Cancer and VTE

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Abstract

- Cancer and VTE have impacted the medical community greatly.
- We researched cancer and VTE to determine the causes, effects, and impacts of cancer and VTE in a patient.
- Our research found that cancer and VTE are related.
- Cancer-related VTE can be treated with anticoagulants (Heparin, DOACs).
- Cancer and VTE is a two-way street and with proper medical care, treatment regimens and prevention guidelines, VTE can be managed to reduce VTE recurrences in cancer patients.

Introduction

- We are members of the Global Thrombosis Forum (GTF), a non-profit organization which is an affiliate of the North American Thrombosis Forum (NATF). Our objective is to increase the awareness of thrombosis in the community.
- Cancer and VTE have impacted the medical community greatly, and it will be beneficial to know why and what a cancer patient goes through when experiencing VTE.
- We have researched cancer and VTE to determine the causes, effects, and impacts of cancer and VTE in a patient.

What is Cancer and VTE?

- Cancer is when the body's cells keep dividing abnormally and take over the other body tissues.
    - It is caused due to abnormal changes or mutations to the DNA within the cells in our body. DNA contains individual genes, each of which has a code telling the cell what functions to perform. Errors in this code can cause the cell to stop its normal function allowing it to grow and divide abnormally and thus become cancerous.
- VTE, or Venous Thromboembolism, is when a blood clot forms in the blood vessels of the body when something changes or slows the flow of blood.
    - The most common causes for VTE are surgery, cancer, immobilization and prolonged hospitalization.

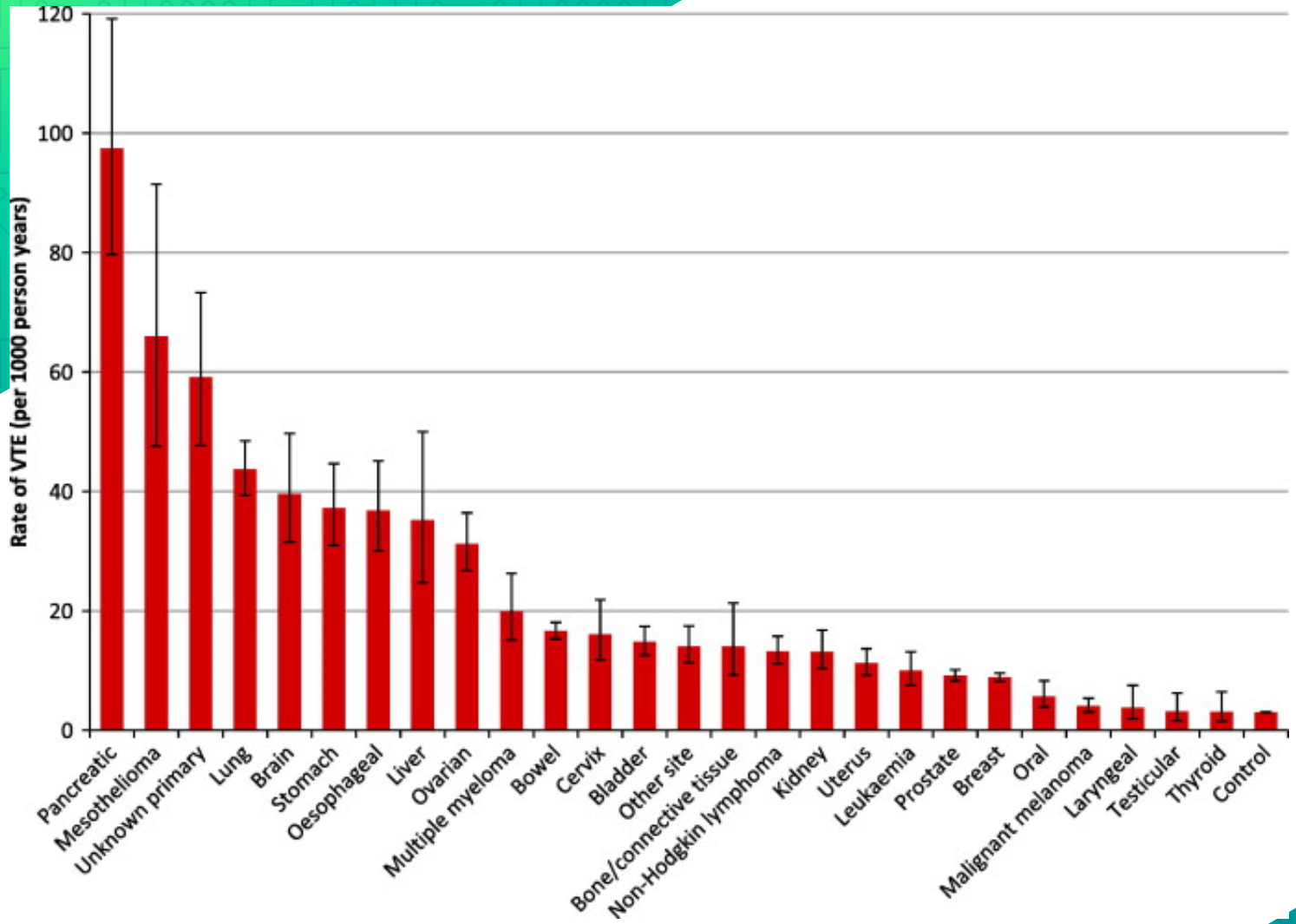


Figure 1: Incidence of VTE from cancers in different organs of the body

Incidence of Cancer-Associated Thrombosis (CAT)

- Research shows approximately 4-15% of cancer patients will experience VTE at some stage and is often seen as soon as 3 ½ months post treatment (7.3%).
    - Cancers that pose a higher risk of VTE in patients are: Pancreatic Cancer, Mesothelioma, Lung Cancer, and Brain Tumor.

Risk factors in generation of CAT

- Advanced age
- Females
- Prior VTE
- Patient comorbidities
- Infection, obesity, anemia
- Chemotherapy
- Hormonal therapy
- A central venous catheter (arm/chest)

Mechanism of development of VTE in cancer patients

- A protein called the tissue factor, plays a role both in oncologic progression and in VTE formation.
- Tissue factor is produced by cancer cells, and acts as an activator of the extrinsic coagulation pathway resulting in the activation of Factor X and consequently in fibrin synthesis and platelet activation.

Mechanism of development of VTE in cancer patients contd.

- Cancer cells can also produce other substances, such as distinct cancer pro-coagulant factors that directly stimulate Factor Xa, inflammatory cytokines that mediate endothelial dysfunction and other tumoral produced substances, such as carcinoma mucins, that also interfere in the coagulation cascade.
- The fibrinolytic system is inhibited by the cancer cell synthesized plasminogen activator inhibitor-1.
- This imbalance in the pro-anticoagulation balance leads to VTE and its clinical repercussions

CAT Primary Prevention

- CAT carries a high VTE recurrence risk, and a high risk of major bleeding with anticoagulation

- Evaluation of individual VTE risk in cancer patients and, in high-risk patients, promote low dosage anticoagulation as primary prophylaxis.

- The Khorana score and Vienna score are used for risk stratification of VTE possibility based on clinical history and basic blood tests.
  Khorana Score: Predictive model for chemotherapy-associated

CAT Primary Prevention contd.

- Several pharmacological agents have been studied for primary prophylaxis of CAT in different scenarios. Nadroparin, a low molecular-weight heparin (LMWH), Semuloparin, an ultra LMWH

- Apixaban, Rivaroxaban

Khorana Score

Patient Characteristics	Risk Score
Very high risk (stomach, pancreas)	2
High risk (lung, lymphoma, gynaecologic, bladder, testicular)	1
Pre Chemotherapy platelet count ≥350,000 per mm^3	1
Haemoglobin level <10 g·dL% or use of red cell growth factors	1
Pre Chemotherapy leukocyte count >11,000 per mm^3	1
BMI ≥35 $kg \cdot m^2$	1

A risk score ≥3 is a high-risk score, 1–2 is an intermediate score, and 0 is a low-risk score.

Vienna Prediction Model

- Designed to estimate the risk of a recurrent VTE event after an unprovoked venous thromboembolism to identify individuals at low risk for VTE recurrence.

- Location: Proximal DVT, Distal DVT, or PE

- d-Dimer level

- Patients are at low risk for VTE when the scores < 180

Treatment Options

- Low molecular weight heparin (LMWH) or Unfractionated heparin (UFH) are recommended treatments however, LMWH is preferred.
- Another therapy is the DOAC (Direct Oral AntiCoagulants) anticoagulant therapy. They are direct, as they block a single blood clotting factor so the chance of forming blood clots is reduced.

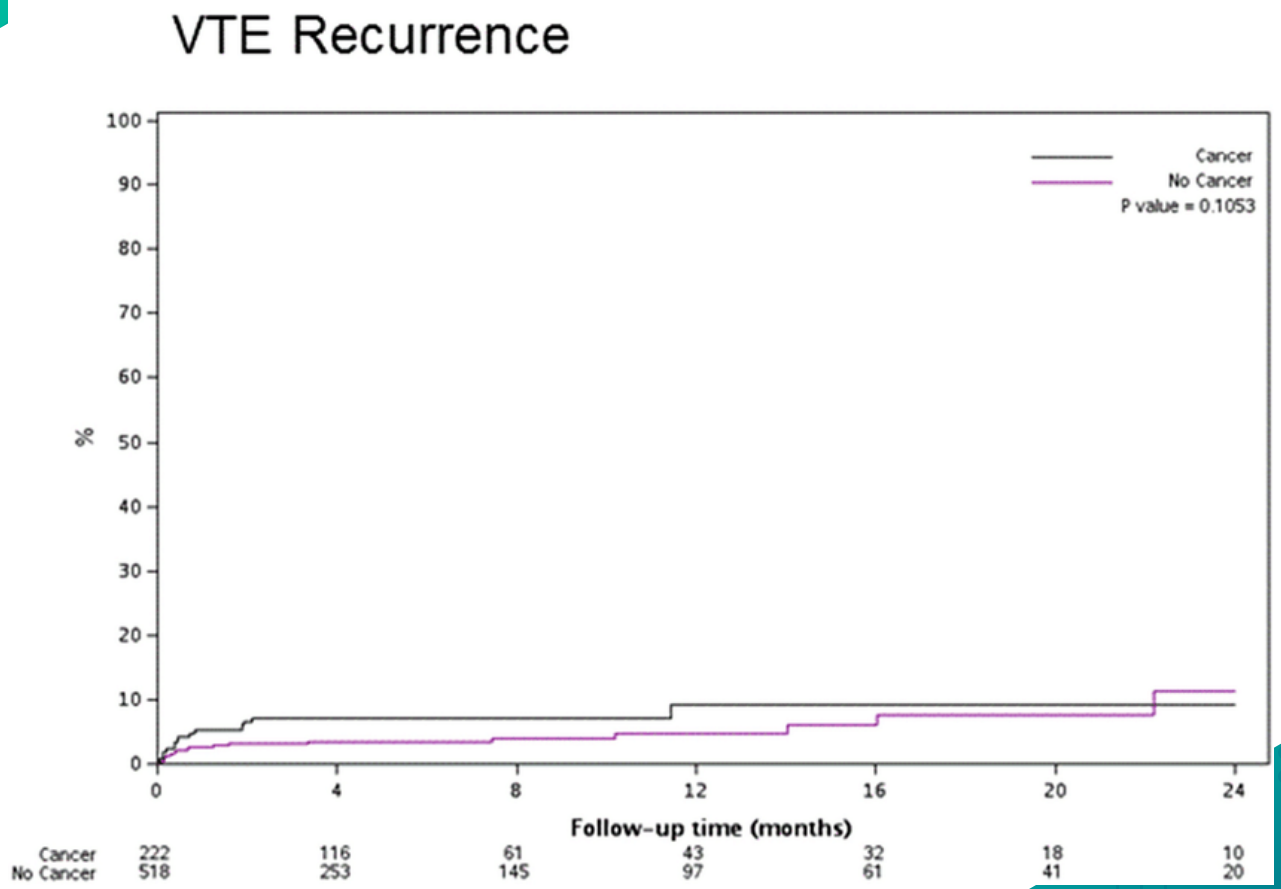
Efficacy of Anticoagulant Therapy

- DOAC therapy, a relatively new treatment, includes dabigatran, rivaroxaban, apixaban, edoxaban, and betrixaban. This treatment does not require blood monitoring and there are fewer drug, dietary, and supplement interactions
- Reduces the risk of VTE by 50%.
- Warfarin and the newer anticoagulants are both equally as effective in providing long term treatments for VTE.

VTE Recurrence

- The incidence of VTE in cancer patients is 0.5% - 20%, and much higher compared to non-cancer patients which is 0.1% - 0.2%.

Figure 2:
Recurrence rates of VTE among patients with and without cancer



Risks of Anticoagulant Therapy

- DOAC therapy does not work for all patients and depends on the type of cancer.
- DOAC treatment has a high risk of bleeding episodes and could lead to recurrent VTE.
- Other side effects include bruising, nosebleeds, vomiting/coughing up blood, diarrhea, constipation, indigestion, dizziness, headaches, rashes, itchy skin, hair loss and jaundice
- INR testing is not required when patient is on DOAC treatment

Prevention of VTE in Cancer Patients

- Stay active, especially as soon as possible after surgery
- Maintain a healthy weight
- Drink plenty of fluids
- Take prescribed anticoagulants
- Do not smoke
- Use compression stockings / intermittent pneumatic compression devices

Conclusion

- Based on this research, we summarize that cancer and VTE are related.
- There are ways to treat cancer-related VTE by using treatments such as anticoagulants (Heparin, DOACs).
- DOACs are very effective and so is LMWH treatment. However, the best treatment for cancer-related VTE depends on the patient's pre-existing conditions and the type of cancer they have.
- Cancer and VTE is a two-way street and with proper medical care, treatment regimens and prevention guidelines this can be managed to reduce VTE recurrences in cancer patients.

Future Directions

Based upon the results from this research, we plan to expand in finding out the incidence of VTE in different types of cancer.

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