position restrictions and prolonged bed rest may lead to slow blood return, causing vascular endothelial damage, platelet aggregation and adhesion, activating the body's coagulation mechanism, and ultimately forming thrombi [12, 13]. Geng Qian [14] reported that the incidence of lower limb DVT in inpatients with orthopedics was as high as 15.1%. Relevant guidelines [15] pointed out that the incidence of VTE can be effectively reduced by implementing VTE prevention measures for orthopedic patients. Nurses play a major role in the prevention and treatment of VTE, and their VTE-related knowledge level directly affects the implementation of VTE

prevention measures. In this study, the total score of DVT knowledge and prevention practice of orthopedic nurses in western Guangxi was  $(92.31 \pm 6.33)$ . According to the evaluation criteria of full score  $\times 85\%$  for good, full score  $\times 60\%$  for poor, and scores between the two for medium [16], the total score of DVT knowledge and prevention practice of orthopedic nurses in western Guangxi in this study was at a medium level overall, indicating that the mastery of DVT knowledge and implementation of prevention practice of orthopedic nurses in western Guangxi need to be strengthened, and relevant knowledge training and management are still needed. The nurses' deep vein thrombosis knowledge score was  $(28.96 \pm 2.17)$ , which was at a good level, but lower than the study of Pan Shucheng et al. [17]. There were differences in different knowledge dimensions, and the scores of basic knowledge and preventive measures were low. Nursing managers need to strengthen the training of basic knowledge and preventive measures to improve the ability of nurses to formulate effective prevention plans.

### 4.3 Analysis of the Current Status of Deep Vein Thrombosis Prevention Practices Among Orthopedic Nurses in Western Guangxi

In this study, the score of the prevention practice of orthopedic nurses in western Guangxi was  $(63.35 \pm 4.76)$ , which was at a medium level. The options were mostly "always" and "often", but in the items of "encouraging patients to use graded compression stockings" and "teaching patients to use graded compression stockings correctly", the majority of them were "occasionally" and "never". This shows that although nurses' awareness of DVT prevention measures has generally improved, there are still deficiencies in actual application, especially in the implementation of anti-thrombotic compression stockings. Anti-thrombotic compression stockings are one of the most commonly used physical methods for preventing deep vein thrombosis. They promote the return of blood in the veins of the lower limbs by decreasing pressure from bottom to top, minimize blood retention, and achieve the purpose of preventing thrombosis [18]. Although its effect is good, the economic, medical resources, and social development of western Guangxi are still far behind those of other cities, and anti-thrombotic compression stockings have not been widely popularized in the region. This may be related to the hospital's inappropriate allocation of resources, the lack of professional guidance and training on the principles and methods of using anti-thrombotic compression stockings, and the patient's compliance with the use of anti-thrombotic compression stockings [19]. It is recommended that hospitals reasonably increase resource allocation to ensure the effective

implementation of mechanical prevention measures; at the same time, increase relevant knowledge training, improve the medical staff's attention to physical prevention, and improve patients' compliance with the use of anti-thrombotic compression stockings.

#### 4.4 Analysis of Factors Affecting the Awareness and Prevention of Deep Vein Thrombosis Among Orthopedic Nurses in Western Guangxi

The results of multivariate linear regression showed that nursing years, years of work in the current department, nurse professional title and grade, and whether or not they had received VTE specialist training were influencing factors in the DVT knowledge dimension; nurse professional title, nurse grade, and whether or not they had received VTE specialist training were influencing factors in the DVT prevention practice dimension. Nurses with long working years can accumulate rich VTE prevention and treatment experience from clinical work; secondly, they have more opportunities to receive training and learning, and can acquire more VTE prevention and treatment knowledge. With the rapid update of knowledge, the professional quality of medical staff requires continuous learning. In the process of improving professional titles and grades, nurses' clinical business capabilities will also improve, and nurses' understanding of VTE will also increase [20]. In this study, nurses who received VTE specialist training scored higher than those who did not receive training, which is consistent with the results of Li Xin et al. [16]. VTE specialist training is the main source of knowledge for nurses. The more solid their VTE knowledge is after receiving relevant knowledge training, the more conducive it is to the implementation of VTE prevention measures. Strengthening nurse training is a prerequisite for the smooth implementation of VTE prevention nursing work. Therefore, in the future, targeted training programs can be formulated based on the weaknesses of nurses' VTE knowledge to improve nurses' VTE awareness level.

## 5. Conclusion

The total scores of DVT knowledge and prevention practices of orthopedic nurses in western Guangxi were at a medium level. The scores of DVT knowledge dimensions were well mastered, and the prevention practices needed to be improved. It is recommended that nursing managers pay attention to the knowledge mastery of nurses on DVT, attach importance to the knowledge training of nurses with low seniority and low professional titles, provide more opportunities for learning and communication, and combine the training content with clinical work to ensure that nurses can flexibly apply theoretical knowledge to actual nursing work. This study adopted a convenience sampling method. Due to the limitations of sample size and research scope, the sample and data were not representative enough and could not represent the cognition of VTE prevention and treatment of all orthopedic nurses in western Guangxi. It is recommended that a multi-stage cluster random sampling method be adopted in future studies, and more medical institutions be covered to increase the representativeness of the research.

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