

Correlation Analysis of Clinical Factors for Deep Vein Thrombosis After Total Hip Arthroplasty

Haoran Yang, Zhuoyi Fu, Haitao Tan *

The 921 Hospital of Joint Logistics Support Force People's Liberation Army of China (The Second Affiliated Hospital of Hunan Normal University), Changsha, Hunan, China

* Corresponding author: Haitao Tan

Abstract: Deep vein thrombosis (DVT) after hip replacement surgery is a severe complication affecting patient recovery, and its formation is the result of multiple factors acting together. This article reviews the correlation between four major factors: blood lipids, blood glucose, blood pressure, and smoking, and the occurrence of DVT. Studies have shown that dyslipidemia (especially elevated triglycerides) and diabetes are significant independent risk factors for DVT, and there is a dose-response relationship between hyperglycemia and thrombosis risk. Although hypertension increases the risk of thrombosis, its independent predictive value in a multifactorial model remains controversial and may exist more as a background factor. Smoking demonstrates a clear dose-dependent hazard, and perioperative smoking cessation is crucial for reducing the risk of complications. Future research should further focus on the interaction of multiple risk factors and the establishment of a standardized risk assessment system.

Keywords: Hip Replacement; Deep Vein Thrombosis; Risk Factors; Cardiovascular Disease.

1. Introduction

Hip replacement surgery is an important surgical method for treating hip joint diseases. With the intensifying aging of the population and the continuous improvement of surgical techniques, the implementation of this surgery has shown a yearly increasing trend. However, postoperative deep vein thrombosis (DVT) of the lower extremities, as a severe complication, affects the recovery process of patients and may also lead to fatal consequences such as pulmonary embolism. The formation of DVT is a result of multiple factors working together, among which traditional cardiovascular risk factors such as dyslipidemia, diabetes, hypertension, and smoking are receiving increasing attention. These factors play a significant role in the thrombosis process by affecting hemorheological properties, vascular endothelial function, and the balance of the coagulation system. Clarifying the relationship between these risk factors and DVT formation is of great clinical significance for developing individualized prevention strategies and reducing the incidence of postoperative complications.

2. Research Status

2.1. Study on the Correlation between Blood Lipids and Deep Vein Thrombosis after Hip Replacement Surgery

The research on the association between dyslipidemia and deep vein thrombosis (DVT) after hip replacement surgery has undergone a development process from basic epidemiological investigations to clinical practice verification. Early basic research laid the theoretical foundation for understanding this association. Doggen et al. (2004) [1] first systematically revealed the relationship between lipid levels and venous thromboembolism (VTE) risk through a case-control study involving 477 postmenopausal women. The study found that elevated triglyceride levels (>1.05 mmol/L)

doubled the risk of VTE (odds ratio [OR] = 2.13), while elevated HDL cholesterol levels (>1.79 mmol/L) significantly reduced the risk of thrombosis (OR = 0.71) [1]. This discovery not only established triglycerides as a risk factor for VTE but, more importantly, revealed the opposite mechanisms of action of different lipid components on thrombosis formation.

With the deepening understanding of the lipid-thrombosis nexus, researchers have begun to explore the possibility of influencing thrombosis formation by regulating lipid levels. Bhatt et al. (2019) [2] demonstrated in the REDUCE-IT trial that lowering triglyceride levels with icosapent ethyl significantly reduced the incidence of ischemic events, providing strong evidence for the role of lipid intervention in thrombosis prevention. However, the results from the PROMINENT trial by Das Pradhan et al. (2022) [3] showed that pemafibrate, while effectively lowering triglyceride levels, had limited efficacy in preventing cardiovascular events and even increased the incidence of venous thromboembolism. This seemingly contradictory result actually reflects the complexity of the lipid regulation mechanism, as different lipid-lowering drugs may affect the coagulation system through different molecular pathways, leading to significant differences in their clinical effects [3].

In the historical research on the relationship between blood lipids and cardiovascular diseases, the independent predictive value of triglycerides has long been controversial. Criqui et al. (1993) [4] found in the well-known Lipid Research Clinics Follow-up Study that although triglyceride levels were significantly correlated with coronary heart disease mortality in univariate analysis, this association lost statistical significance after adjusting for other covariates. This finding once questioned the status of triglycerides as an independent risk factor, but subsequent studies gradually confirmed that triglycerides still have important predictive value in specific subpopulations [4].

In addition to traditional lipid indicators, lipoprotein(a) has garnered attention as an emerging risk factor for thrombosis.

Nowak-Göttl et al. (1999) [5] discovered in a study on venous thromboembolism in children that when the level of lipoprotein(a) exceeds 30 mg/dL, the risk of thrombosis increases by 7.2 times. This finding offers a new perspective on the mechanism of lipid abnormalities in thrombosis formation. The structure of lipoprotein(a) bears a high similarity to plasminogen, potentially promoting thrombosis by competitively inhibiting the fibrinolytic system [5].

In recent years, studies focusing on specific populations undergoing hip replacement surgery have further validated the clinical significance of dyslipidemia. Han Zhe et al. (2023) [6] conducted a systematic review and meta-analysis of 27 studies, including 82,872 patients, and confirmed that hyperlipidemia is a significant risk factor for deep vein thrombosis (DVT) after hip replacement surgery [odds ratio (OR) = 2.47, 95% confidence interval (CI) (1.44, 4.24)]. Huang et al. (2022) [7] conducted a cohort study that further elaborated on the roles of different lipid components, finding that elevated levels of high-density lipoprotein (HDL) cholesterol and apolipoprotein A1 are associated with a reduced risk of DVT in the lower extremities, while elevated triglyceride levels significantly increase the risk of thrombosis.

In terms of the clinical application of specific lipid indicators, multiple studies unanimously point to the importance of triglycerides. Lin Lingying et al. (2020) [8] confirmed through a retrospective analysis of 104 patients undergoing total hip replacement surgery that hyperlipidemia is an independent risk factor for deep vein thrombosis (DVT) formation. Studies by Yang Yuchun et al. (2019) [9] and Zhong Huan et al. (2012) [10] both identified triglyceride levels ≥ 1.7 mmol/L as a risk factor for postoperative DVT occurrence. The consistency of this threshold provides an operable reference standard for clinical risk assessment. In a study involving 462 patients, Hang et al. (2024) [11] further found that total cholesterol levels were significantly correlated with DVT occurrence in univariate analysis, enriching the content of lipid profile assessment.

It is worth noting that there are certain differences in the definition criteria and detection methods of dyslipidemia among different studies, which may affect the comparability of results and the accuracy of clinical application. Early studies mostly adopted traditional four-item lipid profile tests, while recent studies have gradually incorporated more precise indicators such as apolipoproteins and lipoprotein(a), reflecting the advancement in lipid assessment technology and the deepening understanding of thrombosis mechanisms.

2.2. Study on the Correlation between Blood Glucose (Diabetes) and Deep Vein Thrombosis after Hip Replacement Surgery

The research on the association between diabetes and deep vein thrombosis (DVT) after hip replacement surgery has demonstrated a clear trajectory from single-center observations to large-scale evidence-based medical verification. Early clinical observations provided preliminary evidence for this association. Wang et al. (2013) [12] first quantified the impact of diabetes on the risk of DVT through a retrospective analysis of 245 patients who underwent total knee arthroplasty, finding that the risk of thrombosis in diabetic patients was 2.76 times higher than that in non-diabetic patients. This finding was subsequently further validated by Zhao et al. (2014) [13] in a study involving a

cohort of 358 patients, where the thrombosis rate in the diabetic group reached 74.3%, significantly higher than that in the non-diabetic group (50.7%). Logistic regression analysis confirmed that diabetes increased the risk of thrombosis by 2.71 times.

With the accumulation of research evidence, meta-analyses have begun to provide higher-level evidence-based medicine for the diabetes-thrombosis association. Yang et al. (2015) [14] systematically reviewed six cohort studies and used a random-effects model analysis to show that patients with diabetes had a 36% increased risk of deep vein thrombosis (DVT) after total knee arthroplasty (OR=1.36, 95% CI 1.07-1.72). Although this meta-analysis exhibited moderate heterogeneity ($I^2=46.2\%$), when patients were subgrouped according to thrombosis screening methods, the heterogeneity was significantly reduced, enhancing the reliability of the results.

Large-sample database studies provide a macro perspective on the overall impact of diabetes in joint replacement surgery. Bolognesi et al. (2008) [15] analyzed 751,340 patients who underwent primary or revision total hip and knee arthroplasty based on the National Inpatient Sample database from 1988 to 2003. Among them, 64,262 patients (8.55%) had diabetes. The study found that patients with diabetes not only had a lower routine discharge rate and higher hospitalization costs, but also had significantly increased rates of complications such as pneumonia, stroke, and blood transfusion after primary joint replacement surgery.

Recent studies have further deepened our understanding of the thrombosis risk mechanisms in patients with diabetes. Qin et al. (2020) [16] comprehensively evaluated the impact of diabetes on lower limb joint replacement surgery through a systematic review and meta-analysis of 23 studies involving 1,560,461 patients. This study not only confirmed a higher incidence of deep vein thrombosis in patients with diabetes, but also revealed that patients with diabetes are more likely to have comorbidities such as hypertension, kidney disease, and cardiovascular and cerebrovascular diseases, reflecting the complex impact of diabetes as a systemic disease on thrombosis formation.

Prospective studies specifically targeting patients with diabetes have provided more precise risk assessment tools. Deng et al. (2021) [17] conducted a single-center study on 400 patients with diabetes and found that the overall incidence of venous thromboembolism after joint replacement surgery in diabetic patients was as high as 46.8%, with 92.5% being distal venous thrombosis. Multivariate logistic regression analysis revealed that elevated preoperative D-dimer levels (OR=2.11) and total knee arthroplasty (OR=2.29) significantly increased the risk of thrombosis, while postoperative mechanical prophylaxis combined with low molecular weight heparin had a protective effect (OR=0.56).

Blood glucose levels, as the core biochemical indicator of diabetes, have also garnered attention for their direct relationship with thrombosis. Yao et al. (2022) [18] found in a study of patients with femoral neck fractures that there is a dose-response relationship between hyperglycemia at admission and the occurrence of deep vein thrombosis (DVT) before surgery. Through quartile analysis, the researchers discovered that patients with blood glucose levels above 6.60 mmol/L had a 6.89-fold increased risk of DVT before surgery compared to those in the 5.30-5.70 mmol/L group. This finding provides direct evidence for the importance of blood

glucose management in thrombosis prevention.

In the clinical practice of the impact of diabetes on thrombosis after hip replacement surgery, Chinese scholars have made significant research contributions. Ye Mao et al. (2020) [19] confirmed through the analysis of 513 patients that diabetes is an independent risk factor affecting the occurrence of deep vein thrombosis, especially when patients are aged ≥ 75 years and have a BMI ≥ 28 kg/m². The risk of thrombosis further increases. Jiang Linlin et al. (2018) [20] conducted a large-sample study involving 1,090 patients who underwent total hip replacement, reconfirming the important role of diabetes in thrombosis formation. The study's sample size advantage rendered its results statistically significant. Guo Yunyun (2015) [21] conducted a retrospective analysis of 134 patients, not only verifying the role of diabetes as a risk factor but also pointing out the protective effects of early postoperative mobility and anticoagulant medication use, providing practical guidance for clinical prevention strategies.

From the perspective of research methodology, studies on the association between diabetes and thrombosis have undergone a shift from mere correlation analysis to mechanism exploration and verification of prevention strategies. Early research primarily focused on the statistical significance of diabetes as an independent risk factor, whereas recent studies have increasingly emphasized the impact of detailed factors such as blood glucose control levels, diabetic complications, and treatment regimens on thrombosis risk, reflecting the application of precision medicine concepts in orthopedic thrombosis prevention.

2.3. Study on the Correlation between Blood Pressure (Hypertension) and Deep Vein Thrombosis after Hip Replacement Surgery

Research on the association between hypertension and deep vein thrombosis (DVT) after hip replacement surgery has evolved from an overall assessment of cardiovascular risk factors to an analysis specific to orthopedic surgery. Early comprehensive studies laid the theoretical foundation for understanding this association. In a comprehensive review of risk factors for venous thromboembolism, Anderson et al. (2003) [22] identified hypertension as one of the important factors that increase the risk of thrombosis. Although hypertension alone may not be sufficient as an absolute indication for preventive measures, its combined effect with other risk factors is of great significance for thrombosis risk assessment and the development of preventive strategies.

Systematic research on the relationship between cardiovascular risk factors and venous thromboembolism has provided important insights into the mechanism of action of hypertension. Ageno et al. (2008) [23] conducted a meta-analysis of 21 case-control and cohort studies, including 63,552 patients, and found that hypertension increased the risk of venous thromboembolism by 51% (OR=1.51, 95% CI 1.23-1.85). The important contribution of this study lies in revealing the common pathophysiological basis between traditional cardiovascular risk factors and venous thromboembolism, challenging the traditional concept that arterial and venous thrombosis are completely independent.

A meta-analysis specifically targeting orthopedic surgery provides more precise evidence for the role of hypertension in specific surgical populations. Huang et al. (2016) [24] systematically reviewed 16 articles, including 122,012 orthopedic surgery patients, and found that hypertension

significantly increases the risk of postoperative deep vein thrombosis (OR=2.89, 95% CI 2.18-3.83). Although this meta-analysis exhibited some heterogeneity ($I^2=60.9\%$), the symmetry of the funnel plot and the results of the Egger test indicated no significant publication bias, enhancing the reliability of the results.

However, research findings on the association between hypertension and venous thrombosis are not entirely consistent. In a large prospective study conducted in the French E3N cohort, Macdonald et al. (2021) [25] followed up 91,707 women for a long period of time. The results showed that after adjusting for BMI and other potential risk factors, there was no significant association between hypertension and the overall risk of venous thromboembolism. This finding suggests that BMI may be an important confounding factor in the association between hypertension and thrombosis, and the independent predictive value of hypertension may be overestimated.

The latest research specific to hip replacement surgery further clarifies the clinical significance of hypertension. Huang et al. (2025) [26] conducted a meta-analysis of 15 case-control studies involving 17,909 participants, confirming in univariate analysis that hypertension is a significant risk factor for venous thromboembolism after hip replacement surgery. However, in multivariate analysis, hypertension did not enter the final independent risk factor model, which contrasts with other traditional risk factors such as age, gender, BMI, etc. [26].

Observational studies in clinical practice provide a more detailed description of the actual impact of hypertension. In a single-center study of 462 patients undergoing total hip arthroplasty, Hang et al. (2024) [27] found that although hypertension was mentioned in the description of patients' baseline characteristics, in the final multi-factor logistic regression analysis, indicators such as diabetes, preoperative fibrinogen, D-dimer, and INR showed stronger predictive value, suggesting that hypertension may be more of a background disease rather than a major independent risk factor.

Chinese scholars have contributed significant clinical practice evidence to the study of the relationship between hypertension and postoperative deep vein thrombosis (DVT) following hip replacement surgery. Liu Xiaolong et al. (2025) [28] constructed a risk prediction model for postoperative DVT in the lower extremities through the analysis of 148 patients who underwent total hip replacement surgery. Although specific hypertension-related parameters were not detailed in the abstract, this study provided a quantitative tool for clinical risk assessment. Fu Zhiqiang et al. (2023) [29] clearly stated in their study of 150 patients who underwent artificial hip replacement surgery that a history of hypertension was an independent risk factor for DVT occurrence ($P<0.01$), which, together with factors such as age, body mass index (BMI), and smoking history, constituted a multifactorial risk model. Zhang Cheng's (2022) study also confirmed the statistical significance of a history of hypertension as a risk factor for DVT formation ($P<0.05$), further supporting the predictive value of hypertension in the Chinese population [30].

From the perspectives of research quality and methodology, studies examining the association between hypertension and thrombosis face challenges in standardizing definitions and controlling confounding factors. Different studies lack a unified definition of diagnostic criteria, duration of disease,

and control level of hypertension, which may lead to heterogeneity in research results. Furthermore, patients with hypertension often have comorbid cardiovascular risk factors, making it difficult to accurately distinguish the independent effect of hypertension in research.

2.4. Study on The Correlation between Smoking and Deep Vein Thrombosis After Hip Replacement Surgery

The study on the relationship between smoking and deep vein thrombosis (DVT) after hip replacement surgery reflects a comprehensive development process from basic epidemiological investigations to clinical perioperative management strategies. Unlike other traditional cardiovascular risk factors, smoking, as a controllable lifestyle factor, has garnered special attention regarding its mechanism of thrombosis formation and clinical intervention strategies. Early cohort studies have provided important epidemiological evidence for understanding the smoking-thrombosis association. Hansson et al. (1999) [31] found in the long-term follow-up of the Swedish "1913 Birth Cohort Study" that men who smoked more than 15 cigarettes per day had a 2.82-fold higher risk of venous thromboembolism compared to non-smokers (95% CI 1.30-6.13). This discovery not only established smoking as an independent risk factor for venous thrombosis but, more importantly, revealed the synergistic effect of smoking and abdominal obesity.

A large-scale meta-analysis provides the highest level of evidence-based medicine for the relationship between smoking and venous thromboembolism. Cheng et al. (2013) [32] comprehensively quantified the impact of smoking on thrombotic risk by systematically reviewing 32 observational studies involving 3,966,184 participants and 35,151 venous thromboembolism events. The meta-analysis found that the relative risks of venous thromboembolism for former smokers, current smokers, and ever smokers were 1.17, 1.23, and 1.10, respectively, compared to never-smokers. More importantly, it established a clear dose-response relationship: for every additional 10 cigarettes per day, the risk of thrombosis increased by 10.2%; for every additional 10 pack-years, the risk increased by 6.1%. It is worth noting that when analyzing 13 studies adjusted for BMI, the relative risk for current smokers rose to 1.30, suggesting that BMI, as an important confounding factor, may mask the true effect of smoking.

Studies specifically focusing on joint replacement surgery have revealed the comprehensive impact of smoking on postoperative complications. In a prospective cohort study conducted at Mayo Clinic, Singh et al. (2015) [33] analyzed 7,926 patients who underwent primary total hip or total knee arthroplasty and found that current smokers had a 2.37-fold higher risk of deep infection compared to non-smokers (95% CI 1.19-4.72), and a 78% increased risk of prosthesis revision (HR=1.78, 95% CI 1.01-3.13). The unique value of this study lies in its rigorous prospective design and standardized definition of complications, providing strong support for clinical decision-making regarding smoking cessation [33].

A systematic review further confirms the adverse effects of smoking on various complications after joint replacement surgery. Singh (2011) [34] found through a systematic review of 21 studies that the risk of any postoperative complications in current and former smokers was 1.24 times and 1.32 times higher, respectively, compared to non-smokers, with an increased risk of death by 63% and 69%, respectively. The clinical significance of this finding lies in revealing that the

risk for former smokers is still significantly higher than that for never-smokers, suggesting that smoking causes long-term and irreversible damage to the body.

The importance of perioperative smoking management has been particularly emphasized in anesthesiology literature. In a review published in the Turkish Journal of Anesthesiology, Al-Nasser (2019) [35] analyzed nine studies on the relationship between smoking and venous thromboembolism, emphasizing the importance of quitting smoking for at least 4-8 weeks before and after surgery to reduce arterial or venous thromboembolic events. The value of this review lies in its systematic elaboration of smoking management strategies from an anesthesiology perspective, providing a theoretical basis for multidisciplinary collaboration in perioperative management.

Although Chinese scholars started late in the research on the relationship between smoking and thrombosis after hip replacement surgery, they have gradually formed a research system with local characteristics. In the analysis of influencing factors of deep venous thrombosis (DVT) formation in the lower limbs after total hip replacement surgery by Zhou Zemin et al. (2025) [36], although they mainly focused on coagulation indicators such as thromboelastography, they included detailed smoking history data in the baseline data collection, laying a foundation for subsequent in-depth analysis. Wang Zhiqiang (2021) [37] specifically analyzed the risk factors of DVT formation in the lower limbs after hip replacement surgery, providing an important reference for the development of clinical prevention strategies for the Chinese population.

Clinical nursing research provides practical strategies for smoking-related thrombosis prevention. Based on evidence-based nursing methodology, You Weifang (2018) [38] constructed a bundled nursing intervention program for deep venous thrombosis in the lower extremities after artificial hip replacement surgery. The effectiveness of comprehensive intervention measures, including smoking cessation guidance, was verified through a randomized controlled trial involving 60 patients. The innovation of this study lies in incorporating smoking management into a multimodal prevention system, reflecting the application of holistic nursing concepts in thrombosis prevention. Liu Jun et al. (2012) [39] conducted a univariate analysis of smoking as an important baseline variable in the risk factor analysis of 145 patients. Although the specific statistical results were not detailed in the abstract, it provided methodological references for subsequent related research.

Looking at the trajectory of research methodology development, studies on the relationship between smoking and thrombosis have evolved from mere correlation analysis to exploring mechanisms and validating intervention strategies. Early research primarily focused on categorical analysis of smoking status (current, former, never), whereas recent studies have placed greater emphasis on precise assessment of quantitative indicators such as smoking dose, duration, and duration since quitting. However, heterogeneity remains in different studies regarding smoking definition criteria, exposure measurement methods, and follow-up periods, which limits direct comparison of research results and standardization for clinical application.

3. Commentary

Current research on the correlation between deep vein thrombosis (DVT) after hip arthroplasty and blood lipids,

blood glucose, blood pressure, and smoking exhibits clear trends and characteristics. From a research methodology perspective, studies in recent years have gradually shifted from single retrospective cohort studies to systematic reviews and meta-analyses, with evidence levels continuously improving, providing more reliable evidence-based medicine for clinical decision-making. The sample size of studies has also shown an expanding trend, evolving from hundreds of patients in early studies to large-sample meta-analyses involving tens of thousands of cases, significantly enhancing the statistical validity and extrapolability of research results.

However, existing research still exhibits notable deficiencies. Firstly, most studies concentrate on the independent analysis of a single risk factor, lacking in-depth exploration of the interactions among multiple risk factors. Secondly, discrepancies exist in the definition criteria and measurement methods of risk factors across different studies, affecting the comparability of results. Furthermore, most existing research is observational, lacking high-quality randomized controlled trials to verify causality. Future research should prioritize the exploration of multi-factor interaction mechanisms, establish a standardized risk assessment system, and conduct prospective cohort studies to clarify causality, thereby providing stronger scientific support for formulating individualized prevention strategies.

References

- [1] Doggen C J M, Smith N L, Lemaitre R N, et al. Serum lipid levels and the risk of venous thrombosis[J]. *Arteriosclerosis, Thrombosis, and Vascular Biology*, 2004, 24(10): 1970-1975.
- [2] Bhatt D L, Steg P G, Miller M, et al. Cardiovascular risk reduction with icosapent ethyl for hypertriglyceridemia[J]. *New England Journal of Medicine*, 2019, 380(1): 11-22.
- [3] Das Pradhan A, Glynn R J, Fruchart J C, et al. Triglyceride lowering with pemafibrate to reduce cardiovascular risk[J]. *New England Journal of Medicine*, 2022, 387(21): 1923-1934.
- [4] Criqui M H, Heiss G, Cohn R, et al. Plasma triglyceride level and mortality from coronary heart disease[J]. *New England Journal of Medicine*, 1993, 328(17): 1220-1225.
- [5] Nowak-Göttl U, Junker R, Hartmeier M, et al. Increased lipoprotein (a) is an important risk factor for venous thromboembolism in childhood[J]. *Circulation*, 1999, 100(7): 743-748.
- [6] Han Zhe, Cao Dongdong, Sun Xiang, Han Chao, Xie Mengqi, Dong Qiang. Risk Factors of Deep Venous Thrombosis After Hip Replacement Surgery: A Systematic Review and Meta-Analysis [J]. *Chinese Journal of Laboratory Diagnosis*, 2023, 27(04): 379-389.
- [7] Huang Y, Ge H, Wang X, et al. Association between blood lipid levels and lower extremity deep venous thrombosis: a population-based cohort study[J]. *Clinical and Applied Thrombosis/Hemostasis*, 2022, 28: 10760296221121282.
- [8] Lin Lingying, Zeng Liping, Chen Lingxiang, Tang Meixiu. Influencing factors of deep vein thrombosis in patients after total hip arthroplasty [J]. *Guangxi Medical Journal*, 2020, 42(16): 2108-2111+2135.
- [9] Yang Yuchun, Wang Xiaohai, Zhang Yongmei, Dai Tijun. Incidence and risk factors of deep venous thrombosis in the lower extremities after total hip replacement under general anesthesia in elderly patients [J]. *Journal of Regional Anatomy and Operative Surgery*, 2019, 28(02): 108-111.
- [10] Zhong Huan, Zheng Hong, Chen Jiming, Wu Shaoke, Tan Hongchang. Study on the related factors of deep vein thrombosis after total hip arthroplasty [J]. *Chinese Journal of Laboratory Diagnosis*, 2012, 16(06): 1058-1061.
- [11] Hang L, Haibier A, Kayierhan A, et al. Risk factors for deep vein thrombosis of the lower extremity after total hip arthroplasty[J]. *BMC Surgery*, 2024, 24(1): 256.
- [12] Wang S, Zhao Y. Diabetes mellitus and the incidence of deep vein thrombosis after total knee arthroplasty: a retrospective study[J]. *The Journal of Arthroplasty*, 2013, 28(4): 595-597.
- [13] Zhao Z, Wang S, Ma W, et al. Diabetes mellitus increases the incidence of deep vein thrombosis after total knee arthroplasty[J]. *Archives of Orthopaedic and Trauma Surgery*, 2014, 134(1): 79-83.
- [14] Yang G, Meng F, Liu Y, et al. Diabetes mellitus and risk of deep vein thrombosis after total knee replacement: a meta-analysis of cohort studies[J]. *International Journal of Clinical and Experimental Medicine*, 2015, 8(6): 9086.
- [15] Bolognesi M P, Marchant Jr M H, Viens N A, et al. The impact of diabetes on perioperative patient outcomes after total hip and total knee arthroplasty in the United States[J]. *The Journal of Arthroplasty*, 2008, 23(6): 92-98.
- [16] Qin W, Huang X, Yang H, et al. The Influence of Diabetes Mellitus on Patients Undergoing Primary Total Lower Extremity Arthroplasty: A Systematic Review and Meta-Analysis[J]. *BioMed Research International*, 2020, 2020(1): 6661691.
- [17] Deng W, Huo L, Yuan Q, et al. Risk factors for venous thromboembolism in patients with diabetes undergoing joint arthroplasty[J]. *BMC Musculoskeletal Disorders*, 2021, 22(1): 608.
- [18] Yao W, Tang W, Wang W, et al. Association between hyperglycemia on admission and preoperative deep venous thrombosis in patients with femoral neck fractures[J]. *BMC Musculoskeletal Disorders*, 2022, 23(1): 899.
- [19] Ye Mao, Chang Ning, Liang Miaomiao, Guo Lan, Li Jia, Zhang Bo. Analysis of influencing factors of deep venous thrombosis in lower limbs of elderly patients undergoing hip replacement surgery [J]. *Journal of Practical Orthopedics*, 2020, 26(01): 4-7.
- [20] Jiang Linlin, Zhao Qingchun. Analysis of influencing factors of deep venous thrombosis in lower limbs after total hip arthroplasty [J]. *Journal of Clinical Military Medicine*, 2018, 46(09): 1051-1054.
- [21] Guo Yunyun. Logistic Regression Analysis of Deep Venous Thrombosis in Patients After Total Hip Replacement [J]. *Chinese Journal of School Medicine*, 2015, 29(01): 45-46.
- [22] Anderson Jr F A, Spencer F A. Risk factors for venous thromboembolism[J]. *Circulation*, 2003, 107(23_suppl_1): I-9-I-16.
- [23] Ageno W, Becattini C, Brighton T, et al. Cardiovascular risk factors and venous thromboembolism: a meta-analysis[J]. *Circulation*, 2008, 117(1): 93-102.
- [24] Huang L, Li J, Jiang Y. Association between hypertension and deep vein thrombosis after orthopedic surgery: a meta-analysis[J]. *European Journal of Medical Research*, 2016, 21(1): 13.
- [25] Macdonald C J, Madika A L, Lajous M, et al. Association between cardiovascular risk-factors and venous thromboembolism in a large longitudinal study of French women[J]. *Thrombosis Journal*, 2021, 19(1): 58.
- [26] Huang W, Hu W, Lei B, et al. Risk factors for venous thrombosis after hip arthroplasty: a meta-analysis[J]. *BMC Musculoskeletal Disorders*, 2025, 26(1): 508.

- [27] Hang L, Haibier A, Kayierhan A, et al. Risk factors for deep vein thrombosis of the lower extremity after total hip arthroplasty[J]. BMC Surgery, 2024, 24(1): 256.
- [28] Liu Xiaolong, Zhang Liang, Zhang Shijie, Li Zhuangyan. Risk Factors and Construction of Risk Prediction Model for Deep Venous Thrombosis in Lower Extremities after Total Hip Arthroplasty [J]. Journal of Medical Forum, 2025, 46(09): 953-958.
- [29] Fu Zhiqiang, Wang Wei, He Feixiong, Hong Shengkun, Zhou Weijun. Analysis of Risk Factors for Deep Venous Thrombosis in the Lower Extremities Following Total Hip Arthroplasty [J]. Zhejiang Practical Medicine, 2023, 28(03): 226-228+232.
- [30] Zhang Cheng. Analysis of the incidence and influencing factors of deep vein thrombosis in patients after hip replacement surgery [J]. Medical Innovation in China, 2022, 19(19): 136-140.
- [31] Hansson P O, Eriksson H, Welin L, et al. Smoking and abdominal obesity: risk factors for venous thromboembolism among middle-aged men: the study of men born in 1913[J]. Archives of Internal Medicine, 1999, 159(16): 1886-1890.
- [32] Cheng Y J, Liu Z H, Yao F J, et al. Current and former smoking and risk for venous thromboembolism: a systematic review and meta-analysis[J]. PLoS Medicine, 2013, 10(9): e1001515.
- [33] Singh J A, Schleck C, Harmsen W S, et al. Current tobacco use is associated with higher rates of implant revision and deep infection after total hip or knee arthroplasty: a prospective cohort study[J]. BMC Medicine, 2015, 13(1): 283.
- [34] Singh J A. Smoking and outcomes after knee and hip arthroplasty: a systematic review[J]. The Journal of Rheumatology, 2011, 38(9): 1824-1834.
- [35] Al-Nasser B. Influence of tobacco smoking on perioperative risk of venous thromboembolism[J]. Turkish Journal of Anaesthesiology and Reanimation, 2019, 48(1): 11.
- [36] Zhou Zemin, Jin Wangyi, Yang Yang, Guo Kaijin, Zheng Xin, Zhang Xing. Analysis of influencing factors of deep venous thrombosis in lower limbs after total hip arthroplasty [J]. Journal of Xuzhou Medical University, 2025, 45(06): 412-418.
- [37] Wang Zhiqiang. Analysis of Risk Factors for Deep Venous Thrombosis in Lower Limbs Following Hip Replacement Surgery [J]. Chinese Journal of Drugs and Clinical Practice, 2021, 21(12): 2072-2074.
- [38] You Weifang. Research on Clustered Nursing Intervention for Deep Venous Thrombosis in Lower Limbs after Artificial Hip Replacement [D]. Yunnan College of Traditional Chinese Medicine, 2018.
- [39] Liu Jun, Shen Fei, Huang Jihe. Analysis of Risk Factors for Deep Venous Thrombosis Following Total Hip Arthroplasty [J]. Journal of Kunming Medical University, 2012, 33(07): 84-87.