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DRAFT

Please share your comments/suggestions on this task force separately on an individual page by 20th June 2024 on email Id: umeshkapil@gmail.com.

NATIONAL ACADEMY OF MEDICAL SCIENCES (INDIA)

DIRECTORATE GENERAL OF HEALTH SERVICES

MINISTRY OF HEALTH & FAMILY WELFARE

GOVERNMENT OF INDIA

REPORT OF TASK FORCE

ON

Venous Thrombo Embolism



2022

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ON
“Venous Thrombo Embolism

Acknowledgement

Deliberations of the Executive Council of the National Academy of Medical Sciences in Apr 2022, resulted in the establishment of Task Force(s) to focus on various critical aspects of medical care including Venous Thrombo Embolism. This expressed need for guidelines in management and prevention of VTE has been fulfilled vide this document. We are grateful for the encouragement and support provided by the President NAMS, Prof SK Sarin and Prof Umesh Kapil, Secretary NAMS and his Secretariat team, through the duration of the Task Force.

We are grateful to the tireless guidance and inspirational leadership provided by Lt Gen Velu Nair, Chairperson of the VTE Task Force in identifying, perusing, distilling and developing a multitude of international guidelines focused on various aspects of VTE, into actionable and up to date guidance for the Indian context.

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The Task Force Secretariat undertook extensive reviews of literature and evidence, and collated them with an overarching view to present an easy to refer format for clinicians in the Indian context. The public health and health systems focus and orientation was maintained consistently through the proceedings of the Task Force and the resultant document by the efforts of the Secretary, Col MP Cariappa.

The contributions of various other Haemato-Oncologists, other domain experts is acknowledged

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Preface

There is a perceived gap in the utilization of appropriate prophylaxis for prevention of VTE and its guidelines based management across different strata of the healthcare system. In view of the ageing population of India, and the increasing burden of non communicable diseases along with infectious diseases affecting healthcare service delivery, there is a dire need to have an early impact on the incidence and burden of DVT and PE in India.

The measures required to be taken call for stakeholders to take effective action to create a future for India, where:

- (a) The population at large is knowledgeable about the risk factors, triggering events, and symptoms of VTE, and individuals feel empowered to talk with their healthcare providers about VTE whenever appropriate.
- (b) Evidence-based practices for the screening, prevention, diagnosis, and treatment of DVT/ PE are clearly understood and routinely applied by all medical professionals in all settings.
- (c) New scientific evidence is constantly being uncovered to fill gaps in knowledge, and these findings are quickly and easily disseminated to the public and put into practice by healthcare professionals.

The overall results of the above action agenda will be to save many lives each year and to reduce the suffering for many more. Implementing the vision for a VTE free healthcare system as proposed in this document will not be an easy task, and undoubtedly progress will take time. Many barriers will emerge, however solutions must be found and, more importantly, set into motion sooner than later.

We will need the energy and commitment of individuals, families, the healthcare system, private sector organizations, and government systems at all levels to work together to build solutions that will bring better health to Indians. With these dedicated efforts we can make this vision a reality. This document prepared by a NAMS Task

Force, is intended to be a synthesis of a cross section of available professional society guidelines focused on prevention and management of VTE for the Govt of India to issue suitable guidelines for implementation across the primary healthcare system. This initiative was wholeheartedly supported and encouraged by Prof SK Sarin, President, NAMS and Prof Umesh Kapil, Secretary NAMS.



Lt Gen (Dr) Velu Nair, PVSM, AVSM, VSM (Retd)**

MD(Med), FRCP (London), FRCP (Glasgow), FACP (USA), FICP, FAMS, FIACM, FUICC (UK), FISHTM

Chairperson, NAMS VTE Task Force

Former Director General Medical Services, Army

Presently, Chief Consultant - Haemato-Oncology & Bone Marrow Transplant

Apollo Comprehensive Blood & Cancer Center (CBCC), Gandhinagar, Gujarat

List of abbreviations

ACCP	American College of Chest Physicians
AHA	American Heart Association
APLA	Anti phospholipid antibody syndrome
ASCO	American Society of Clinical Oncology
ASH	American Society of Haematology
BMI	Body mass index
CrCl	Creatinine clearance
DOAC	Direct acting oral anticoagulant
DVT	Deep venous thrombosis
ENDORSE	Epidemiologic International Day for the Evaluation of Patients at Risk for Venous Thromboembolism in the Acute Hospital Care Setting
ESA	European Society of Anaesthesiology
ESC	European Society of Cardiology
HIT	Heparin induced thrombocytopenia
IPC	Intermittent pneumatic compression
ISHBT	Indian Society of Haematology & Blood Transfusion
ITAC	International Initiative on Thrombosis and Cancer
IVC	Inferior vena cava
LMWH	Low Molecular weight heparin
NICE	National Institute of Clinical Excellence
OSA	Obstructive sleep apnoea
PAH	Pulmonary artery hypertension
PE	Pulmonary Embolism
PE	Pulmonary embolism
PICO	Population, Intervention, Comparator, and Outcome
PTS	Post thrombotic syndrome
RV	Right ventricle
SVT	Splanchnic vein thrombosis
TF	Task Force
UFH	Unfractionated heparin
VKA	Vitamin K antagonist
VTE	Venous Thromboembolism
VT	Venous Thrombosis

Operational definition of terms used

Pulmonary embolus (PE) refers to obstruction of the pulmonary artery or one of its branches by material (eg, thrombus, tumor, air, or fat) that originated elsewhere in the body. Patients with **acute PE** typically develop symptoms and signs immediately after obstruction of pulmonary vessels. Some patients with PE may also present **subacutely** within days or weeks following the initial event. Patients with **chronic PE** slowly develop symptoms of pulmonary hypertension over many years (ie, chronic thromboembolic pulmonary hypertension; CTEPH).

Symptomatic PE refers to the presence of symptoms that usually leads to the radiologic confirmation of PE, whereas **asymptomatic PE** refers to the incidental finding of PE on imaging (eg, contrast-enhanced computed tomography performed for another reason) in a patient without symptoms.

Executive summary

Venous thromboembolism (VTE) comprises of deep vein thrombosis (DVT) and pulmonary embolism (PE). It can result in significant mortality, morbidity, and healthcare costs. Approximately 30% of patients with symptomatic VTE manifest with PE, and others with DVT. The incidence of DVT in India in the general population is about 1.79 per thousand. Approximately 30 % of patients with symptomatic VTE manifest with PE, and others with DVT. More than 50% of post- surgical procedures patients are at risk of developing VTE. The prevailing notion that the incidence of VTE in Asians is less than that in the Western population has been disproved by recent reports.

Increasing age, male gender, trauma, surgery, prolonged hospitalization, malignancy, neurologic disease, central venous catheter, prior superficial vein thrombosis, and varicose veins have been identified as some of the major risk factors for developing VTE. In women, oral contraceptive pill use, pregnancy, and hormone replacement therapy are established as independent risk factors. Some of the important risk factors for surgical patients developing VTE are age, type of surgery, length of procedure, and duration of immobilization.

An extensive review of up-to-date published literature and consensus statements / guidelines was undertaken by a Task Force of the NAMS specifically focusing on the prevention and management of VTE. These guidelines have emerged therefrom.

The Task Force has recommended that consensus be achieved amongst the various stake holders in the health of the people of India, towards a national Vision i.e *a Venous Thrombo Embolism-free healthcare system and eventually a VTE free population.*

The key issues identified by the Task Force on taking recourse to a systems approach to appropriate prevention and management of VTE include but are not limited to lack of *Trained human resources* (healthcare professionals); inadequate *Laboratory diagnostic support* ; inadequate *availability of pharmaceutical supplies*; *lack of awareness in the community* ; *need for suitable Research along with equitable distribution of facilities for management of VTE.*

Efficient use of healthcare resources is extremely crucial, and diagnostic testing without significant clinical utility are not recommended as per multiple specialty

societies, including the current ACCP and ASH guidelines. Reduction of the risk of VTE can be done by screening patients pre- and post-operatively with accurate diagnostic testing. By diagnosing VTE early, treatment could be provided to halt progression and avoid morbidity and mortality associated with acute VTE. Screening “at-risk” patients is impractical and too expensive to be undertaken outside of clinical trials.

Recommendations have been made to bridge critical gaps/ deficiencies as identified, including capacity building. Presently there is no formal system for upgradation and verification of skillsets of healthcare professionals in managing and prescribing prophylaxis for VTE. Recommendations have been made by the Task Force to address this suitably.

There needs to be concerted efforts by policy makers and medical professional bodies, to focus attention on the policy gaps, and also India specific recommendations on awareness and training for prevention of VTE. Consideration may also be given in due course to identification of high risk populations for screening and further management as per treatment guidelines.

Thus, there is a need for budgetary allocation of funds and policy initiatives, for assigning of research priorities, and a need for convergence of medical specialities, to better serve the Indian population.

A community based strategy is recommended to create awareness periodically. This is recommended to be steered by a special Committee or Cell that may be established by Ministry of Health and Family Welfare, with the cooperation of the Indian Society of Haematology & Blood Transfusion, in coordination with the Indian Public Health Association.

After due deliberations on the need for current evidence about thromboprophylaxis practices, the NAMS Task Force has proposed the conduct of a rapid multicentric cross sectional study on a pan India basis, to ascertain a representative view of the VTE burden and real world prophylaxis practices. This is intended to be undertaken to develop indigenous VTE risk assessment tools and prophylaxis strategies.

Introduction

1. Venous thromboembolism (VTE) comprises of deep vein thrombosis (DVT) and pulmonary embolism (PE). It can result in significant mortality, morbidity, and healthcare costs. Approximately 30% of patients with symptomatic VTE manifest with PE, and others with DVT. The annual incidence of PE ranges from 39- 115 per 100,000 population, and for DVT, the incidence ranges from 53- 162 per 100,000 population. VTE not only disables patients, but also prolongs hospital stay, leading to increase in cost of treatment.

2. PE is one of the commonest causes of sudden unexplained deaths in hospitalized patients. An early diagnosis and prompt , effective treatment is crucial, as the mortality rate of untreated PE is about 30%, and nearly 30% of untreated DVTs suffer severe swelling or ulceration of the lower limbs. With timely diagnosis and treatment, PE related deaths are less than 1%. Venous thrombosis (VT) generally lacks specific signs and symptoms, which can lead to a delayed or inaccurate diagnosis and inferior patient outcomes. Hence awareness creation amongst treating physicians is a key approach to combating VTE.

3. The most common presentations of VT are DVT of the lower extremity and PE. These can result in significant mortality, morbidity, and healthcare costs. The causes of venous thrombosis can be divided into two groups: hereditary and acquired, and are often multiple in a given patient. A major theory delineating the pathogenesis of VTE, often called Virchow Triad proposes that VTE occurs as a result of:-

- (a) Alterations in blood flow (ie, stasis)
- (b) Vascular endothelial injury
- (c) Alterations in the constituents of the blood (ie, inherited or acquired hypercoagulable state)

4. A risk factor for thrombosis can be identified in over 80 percent of patients with venous thrombosis. Furthermore, there is often more than one factor at play in a given patient. Accordingly, many patients with VTE fulfil most or all of Virchow triad of stasis, endothelial injury, and hypercoagulability. As examples:

- (a) Fifty percent of thrombotic events in patients with inherited thrombophilia are associated with the additional presence of an acquired risk factor (eg, surgery, prolonged bed rest, pregnancy, oral contraceptives). Some patients have more than one form of inherited thrombophilia or more than one form of acquired thrombophilia and appear to be at even greater risk for thrombosis
- (b) In a population-based study of the prevalence of VTE, 56 % of the patients had three or more of the following six risk factors present at the time of VTE: >48 hours of immobility in the preceding month; hospital admission, surgery, malignancy, or infection in the past three months; or current hospitalization.

Background

5. The incidence of DVT in India in the general population is about 1.79 per thousand. Approximately 30 % of patients with symptomatic VTE manifest with PE, and others with DVT. More than 50% of post- surgical procedures patients are at risk of developing VTE. The risk of VTE following total knee arthroplasty (TKA) is 72.2%, following abdominal or thoracic surgeries is 40%, and following total hip arthroplasty (THA) is 42.9%. Idiopathic DVT is noted in 43% of patients with 52% of patients developing DVT after a precipitating event, and 6% of patients showing recurrence of DVT. VTE is a relatively common cause of death in hospitalized patients, approximating to about 75% of all hospital-acquired VTE. The incidence of DVT in post- major lower limb surgery in Indian patients is comparable to Western data.

6. Increasing age, male gender, trauma, surgery, prolonged hospitalization, malignancy, neurologic disease, central venous catheter, prior superficial vein thrombosis, and varicose veins have been identified as some of the major risk factors for developing VTE. In women, oral contraceptive pill use, pregnancy, and hormone replacement therapy are established as independent risk factors. Some of the important risk factors for surgical patients developing VTE are age, type of surgery, length of procedure, and duration of immobilization.

7. VTE is a major cause of cardiovascular morbidity and mortality and has a known genetic contribution. Genetic risk factors predispose to thrombophilia and play

the most important aetio-pathogenic role in VTE in people younger than 50 years. At least one inherited risk factor could be found in about half of the cases with a first episode of idiopathic VTE. A revolutionary contribution to the genetic background of VTE was brought by the achievements of the genome-wide association studies which analyze the association of a huge number of polymorphisms in a large sample.

8. The detection of hereditary thrombophilia has an impact on the management of the anticoagulation in children with purpura fulminans, pregnant women at risk of VTE and may be useful in the assessment of the risk for recurrent thrombosis in patients presenting an episode of VTE at a young age (<40 years) and in cases with positive family history regarding thrombosis. Data showing the clinical usefulness and benefits of testing are limited or non-existent, as are data supporting the benefit of primary or secondary VTE prophylaxis based on thrombophilia status alone. Patients with inherited thrombophilia can often be identified by coagulation experts on the basis of the patient's personal and family history of VTE, even without knowledge of test results. Factors associated with the presence of an inherited thrombophilia include VTE at a young age (often considered to be less than 40 to 50 years of age); a strong family history of VTE; VTE in conjunction with weak provoking factors at a young age; recurrent VTE events; and VTE in an unusual site such as the central nervous system or splanchnic veins.

9. While acute precipitants and clinical risk factors are often the focus of determining the cause of VTE, a small minority of patients have a mutation in a limited number of genes leading to an inherited thrombophilia. To that end, hypercoagulability and / or genetic testing can identify some uncommon genetic mutations such as factor V Leiden, antithrombin deficiency, protein C or S deficiency, or a prothrombin gene mutation. However, standard testing is usually unrevealing, with mutations present in only about 5% of the general population. Thus, for many patients with VTE, no clear precipitant or risk factor is ever identified.

10. When a patient experiences a VTE event without an acute precipitant such as recent surgery, immobilization, or trauma, one often considers clinical risk factors and contemplates testing for a handful of known, monogenic thrombophilia disorders. However, use of thrombophilia testing has fallen out of favour in part due to the low yield in terms of numbers of patients identified. Given the genetic backdrop, the

studies done in India have certain limitations which include but are not limited to sample size being quite limited and the studies having been done in context of VTE with some other co-morbidity. Further, mostly targeted polymorphisms have been analysed with no study involving a global approach at genome-wide level. Indian data depicts that the established thrombophilia genetic markers Factor V Leiden, Prothrombin G20210A have a limited role from the Indian perspective. Several studies have shown role of Factor V Leiden in VTE risk but only with certain co-morbidities in the Indian population. In recently published landmark studies regarding genetics of VTE in the journal Blood and in Nature Genetics, in contrast to uncommon thrombophilias, genome-wide association studies were used to identify 297 independent single nucleotide polymorphisms associated with VTE, from which a polygenic risk score was developed. These data demonstrate that consideration of broader polygenic risk can identify a much larger proportion of patients at risk for VTE and is a stronger predictor than many chronic clinical risk factors. We need to extend these kinds of studies in Indian population for getting a comprehensive genetic view on VTE.

11. Preventing fatal PE is the primary goal of anticoagulant prophylaxis for VTE. Prevention of VTE also avoids significant post-VTE morbidity. Conditions that can develop despite appropriate treatment of VTE are post-thrombotic syndrome (PTS), chronic thromboembolic pulmonary hypertension (CTEPH), and post-PE syndrome. The prevalence and potential severity of these conditions must be considered when determining the potential benefits of preventing VTE. Averting sudden death and reducing post-PE morbidity are not the only benefits of anticoagulant prophylaxis, and prevention of VTE is important to avoid patient discomfort, anticoagulant treatments and their associated risks, specialist visits, delays in procedures, and the potential for additional testing.

Terms of Reference for the Task Force

12. The Executive Council of the National Academy of Medical Sciences had assigned the following terms of reference for the Task Force on VTE in Apr 2022. All recommendations of the Task Force were to be placed before the Executive Council of the NAMS by end July 2022, for approval and onward submission to Government of India.

- (a) The Task Force was required to make recommendations to the Government of India for prevention and control of Venous Thrombosis and Embolism in India at the health policy and implementation levels.
- (b) The Task Force would prepare a "White Paper" which may include the existing morbidity and mortality status if available due to Venous Thrombosis and Thromboembolism.
- (c) The Task Force would identify existing lacunae and deficiencies in the thematic area and make recommendations to address these.

Methodology

13. On receipt of the Terms of Reference from the NAMS Executive Council, the Task Force (TF) was convened under the Chairmanship of Lt Gen Velu Nair with membership from a cross section of domain experts (list at Annexure 1).

14. Through a process of discussions in the virtual mode, a consensus was reached amongst the Members of the TF, on the methodology to be adopted for developing ibid guidelines. The task at hand was divided into sections and members allocated the sections based on their specific domain expertise.

15. An extensive literature review was undertaken using the websites PubMed and Google Scholar using the search terms "Venous Thrombo Embolism" AND "Management" AND "Prophylaxis" AND "Prevention" for English language documents, with a preference for Review articles, Clinical Trials , Consensus Statements and Guidelines. Professional Society websites were browsed for latest guidelines and consensus statements. Contribution from the scientific committee was requested through a personal communication from the Chairperson to all members of the Indian Society for Haematology. Thus, almost all published work from India was reviewed

along with all similar international work on VTE. A synthesis of the obtained literature was prepared and deliberated upon by the Task Force.

16. A series of weekly meetings were conducted in virtual mode for reviewing the progress being made, and to discuss the allocated sections of the White Paper. Minutes of the Meetings were prepared and circulated within the TF for information and guidance.

17. While developing the document, the PICO framework was relied upon to define the various at-risk patient groups and recommend the interventions required. Iterations of the document developed with the contributions of the members were circulated and discussed sequentially over the term of the TF. This modification of the Delphi technique was essential for the process of eventual consensus, as the guidelines required reference to the latest evidence and conformity with professional Society guidelines, keeping in view the requirements of the country and the best interests of the patient population.

Situational Analysis

Current situation in India

18. The prevailing notion that the incidence of VTE in Asians is less than that in the Western population has been disproved by recent reports. The incidence of postoperative DVT in Indian patients undergoing major lower limb surgery is as high as seen in the Western world. (43.2% and 60% patients in the groups with and without prophylaxis, respectively). In a study covering 549 patients, acute DVT without PE, acute DVT with PE, and PE alone were reported in 64%, 23%, and 13% patients respectively. The mean age was 47 (± 16) years, and 70% of the patients were males. A history of DVT (34%), surgery including orthopaedic surgery (28%), trauma (16%), and immobilization >3 days(14%) were the most common risk factors for VTE. Hypertension (25%), diabetes (19%), and neurological disease (other than stroke) (8%) were the most common co-morbidities. Most (94%) were treated with heparin alone (82%) or fondaparinux (2%) for initial anticoagulation; low molecular weight heparin alone(5%) or warfarin/ acenocoumarol (76%) for long-term anticoagulation.

19. In the MEGA study, patients who were tested for thrombophilia after a first episode of VTE, were analysed for the outcomes of testing and for reduction in the risk

of recurrence. It was observed that despite thrombophilia testing at the time of first VTE, 35% of patients had recurrent VTE during follow-up compared with 30% of patients who did not have recurrent VTE. This indicated that testing at time of first VTE did not reduce the risk of recurrence of VTE. Testing for inherited thrombophilia does not reduce the recurrence of VT. The recurrence risk for VTE is determined by the clinical situation (e.g., provoked vs. unprovoked) along with non-Mendelian risk factors (e.g., body mass index and age) rather than the inherited thrombophilia panel.

20. The proportion of Indian patients at risk for VTE (53.6%) was similar to that of the global patients at risk for VTE (51.8%). However, ENDORSE data showed that globally 50.2% at-risk patients received ACCP-recommended prophylaxis, whereas in India, only 17.4% of at-risk patients received such prophylaxis. Among at-risk patients, 18.5% surgical and 22.4% medical patients received any VTE prophylaxis. Similarly, 16.3% surgical and 19.1% medical patients received ACCP recommended thromboprophylaxis. In a prospective registry on venous thromboembolic events (PROVE) conducted in 19 countries, 3526 patients with symptomatic DVT were enrolled; out of which 667 were from India. Prior VTE prophylaxis had been given to only 5% of enrolled Indian patients compared to 12% in the overall PROVE population.

21. Thus, thromboprophylaxis in India may not be routine practice in most institutions other than tertiary care hospitals. This large population of patients at-risk for VTE identifies an unmet need. There is thus, a need to understand the incidence and prevalence of VTE in various medical and surgical settings better.

22. The most common reasons for the underutilization of pharmacological thromboprophylaxis are varied and often include (but are not limited to) lack of knowledge, ignorance, fear of bleeding, and any contraindication to anti-coagulants. This can be interpreted to imply poor awareness of the risks for VTE in patients. The current paradigm for diagnosis and management of thrombosis has provided a variety of tools. However, it has also left some unanswered questions such as methods for risk stratification to predict the risk for recurrent VTE requiring aggressive anticoagulation.

Current infrastructure, facilities, technologies, policies, programs etc. in India in context of the problem of VTE

23. The ICMR has recently launched a National Hospital based Registry on Venous Thromboembolic Disorders (i-RegVeD) with the aim of establishing a nationwide surveillance network through selected hospitals for collection of data for generating evidence on VTE prevalence. This will be of relevance for planning suitable, calibrated responses, and strengthening healthcare facilities across different treatment settings. This registry is based on a standard reporting framework with data capture using electronic information technology for timely analytics of patterns of disease distribution, treatment and outcomes of VTE patients. The data is intended to be used for relevant and appropriate research and innovation including identifying risk factors for VTE disease. It is anticipated that the registry shall contribute to improving patient management for VTE and related manifestations, and also guide policy and health planning in the future.

24. Presently there is no formal campaign or system for upgradation and verification of skillsets of healthcare professionals in managing and prescribing prophylaxis for VTE. Online consensus statements and guidelines are available from international professional societies which can be accessed by any interested healthcare professional, however there is no focused initiative to regulate or standardise the approach across the Indian healthcare system.

25. Across the healthcare hierarchy in India, in the governmental public healthcare system, the availability of laboratory diagnostics capabilities, and pharmaceutical supplies for managing , monitoring and providing prophylaxis for VTE is not uniform. This problem is especially acute at the peripheral levels of the healthcare system, from the District Hospital downwards, compounded by the problem of relative lack of trained and specialist human resources. In the private health care system which accounts for the majority of tertiary healthcare sought by the Indian population with considerable out of pocket expense being incurred, the management of VTE amongst other conditions, is dependent mostly on perceived commercial considerations.

26. With the Indian Public Health Standards being formulated to address the human resource and equipment needs across a standard template and scale, in an ideal scenario, the requirements of trained human resources has been addressed.

However, ground reality indicates otherwise, with scorecards from the Niti Aayog revealing the realities. So far, there has been no comprehensive assessment of the competence per se, of such trained personnel across a spectrum of clinical domains, leave alone VTE as a focus area.

27. The National Essential Diagnostics List was promulgated in 2019, with states being empowered to augment the list and provide equipment to suit their specific inclinations or areas of focus in disease and health management. This guideline serves to provide a generic template for states to plan service delivery. The framework for VTE management thus can capture the parameters outlined in this document to provide support to States in planning their response.

Key issues / gaps identified in context of VTE

28. These include but are not limited to the following:-

(a) *Trained human resources* (healthcare professionals)- Availability of an adequate number of personnel adequately oriented towards VTE and skilled suitably to manage VTE in different clinical settings and provide thromboprophylaxis as required.

(b) *Laboratory diagnostic support* - facilities that are commensurate with the basic minimum requirements to screen for, diagnose, and manage VTE at different levels of the healthcare system.

(c) *Availability of pharmaceutical supplies* - Appropriate drug stocking and replenishment systems including required logistics, for the healthcare facilities to provide appropriate care and manage VTE at different levels of the healthcare system.

(d) *Awareness in the community* - about VTE and the risks posed to health. To inculcate required healthcare seeking behaviour with specific reference to prevention, and early recognition.

(e) *Research and future direction* – To study the incidence and prevalence in the Indian population and undertake research to identify suitable protocols for screening, diagnosis and management appropriate for the country.

(f) *Equitable distribution of facilities for management of VTE* – Availability of healthcare facilities that are adequate and accessible, affordable and sustainable, appropriate and acceptable in geographical vicinity of at risk population clusters.

Recommendations

Vision

29. It is recommended that consensus be achieved amongst the various stake holders in the health of the people of India, towards a national Vision i.e a *Venous Thrombo Embolism-free healthcare system and eventually a VTE free population*.

30. The National Academy of Medical Sciences envisions a healthcare system in India, both in the public sector and the private health care system, in which a collaborative, multidisciplinary approach will ensure a VTE-free population and a VTE-free healthcare system, through standardised, evolving, evidence based guidelines, to deliver sustainable, high quality, affordable and patient focused care.

31. Further to National Health Policy 2017, the goal of a VTE-free healthcare system and VTE-free population, being proposed by the National Academy of Medical Sciences, is for attainment of the highest possible level of health and wellbeing for all, at all ages, through a preventive and promotive health care orientation, and universal access to good quality health care services without anyone having to face financial hardship as a consequence, by eliminating incidence of VTE amongst other initiatives of the Govt of India.

Recommendations made to bridge critical gaps/ deficiencies

32. Presently thromboprophylaxis as an approach in management of patient populations at-risk is underutilized in India, hence measures to overcome this unmet need are warranted. There is also a need to have focused, simple guidelines, with algorithms and charts for care providers for early diagnosis of VTE and prompt management in different VTE settings (including at the community level). In addition, it is important to increase awareness amongst treating physicians regarding guidelines on testing for VTE, while avoiding unnecessary testing. These need to be undertaken in the backdrop of promoting health literacy on a broader palette for the larger population.

33. The various recommendations of the NAMS Task Force include but are not limited to the following:-

	Key Focus areas / Gaps	Action Recommended
(a)	<i>Trained human resources</i>	It is recommended that periodically updated online training modules may be made available for healthcare personnel nationally, with regional mentoring by medical institutions of eminence.
(b)	<i>Laboratory diagnostic support</i>	It is recommended that the National Essential Diagnostics List 2019 and the relevant facility wise Indian Public Health Standards be utilized to standardize the laboratory requirements for basic minimum requirements to screen for, diagnose, and manage VTE at different levels of the healthcare system.
(c)	<i>Availability of pharmaceutical supplies</i>	It is recommended that States be advised to refine their Essential Drugs List to include / retain appropriate drugs and ensure stocking and replenishment systems including required logistics, for their healthcare facilities to provide appropriate care and manage VTE at different levels of the healthcare system.
(d)	<i>Awareness in the community</i>	It is recommended that periodic campaigns be launched regionally with standard content about VTE and the risks posed to individual health. Behaviour change campaigns may also be promoted, to inculcate required healthcare seeking behaviour with specific reference to prevention, and early recognition of VTE.
(e)	<i>Research and future direction</i>	It is recommended that funding be made available to study the incidence and prevalence in the Indian population and undertake research to identify suitable protocols for screening, diagnosis and management appropriate for the country

(f)	<i>Equitable distribution of facilities for management of VTE</i>	It is recommended that State Govts may be advised to plan for availability of healthcare facilities that are adequate and accessible, affordable and sustainable, appropriate and acceptable in geographical vicinity of at risk population clusters.
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Way Forward

34. The NAMS Task Force after due deliberations on the need for current evidence about thromboprophylaxis practices, has proposed the conduct of a rapid multicentric cross sectional study on a pan India basis, to ascertain a representative view of the VTE burden and real world prophylaxis practices. This is intended to be undertaken to develop indigenous VTE risk assessment tools and prophylaxis strategies.

35. Efficient use of healthcare resources is extremely crucial, and diagnostic testing without significant clinical utility are not recommended as per multiple specialty societies, including the current ACCP and ASH guidelines. There are two major ways to reduce the risk of VTE. The first is to screen patients pre- and post-operatively with accurate diagnostic testing. By diagnosing VTE early, treatment could be provided to halt progression and avoid morbidity and mortality associated with acute VTE. Unfortunately, contrast venography is expensive, painful, and impractical to perform outside of clinical studies. Less invasive studies, such as venous ultrasonography, are less sensitive in asymptomatic patients than in symptomatic patients. Screening “at-risk” patients is impractical and too expensive to be undertaken outside of clinical trials.

36. The second approach is to undertake measures to prevent VTE. General measures, such as encouraging early ambulation after surgery, can be adopted universally without harm. In addition, active prophylaxis with either mechanical or pharmacologic means has been proven to lower the risk of VTE. Mechanical prophylaxis refers to devices, such as graduated compression stockings and intermittent pneumatic compression devices, which decrease venous stasis in the lower extremities. Mechanical prophylaxis does not carry a risk of bleeding but can be

uncomfortable, and prolonged use can lead to skin breakdown and other cutaneous complications.

Suggested policy activities and advocacy for policy makers

37. DVT and PE have been recognised to be major public health problems across the world today. Clinicians and hospitalists are assumed to know how to reduce the morbidity and mortality resulting from DVT / PE, yet it is perceived that this knowledge is mostly not being applied systematically at the population level or even uniformly across healthcare facilities. Without a concerted effort to stem the public health crisis that unrecognised VTE poses, the incidence and burden of these diseases will only grow larger as the population in India ages.

38. The key actions required to be taken by policy makers in various settings have been given at Annexure 7.

39. The recently launched ICMR registry for VTE is recommended to be actively promoted for voluntary participation by healthcare facilities across the country.

Recommendations for healthcare professionals

40. It is proposed that a focused, continuing professional education campaign be conceptualised and launched, targeting healthcare professionals. An outline of such an educational module is at Annexure 8. This is proposed to be done in tandem with a suitably structured patient and community focused campaign.

Suggestions to create awareness among general public, NGOs, community stake holders

41. A community based strategy is recommended to create awareness periodically. This is recommended to be steered by a special committee or cell that may be established by the Ministry of Health and Family Welfare, with the cooperation of the Indian Society of Haematology in coordination with the Indian Public Health Association.

42. The specific areas of focus of community focused campaigns may include but not be limited to the following:-

- (a) All about healthcare associated VTE including risk factors

- (b) All about Blood Clots and travel
- (c) All about blood clots and pregnancy
- (d) All about blood clots and cancers.

The intent would be to provide information as appropriate, with a regional flavour, and to promote healthcare seeking behaviour on a broader palette of behaviour change communication aimed at health literacy.

Areas of future research

43. In the current scenario to establish a thrombophilia testing setup in Indian population is difficult as there is a relative lack of well designed, population based studies that could associate genetic risk factors with disease prevalence. A large-scale population based genome wide association study is thus essential to identify the genetic associations with VTE. Details are further outlined at Annexure 11.

Documents referred by the Task Force

Technical documents from various professional societies such as the ASH, ACCP etc were perused. Apart from these, landmark peer reviewed articles over the past two decades where also reviewed.

Annexure 12 , 'Suggested further reading' includes some of the relevant articles / documents referred to by the TF.

Annexure 1

VTE Task Force Members

Task Force Members	Designation	Contact
Lt Gen (Dr) Velu Nair (Retd), PVSM, AVSM, VSM** Group Head- Medical Services & Chief Consultant – Haemato-Oncology & Bone Marrow Transplant, Apollo CBCC, Gandhinagar, Gujarat Former, DGMS Army & Dean AFMC, Pune	Chairperson	9818256670 nairvelu2000@yahoo.com
Col (Dr) MP Cariappa, (Retd) Public Health Advisor Delta Zulu Consultancy / Tata Trusts	Secretary	8551095077 mpcariappa@gmail.com
Dr. Pankaj Malhotra Professor & Head, Dept. of Clinical Haematology & Medical Oncology, PGIMER Chandigarh	Member	7087009680 malhotrapankaj@hotmail.com
Dr Manisha Madkaikar Director NIIH Mumbai	Member	9892472552 directorniih@gmail.com madkaikarmanisha@gmail.com
Dr Soniya Nityanand Director Dr RML Institute of Medical Sciences, Lucknow	Member	9415018833 soniya_nityanand@yahoo.co.in
Prof Mohammad Zahid Ashraf Professor Department of Biotechnology Jamia Millia Islamia	Member	9871426706 zashraf@jmi.ac.in
<u>Co-opted Members</u>		
Dr Bipin Kulkarni Asst Director NIIH Mumbai		kulkarni.bipin@gmail.com
Dr VA Arun, Dept. of Clinical Haematology & Medical Oncology, PGIMER Chandigarh		arunva5407@gmail.com

VTE PROPHYLAXIS: RECOMMENDATIONS

Medical patients			
Risk stratification	Score	Choice of prophylaxis	Remarks
IMPROVE VTE IMPROVE Bleeding Risk Score	IMPROVE VTE score <3	Nil	
	IMPROVE VTE score ≥3 & IMPROVE Bleeding risk score <7	LMWH UFH or Fondaparinaux	<u>If</u> • CrCl <30ml/min or • cost constraints <u>then,</u> UFH can be used as an alternative • LMWH preferred over DOAC
	IMPROVE VTE score ≥3 & IMPROVE Bleeding Risk score ≥7	Mechanical prophylaxis with graduated compression stockings or intermittent pneumatic compression	Switch to pharmacologic prophylaxis once the bleeding risks return to normal

Duration :

- For the period of hospitalization (UFH/LMWH) or
- Extended prophylaxis up to 40 days (Rivaroxaban)

Surgical patients			
Risk stratification	Score	Choice of VTE prophylaxis	Remarks
Caprini score	< 0 At very low risk for VTE	<ul style="list-style-type: none"> • Early ambulation recommended. • No specific pharmacologic or mechanical prophylaxis 	
	1-2 At low risk for VTE	<ul style="list-style-type: none"> • Mechanical prophylaxis, preferably with intermittent pneumatic compression 	
	3-4 At moderate risk for VTE	<ul style="list-style-type: none"> • LMWH / UFH or • intermittent pneumatic compression 	
	≥ 5 At high risk for VTE	<ul style="list-style-type: none"> • Combined prophylaxis 	
Duration		<ul style="list-style-type: none"> • Extended antithrombotic prophylaxis (6 weeks) preferred over short-term antithrombotic prophylaxis 	LMWH or UFH preferred
		<ul style="list-style-type: none"> • Early or delayed antithrombotic prophylaxis (> 12h) acceptable 	
In case of high bleeding risk		<ul style="list-style-type: none"> • Mechanical prophylaxis • IVC filters are not to be used 	

ORTHOPEDIC SURGICAL CASES			
Procedure	Duration	Options	Remarks
Total hip arthroplasty or TKA	Minimum of 10 to 14 days	Any one of LMWH Fondaparinux Apixaban, Dabigatran, Rivaroxaban, UFH Vit K antagonist Aspirin	Direct oral anticoagulants (DOACs) preferred over low-molecular weight heparin
Hip fracture repair		Any one of LMWH UFH Fondaparinaux Vit K antagonist Aspirin Intermittent pneumatic compression	
Arthroscopic knee surgery / Foot or ankle surgery / Upper limb surgery	6 to 12 hours after surgery for 14 days	LMWH	<ul style="list-style-type: none"> if total anaesthesia time is > 90 minutes person's risk of VTE outweighs their risk of bleeding Immobilisation is required post operative period

- Extended thromboprophylaxis is recommended in the outpatient period for up to 35 days from the day of surgery rather than for only 10 to 14 days.
- Dual prophylaxis may preferred over mono-prophylaxis.
- For asymptomatic patients following major orthopaedic surgery, doppler ultrasound screening before hospital discharge is not needed.

POLYTRAUMA	
Category	Recommendation
Major trauma and low to moderate risk for bleeding	LMWH or UFH
High bleeding risk	Do not use pharmacologic prophylaxis

ACUTE SPINAL CORD INJURIES	
Recommendation	Remarks
Mechanical prophylaxis And / Or pharmacological prophylaxis	Consider adding pharmacological VTE prophylaxis with LMWH 24 hours after initial admission if no surgery is planned in the next 24 to 48 hours, if the benefit of reducing the risk of VTE outweighs the risk of bleeding
	Continue VTE prophylaxis in people with spinal injury for 30 days or until the person is mobile or discharged, whichever is sooner

UROLOGIC SURGERY	
Category	Recommendation
Transurethral resection of the prostate	Do not use pharmacologic prophylaxis
Radical prostatectomy	Do not use pharmacologic prophylaxis
An extended node dissection and/or open radical prostatectomy	May consider LMWH / UFH
VTE risk factors	May consider LMWH / UFH

VASCULAR SURGERY	
Category	Recommendation
In routine surgeries	Do not use pharmacologic prophylaxis
Open vascular surgery or major endovascular procedures, including endovascular aneurysm repair, when risk of VTE outweighs risk of bleeding	Consider pharmacological VTE prophylaxis with LMWH for a minimum of 7 days

LAPAROSCOPIC SURGERY	
Category	Recommendation
In routine surgeries	Do not use pharmacological prophylaxis
If risk factors for VTE +	Consider prophylaxis

GYNECOLOGICAL SURGERY	
Category	Recommendations
Major surgery	LMWH or UFH

NEUROSURGERY	
Recommendation	Remarks
Mechanical prophylaxis in routine	
Post operative pharmacologic prophylaxis if prolonged immobilisation anticipated	Do not use pharmacological prophylaxis routinely

BARIATRIC SURGERY	
Recommendation	Remarks
LMWH or UFH or Intermittent pneumatic compression	Duration - for 10-15 days Dual prophylaxis if risk factors +, <ul style="list-style-type: none"> • age >55 y • BMI>55 • history of VTE • OSA • hypercoagulability • PAH

MALIGNANCY		
Category	Prophylaxis	Remarks
Hospitalised cancer patients	LMWH or UFH	till discharge
Cancer patients undergoing surgery	LMWH or Fondaparinaux or Mechanical prophylaxis (only if risk of bleed is high)	Post operative or pre op prophylaxis
Ambulatory patients (Risk stratification by Khorana score)	No VTE prophylaxis	If receiving chemotherapy and at low risk for thrombosis
	<u>If score ≥ 2</u> Rivaroxaban or Apixaban	Those who are receiving systemic anticancer therapy and are at intermediate-to-high risk of VTE
Multiple myeloma patients	ASA or fixed low-dose VKA or LMWH	receiving lenalidomide, thalidomide, or pomalidomide-based regimens
Outpatients with cancer and indwelling central venous catheters	no role of routine prophylaxis with LMWH or UFH or Vit K Antagonists	

LONG-DISTANCE TRAVELERS (travel time > 4hours)	
No risk factors for VTE	High VTE risk
	Recent surgery, h/o VTE, postpartum, active malignancy, hormone replacement therapy obesity, or pregnancy
No prophylaxis recommended	Graduated compression stockings or LMWH or Aspirin

PREGNANCY	
Category	Recommendation
Women undergoing assisted reproductive therapy	Routine prophylaxis Not recommended
If they develop severe ovarian hyperstimulation syndrome	Prophylactic antithrombotic therapy with Aspirin / LMWH recommended
Women who have a history of VTE	Postpartum anticoagulant prophylaxis recommended
Women with a history of VTE that was unprovoked or associated with a hormonal risk factor	Antepartum anticoagulant prophylaxis recommended

Pregnant women having	Family history of VTE		
	None	With family history	Regardless of family history
antithrombin deficiency		Postpartum prophylaxis	
antithrombin deficiency or are homozygous for prothrombin mutation	Antepartum prophylaxis to prevent a first VTE event Not recommended		
heterozygous for Factor V Leiden or prothrombin mutation		Postpartum prophylaxis Not recommended	
heterozygous for Factor V Leiden or prothrombin mutation / protein C or S deficiency			Antepartum prophylaxis to prevent a first VTE event Not recommended
heterozygous for the factor V Leiden mutation or prothrombin mutation or who have antithrombin, protein C, or protein S deficiency	Postpartum prophylaxis Not recommended		
protein C, or protein S deficiency,		Postpartum prophylaxis with LMWH x 6 weeks	
antithrombin deficiency, and for those who are homozygous for Factor V Leiden mutation or have combined thrombophilias		Antepartum prophylaxis	Antepartum prophylaxis
combined thrombophilias or are homozygous for Factor V Leiden mutation or prothrombin mutation			Postpartum prophylaxis with LMWH, or Vit K antagonists targeted at an INR of 2.0 to 3.0 for 6 weeks

Level of healthcare	Prophylaxis of VTE by HealthCare Workers					
	Patient / Family members	ASHA	ANM	Community Health Officer	Medical Officer	Specialist
Community Level	Follow treatment as prescribed	Advise patients to follow treatment as prescribed				
Health & Wellness Centre				Advise patients to follow treatment as prescribed		
Primary Health Centre					Advise patients to follow treatment as prescribed	
Community Health Centre						Prescribe treatment as per guidelines
District Hospital					Counsel on medication compliance	
Medical College Hospital						

VTE MANAGEMENT: RECOMMENDATIONS

Outpatient Treatment (Home based)		
in DVT	Uncomplicated DVT and PE at low risk for complications	Uncomplicated DVT <ul style="list-style-type: none"> - No co-morbid illness requiring admission - Low bleeding risk - No evidence of limb threatening DVT - No Phlegmasia caerulea dolens, or limb ischemia
in PE	HESTIA score 0	Low risk PE <ul style="list-style-type: none"> + No RV dysfunction + Normal cardiac biomarker

Choice of anticoagulant			
DOAC	VKA preferred	UFH	LMWH
	<ul style="list-style-type: none"> ➤ Moderate to severe liver disease ➤ eGFR < 30ml/min ➤ APLA ➤ Inhibitors or inducers of P-gp or ➤ Strong inhibitors or inducers of CYP3A4 ➤ Breast feeding mother ➤ Financial constraints 	<ul style="list-style-type: none"> ➤ e GFR < 15 ml/min; ➤ PE with hemodynamic instability 	<ul style="list-style-type: none"> ➤ <u>Bridge for</u> <ul style="list-style-type: none"> • VKA • Dabigatran • Edoxaban; Pregnancy; ➤ APLA ➤ Malignancy ➤ if DOAC cannot be used

Duration of anticoagulation		
Category	Primary phase	Secondary Phase
VTE provoked by transient risk factors	3 months	
VTE provoked by chronic (persistent) risk factors	3 months	Indefinite anticoagulation with periodic assessment (annual) for risk factors of bleeding and risk factor for VTE
Unprovoked VTE	3 months	Indefinite anticoagulation with periodic assessment for risk factors of bleeding
HAS-BLED score ≥ 4		Avoid indefinite anticoagulation

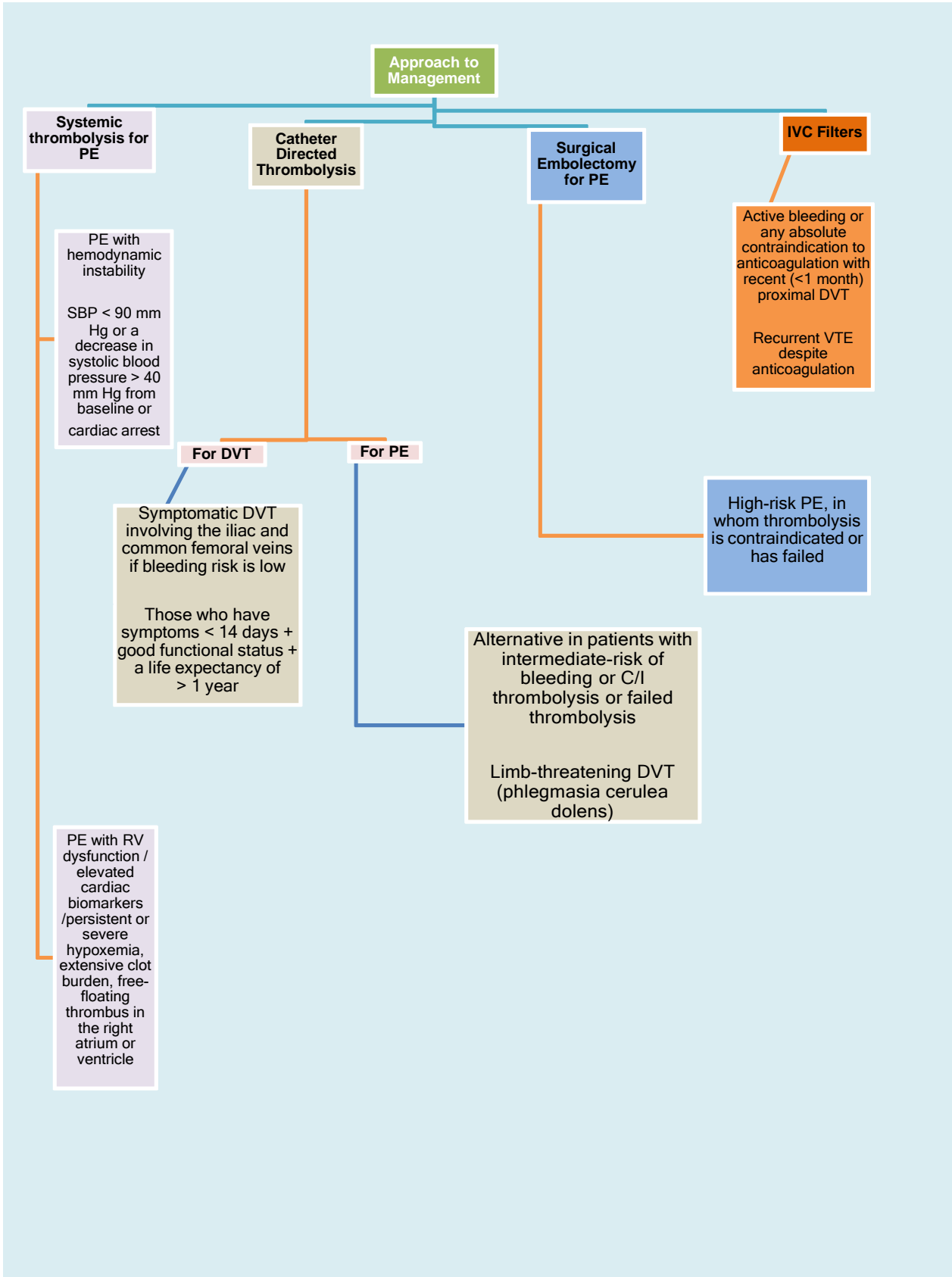
Remarks

- **Secondary treatment phase**

Vit K Antagonist @ INR 2-3 (A)

Low dose DOAC (Apixaban/Rivaroxaban) are as good as standard dose DOAC

- Aspirin 75 mg or 150 mg daily in people who decline extended anticoagulation treatment or patients with an unprovoked proximal DVT or PE who are stopping anticoagulant therapy
- Routine use of prognostic scores HERDOO2, Vienna and DASH scores, D Dimer testing, or ultrasound to detect residual vein thrombosis no longer recommended in unprovoked VTE



PREGNANCY	
Drug of choice	LMWH over UFH
As soon as the patient is in labour, heparin should be stopped immediately	
↓	
Spinal/epidural anaesthesia or analgesia should be used 12 hours after prophylactic and 24 hours after therapeutic LMWH while these techniques can be used 6 hours after stopping conventional heparin	
↓	
Heparins should be restarted at least 4-6 hours after removal of an epidural catheter	
↓	
At discharge, the patient may be transitioned to VKAs which are safe during breastfeeding	
↓	
Anticoagulant treatment should be continued until 6 weeks after delivery and at least for 3 months	

MALIGNANCY	
DOAC preferred	Apixaban Rivaroxaban Edoxaban
if DOAC cannot be used	LMWH
Alternative if patient does not accept injectable therapy	Vitamin K Antagonist
Duration	At least 6 months; Reassess the risk of recurrent VTE and bleeding before deciding on continued anticoagulation

CEREBRAL VENOUS THROMBOSIS		
Initial phase	Primary & Secondary phase	Duration
LMWH or UFH	Warfarin or DOAC	3 months if transient risk factors
		At least 6 months if unprovoked
		Indefinite if persistent hypercoagulability identified

SPLANCHNIC VEIN THROMBOSIS	
Acute SVT	Incidental chronic SVT
<ul style="list-style-type: none"> ➤ DOACs should be considered in noncirrhotic patients ➤ DOACs are contraindicated in Child-Pugh class C liver disease and for rivaroxaban in class B and C liver disease. ➤ LMWH or VKAs if contraindications to DOACs. ➤ Indefinite anticoagulation : unprovoked or persistent risk factors ➤ Prophylactic banding should be instituted in cirrhotic patients to decrease variceal bleeding 	<p>Anticoagulation if malignancy or extensive SVT</p>

APLA (Anti Phospholipid Antibody syndrome)	
<p>Triple positive APLA or</p> <p>Arterial thrombosis + thrombotic APS patients with small vessel thrombosis or</p> <p>aPL-related cardiac valvular disease</p>	<p>Vit K Antagonists preferred over DOAC</p> <p>Indefinite anticoagulation</p>

SUPERFICIAL VEIN THROMBOSIS	
Anticoagulation if <ul style="list-style-type: none"> ➤ SfVT > 5 cm ➤ proximity to SFJ ➤ other risk factors for VTE <ul style="list-style-type: none"> - male sex, - >65 yrs - cancer - systemic inflammation - previous VTE - no contraindications to anticoagulation 	Options : <p>Fondaparinux 2.5 mg SC OD x 45d</p> <p>Rivaroxaban 10 mg OD or Enoxaparin 40mg OD x 30 days</p>

ISOLATED DISTAL DVT	
Serial imaging of the deep veins for 2 weeks over anticoagulation	If severe symptoms or risk factors for extension are absent <ul style="list-style-type: none"> - Elevated D-dimer - Thrombosis is extensive (eg, >5 cm in length, multiple veins, >7 mm in maximum diameter) - Thrombosis is close to the proximal veins - No reversible provoking factor for DVT - Active cancer - History of VTE - Inpatient status

ISOLATED SUBSEGMENTAL PULMONARY EMBOLISM	
Clinical surveillance if low risk for recurrent VTE	Anticoagulation if high risk for recurrent VTE due to following risk factors <ul style="list-style-type: none"> - Inpatient status - Reduced mobility - Active cancer - No reversible risk factor for VTE - Pregnancy

Management of HIT	
4T score >4	4T score 4-5
pretest probability of HIT is intermediate / high	pretest probability intermediate
↓	↓
Discontinue heparin	Anticoagulation for patients with suspected HIT + Prophylactic dose if bleeding risk is high
↓	↓
Switch to alternate anticoagulant <ul style="list-style-type: none"> ➤ Argatroban/ Bivalirudin/ Danaparoid ➤ Fondaparinux ➤ DOAC 	No Vit K Antagonists No prophylactic platelet transfusion

Choice of anticoagulant in HIT	
Critical Illness, High bleeding risk or Potential need for urgent procedure	Argatroban / Bivalirudin
Clinically stable	Fondaparinux / DOAC
Life or limb threatening thrombosis	Argatroban / Bivalirudin/ Danaparoid Fondaparinux
Child-Pugh Class B and C	Avoid DOAC or Argatroban
↓	
Transition to DOAC when patient is clinically stable	
↓	
Start DOAC <ul style="list-style-type: none"> ▪ within 2 hours of stopping argatroban or bivalirudin infusion, ▪ within 8-12 hours after stopping Danaparoid infusion, ▪ 24 hours after last dose of fondaparinux VKA s if platelet count > 1.5L/ul : Overlap parenteral agent with warfarin for ≥ 5 days and until INR : 2 - 3 	

Duration of anticoagulation	3 months or till platelet recovery if no DVT
POST THROMBOTIC SYNDROME (PTS)	
Prophylaxis	Optimal anticoagulation is key for PTS prevention
	No role in use of compression stockings in acute DVT as prophylaxis against PTS
Catheter directed thrombolysis	<ul style="list-style-type: none"> ▪ for DVT involving the iliac and common femoral veins if bleeding risk is low ▪ Those who have symptoms < 14 days, ▪ good functional status, ▪ a life expectancy of > 1 year
Management	<u>All cases</u> <ul style="list-style-type: none"> ▪ Elastic compression stockings, ▪ leg elevation, ▪ weight loss, ▪ exercise
	Pentoxifylline may be used for treating venous ulcers on its own or with compression stockings
	<u>Moderate-to-severe PTS</u> Endovascular recanalization or surgical bypass or disobliteration may be considered in patients with chronic venous occlusion class CEAP 4-6
	<u>Severely symptomatic patients with PTS</u> segmental vein valve transfer or venous transposition may be considered

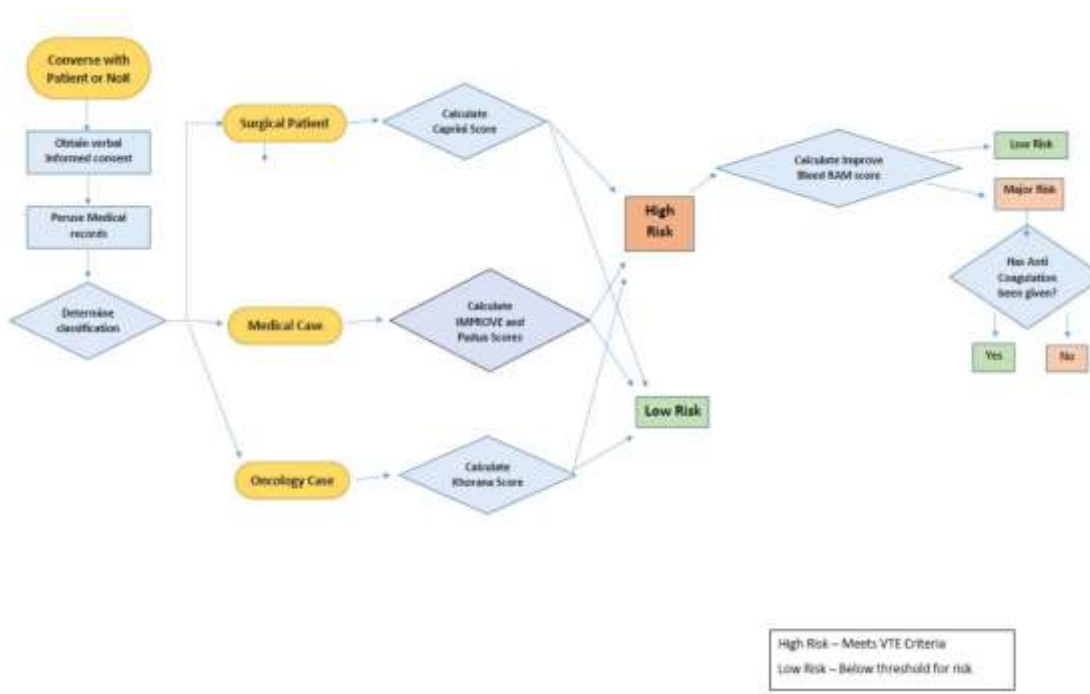
Level of healthcare	Management of VTE by HealthCare Worker					
	Patient / Family members	ASHA	ANM	Community Health Officer	Medical Officer	Specialist
Community Level	Follow treatment as prescribed	Advise patients to follow treatment as prescribed				
Health & Wellness Centre				Advise patients to follow treatment as prescribed		
Primary Health Centre					Advise patients to follow treatment as prescribed Counsel on medication compliance	
Community Health Centre						Advise patients to follow treatment as prescribed
District Hospital						
Medical College Hospital						

SCORING SYSTEMS

Scoring System	Population At Risk	# Of Inputs/ Variables	Outputs And Risk Categories	Lowest Risk Category	Highest Risk Category	Comments
Caprini	Surgical Patients	>30	Risk of VTE at 3 months	Lowest risk <0.7% (0 points)	Highest risk 10.7% (≥9 points)	No formal validation with original study. External validation studies in surgical subpopulations .
Padua Prediction Score	Medical Inpatients	11	Risk of VTE at 3 months	Lowest Risk 1.1% (<4 points)	Highest risk 3.5% (≥4 points)	Internal validation showing 32-fold variation in VTE risk across 11 studies An external validation in patients with sepsis did not find correlation with VTE risk
IMPROVE Score	Medical Inpatients	7	Risk of VTE at 3 months	Lowest Risk 0.4% (0 points)	Highest risk 5.7% (≥4 points)	Validation includes 1 retrospective, 1 case control, and 1 prospective multicentre study*
Khorana Score	Ambulatory Cancer patients	5	Risk of VTE at 2.5 months	Lowest Risk 0.8% (0 points)	Highest risk 7.1% (≥3 points)	Internal development and validation cohort included in original study Multiple prospective and retrospective validation studies

*AUC 0.69-8.77 for predicting VTE
Negative predictive value 98.5%, Positive predictive value 6.7%, C-static =0.7

Decision Aid for using various Scores to determine risk of patient for VTE and requirement to initiate prophylaxis



PADUA score	
VTE risk factor	Points
Decreased mobility	3
Thrombophilia	3
Previous trauma or surgery within the last month	2
Age \geq 70	1
Heart or respiratory failure	1
Ischemic stroke or acute myocardial Infarction	1
Acute rheumatologic disorder and/or acute infection	1
Obesity	1
Hormonal therapy	1

score <4	Low risk	confers a < 0.3% 90-day risk of symptomatic VTE in patients who do not receive anticoagulation during hospitalization
score \geq4	High risk	confers an 11% risk of symptomatic VTE

IMPROVE VTE score	
VTE Risk Factor	VTE Risk Score
Previous VTE	3
Known thrombophilia	2
Current lower limb paralysis or paresis	2
History of cancer	2
ICU/CCU stay	1
Complete immobilization \geq 1 day	1
Age \geq 60 years	1

IMPROVE: International Medical Prevention Registry on Venous Thromboembolism
 CCU / ICU: Cardiac/ Intensive Care Unit

score <3	Low risk	confers a <1.5% VTE risk
score \geq3	High risk	confers an >4% risk of symptomatic VTE

4T Score			
Category	2 points	1 points	0 points
Thrombocytopenia	> 50% fall, or nadir $\geq 20 \times 10^9/L$	30-50% fall, or nadir $10-19 \times 10^9/L$	< 30% fall, or nadir $< 10 \times 10^9/L$
Timing of the decrease in platelet count	Days 5 to 10, or \leq day 1 with recent heparin (past 30 days)	> Day 10 or timing unclear, or <day 1 if heparin exposure within past 30-100 days	<Day 4 (no recent heparin)
Thrombosis or other sequelae	Proven thrombosis, skin necrosis, or acute systemic reaction after heparin bolus	Progressive, recurrent, or silent thrombosis; erythematous skin lesions	None
Other causes of thrombocytopenia	None evident	Possible	Definite

Score	Probability	risk of HIT
0 -3	Low	<1 %
4-5	Intermediate	~10 %
6-8	High	~50%

IMPROVE BLEED RAM	
Risk Factors	Point
Moderate renal failure (CrCl 30-50 ml/min.)	1
Male Sex	1
Age 40 - 84 years	1.5
Active Cancer	2
Rheumatic disease	2
Central venous catheters	2
Admissions in Intensive Care	2.5
Severe Renal Failure (CrCl < 30 ml/min.)	2.5
Liver insufficiency (INR > 1.5)	2.5
Age ≥ 85	3.5
Thrombocytopenia (<50x10 ⁹ cell/L)	4
Recent (3 months) bleeding	4
Active gastro-intestinal ulcer	4
High bleeding risk when total score ≥7	4

Score	Risk	Implication
<7	Low	have a major bleed risk of approx 0.4%
≥7	High	have a major bleed risk of 4.1%

Caprini score			
5 points	3 points	2 points	1 point
<ul style="list-style-type: none"> • Stroke (in the previous month) • Fracture of the hip, pelvis or leg • Elective arthroplasty • Acute Spinal cord injury (in the previous month) 	<ul style="list-style-type: none"> • Age 75 years • Prior episodes of VTE • Positive family history for VTE • Prothrombin 20.210A • Factor V Leiden • Lupus anticoagulants • Anticardiolipin antibodies • High homocysteine • Heparin induced thrombocytopenia • Other congenital or acquired thrombophilia 	<ul style="list-style-type: none"> • Age 61-74 years • Arthroscopic surgery • Laparoscopy lasting >45 min • General surgery lasting > 45min • Cancer • Plaster cast • Bed bound for >72h • Central venous access 	<ul style="list-style-type: none"> • Age 41-60 years • BMI >25 kg/m² • Minor surgery • Edema in the lower extremities • Varicose veins • Pregnancy • Postpartum • Oral contraceptive • Hormonal therapy • Unexplained or recurrent abortion • Sepsis (in the previous month) • Serious lung disease such as pneumonia (in the previous month) • Abnormal pulmonary function test • Acute myocardial infarction • Congestive heart failure (in the previous month) • Bed rest • Inflammatory bowel disease

BMI: Body mass index

Score <2	Low risk
Score 3-4	Moderate risk
Score ≥5	High risk

Khorana Score	
Patients' characteristics	Risk score
<i>Site of cancer</i>	
• Very high risk (stomach, pancreas)	2
• High risk (lung, lymphoma, gynaecological, bladder, or testicular)	1
Prechemotherapy platelet count $\geq 350 \times 10^9/L$	1
Prechemotherapy haemoglobin level $< 100 \text{ g/L}$ or use of red cell growth factors	1
Prechemotherapy leukocyte count $> 11 \times 10^9/L$	1
Body Mass Index $\geq 35 \text{ kg/m}^2$	1

Score 0	Low risk
Score 1-2	Intermediate risk
Score >2	High risk

HESTIA Criteria
If any of the below are answered "Yes," the patient should NOT be treated as an outpatient.
1. Hemodynamically unstable?
2. Thrombolysis or embolectomy necessary?
3. Active bleeding or high risk of bleeding?
4. Oxygen supply to maintain oxygen $> 90\%$ > 24 hours?
5. Pulmonary embolism diagnosed during anticoagulant treatment?
6. In severe pain needing IV pain medication > 24 hr (or multiple doses in the ED)?
7. Medical or social reason for treatment in hospital > 24 hr?
8. Creatinine clearance less than 30 mL/min ?
9. Severe liver impairment or disease?
10. Pregnant?
11. Documented history of heparin induced thrombocytopenia?

HAS-BLED Score	
Risk factor	Score
Hypertension	1
Abnormal renal/liver function	1 or 2
Stroke	1
Bleeding tendency	1
Labile INR	1
Age (eg. >65)	1
Drugs (eg. concomitant aspirin, NSAIDs, etc) or alcohol	1 or 2
Maximum score	9
Notes: <i>Hypertension is defined as a systolic blood pressure > 160 mmHg.</i> <i>1 point is awarded for each of abnormal renal or liver function, and drugs or alcohol.</i>	

Score	Risk of Bleeding
0-2	Low risk
Score ≥	High risk

Diagnosis of VTE

1. Ineffectively managed lower extremity DVT has risks associated with it, (eg, pulmonary emboli) as also the inherent risks of anticoagulation (eg, resultant major or life-threatening bleeding), hence, the accurate diagnosis of VTE is essential. Features of lower extremity DVT are usually nonspecific and many patients are asymptomatic.

2. **History:** DVT should be suspected in patients who present with leg swelling, pain, warmth, and erythema. information that should be sought from patients and informants include:-

- (a) History of immobilization or (prolonged) hospitalization
- (b) Recent surgery or trauma (typically within 12 weeks of surgery or trauma)
- (c) Obesity
- (d) Previous VTE
- (e) Malignancy or symptoms suggestive of malignancy
- (f) Use of oral contraceptives or hormone replacement therapy
- (g) Pregnancy or postpartum status
- (h) Stroke with hemiplegia or immobility
- (i) Age >65 years
- (j) Family history of VTE
- (k) Heart failure
- (l) Inflammatory bowel disease

3. **Physical examination** — A thorough physical examination of the legs, abdomen, and pelvis should be performed in patients with suspected DVT to look for the following, by the 'Look - Touch - Measure' technique :-

- (a) Dilated superficial veins
- (b) Unilateral oedema or swelling with a difference in calf or thigh diameters
- (c) Unilateral warmth, tenderness, erythema
- (d) Pain and tenderness along the course of the involved major veins
- (e) Local or general signs of malignancy.

Note :- Initial diameters should be recorded at presentation, to maintain a baseline. A larger calf diameter is the most useful finding at presentation. Subsequent measurements are not of much significance, with pain and tenderness being a more

reliable indicator. Homans' sign (calf pain on passive dorsiflexion of the foot) is unreliable for the presence of DVT.

4. **Laboratory** Routine laboratory tests (eg, complete blood count, routine biochemistry tests, liver function tests, coagulation studies) are not useful diagnostically, but may provide clues as to the underlying cause and may influence treatment decisions if DVT is confirmed.

5. Young patients (<40 years) with an episode of unprovoked VTE in unusual sites (cerebral venous sinuses and splanchnic circulation) and those with history of VTE in the family or recurrent VTE will warrant a screen for inherited thrombophilia. The duration of anti-coagulation varies from long-term in recurrent VTE to short-term (3 months) in the presence of reversible risk factors like surgery. All non-genetic tests for thrombophilia (PC, PS, AT, APC-R) should be done after withdrawal of anti-coagulation for a period of 4 weeks. However, genetic tests such as FVL, Prothrombin gene mutation and MTHFR gene mutations can be tested during anti-coagulation.

6. In the Indian population most of the studies have been limited to certain variants only. Many Indian studies have reported the role of MTHFR polymorphisms in VTE risk, however a recently published report suggests MTHFR polymorphisms should not be a part of inherited thrombophilia testing and eliminating MTHFR from thrombophilia testing will reduce patient concerns and decrease health care costs.

Suspected first DVT (risk stratification)

7. An approach that incorporates clinical assessment of the pretest probability (PTP) and D-dimer testing in selected patients, is recommended. This approach allows for the strategic use of ultrasonography for diagnosis or alternative imaging modalities such as CT or MRI. The goal of diagnostic testing is to "rule-in" (>85% post-test probability of DVT) or "rule out" DVT (<2 % post-test probability of VTE in the next three months) with an acceptable level of certainty, thereby justifying instituting or withholding anticoagulant therapy, respectively.

8. **Assessment of clinical pretest probability (PTP)** In patients with suspected first DVT, we recommend estimation of the clinical PTP. Subsequent measurement of the D-dimer level and compression ultrasonography are dependent upon the assigned PTP of DVT. We may use the Wells score for the purpose of estimating PTP. Some experts due to reproducibility prefer the revised Geneva system as it also overcomes the inter-observer variability.

Wells Score

Clinical feature	Score
Active cancer (treatment ongoing or within previous 6 months or palliative care)	1
Paralysis, paresis, or recent plaster immobilization of the lower extremities	1
Recently bedridden for >3 days or major surgery, within 4 weeks	1
Localized tenderness along the distribution of deep venous system	1
Entire leg swollen	1
Calf swelling by more than 3 cm when compared to the asymptomatic leg (measured below tibial tuberosity)	1
Pitting oedema (greater in the symptomatic leg)	1
Collateral superficial veins (non-varicose)	1
Alternative diagnosis as likely or more likely than that of DVT	-2

Score	Classification
3-8	High Probability
1- 2	Moderate Probability
≤ 0	Low Probability

Revised Geneva Score	
Items	Points
Previous PE or DVT	1
Heart Rate	
• 75-94 BPM	1
• ≥ 95 BPM	2
Previous Surgery or Fracture	1
Hemoptysis	1
Active Cancer	1
Unilateral Leg Pain	1
Pain on lower limb palpation and unilateral edema	1
Age >65 Years	1

3 point Score	Clinical Probability
≥ 5	High
2-4	Intermediate
0-1	Low

2 point Score	Clinical Probability
≥ 3	PE Likely
0-2	PE Unlikely

9. In patients with suspected first DVT, it is recommended that based on the clinical Pre Test Probability (PTP), that further action be taken:-

- (a) **Low probability** – In patients with a **low** PTP for DVT, we recommend that D-dimer levels be obtained. Patients in whom the D-dimer level is normal (eg, <500 ng/mL) do **not** need further testing, while those in whom the D-dimer is positive (eg, ≥500 ng/mL) should have US of the lower extremities. Patients can proceed directly to US if the D-dimer is expected to be positive due to another condition. DVT is diagnosed if US is positive; no further testing is required if US is negative.
- (b) **Moderate probability** – In patients with **moderate** PTP for DVT, we recommend that D-dimer levels be obtained. Patients in whom the D-dimer level is normal do **not** need further testing, while those in whom the D-dimer is positive should have US of the lower extremities. Patients can proceed directly to ultrasonography if the D-dimer is expected to be positive due to another condition. DVT is diagnosed if US is positive. When neither proximal nor distal DVT is identified on whole leg US, no further testing is required; in contrast, in those in whom proximal US is negative, repeat proximal US should be performed at one week to detect extension of distal DVT into the proximal veins.
- (c) **High probability** – For patients with a **high** PTP for DVT, we suggest that US be performed. DVT is diagnosed if US is positive. If DVT is not identified, options include high sensitivity D-dimer level measurement (if not expected to be positive due to another condition), repeat proximal CUS at one week (off anticoagulation), whole leg US (if not already performed), or iliac vein US (when iliac vein DVT is suspected). Choosing among these options should be individualized. In general, if one or more of these tests are negative in a patient without proximal DVT on ultrasound, then no further testing is required.

D-dimer

10. D-Dimer is a degradation product of cross-linked fibrin and is elevated in nearly all patients with acute DVT. However, it is nonspecific since elevated levels are found in many other conditions (eg, malignancy, sepsis, recent surgery or trauma, pregnancy, renal failure), i.e, D-dimer has high sensitivity but poor specificity for VTE. Hence a negative result (eg, <500 ng/mL) is useful for ruling out DVT, particularly in

those with a low or moderate pre-test probability (PTP) for thrombosis; however, a negative test is obtained in about 30 percent of outpatients (lower in inpatients or if there has been a previous VTE). A positive result (eg, ≥ 500 ng/mL) is not diagnostic and indicates the need for further investigation. D-dimer testing is of limited value in patients with high PTP since the negative predictive value is lower in this population. In summary, D-dimer assay should not be used as a stand-alone test in patients suspected of having DVT, but rather should be used in conjunction with clinical PTP and/or ultrasonography.

Imaging

11. CUS with Doppler is the diagnostic test of choice in patients with suspected DVT. In general, the sensitivity and specificity of proximal CUS is greater than 95 percent. Duplex US has less accuracy than CUS, since specificity of an abnormal duplex ultrasonogram is lower than that of an abnormal compression ultrasonogram. Point-of-care-ultrasonography is not recommended for diagnosis unless the situation is urgent or emergent.

12. **Ultrasonography interpretation** – Interpretation of CUS in patients with a first suspected DVT :-

(a) **Positive** –

- (i) Using ultrasound probe pressure, the presence of thrombus is diagnosed by demonstrating non-compressibility of the imaged vein. Veins that can be assessed for compressibility are the proximal (eg, the common femoral, femoral, and popliteal veins) and distal veins (eg, peroneal, posterior and anterior tibial, and muscular veins); iliac veins often cannot be assessed for compressibility
- (ii) Lack of compressibility of a vein with the ultrasound probe is the most sensitive (>95 percent) and specific (>95 percent) sonographic sign for **proximal** vein thrombosis.
- (iii) The addition of colour flow Doppler does not improve the sensitivity, but can provide supportive evidence of thrombus and also help to identify calf veins.
- (iv) Variation of venous size with the Valsalva manoeuvre has a low sensitivity and specificity for the diagnosis.

- (v) In contrast, CUS is less sensitive for the detection of calf vein and iliac vein thrombus since these veins are less readily compressed (particularly calf veins).
- (b) **Negative** — A negative study is one that demonstrates full compressibility of all imaged veins.
- (c) **Non-diagnostic** — A nondiagnostic study is one where there is uncertainty about whether DVT is present or absent.
 - (i) Nondiagnostic findings are less common in outpatients compared with inpatients, with less than 5% of outpatients expected to have nondiagnostic findings of the proximal veins.
 - (ii) Nondiagnostic findings are also less common when imaging the proximal veins compared with the distal veins (ie, with whole leg US); however, nondiagnostic findings that are confined to the distal veins are also less important and can usually be managed by withholding anticoagulant therapy while doing serial ultrasound testing.
 - (iii) The main reasons for a nondiagnostic examination are
 - (aa) difficulty visualizing the deep veins because of morbid obesity, oedema, recent surgery or trauma, skin lesions, contractures, or leg casts.
 - (ab) although the deep veins are well visualized, small or atypical appearing abnormalities of uncertain significance may be identified.
 - (ac) in patients with previous DVT, when thrombus is present, it is often difficult to assess if it is acute or old (residual thrombosis can persist indefinitely).

13. Further investigation(s) (eg, repeat proximal CUS at three and seven days) in those with nondiagnostic studies should be individualized and depend upon why the US is considered nondiagnostic, the extent and position of the venous segment (eg, distal or proximal veins) that is nondiagnostic, clinical PTP, results of D-dimer testing and the clinician's overall assessment of the risk associated with undiagnosed DVT.

14. **Imaging at first occurrence**

For patients who are not initially stratified according to clinical pretest probability (PTP) of low, moderate, or high risk the initial test of choice is ultrasonography (US).

- (a) When whole leg US is negative no further investigations are necessary unless iliac vein thrombosis is suspected.
- (b) When the proximal compression ultrasonography (CUS) is negative, options include whole leg US (to detect distal DVT), repeat proximal CUS at three to seven days (to detect extension of distal DVT into the proximal veins), measuring a high-sensitivity D-dimer level, or assessing clinical PTP (low PTP excludes DVT with a negative proximal CUS).

15. Diagnostic compressive ultrasonography

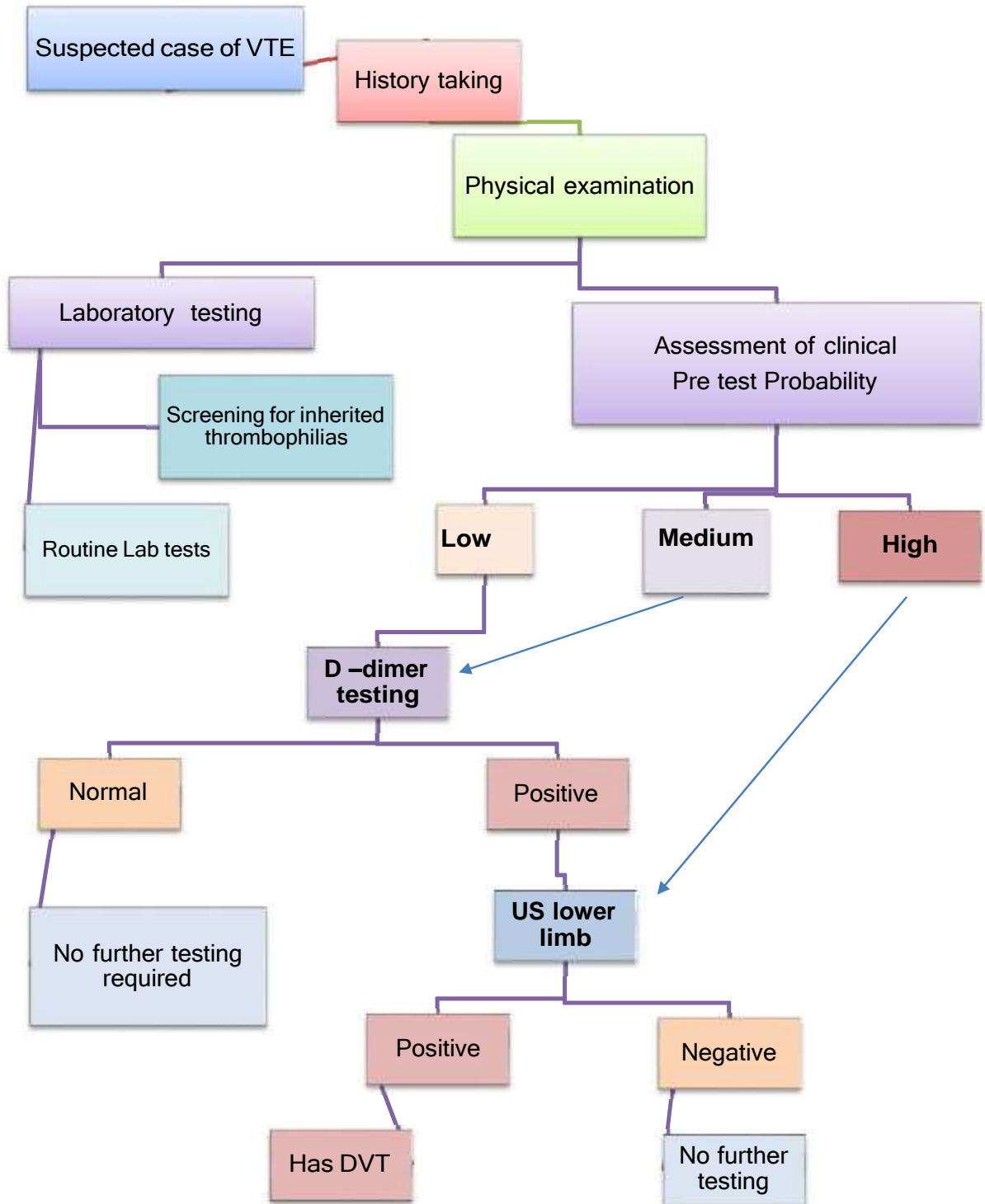
- (a) Proximal CUS - In most patients with suspected DVT, CUS with Doppler is the imaging test of choice. The presence of DVT is diagnosed by demonstrating non-compressibility of the imaged vein.
- (b) Whole leg CUS – Both proximal and whole leg ultrasonography have a high sensitivity for the detection of thrombus in the proximal veins (ie, common femoral, femoral and popliteal veins). Whole leg ultrasonography additionally examines the veins in the calf (peroneal, posterior and anterior tibial, and muscular veins) and can therefore detect isolated distal DVT.

16. Imaging in Recurrence

For most patients with suspected ipsilateral DVT recurrence, proceeding directly to US (proximal or whole leg ultrasonography) or using an approach similar to that described for first suspected DVT is appropriate. When an ultrasonographic abnormality is identified in patients with suspected recurrence, it may be difficult for the clinician to determine whether it is due to old or new thrombus. Availability of a previous ultrasound report that documents the extent of residual thrombosis greatly improves the accuracy of ultrasound for recurrent DVT. In absence of a previous ultrasound report, magnetic resonance direct thrombus imaging (MRDTI) may be useful.

15. **Alternative imaging modalities** – For patients with suspected DVT, contrast-enhanced computed tomographic venography (CTV) and magnetic resonance venography (MRV) are rarely used diagnostically, unless there is uncertainty about iliac vein or IVC thrombosis after ultrasonography. Ascending contrast venography, which was the earlier gold standard for DVT diagnosis, and impedance plethysmography are now not recommended to be used.

Clinical Decision Aid – Diagnostic workup of a suspected case of VTE



MOLECULAR ASPECTS AND GENETIC BACKDROP OF VTE

Ordering thrombophilia tests is easy; determining whom to test and how to use the results is not (Connors 2017).

To understand the Indian perspective of genetic risk factors in VTE a literature review was undertaken to identify the genetic variants that have been reported in association with VTE.

Indian data depicts that the established thrombophilia genetic markers FV Leiden, Prothrombin G20210A have a limited role from the Indian subcontinental perspective. Several studies have shown a role of FV Leiden in VTE risk however only with certain co-morbidities in Indian population. To understand this limited role, we reviewed the literature from other Asian countries also. The data shows no role of established genetic markers in Chinese and Thai population as well. The prevalence of FV Leiden phenotype shown by Ridker et al, is 0.4% in an Asian population.

In the Indian population most of the hospital based studies have been limited to certain variants only. Many studies have reported the role of MTHFR polymorphisms in VTE risk, however a recently published report suggests MTHFR polymorphisms should not be a part of inherited thrombophilia testing and eliminating MTHFR from thrombophilia testing will reduce patient concerns and health care costs.

VTE variants studied and reported in India

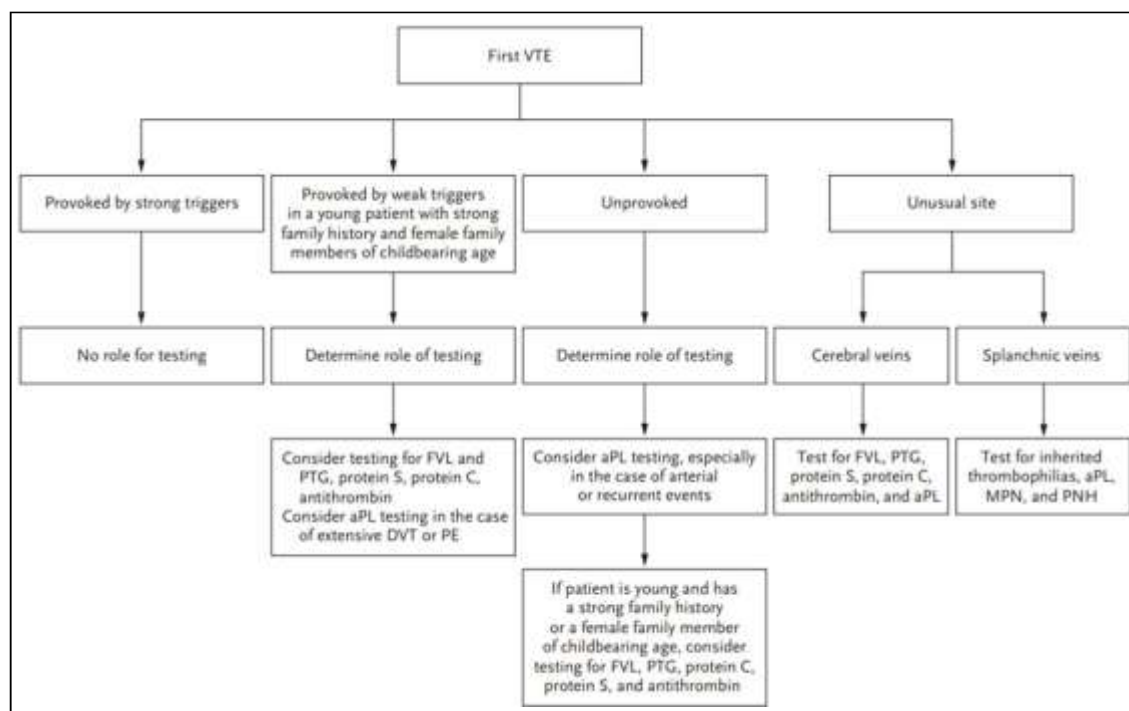
Variant	Association	Sample Size	Author & Journal
Factor V Leiden G1691A mutation and prothrombin G20210A	Significantly associated in Kashmiri population	250 patients 250 controls	Shafia et al., Gene (2018)
MTHFR C677T polymorphism	No significant association in Kashmiri population		
EDN T1370G (endothelin gene)	Significant association with VTE occurrence	133 patients with VTE 164 controls	Kumari et al., Clinical and Applied Thrombosis/Hemostasis (2017)
CYP4F2 1347 G>A polymorphism	Significant association with PVT (portal vein thrombosis)	91 PVT cases 136 controls	Kalpna et al., Medicine (2019)

Variant	Association	Sample Size	Author & Journal
JAK2V617F mutation	May increase the risk of thrombosis in patients with Philadelphia negative chronic myeloproliferative neoplasms.	65 (46 males and 19 females) CMPN cases	Singh et al., Indian J Pathol Microbiol (2018)
FV Leiden	Inherited APCR in patients with DVT – significant association	50 APCR + patients 50 controls	Sharma et al., Clinical and Applied Thrombosis/ Hemostasis (2017)
Factor V leiden (FVL) mutation and PAI 4G/4G homozygosity	Increase DVT risk in pregnant women in Western India	Prevalence of DVT in 34720 prenatal women	Vora et al. Thrombosis (2007)
Factor V Leiden	Significant Association with Myocardial Infarction Patients	120 patients of MI (age < 40) 100 controls	Khare et al., Indian Journal Of Medical Sciences (2004)
MTHFR 677TT polymorphism	Increased risk of thrombosis in patients with hyperhomocysteinemia	124 patients with DVT	Paradkar et al., Indian Journal of Clinical Biochemistry (2020)
MTHFR 677C/T	Contribute towards susceptibility to thrombosis	93 male patients 102 controls	Kumari et al., Thrombosis (2014)
PAI-1 –844G/A, fibrinogen- β –455G/A	Protective role		
FVL (1691G/A), pro-thrombin (20210G/A), and TFPI (-536C/T)	Limited role in Indian population		
eNOS894G/T and 2479G/A polymorphisms	Possess the risk of VTE	100 cases of DVT 200 controls	Akhteret al., Clinical Laboratory (2022)
MTHFR C677T and prothrombin G20210A mutation	No significant association in west Indian population	Cases of DVT 252 males 180 females	Ghosh et al., Clinical and Applied Thrombosis/Hemostasis (2001),

Variant	Association	Sample Size	Author & Journal
Variant allele 4G of PAI-1 4G/5G polymorphism	Significantly associated with ischemic stroke in young Indians	100 cases 100 controls	Akhter et al., Clinical and Applied Thrombosis/Hemostasis (2017)
TFPI polymorphisms (polymorphisms (33T > C, 399C > T and 536C > T))	33T > C protective and 399C > T as an risk factor	100 DVT patients 100 controls	Kamal et al., Blood Cells, Molecules, and Diseases (2017)
CYP2C9 polymorphisms (rs1799853, rs1057910, rs1057909, and rs28371686), VKORC1 promoter polymorphism (rs9923231)	CYP2C9 and VKORC1 polymorphisms, suggested that an increase in the anti-coagulant drug dose may be necessary for Indian patients	124 patients with DVT.	Arunkumar et al., Drug Discoveries & Therapeutics (2017)

Algorithm for Selecting Patients with a First VTE episode for Thrombophilia Testing.

(Source: N Engl J Med 2017;377:1177-87)



We also reviewed the literature regarding European and American populations and a recently published trans-ancestry meta-analysis and also another independent study which tested approximately 13 million DNA sequence variants for association with VTE and reported the variants associated with VTE. A similar approach could be replicated in the Indian population and validation of these variants in the context of different regional /ethnic population groups could be considered to identify a set of variants uniquely associated with Indian population (if at all).

Hence, a large-scale population based genome wide association study is recommended amongst the Indian population with representation from different regional and ethnic groups, to identify the genetic associations with VTE.

Public Health Response to Reducing DVT and PE

1. DVT and PE are major public health problems across the world today. It is essential for policy makers to direct public health responses to reducing the burden of VTE, in various settings. The required set of actions are ideally organized by the CARE framework to be customized to the requirement and context on a regional basis:-

- (a) *Communication* refers to the provision of information to motivate and empower individuals and health care professionals in various settings to catalyse change that will lead to more effective prevention, diagnosis, and treatment of first-time and recurrent DVT/PE.
- (b) *Action* refers to interventions and activities that will assist various stakeholders in preventing, screening, diagnosing, and managing medical conditions or diseases more effectively.
- (c) *Research* into the various aspects of VTE that may require to be addressed or investigated further.
- (d) *Evaluation* refers to ongoing assessment of the various activities and interventions for VTE to ascertain their practicality, feasibility, cost benefit etc.

Note : The US Surgeon General's 'call to action to prevent DVT and PE' (2008) provides an excellent framework which can be suitably adapted to the Indian context.

Setting: Communities

2. The community which comprises of individuals and their families need to understand DVT and PE as threats to their health and life, they need to understand the risk factors for these conditions, and to learn how to reduce these risks. They need to recognize the signs and symptoms and to know about available medical management modalities. Patients and their family members should actively discuss these conditions when interacting with their healthcare providers. The goal is to raise awareness among patients and their family members and empower them to ask their healthcare providers about preventive treatment during hospitalization, after a traumatic event, or in other high-risk situations.

3. A broad-based health risk communication campaign can play a major role in raising awareness at the community level. From a public education and social marketing standpoint, communications campaigns can disseminate structured health messages aimed at educating individuals about DVT/PE. It is essential to harness social and other media, to address gaps that exist in the availability of appropriate educational materials pertaining to VTE among other medical conditions. Emphasis should be placed on opportunities for communication at the family and community level, with a specific focus on high-risk groups.

Communication

4. Policymakers and healthcare administrators need to take the following steps, among others:

- (a) Increasing public knowledge of DVT/PE and the severity of the burden these disorders place on society.
- (b) Educating people about the signs, danger signs, and precipitating circumstances, including medical procedures, hospital stays, and trauma.
- (c) Educating the general public on genetic predispositions to DVT/PE
- (d) Supporting public education by letting people know how serious the issue is in terms of incidence and mortality/morbidity.
- (e) Publication of specific patient tales via news channels and social media, as human interest stories frequently have a greater impact than statistics alone.
- (f) Highlighting the substantial gap between what is understood about how to prevent and treat DVT/PE and what is happening in practice today.
- (g) Facilitating the development and dissemination of uniform messages about DVT/PE that are consistent with existing guidelines.

Action

5. Actions that need to be initiated by policy makers and medical administrators include but are not limited to:-

- (a) Forming community coalitions to sponsor public awareness campaigns.
- (b) Developing tools and materials that patients can use when talking with their physicians and other health professionals.
- (c) Creating local networks and peer support programs for patients and their family members.

- (d) Working with volunteer groups, professional societies, and the media as part of a national awareness campaign intended to educate both the public and health professionals about the incidence of the disease, along with its symptoms and risk factors.
- (e) Making available to the media accurate messages about DVT/PE for news stories and media programming, including television shows or podcasts.
- (f) Encouraging community-based advertising campaigns.
- (g) Consider using a celebrity spokesperson to deliver messages about these conditions, especially a celebrity who may have had a personal experience related to either DVT or PE.

Research and Evaluation

6. It is recommended for policy makers and healthcare system administrators to assign priority to this often neglected aspect of interventions focused on medical conditions. This is essential to :-

- (a) Gain a better understanding of what the public already knows about DVT/PE, gaps in their understanding, and how best to address those gaps.
- (b) Develop and test messages to determine which approaches work best to educate the public, inform them of when they are at risk, and empower them to raise issues proactively with their clinicians.
- (c) Investigate, in a culturally and linguistically appropriate manner, why certain ethnic groups are more or less likely to develop these conditions.
- (d) Investigate the causes of age and gender based variations in the incidence and recurrence of these diseases, including why men are more susceptible to a recurrence.
- (e) Research the role (if any) that behaviour modification (e.g., smoking cessation, increased physical activity, weight loss) plays, in reducing risk.
- (f) Conduct research to better understand why obesity increases risk.
- (g) Investigate the role that prolonged immobility due to travel (air, car, rail), hospitalization, or confinement to bed, plays in increasing risk.
- (h) Conduct an analysis of the economic toll of DVT/PE on individuals, families, communities, and the nation as a whole. This analysis should include not only the direct costs (i.e., healthcare expenditures), but also indirect costs such as lost productivity and wages due to time away from work.

- (i) Evaluate the impact of communication and social marketing programs, including pre and post-evaluation levels of consumer awareness and knowledge.
- (j) Conduct formative research to ensure that media messages are positive, realistic, relevant, consistent, and effective.

Setting : The Healthcare System

7. The healthcare system is uniquely positioned to implement interventions aimed at reducing the incidence and burden of DVT/PE as the majority of cases occur within the healthcare system itself. There is a gap between the implementation of a required standard of care with broad compliance to evidence based guidelines, and ground realities.

8. Healthcare systems in the public and private sectors and also medical colleges have a crucial role to play in preventing and reducing the burden of DVT/PE. Much is left to be done—to apply evidence-based medicine in real-world settings, and to investigate the gaps in knowledge related to the management of VTE.

Communication

9. Actions that need to be initiated by policy makers and healthcare administrators include but are not limited to:-

- (a) Informing healthcare professionals and administrators about the problem of DVT/ PE in terms of mortality, morbidity, and direct and indirect costs.
- (b) Promoting evidence-based practice by sharing existing guidelines with healthcare professionals on the prevention, diagnosis, and treatment in specific at risk populations.
- (c) Promoting the findings and recommendations from expert groups such as professional societies related to the importance of screening all hospitalized patients for risk for these diseases, and providing appropriate preventive treatment based on those screenings.
- (d) Educating healthcare professionals about the availability of genetic testing wherever feasible, about when it may be appropriate to discuss with and test patients, and the importance of counselling for those who test positive.
- (e) Educating healthcare professionals at all levels about the relative risks of excessive bleeding from properly managed anticoagulation therapy versus the risks of not using such therapy.

- (f) Informing healthcare professionals about the availability and appropriate use of treatment options, including anticoagulation therapy and clot dissolving /clot removal therapies.

Action

10. Actions that need to be initiated by policy makers and healthcare administrators include but are not limited to:-

- (a) Convening a Task Force such as the NAMS Task Force, to forge consensus on a single set of clear, standardized, evidence-based guidelines in those areas where multiple and/or conflicting guidelines currently exist.
- (b) Instituting formal systems related to risk assessment and the provision of preventive therapy (prophylaxis) to appropriate high-risk individuals in the healthcare system and community.
- (c) Consistently tracking performance on current and future DVT measures that are endorsed by professional Societies, and developing quality improvement initiatives designed to improve performance on these measures over time.
- (d) Developing and improving easy-to-use tools (such as internet based apps) that provide ready access to relevant data and information at the point of care. These tools will help healthcare professionals to follow existing evidence-based guidelines and assist in enhancing their patient care service delivery.
- (e) Developing and/or refining tools and/or algorithms to determine who should undergo diagnostic imaging tests for DVT/PE. These tools could incorporate clinical manifestations, biomarkers and genetic profiles, patient and family history, the results of simple tests, and other information to determine who should be screened.
- (f) Identifying and supporting healthcare professionals who can provide evidence-based preventive, diagnostic, and therapeutic care and serve as models in their respective hospitals.
- (g) Encouraging Medical and Nursing Colleges to provide adequate education and training to ensure that the new generations of doctors and nurses are aware of the magnitude of the problem and how to prevent, diagnose, and treat DVT/PE in accordance with the latest scientific evidence.

- (h) Encouraging Medical and Nursing Colleges, and other organizations to incorporate training into continuing medical education and recertification processes such as renewal of registrations.
- (i) Supporting the development of hospital- and community-based support programs for patients with DVT/PE and their family members.

Research and Evaluation

11. It is recommended for policy makers and healthcare system administrators to assign priority to this often neglected aspect of interventions focused on medical conditions. This is essential to :-

- (a) Conduct further research into the benefits and risks associated with various strategies (pharmacological, mechanical, and surgical) for dissolving or removing clots, and to determine which patients, if any, would benefit from these approaches (as an alternative to anticoagulation therapy).
- (b) Conduct further research into the pathophysiology of DVT/PE, including the roles of inflammation, obesity, stasis, and the basic endothelial cell biology and vessel response to stasis and thrombosis. This research can lead to the development of novel prevention and treatment strategies.
- (c) Investigate whether more biomarkers can be identified that will allow for the development of individualized risk profiles for primary and recurrent DVT/PE, and chronic venous insufficiency. These biomarkers can possibly be used to help predict an individual's response to therapy.
- (d) Investigate the role of prolonged air, car, boat or rail trips (and other situations causing long periods of immobility) on raising risk, both for the general population and certain high-risk groups, such as women on oral contraceptives or individuals with a genetic predisposition to DVT/PE.
- (e) Investigate the role of compression ultrasonography (CUS) in diagnosing isolated calf DVT, and study the benefits and costs associated with treatment.
- (f) Continue to study the effectiveness of various tests including the D-dimer and other tests in diagnosing recurrence of the disease .
- (g) Investigate the safety and effectiveness of various approaches to diagnosing DVT/ PE in pregnant women.

- (h) Conduct further research into the best drugs, dosing strategies, and treatment regimens for anticoagulation therapy for certain patient populations, including children (from infancy through adolescence), obese individuals, and those with renal insufficiency.
- (i) Conduct further research on the benefits and risks of preventive and therapeutic anticoagulation therapy for certain patient populations, including children, pregnant women, individuals with a genetic predisposition to DVT/PE (with or without prior events), cancer patients, and the elderly. Such research should also address how to treat individuals with multiple risk factors, such as pregnant women or children with genetic predisposition.
- (j) Conduct further research into the appropriate duration of anticoagulation therapy in specific patient populations, including whether some high-risk groups should remain on the therapy indefinitely.
- (k) Investigate the role that pharmacogenetics can play in determining optimal warfarin dosing in individuals.
- (l) Investigate and evaluate the various approaches (e.g., pharmacological, mechanical, and/or a combination) to reducing the risk and impact of chronic venous insufficiency.
- (m) Conduct research into when genetic testing is appropriate, including whether and when to test the asymptomatic family members of those with a genetic predisposition to DVT/PE.
- (n) Conduct further research into the optimal therapy for those with genetic predisposition, and how that therapy might vary depending upon the number of genetic and other acquired risk factors or triggering events. Research should focus on the impact of specific thrombophilic disorders on anticoagulant therapy management and the identification of optimal prophylactic strategies for asymptomatic individuals during high-risk situations.
- (o) Conduct research into how upper extremity DVT—a less common and less studied form than DVT in the legs—should best be evaluated, diagnosed, and managed.

Setting : Policymakers and Governments

12. Healthcare policymakers at the state and national level have a crucial role to play in raising awareness and encouraging the development and use of evidence-based guidelines. The scientific community and professional societies such as the National Academy of Medical Sciences, Indian Society of Haematology, Indian Public Health Association and the Indian Medical Association, must seek to collaborate, partner, facilitate and steer actions required for advocacy with all stakeholders. Governments at the state and the national level , along with the scientific community, must work together, to focus on the following areas :-

(a) Communication

- (i) Raise policymakers' awareness of DVT/PE and the magnitude of the problems caused by the disease, as well as the need to support research, and infrastructure that are consistent with provision of evidence-based care.
- (ii) Support public awareness campaigns.
- (iii) Support the education of health professionals, including the dissemination of evidence-based guidelines.

(b) Action

- (i) Review Ayushman Bharat reimbursement policies to ensure that they encourage the provision of evidence- based prevention, diagnosis, and treatment. Subsequently to make recommendations to the Govt of India for needful action as may be required.
- (ii) Support the formation of community-based, regional, and national multistakeholder coalitions dedicated to raising awareness about these VTE.
- (iii) Form task forces, steering committees, or advisory committees dedicated to addressing the problems resulting from VTE.
- (iv) Support actions that lead to enhanced awareness about DVT/PE among healthcare professionals and obtain better adherence to evidence-based practices.

(c) **Research and Evaluation**

- (i) Support basic, clinical, and epidemiological research that is intended to fill critical gaps in current knowledge about DVT/PE.
- (ii) Support translational research and the development of other tools that are intended to speed the adoption of new scientific knowledge into the everyday practice of medicine.
- (iii) Support the training of scientific investigators and healthcare professionals who are interested in VTE.

VTE TRAINING AND EDUCATION FOR HEALTHCARE PROFESSIONALS

It is recommended that an online training course for Healthcare professionals be proposed by NAMS to be hosted on the Govt of India website for training (www.igot.gov.in). This training course may be updated periodically as per evolving evidence and peer reviewed best practices.

An outline template for such a training course may be taken from <https://www.cdc.gov/ncbddd/dvt/training.html#accreditation>

Stop the Clot®: What Every Healthcare Professional Should Know

Course Overview: A self-paced, online course providing the most current foundational information on assessing, treating, and managing patients who have blood clots and clotting disorders.

Target Audience: Physicians, Nurses, and other healthcare professionals

Content:

1. Basics of Blood Clots
2. Thrombophilia and Blood Clots
3. Anticoagulation Medications
4. Post-Thrombotic Syndrome
5. Pulmonary Hypertension
6. Prevention of Blood Clots

Course Objectives

At the conclusion of this proposed training course, participants should be able to do the following:

1. Explain three signs and symptoms of deep vein thrombosis (DVT) and pulmonary embolism (PE).
2. Describe three factors that increase the risk of developing a blood clot in the form of a DVT and/or PE.
3. Describe three management considerations for the use of anticoagulant medications.
4. Explain three signs and symptoms of post-thrombotic syndrome that providers should include in patient education plans for blood clot survivors.
5. Explain two facts about pulmonary hypertension and its relationship to PE.
6. Describe three appropriate treatment / management options to prevent blood clot recurrence and secondary complications.

Theoretical Framework : Prevention of VTE

Annexure 9

PERIOD OF PRE PATHOGENESIS		PERIOD OF PATHOGENESIS	
<p><i>This is the stage when conditions within the body predispose to VTE, however VTE has not set in as yet.</i></p>		<p><i>This is the stage when VTE has set in.</i></p>	
Disease Process		<p>DEATH</p> <p>_____</p> <p>_____ _____ Chronic State</p> <p>_____ _____ Disability</p> <p>_____ _____ Illness</p> <p>_____ _____</p> <p>Clinical Horizon Signs & Symptoms</p>	
		RECOVERY	
LEVELS OF PREVENTION	Primary Prevention	Secondary Prevention	Tertiary Prevention
MODES OF INTERVENTION	Health Promotion	Early Diagnosis & Treatment	Disability Limitation
	Specific Protection		Rehabilitation

COMPREHENSIVE PRIMARY HEALTHCARE FRAMEWORK APPROACH : PREVENTION OF VTE**PRIMARY PREVENTION**

	Actions at - Level	Actions by	Remarks
Health Promotion	Community level	ASHA/ ANM	Conduct of community level Health Education campaigns to <i>promote healthy lifestyles and promote early healthcare seeking behaviour</i>
	Health & Wellness Centre level	CHO	Conduct of outreach health education for communities and support for ASHA/ ANM
	Primary Health Centre level	MO	Supervision and conduct of outreach health education activities for communities and patients, including support and guidance to CHOs
	Community Health Centre level	MO/ Specialist	Supervision and conduct of outreach health education activities for communities and patients, including support and guidance to MOs

	District Hospital level	Specialist	Supervision and conduct of outreach health education activities for communities and patients, including support and guidance to MOs and Specialists
	Medical College level	Specialist	Conduct of outreach health education activities, in rural / urban field practice areas, providing support and guidance to MOs and Specialists
	Tertiary Hospital level	Specialist / Sub Specialist	Conduct of health education activities for inpatients and relatives / caregivers, providing support and guidance to MOs and Specialists
Specific Protection			Nil

SECONDARY PREVENTION

	Actions at - Level	Actions by	Remarks
Early Diagnosis	Community level	ASHA/ ANM	Early recognition of symptoms with prompt referral
	Health & Wellness Centre level	CHO	
	Primary Health Centre level	MO	
	Community Health Centre level	MO/ Specialist	Early recognition of signs and symptoms , with a high degree of clinical suspicion
	District Hospital level	Specialist	
	Med College level	Specialist	Training module (online) can be developed for early diagnosis at the health care facility level
	Tertiary Hospital level	Specialist / Sub Specialist	

	Actions at - Level	Actions by	Remarks
Prompt Treatment	Community level	ASHA/ ANM	Referral without delay, and encouragement to patient to seek medical attention urgently.
	Health & Wellness Centre level	CHO	
	Primary Health Centre level	MO	Commence treatment as per Guidelines and referral as per criteria.
	Community Health Centre level	MO/ Specialist	
	District Hospital level	Specialist	
	Med College level	Specialist	
	Tertiary Hospital level	Specialist / Sub Specialist	Management as per Guidelines.

TERTIARY PREVENTION

This is the phase where long term anti coagulation is indicated, adhering to guidelines

Disability Limitation	Actions at - Level	Actions by	Remarks
		Community level	ASHA/ ANM
	Health & Wellness Centre level	CHO	To brief patients attending OPD in the HWC to comply with prescribed medications and follow up at required frequency, with self care as applicable. Referral as needed
	Primary Health Centre level	MO	To brief patients attending OPD in the PHC to comply with prescribed medications and follow up at required frequency, with self care as applicable. Referral as needed
	Community Health Centre level	MO/ Specialist	
	District Hospital level	Specialist	To undertake required investigations, and monitor patients for health status and ascertain compliance with prescribed medications. Referral as needed.
	Med College level	Specialist	
	Tertiary Hospital level	Specialist / Sub Specialist	To undertake investigations and management as needed.

	Actions at - Level	Actions by	Remarks
Rehabilitation	Community level	ASHA/ ANM	Counselling for maintenance of healthy lifestyle and risk reduction as applicable, with information on early recognition, and encouragement to health care seeking behaviour.
	Health & Wellness Centre level	CHO	
	Primary Health Centre level	MO	
	Community Health Centre level	MO/ Specialist	Advice on healthy lifestyle and risk reduction as applicable, with provision of physiotherapy services if available.
	District Hospital level	Specialist	
	Med College level	Specialist	Advice on long term rehabilitation as applicable , at the post VTE recovery stage
	Tertiary Hospital level	Specialist / Sub Specialist	
		Specialist	

AREAS OF RESEARCH/ FUTURE DIRECTIONS

1. Advances in technology and pharmacology have already improved our ability to predict and prevent VTE. However the following major barriers to improving VTE prevention still exist :-
 - (a) the limitations on overall benefit to thromboprophylaxis inherent to current anticoagulant medications.
 - (b) the imperfect science of individualizing VTE risk stratification and the inherent complexity of predicting multifactorial and competing phenomena.
2. As per various position papers, future direction can be focused towards therapeutics and technology including the importance of antithrombotic options with less bleeding and technological advances including artificial intelligence and machine learning to refine risk stratification and facilitate their implementation.
3. A more pragmatic approach to pharmacologic prevention is what is necessitated in India today given the diversity in healthcare settings. Over the past decade, the tolerability, acceptability, and quality of life for patients at risk of VTE have changed with the advent of effective oral therapies for VTE treatment and prevention. In those with cancer, patient-reported quality of life is better with oral anticoagulant treatment compared to daily subcutaneous LMWH injection. While not as rigorously studied, quality-of-life improvements with oral therapies are likely similar in the prophylactic setting.
4. Novel agents for pharmacologic prophylaxis are currently being developed that target various factors. If these trials or other new agents are successful at reducing VTE without substantially increasing the risk of bleeding, existing approaches to VTE prevention could change dramatically.
5. Efforts to predict and prevent venous thromboembolic disease are predicated on our ability to accurately identify patients at risk. The benefits of thromboprophylaxis must be weighed against the financial costs and potential for increased bleeding. Understanding which patients are at greatest risk can help healthcare professionals and their patients to make informed decisions about the use of anticoagulants to prevent VTE. We must continue to collect and analyze large data sets on patient-

specific and acquired risk factors, and how they interact, to improve existing risk assessment models.

6. The discovery and evaluation of novel biomarkers to risk-stratify patients may be an area of significant interest going forward, and serum biomarkers such as Vascular Endothelial Growth Factor (VEGF), Interferon-alpha, Interleukin-15 (IL-15), and Citrullinated histone H3 (H3cit) may see further investigation for this purpose.

7. The development and validation of prediction models should seek to increase the accuracy of prediction without sacrificing usability. As we seek to individualize preventive efforts, the primary obstacles that affect implementation of risk assessment models will be the complications and complexity of any proposed algorithm. Scoring systems and other risk-assessment models can be implemented for use by healthcare professionals if they are easily accessible and understood, but developing sufficient predictive power for VTE often requires the combination of several variables. Scoring systems can quickly become time-consuming for use by physicians, and hiring additional data entry personnel adds significant cost. Predictive algorithms that appropriately consider and calculate bleeding risks for individual patients to avoid harms from VTE prophylaxis increase complexity and add additional workload. Scoring systems developed in the present times must not lose sight of the practical challenges of implementation by treating clinicians in busy hospital settings.

8. We have made tremendous progress in understanding the epidemiology and prevention of VTE and have transitioned from studies detailing the benefits of “mini-dose” unfractionated heparin given to post-operative patients to sophisticated algorithms that leverage patient-specific and acquired risk factors to determine which patients will derive the greatest benefit from VTE prophylaxis. As scoring systems and other decision support tools increase in accuracy and complexity, we risk overburdening overworked clinicians, and hence we need to beware of this pitfall.

Suggested Reading

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