

Original Research Article

A PROSPECTIVE STUDY ON ASSESSING THE EFFECTIVENESS OF KAGOSHIMA SCORE IN DIAGNOSIS OF DEEP VEIN THROMBOSIS IN SURGICAL PATIENTS

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ABSTRACT

Background: Deep vein thrombosis (DVT) is a significant cause of perioperative morbidity and mortality in surgical patients. Early identification of patients at risk is essential for timely prophylaxis and prevention of complications. The Kagoshima-DVT score is a recently developed preoperative risk assessment tool that incorporates clinical and laboratory variables for predicting DVT. Objective-To evaluate the effectiveness of the Kagoshima-DVT score in predicting preoperative deep vein thrombosis among patients undergoing major surgery.

Materials and Methods: This prospective observational study was conducted in the Department of General Surgery, Mahatma Gandhi Memorial Government Hospital, Tiruchirappalli, from May 2024 to April 2025. Fifty adult patients undergoing elective major surgery under general or regional anaesthesia were included. The diagnostic performance of the Kagoshima score was assessed using sensitivity, specificity, positive predictive value, negative predictive value, and accuracy.

Results: The mean age of the study population was 54.16 ± 11.25 years, and 58% were male. Based on the Kagoshima score, 36% were classified as low risk, 8% as intermediate risk, and 56% as high risk for DVT. Whole-leg ultrasonography Doppler detected DVT in 25 (50%) patients. The Kagoshima score demonstrated a sensitivity of 100%, specificity of 88%, positive predictive value of 89.29%, negative predictive value of 100%, and overall diagnostic accuracy of 94%.

Conclusion: The Kagoshima-DVT score is a simple, reliable, and highly accurate preoperative screening tool for identifying surgical patients at risk of deep vein thrombosis. Patients with a score of 3 or higher should undergo whole-leg ultrasonography Doppler evaluation to facilitate early diagnosis and appropriate thromboprophylaxis.

Keywords: Deep vein thrombosis, Kagoshima score, D-dimer, whole-leg ultrasonography, surgery.

INTRODUCTION

Deep vein thrombosis (DVT) occurs when blood clots develop in deep veins due to venous stasis, vascular damage, and hypercoagulability, as delineated in Virchow's Triad since 1856.^[1] Deep vein thrombosis frequently impacts the thighs and lower extremities. Upon development, it manifests as unilateral leg swelling, cramping pain, localized warmth, and skin discoloration. Prior to the onset of

DVT, healthcare practitioners should evaluate patients regarding their risk status. This facilitates efficient management via risk classification, potentially averting the occurrence of DVT. One assessment strategy involves utilizing screening tools like the Wells Clinical Prediction Model, which assists in classifying patients into various DVT risk categories.^[2]

Screening tool efficiently classifies hospitalised patients into low-risk, moderate-risk, and high-risk

categories. Patients with high-risk classification are particularly susceptible to deep vein thrombosis (DVT). A study reveals that among 298 assessed individuals, 18 (6%) tested positive for DVT after employing the Wells Clinical Prediction tool.^[3] A study indicated that the prevalence of DVT among hospitalised patients rose from 0.8% to 1.3% of admissions. Research conducted in Brazil, Mumbai, and Cameroon revealed diverse hazards among surgical patients, with deep vein thrombosis (DVT) identified as the primary cause of morbidity and mortality. Furthermore, 10–30% of patients experience DVT within one month, whereas 25% of untreated cases result in abrupt death, primarily due to pulmonary embolism. DVT can lead to long-term consequences, including post-phlebotic syndrome and chronic venous insufficiency, which may substantially impact everyday living.^[4,5]

Multiple risk factors contribute to the development of DVT, including age, body mass index, family history, immobility, medical problems, nursing interventions, prophylaxis, and hematological parameters such as haemoglobin, D-dimer, cholesterol levels, and bilirubin.^[6] Nurses are essential in reducing DVT risk by implementing interventions, including the use of compression stockings, administering anticoagulants, and enhancing blood circulation through massage. Patients must initiate pharmacological and mechanical prophylaxis a minimum of 24 hours prior to surgery to mitigate the risk factors for DVT.^[7] Early mobilisation and antiembolism stockings are the preferred postoperative therapies for low-risk patients. Furthermore, intermediate-risk patients should get intermittent pneumatic compression (IPC) and anticoagulant pharmacotherapy. Patients at high risk should undergo pharmaceutical intervention.^[8]

Healthcare personnel must recognise the risk factors for DVT during initial admission and administer medicine as required. The Safe Surgery Checklist in the Operating Room evaluates the necessity of DVT prevention "prior to the surgical incision".^[9] During the postoperative phase, nurses observe for signs and symptoms of DVT, assist patients with early mobilization, facilitate deep breathing and coughing exercises, and instruct them on the use of elastic compression stockings and IPC devices. Numerous national and international guidelines exist for the identification, prevention, and management of risk factors associated with DVT.^[10] Healthcare providers must employ valid and reliable instruments to assess the risk level of DVT. The Kagoshima-DVT score is a recently developed tool for diagnosing DVT in asymptomatic patients before surgery. To evaluate the efficacy of the Kagoshima-DVT score in identifying DVT in patients prior to surgery, using ultrasonography Doppler as the gold standard.

Our objectives are 1. To assess the effectiveness of predictive ability and reliability of Kagoshima score

in risk stratification for deep vein thrombosis prophylaxis.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery, Mahatma Gandhi Memorial Government Hospital (MGMGH), Tiruchirappalli in 2025. A total of 50 patients aged more than 18 years who were admitted for elective major surgical procedures with an expected duration of at least 2 hours under regional or general anaesthesia were included in the study after obtaining informed written consent. Patients with recurrent deep vein thrombosis (DVT), pre-existing DVT at admission, bleeding diathesis, pregnancy, those receiving anticoagulant or antiplatelet therapy, patients with contraindications to anticoagulant therapy, and those unwilling to participate were excluded from the study.

Detailed demographic and clinical data were collected using a predesigned and structured proforma. At admission, all eligible patients were assessed using the Kagoshima DVT Risk Score. Baseline laboratory investigations including complete blood count, renal function tests, serum electrolytes, and D-dimer levels were performed. Subsequently, all participants underwent Whole Leg Ultrasonography (WLUS) Doppler examination for the detection of deep vein thrombosis. The relationship between the Kagoshima Risk Score and WLUS Doppler findings was evaluated to determine the usefulness of the scoring system in predicting the risk of DVT among patients undergoing major surgery. Data were collected by the principal investigator through direct interviews and clinical assessment after assuring confidentiality and privacy. Ethical approval was obtained from the Institutional Ethics Committee before commencement of the study, and all participants provided written informed consent. Statistical analysis was performed using appropriate statistical software. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test, Student's t-test, and Z-test were used for comparison of variables as appropriate. Regression analysis was performed to identify factors associated with DVT occurrence. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Among the 50 study participants, the mean age was 54.16 ± 11.25 years, with the majority (32%) belonging to the 51–60 years age group. Males constituted 58% of the study population. Regarding BMI, 48% had normal weight, 44% were overweight, and 8% were obese. A history of deep vein thrombosis was present in 26% of patients. The

most common comorbidity was hypertension (50%), followed by cancer (46%), coronary artery disease

(44%), COPD (42%), and diabetes mellitus (40%). Thirty percent of the participants were smokers.

Table 1: Baseline characteristics of study population N=50

Variable	Category	Number (n)	Percentage (%)
Age (years)	30-40	4	8
	41-50	14	28
	51-60	16	32
	61-70	14	28
	71-80	2	4
	Mean Age (years)		54.16 ± 11.25
Gender	Male	29	58
	Female	21	42
BMI	Normal	24	48
	Overweight	22	44
	Obese	4	8
History of DVT	Yes	13	26
	No	37	74
Comorbidities	Diabetes Mellitus	20	40
	Hypertension	25	50
	Cancer	23	46
	Coronary Artery Disease	22	44
	COPD	21	42
	Smoker	15	30

Table 2: Risk determinants and Investigation characteristics

Variable	Category	Number (n)	Percentage (%)
Steroid Administration	Yes	35	70
	No	15	30
Regular Exercise	Yes	10	20
	No	40	80
Sedentary Lifestyle	Yes	23	46
	No	27	54
Prolonged Immobility	Yes	30	60
	No	20	40
D-dimer	>1.5 µg/mL	25	50
	≤1.5 µg/mL	25	50
Kagoshima Score	Low Risk (0-2)	18	36
	Intermediate Risk (3-4)	4	8
	High Risk (≥5)	28	56
Whole Leg Ultrasonography Doppler	Normal	25	50
	Deep Vein Thrombosis	25	50

Steroid administration was reported in 70% of patients, whereas only 20% performed regular exercise. Sedentary lifestyle and prolonged immobility were observed in 46% and 60% of patients, respectively. Elevated D-dimer levels (>1.5

µg/mL) were present in 50% of participants. Based on the Kagoshima score, 56% of patients were classified as high risk for DVT, and whole-leg ultrasonography Doppler detected DVT in 50% of the study population.

Table 3: Comparison between the Kagoshima score and Doppler of the patients

Kagoshima Score	Doppler		Total
	DVT	NO DVT	
DVT	25	3	25
NO DVT	0	22	25
Total	25	25	50

According to Kagoshima score, 28 patients in this study having deep vein thrombosis and 22 patients having normal study. According to whole leg ultrasonography Doppler, 25 patients having deep vein thrombosis and 25 patients having normal study.

Kagoshima score for deep vein thrombosis having 100% sensitivity, 88% specificity, 89.29% having positive predictive value, 100% negative predictive value and 94% accuracy.

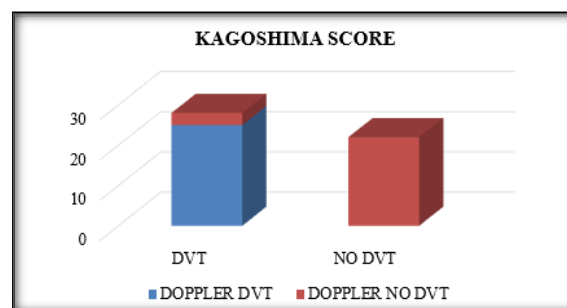


Figure 1: Comparison between the Kagoshima score and Doppler of the patients

DISCUSSION

A major consequence for surgical patients is deep vein thrombosis (DVT), which causes significant morbidity and mortality. Early identification of DVT risk factors should be based on surgeons' use of accurate risk assessment tools. This study evaluated the preoperative and postoperative risk factors for DVT among surgical patients in a tertiary care hospital. Prior to administering thromboprophylaxis, healthcare professionals should identify individual DVT risk factors to facilitate appropriate preventive strategies.^[1-6]

Our research indicated that DVT in inpatients and outpatients before surgery under anaesthesia is independently associated with one laboratory variable (D-dimer ≥ 1.5 $\mu\text{g/mL}$) and five clinical variables: age ≥ 60 years, female sex, ongoing glucocorticoid therapy, cancer with high risk of DVT, and prolonged immobility. Furthermore, the pre-test probability score (Kagoshima-DVT score) was useful in identifying DVT prior to surgery. Preoperative patients with a Kagoshima-DVT score of 3 or above (intermediate- or high-risk groups) should be considered for whole-leg ultrasonography (WLUS).^[11]

The majority of patients (32%) in the present study were aged between 51–60 years, while 28% belonged to the 41–50 years age group and another 28% to the 61–70 years age group. The mean age was 54.16 ± 11.25 years. Out of 50 patients, 29 (58%) were males and 21 (42%) were females.

Burcin et al. reported that most participants were male (53.3%) and older than 60 years (48.3%). Although the risk increases after 60 years because ageing leads to venous insufficiency, endothelial dysfunction, reduced mobility, muscle weakness, and associated systemic diseases, DVT can occur at any age.^[9]

In our study, 48% of patients had normal BMI, 44% were overweight, and 8% were obese. Obesity is a recognised risk factor for DVT. Ageno et al. demonstrated that obese individuals are nearly twice as likely to develop pulmonary embolism and DVT compared with normal-weight individuals. Conversely, Wang et al. reported no significant difference in venous thromboembolism incidence between normal-weight and obese patients undergoing general surgery. Özkaya et al. identified obesity and a previous history of DVT as major individual risk factors for DVT among surgical patients.^[9]

A history of DVT was present in 26% of patients, while 74% had no previous history of DVT. Previous DVT is a well-established predictor for recurrent thromboembolic events.^[7,9]

Among the comorbid conditions evaluated, diabetes mellitus was present in 40% of patients, hypertension in 50%, cancer in 46%, coronary artery disease in 44%, COPD in 42%, and smoking history in 30%. Burcin et al. observed that more than half of

their participants had chronic diseases, predominantly hypertension and diabetes mellitus, which contribute to endothelial dysfunction and increase the risk of DVT.^[9]

In the present study, 70% of patients had a history of steroid administration. Prolonged immobility was observed in 60% of patients, while only 20% engaged in regular exercise. Sedentary lifestyle was present in 46% of patients. These findings support previous reports indicating that glucocorticoid use and immobility are important risk factors for venous thromboembolism.^[9,11]

D-dimer levels greater than 1.5 $\mu\text{g/mL}$ were observed in 50% of patients. Elevated D-dimer levels are widely recognised as a marker associated with thrombus formation and are useful in DVT risk stratification.^[3,9,11]

According to the Kagoshima score, 36% of patients were classified as low risk, 8% as intermediate risk, and 56% as high risk for DVT. Whole-leg ultrasonography Doppler demonstrated DVT in 50% of patients and normal findings in the remaining 50%.

According to the Kagoshima score, 28 patients were predicted to have DVT, whereas WLUS confirmed DVT in 25 patients. The Kagoshima score demonstrated 100% sensitivity, 88% specificity, 89.29% positive predictive value, 100% negative predictive value, and 94% overall diagnostic accuracy. These findings indicate excellent performance of the score in identifying surgical patients at risk for DVT.^[11]

The risk factors evaluated in our study have been documented previously. Advanced age has consistently been associated with venous thromboembolism. Patients aged 60 years or older undergoing surgery is considered to be at increased risk for perioperative DVT. Female sex has also been associated with a higher incidence of thromboembolic events in Japanese populations. Glucocorticoid therapy has been linked to alterations in coagulation factors and an increased risk of venous thromboembolism. Although obesity is generally considered a risk factor for VTE, BMI ≥ 25 kg/m^2 did not show a statistically significant association in the original Kagoshima study, possibly because a large proportion of cancer patients were underweight and nutritionally compromised.^[10,11]

CONCLUSION

We established a pre-test probability score (Kagoshima-DVT score) for predicting DVT before surgery using one laboratory criterion (D-dimer ≥ 1.5 $\mu\text{g/mL}$) and five clinical variables (age ≥ 60 years, female sex, ongoing glucocorticoid therapy, high-risk cancer for DVT, and prolonged immobility) applicable to both inpatients and outpatients. The score categorised patients into low-, intermediate-, and high-risk groups before surgery, enabling

selective use of WLUS and improving DVT detection. In the present study, the Kagoshima score demonstrated 100% sensitivity, 88% specificity, 89.29% positive predictive value, 100% negative predictive value, and 94% diagnostic accuracy, suggesting that it is a highly effective screening tool for preoperative DVT detection.

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