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ORIGINAL ARTICLE

Clinical Profiles of Cancer-Associated Thrombosis among Newly Diagnosed Patient with Solid Cancer

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ABSTRACT

Introduction: Cancer-associated thrombosis (CAT) is a clinically significant complication that is linked to cancer patients. However, evidence regarding epidemiology of CAT and clinical characteristics in Malaysian cancer patients is very limited. The objective of this study is to investigate baseline characteristics of cancer patient with VTE and clinical profile of the VTE event. **Methods:** There were 462 cancer patients who were in anticoagulant recipient list from Radiology and Oncology Pharmacy Department, Hospital Kuala Lumpur between 2018 and 2021. A total of 208 patients met the inclusion and exclusion criteria of our study. We analysed retrospectively with respect to underlying diseases or predisposing factors. **Results:** Mean age of CAT patient was 50.51 years old and body mass index was normal (24.01kg/m^2). Patients were mostly having good performance status (0-1). The prevalence rates of CAT were higher in breast, gynaecology and lung. About 63% of the cases experienced DVT, 27.3% had pulmonary embolism and 9.6% of the cases experienced both DVT and PE. Lower extremities DVT was prevalence (28.4%) and followed by upper extremities DVT. Slightly more than 50% of the cases developed VTE within 3 months of cancer diagnosis. **Conclusion:** The clinical profiles of CAT in our study were different with patients in the West. Nevertheless, risk factors for cancer-related thrombosis found in our study were much consistent with current literature from Asia. The findings in this study may gave an insight on the direction of management of CAT and improve thromboprophylaxis strategies among newly diagnosed cancer patient.

KEYWORDS: Venous thromboembolism, cancer, risk factor, clinical profile

INTRODUCTION

Cancer-associated thrombosis (CAT) is hypercoagulation disorder that frequently afflicted the cancer patients [1]. This blood clotting event mainly affecting both arteries and veins, and cancer patients are particularly susceptible venous thromboembolism (VTE), as the malignancies can disrupt the delicate balance of blood coagulation and fibrinolysis [2]. Notably, an escalating trend in CAT incidences has been observed across various cancer types, with the exceptional to brain and myeloma cancer [3]. Despite the growing recognition of CAT as a critical complication among cancer patient in Asia [4,5], its multifaceted and asymptomatic nature, coupled with the absence of a practical risk assessment tool, contributes to the underutilization of thromboprophylaxis, an intervention that able to reduce the VTE rates by 50% in cancer patients [6,7].

Beyond the thrombotic role, CAT casts a far-reaching shadow on the survival trajectory of cancer patients[7]. CAT led to series of devastating complications such as haemorrhage, and post-thrombotic syndrome, that could complicating cancer treatment and diminishing patients' quality of life[8]. Despite that, our knowledge about the risk profile of VTE in cancer patients, especially among Asians, is still limited due to a lack of sufficient data. Existing studies are often small and diverse, and mainly focusing on

specific cancer types. While some population and hospital-based studies have been conducted in Asia, they heavily rely on data from Caucasians and East Asians, raising concerns about their applicability to the diverse ethnic groups in other part of the region[5].

To the best of our knowledge, no previous study has focused primarily on investigating the evidence on the prevalence of VTE among cancer patients in Malaysia. Therefore, the primary goal of this study was to identify the clinical profiles of newly diagnosed cancer patients in Malaysia who had experienced cancer-related thrombosis events and to comprehend the characteristics of these VTE events. The findings from this study are crucial not only for understanding the risk factors for CAT in the Malaysian population but also for confirming or refuting conflicting findings between Asian and Western populations regarding cancer-associated thrombosis.

MATERIALS AND METHODS

Study Population and Data Collection

This cross-sectional study was conducted from September 2021 to August 2022 at the Department of Radiotherapy and Oncology in Hospital Kuala Lumpur, which served as the national referral centre for oncology. The centre handled approximately 4000 new cancer cases yearly and had an in-patient capacity for around 200 patients. The medical data for this present study, comprising of comprehensive health and treatment details in handwritten form, were sourced from the list of anticoagulant recipients (both out- and in-patients) in the pharmacy department. We managed to obtain a list of 462 patients from 2018 to August 2021, of which were having potential of VTE occurrences.

We carefully screened and selected cancer patients from the list based on specific criteria, including: (i) those who were newly diagnosed with cancer (having not undergone any prior treatment or currently in their first cycle of chemotherapy), (ii) adults aged 18 and above seeking medical attention for radiotherapy, chemotherapy, or surgery, and (iii) individuals with confirmed cases of VTE events. Conversely, we excluded cancer patients who (i) had undergone any thromboprophylaxis treatment prior to their cancer diagnosis, (ii) had a history of thrombosis before being diagnosed with cancer, (iii) presented with more than one primary malignant disease at the time of diagnosis or had cancer sites that could not be categorized, and (iv) were currently pregnant at the time of diagnosis.

Data Extraction

Patient profiles, including age, gender, ethnicity, height, weight, ECOG status, smoking status, and comorbidities (hypertension, heart failure, ischemic heart disease, renal insufficiency, thyroid issues, and diabetes mellitus), were retrieved from medical records at the time of their presentation to the oncology department. Their CAT clinical profiles were extracted from the histopathology report, including the primary cancer site, staging, and metastasis status following the criteria reported previously[9][10]. We included all cancer types, except for haematological cancers, as the study site was not a referral centre for such cases.

The stage of the diseases was classified according to the American Joint Committee of Cancer Staging Classification. For patients without documented staging in their records, the following classification system was applied: stage I for localized cancer; stage II if regional lymph node was involved; stage III if locally or regionally advanced was detected, and; stage IV for if there was evidence of distant metastases. Additionally, important acquired risk factors for thromboembolism, such as pregnancy, surgery, central venous catheterization, and infection, were assessed and retrieved prior to the occurrence of VTE.

Validation of VTE were done through imaging tests, employing CT scans, CTPA, or Doppler ultrasonography. The type of VTE and the location of deep vein thrombosis (DVT) were tabulated. The locations were categorized into lower extremities, upper extremities, intraabdominal thrombosis, thrombosis of the vena cava, or multiple thrombotic sites. The timing of each event was recorded for all cases.

Ethical Approval

The study received ethical approval from the Medical Research Ethics Committee of the university (REC/04/2020 (UG/MR/133)). Permission to conduct research within Ministry of Health facilities was

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granted by the National Medical Research Register (NMRR) under the approval reference (NMRR-19-4016-46553 (IIR)). Additionally, approval for field data collection at the hospital was obtained from the hospital's Clinical Research Centre (CRC HKL).

Data Analysis

The baseline and clinicopathologic characteristics of patients with cancer-associated thrombosis were described using descriptive statistics, including frequency and percentage for categorical data, and mean and standard deviation for continuous data. To compare between male and female groups, independent t-tests were employed for continuous variables, while chi-square or Fisher's exact tests were utilized for categorical variables when appropriate. Listwise deletion was used for handling missing data in which cases with missing values on any variable of interest are excluded from the analysis. All analyses were performed using SPSS software version 28, and a 2-sided $P < .05$ was set as statistically significant.

RESULTS

From the Pharmacy Department's records, we identified a cohort of 462 cancer patients who were recipients of anticoagulant treatment. The eligibility of these patients for inclusion in our study was subsequently confirmed through a thorough review of their medical records. Following this process, a total of 208 cases were deemed suitable for inclusion, taking into account the availability of complete medical documentation and adherence to our specified inclusion and exclusion criteria for this study.

Venous thromboembolism (VTE) was identified among newly diagnosed cancer patients, and its prevalence was notably higher in men than in women (Figure 1). Among the participants, 81.7% were under the age of 65. The mean age at diagnosis stood at 50.51 ± 15.7 years, ranging from 18 to 77 years. A statistically significant age difference emerged between gender, with a mean age of 46.65 ± 16.89 years for males (n = 111), and mean age of 54.94 ± 12.92 years for females (n = 97) ($P < 0.001$).

Approximately four-fifths of cancer patients exhibited a positive Eastern Cooperative Oncology Group (ECOG) performance status, with scores ranging from 0 to 1 (Table 1). This indicates robust mobility and minimal functional restrictions in the patient cohort. The study cohort predominantly comprised individuals of Malay ethnicity, accounting for 68.3% of participants. The ethnicity pattern in our study population following the Malaysian demographic profile where Malays is the majority ethnic in Malaysia. Notably, diabetes and hypertension were common comorbidities, observed in 44.7% and 34.1% of patients, respectively, differing from Western patient profiles.

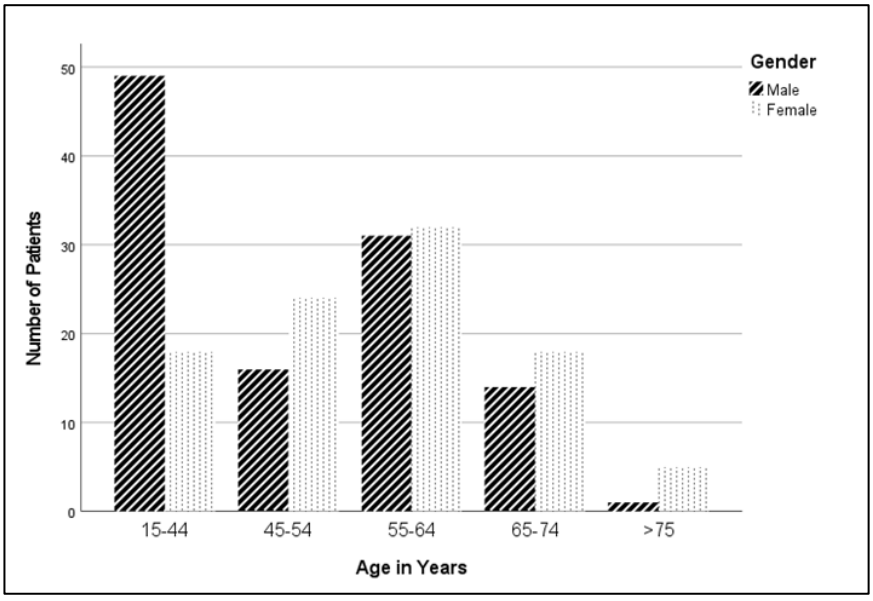

Figure 1 Age and sex distribution in 208 cancer patients with VTE

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Table 1 Baseline characteristics of cancer patients with VTE (n=208)

Demographic	Total	Male(n=111)	Female(n=97)	P value
Mean age (SD)	50.51(15.69)	46.65(16.89)	54.94(12.92)	***<0.001***
Ethnics	N (%)			
Malays	142(68.3%)	73(65.8%)	69(71.1%)	
Chinese	44(21.2%)	30(27.0%)	14(14.4%)	***0.036***
Indians	22(10.5%)	8(7.2%)	14(14.4%)	
BMI(n=184)	Mean (SD)	N=99	N=85	
	24.02 (5.7)	22.45 (4.79)	25.85(6.86)	***<0.001***
ECOG	N (%)			
0	63(30.3%)	32(28.8%)	31(32.0%)	
1	91(43.8%)	49(44.1%)	42(43.3%)	*0.937*
2	30(14.4%)	16(14.4%)	14(14.1%)	
3	24(11.6%)	14(12.6%)	10(10.3%)	
Comorbidities				
Hypertension	71(34.1%)	28(25.2%)	43(44.3%)	0.004
Diabetes Mellitus	93(44.7%)	47(42.3%)	46(47.4%)	0.462
Heart Failure[b]	2(1%)	2(1.8%)	0(0.00%)	*0.500*
IHD[b]	5(2.4%)	3(2.7%)	2(2.1%)	*1.000*
Airway Disease[b]	3(1.4%)	1(0.9%)	2(2.1%)	*0.599*
Renal insufficiency[b]	4(1.9%)	00.00%)	4(4.1%)	***0.046***
Thyroid insufficiency[b]	3(1.4%)	1(0.9%)	2(2.1%)	*0.599*
VTE risk factors				
CVC	145(69.7%)	76(68.5%)	69(71.1%)	*0.676*
Smoker	66(31.9%)	62(55.9%)	4(4.1%)	***0.001***
Infection	57(27%)	30(27.0%)	27(27.8%)	*0.896*

Note: [b] Fisher exact test otherwise chi square test, CVC= central venous catheter, ECOG=Eastern Cooperative Oncology Group Performance status;IHD=Ischaemic Heart disease

The distribution of cancer types revealed distinct trends in our study (Table 2). Breast (14.4%), lung (13.8%), and kidney (7.8%) cancers were the most prevalent. Notably, gender disparities in cancer incidences were statistically significant ($P < 0.05$).

Among male patients with VTE, lung (31.1%) and kidney (19.7%) cancers were predominant, while females exhibited higher rates of breast (31%), sarcoma (9.3%), and lung (8.3%) cancers. Moreover, a majority of VTE cases were associated with advanced-stage and metastasized cancer, emphasizing the advanced disease state in this cohort.

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Table 2 Distribution of Primary site of tumour stratified by gender

Cancer Type	Total	Male	Female	P value
Breast	30(14.4%)	0	30(31.0%)	*N/A*
Gynaecology	29(13.9%)	0	29(29.9%)	*N/A*
Lung	27(13.0%)	19(17.1%)	8(8.2%)	*0.058*
Kidney	16(7.7%)	12(10.8%)	4(4.1%)	*0.071*
Heart/mediastinum	16(7.7%)	15(13.5%)	0(%)	***<0.001***
Colon/Duodenal[b]	10(4.8%)	5(4.5%)	5(5.2%)	*1.00*
Nasopharynx[b]	10(4.8%)	6(5.4%)	4(4.7%)	*0.754*
Sarcoma[b]	10(4.8%)	1(0.9%)	9(9.3%)	***0.007***
Pancreas[b]	8(3.8%)	5(4.5%)	3(3.1%)	*0.726*
Bladder[b]	8(3.8%)	5(4.5%)	3(3.1%)	*0.727*
Rectal[b]	7(3.4%)	6(5.4%)	1(1.0%)	*0.105*
Stomach[b]	6(2.9%)	5(4.5%)	1(1.0%)	*0.218*
Stage(n=203)				
I	5(2.4%)	2(1.9%)	3(3.2%)	0.064
II	36(17.3%)	20(18.5%)	16(16.8%)	
III	57(27.4%)	38(35.2%)	19(20.0%)	
IV	105(50.5%)	48(44.4%)	57(60.0%)	
Presence of metastasis(n=203)				
	115(55.3%)	64(59.3%)	51(53.7%)	***0.042***

Note: [b]Fisher exact test otherwise chi square test

Table 3 Clinical characteristics of VTE events and anatomic distribution of VTE event

	Total	Male	Female	P value
Type of VTE				
DVT	131(63%)	73(65.8%)	58(59.8%)	0.672
PE	57(27.4%)	28(25.2%)	29(29.9%)	
DVT & PE	20(9.6%)	10(9.0%)	10(10.3%)	
Location of VTE				
PE	57(25.5%)	28(22.5%)	29(28.9%)	
DVT Lower extremities	59(28.4%)	28(25.2%)	31(32.0%)	
DVT Upper extremities	31(14.9%)	21(18.9%)	10(10.3%)	
Thrombosis of renal vein, hepatic vein or portal vein	21(10.1%)	12(10.8%)	9(9.3%)	*0.188*
Thrombosis of vena cava	8(3.8%)	7(6.3%)	1(1.0%)	
Multiple thrombotic sites	17(8.3%)	9(8.1%)	8(8.2%)	
Unspecified site	15(7.2%)	6(5.4%)	9(9.3%)	

Note: DVT=Deep vein thrombosis; PE= Pulmonary embolism

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The majority of VTE events (50.5%) occurred within the initial 90 days following diagnosis, with 31.7% happening at the time of diagnosis (Table 4). The median time-to-VTE was 60 days, ranging from 0 to 1,440 days. For patients experiencing a VTE, cumulative occurrences within 30, 90, 180, and 365 days post-diagnosis were 13.9%, 10.0%, 13.0%, and 11.5%, respectively. The anatomic distribution of VTE is detailed in Table 3. Out of 208 patients with VTE, 27.4% had pulmonary embolism (PE), 9.6% had both deep vein thrombosis (DVT) and pulmonary embolism, and 63% experienced DVT only. Among those with DVT, 39.1% had it in the lower extremities, 20.5% in the upper extremities, 14% in intra-abdominal locations (thrombosis of renal, hepatic, or portal vein), and 21.2% had thrombosis at multiple or unspecified sites.

Table 4 Time-to-VTE after cancer diagnosis among all cancer patients

Time to event	Total	Male	Female	p value
<3 months	105(50.5%)	65(58.6%)	40(41.23%)	***0.019***
3-6 months	37(17.8%)	20(18.0%)	17(17.5%)	*0.795*
6-12 months	26(12.5%)	13(11.7%)	13(13.4%)	*0.713*
>12 months	40(19.2%)	13(11.7%)	27(27.8%)	***0.006***

DISCUSSION

Using records from radiotherapy and oncology, our study looks into the characteristics of VTE in newly diagnosed patients with different cancers between August 2018 and August 2021. We excluded patients with a history of VTE or pregnancy to focus on cancer-related factors. We also considered additional VTE risk factors like ECOG status, BMI, comorbidities, sepsis, central venous catheter use, and smoking. Our aim is to understand the connections between these factors and the occurrence of VTE in this group of patients.

Past research highlighted women often have higher risk of developing VTE due to factors such as pregnancy, heightened estrogen activity, and the use of hormone replacement therapy[12] or contraceptive pills [13]. However, our study revealed a significantly higher incidence of specific baseline characteristics in males compared to females, suggesting the possibility presence of separate gender-specific risk factors contributing to the development of cancer-associated thrombosis.

We found that the average age of study cohort was 50.51 years (±15.69 years), which was a bit different from what other research suggested—usually around 60 years for developing CAT(14)(15). Looking into the details, we found that about 15% of our group had testis and mediastinum cancer (germ cell tumor) and were pretty young, in their 20s, this could be the reason of discrepancy of age and also gender compared to other studies.

The mean body mass index (BMI) in our study was within the normal range at 24.01. While obesity was identified as a relatively weak factor contributing to venous thromboembolism, existing studies have suggested its significant impact primarily among women [16]. Notably, weight loss event in this study cohort aligned with experiences reported by others [17]. We also observed a notable difference in BMI, with women being slightly overweight compared to men, who maintained a normal BMI. Although the prevalence of overweight was higher in women the association between obesity (using a cutoff point of 25 kg/m^2) and thrombosis was evident in cancer patients [18]. Additionally, obesity was linked to outcomes such as survival and cancer recurrence [19]. Majority of patients demonstrated good mobility, as evidenced by their Eastern Cooperative Oncology Group (ECOG) performance status, with most falling within the ECOG 0 and 1 categories [19]. Immobility can exacerbate blood stasis and promote the accumulation of clotting factors, thereby heightening the risk of thrombosis [20,21]. We also found that there wasn't a significant difference in performance status between genders.

Cancer patients frequently present with medical comorbidities, impacting their quality of life, prognosis, and healthcare costs. Common comorbidities in our study included diabetes mellitus (44.7%) and hypertension (34.1%), aligning with earlier research linking congestive heart failure, hypertension, and diabetes mellitus to increased VTE risk in cancer

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patients [22,23]. While no significant gender differences were noted except in hypertension and kidney disease, the exact impact of comorbidities on cancer patient mortality remains uncertain due to the complex interplay between these conditions and cancer[24,25]. Additionally, traditional thrombosis risk factors such as smoking and central venous catheter use were prevalent, with smokers facing a 50% increased VTE risk and cancer patients with active central venous catheters being particularly susceptible [18,26,27]. Active cancer also posed an 18-fold higher risk of upper extremity deep vein thrombosis [24]. Notably, gender differences were insignificant regarding central venous catheter usage and infection in our study cohort.

Despite the well-established link between thrombosis and cancer, focusing on specific cancer characteristics, such as cancer type, can offer valuable insights for thromboprophylaxis strategies. Extensive evidence suggests that certain primary cancer sites carry a heightened risk of venous thromboembolism (VTE) [28]. In our study, lung, kidney, and testis cancers were the most prevalent primary sites, with notable gender differences observed, particularly in lung and heart/mediastinum cancers among males, and breast and gynecological cancers among females. This pattern aligns with VTE prevalence in Asian populations, where breast, gynecological, and lung cancers dominate, contrasting with Western populations where pancreas, stomach, and brain cancers are more prevalent [28–30]. Higher VTE occurrence was markedly associated with advanced cancer stages (III and IV), consistent with existing literature linking cancer stage and aggressiveness to elevated VTE risk [1,3,28,31]. Mechanistically, advanced cancer stages are associated with increased release of procoagulant factors, triggering the coagulation cascade and clot formation [31]. This understanding underscores the importance of cancer stage in predicting thrombotic events, as supported by previous studies, particularly in Asian populations [32,33].

Most of VTE event were incidentally discovered upon routine clinical staging, surveillance or restaging scan. An active assessment of VTE was not a practice among newly diagnosed cancer patient in our study site. Most VTE events (45.64%) occurred within 90 days after diagnosis, with 31.7% of VTE events occurring on diagnosis (Table 2). Median time-to-VTE was 60 days (range, 0–1,440 days). Among patients who experience a VTE, the cumulative occurrence of VTE within 30, 90, 180, and 365 days after diagnosis date were 13.9%, 10.0%, 13.0%, and 11.5% respectively. The finding in our study is consistent with other studies that found patients were at the maximum risk in the first 3 months after cancer diagnosis, followed by a declining incidence. However, cancer patient remain at higher risk if compared to normal population for up to 15 years after diagnosis [34].

Anatomic distribution of VTE is shown in Table 2. Among 208 patients with VTE, 27.4% of patients had pulmonary embolism (PE), 9.6% of patients had both DVT and pulmonary embolism and 63% experienced DVT only. Among those with deep vein thrombosis, 39.1% had lower extremities, 21.2% had at upper extremities, 14% had intra-abdominal thrombosis (thrombosis of renal, hepatic, or portal vein) and 19.5% had thrombosis at multiple site or unspecified site. This study support the evidence from [35]. where lower extremities DVT were common site of VTE among cancer patient.

This study is accompanied with several limitation. Since this was a retrospective, cross-sectional study, we could not find a causal relationship between the diagnosis of VTE and risk factors. We have no control over risk factor that might relates to CAT. In addition, medical records were handwritten and the fact that there were many misplaced or missing medical records. The problems with paper based medical record are time consuming for retrieving files and to get all information from the record. Another limitation in this study was using anticoagulant recipient list in which actual prevalence of VTE may be underestimated. We did not include the chemotherapy received by the patient. Furthermore, patient who are asymptomatic will not be assessed for VTE. This is preliminary study which give estimates of clinical profile of cancer patients with VTE event. This may be useful in helping in decision making of VTE prophylaxis in clinical practice.

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CONCLUSION

In conclusion, the present study describes baseline clinical profile of newly diagnosed cancer patients with venous thromboembolism events across different types of cancer. The findings were mostly similar to what were found in previous literatures. The characteristics of the VTE events were also similar to existing evidence from Western and East Asian countries. This study found that mean age of cancer associated thrombosis patients was much younger (50.51 years) than existing research findings. Most of the patients were having advanced stage of cancer and about 31.7% of the VTE event encountered at routine clinical staging at the point of diagnosis of cancer through computed tomography scan. Finally, future study may be conducted using prospective study to include all relevant factors including active screening for the presence of VTE to better estimate the risk factors most relevant to cancer associated thrombosis.

Conflict of interest

Authors declare none.

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Authors' Contribution

Faiza: Data Curation, Conceptualization, Writing- Original draft preparation, Methodology.

Kwok-Wen: Writing- Reviewing and Editing, Data curation.

Mathumalar Loganathan Fahrni: Supervision and Visualization.

Khairil Anuar Md Isa: Supervision and Methodology.

Muthukkumaran Thiagarajan: Supervision and Methodology

Ethical Clearance

Taken from Research Ethics Committee UiTM - REC/04/2020 (UG/MR/133), and National Medical Research Register- NMRR-19-4016-46553 (IIR)

Ethical Approval

The study was approved by the Medical Research Ethics Committee of the Faculty of Pharmacy at University Technology Mara, Malaysia. Permission to do research using ministry of health facility was obtained from NMRR and approval for field data collection in Hospital Kuala Lumpur was obtained from CRC HKL.

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REFERENCES

1. Ikushima S, Ono R, Fukuda K, Sakayori M, Awano N, Kondo K. Trousseau's syndrome: Cancer-associated thrombosis. Jpn J Clin Oncol. 2016;46(3):204–8.
2. Amer MH. Cancer-associated thrombosis: Clinical presentation and survival. Cancer Manag Res. 2013;5(1):165–78.
3. Mahajan A, Brunson A, Adesina O, Keegan THM, Wun T. The incidence of cancer-associated thrombosis is increasing over time. Blood Adv. 2022;6(1):307–20.
4. Angchaisuksiri P. Venous thromboembolism in Asia -an unrecognised and under-treated problem? Thromb Haemost. 2011;106(4):585–90.
5. Lee LH, Nagarajan C, Tan CW, Ng HJ. Epidemiology of Cancer-Associated Thrombosis in Asia: A Systematic Review. Front Cardiovasc Med. 2021;8(May).
6. Abdol Razak N, Jones G, Bhandari M, Berndt MC, Metharom P. Cancer-associated thrombosis: An overview of mechanisms, risk factors, and treatment. Cancers (Basel). 2018;10(10):1–21.
7. Brenner B, Hull R, Arya R, Beyer-Westendorf J, Douketis J, Elalamy I, et al. Evaluation of unmet clinical needs in prophylaxis and treatment of venous thromboembolism in high-risk patient groups: Cancer and critically ill. Thromb J. 2019;17(1):1–12.
8. Mulder FI, Horváth-Puhó E, van Es N, van Laarhoven HWM, Pedersen L, Moik F, et al. Venous thromboembolism in cancer patients: a

population-based cohort study. Blood. 2021;137(14):1959–69.
9. Lyman GH. Venous Thromboembolism in the Patient with Cancer: Focus on Burden of Disease and Benefits of Thromboprophylaxis. Cancer. 2012;100(2):130–4.
10. Rebouças D, Costa M, Thuler L, Garces A, Aquino L, Bines J. Breast cancer-associated venous thromboembolism: A case-control study. The Breast. 2016;28:84–8.
11. Lee E, Kang SB, Choi S Il, Chun EJ, Kim MJ, Kim DW, et al. Prospective study on the incidence of postoperative venous thromboembolism in Korean patients with colorectal cancer. Cancer Res Treat. 2016;48(3):978–89.
12. Vinogradova Y, Coupland C, Hippisley-Cox J. Use of hormone replacement therapy and risk of venous thromboembolism: Nested case-control studies using the QResearch and CPRD databases. BMJ. 2019;364:1–14.
13. Jara-Palomares L, Otero R, Jiménez D, Praena-Fernández JM, Rivas A, Font C, et al. Sex Differences in Patients With Occult Cancer After Venous Thromboembolism. Clin Appl Thromb. 2018;24(3):489–95.
14. Chew TW, Gau CS, Wen YW, Shen LJ, Mullins CD, Hsiao FY. Epidemiology, clinical profile and treatment patterns of venous thromboembolism in cancer patients in Taiwan: A population-based study. BMC Cancer. 2015;15(1):1–10.
15. Qdaisat A, Kamal M, Al-Breiki A, Goswami B, Wu CC, Zhou S, et al. Clinical characteristics, management, and outcome of incidental pulmonary embolism in cancer patients. Blood Adv. 2020;4(8):1606–14.
16. Ntinopoulou P, Ntinopoulou E, Papathanasiou I V., Fradelos EC, Kotsiou O, Roussas N, et al. Obesity as a Risk Factor for Venous Thromboembolism Recurrence: A Systematic Review. Med. 2022;58(9):1–14.
17. Cancer.Net Editorial Board. Weight Loss. 2005-2022 American Society of Clinical Oncology (ASCO). 2022.
18. Haggstrom L, Parmar G, Brungs D. Central Venous Catheter Thrombosis in Cancer: A Multi-Centre Retrospective Study Investigating Risk Factors and Contemporary Trends in Management. Clin Med Insights Oncol. 2020;14.
19. Petrelli F, Cortellini A, Indini A, Tomasello G, Ghidini M, Nigro O, et al. Association of Obesity with Survival Outcomes in Patients with Cancer: A Systematic Review and Meta-analysis. JAMA Netw Open. 2021;4(3):1–30.
20. Previtali E, Bucciarelli P, Passamonti SM, Martinelli I. Risk factors for venous and arterial thrombosis. Blood Transfus. 2011;9(2):120–38.
21. Al Diab AI. Cancer-related venous thromboembolism: Insight into underestimated risk factors. Hematol Oncol Stem Cell Ther. 2010;3(4):191–5.
22. Søgaard M, Thomsen RW, Bossen KS, Sørensen HT, Nørgaard M. The impact of comorbidity on cancer survival: A review. Clin Epidemiol. 2013;5(SUPP 1):3–29.
23. Rijal S, Kaur G, Loh CC, Sagireddy S, Dweik H, Makrani MP, et al. Risk Factor Analysis of Venous Thromboembolism in Cancer: A National Inpatient Sample Study. Cureus. 2022;14(4):10–5.
24. Carr ME. Diabetes mellitus: A hypercoagulable state. J Diabetes Complications. 2001;15(1):44–54.
25. Zhang Y, Yang Y, Chen W, Liang L, Zhai Z, Guo L, et al. Hypertension associated with venous thromboembolism in patients with newly diagnosed lung cancer. Sci Rep. 2016;6(December 2015):1–7.
26. Galli E, Maggio E, Pomero F. Venous Thromboembolism in Sepsis: From Bench to Bedside. Biomedicines. 2022;10(7):1–20.
27. Paulsen B, Gran O V., Severinsen MT, Hammerstrøm J, Kristensen SR, Cannegieter SC, et al. Association of smoking and cancer with the risk of venous thromboembolism: the Scandinavian Thrombosis and Cancer cohort. Sci Rep. 2021;11(1):1–9.

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https://doi.org/10.24191/jchs.v10i1.5425

28. Blom JW, Doggen CJM. Malignancies, prothrombin mutation and the risk of venous thrombosis. JAMA. 2005;293(6):715–22.
29. Yamashita Y, Wada H, Nomura H, Mizuno T, Saito K, Yamada N, et al. Elevated fibrin-related markers in patients with malignant diseases frequently associated with disseminated intravascular coagulation and venous thromboembolism. Intern Med. 2014;53(5):413–9.
30. Ambrosino P, Tarantino L, Di Minno G, Paternoster M, Graziano V, Petitto M, et al. The risk of venous thromboembolism in patients with cirrhosis: A systematic review and meta-analysis. Thromb Haemost. 2017;117(1):139–48.
31. Cronin-fenton DP, Søndergaard F, Pedersen LA, Fryzek JP, Cetin K, Acquavella J, et al. Hospitalisation for venous thromboembolism in cancer patients and the general population: a population-based cohort study in Denmark, 1997 – 2006. Br J Cancer. 2010;103(July):947–53.
32. Ohashi Y, Ikeda M, Kunitoh H, Sasako M, Okusaka T, Mukai H, et al. Venous thromboembolism in cancer patients: report of baseline data from the multicentre, prospective Cancer-VTE registry. Jpn J Clin Oncol. 2020;50(11):1246–53.
33. Chou SC, Pai CH, Lin SW, Tien HF. Incidence and risk factors for venous thromboembolism in a cohort of Taiwanese patients with lung, gastric, pancreatic cancers or lymphoma. J Formos Med Assoc [Internet]. 2022;121(1):360–6. Available from: https://doi.org/10.1016/j.jfma.2021.04.025
34. Walker AJ, Card TR, West J, Crooks C, Grainge MJ. Incidence of venous thromboembolism in patients with cancer-A cohort study using linked United Kingdom databases. Eur J Cancer. 2013;49(6):1404–13.
35. Qdaisat A, Wechsler AH, Carreras MTC, Menendez JR, Lipe D, Highsmith EA, et al. Concomitant Deep Vein Thrombosis in Cancer Patients with Unsuspected Pulmonary Embolism. MDPI. 2022;1–13.

Vol 10(1) (2025) 29-38 | jchs-medicine.uitm.edu.my | eISSN 0127-984X
https://doi.org/10.24191/jchs.v10i1.5425