

**Stroke subtypes in cancer patients and contributing risk factors  
in the stroke underlying mechanism, a retrospective study**

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## Introduction

In the literature, 30% of active cancer patients were diagnosed with a recurrent thromboembolic event by 3 months, including 13% with recurrent ischemic stroke, which is nearly threefold higher than typical recurrent stroke rates in non-cancer patients. Additionally, cancer reported in 10% of hospitalized ischemic stroke patients and this association may be on the rise.

## Objectives

Identifying ischemic stroke subtypes will help us to understand the underlying stroke mechanism, cancer and its treatment increase stroke risks, However, several confounding vascular risk factors contribute to stroke occurrence in cancer patients, in our study we looked for the distribution of multiple vascular risk factors in cancer and non-cancer patients.

## Methods

We selected cancer patients with ischemic stroke who were admitted to King Fahad Specialist tertiary hospital at Dammam, between January 2018 and April 2020. The cancer ischemic stroke group comprised patients with active cancer prior to the onset of ischemic stroke. The control group comprised age- and sex-matched non-cancer patients with ischemic stroke who were admitted to the same hospital during the same period. The control group patients were selected at random. A retrospective review of cancer patients with ischemic stroke was done to identify vascular risk factors, stroke subtypes and cancer types. Brain magnetic resonance imaging including vascular imaging (magnetic resonance angiography for carotids and brain vessels), 48hrs Holter monitor and echocardiography were performed on most patients admitted with ischemic stroke. All data were analyzed using SPSS software, the Chi-square test was used to compare stroke risk factors and subtypes between cancer patients with ischemic stroke and the control group.

## Results

TABLE 1. Stroke Risk Factors in Cancer vs Non-cancer Patients with Ischemic Stroke

Risk factor	Cancer patients	Non-Cancer patients	P value
Mean age	62.3	60.75	-
Male	30%	45%	P:0.017
Hypertension	60%	80%	P:0.012
Diabetes	55%	50%	P:1.022
Dyslipidemia	30%	15%	P:0.017
Atrial fibrillation	10%	35%	P:0.02
Previous stroke	45%	25%	P: 0.012
Smoking	15%	5%	P: 0.02
Ischemic heart disease	15%	10%	P:1.022

Stroke etiology was based on TOAST classification and was classified to small vessel disease, cardioembolic stroke, large vessel disease and embolic stroke of undetermined source, the majority of cancer patients with stroke had embolic stroke of undetermined source which constitute 50% of patients, other different etiologies were small vessel disease (20%), cardioembolic source (15%), and large vessel disease were only (5%).

## Discussion

Multiple underlying mechanisms of ischemic stroke in cancer patients were found in the literature like hypercoagulable state due to cytokines release, marantic endocarditis (non-bacterial endocarditis), coagulopathies due to chemotherapy and radiation therapy, and radiation induced vasculopathy.

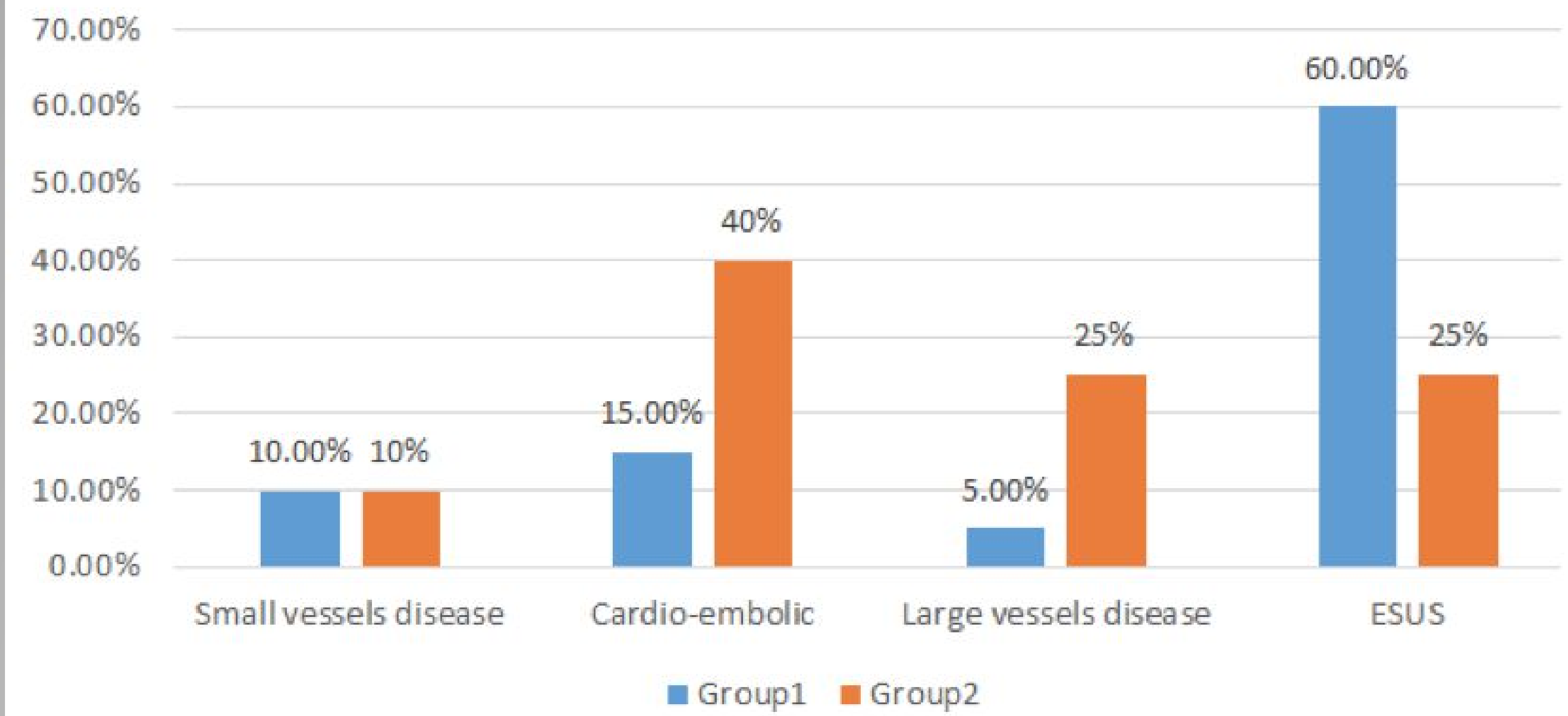
Our study found the main stroke subtype among cancer patients was embolic stroke of undetermined source, where is the main stroke subtypes found among non-cancer patients were cardioembolic stroke and large artery disease, which leads us to hypothesize that cancer associated stroke has other factors involved like coagulopathy and inflammation.

The limitations of the study are: it is single center retrospective study, the duration between the cancer diagnosis and ischemic stroke onset was not reported, and lastly, the type of cancer treatments were not considered, other future studies are needed to expand these mentioned factors.

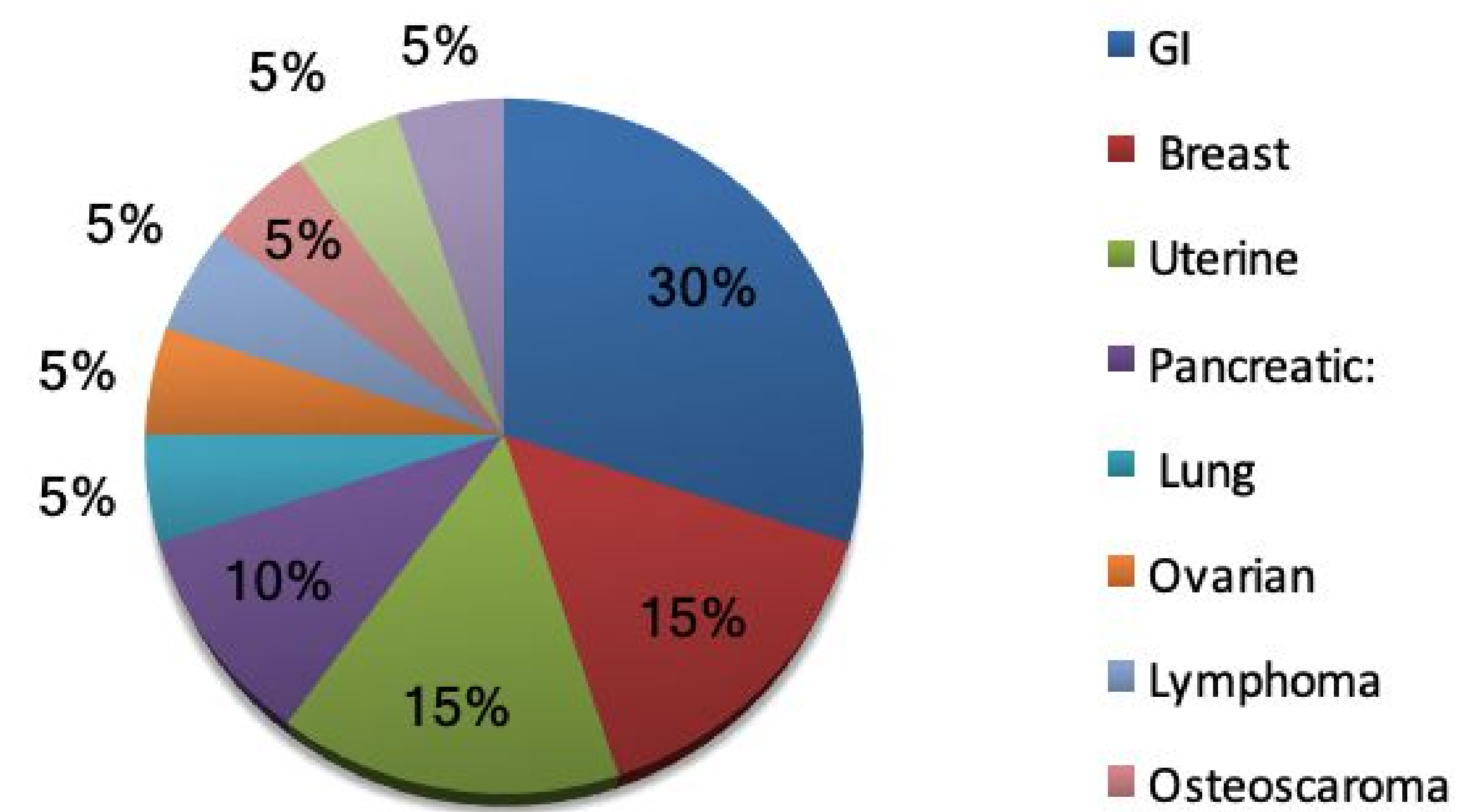
## Conclusion

Patients with cancer have a substantial risk of ischemic strokes, there are different mechanisms for stroke associated with cancer, in addition to the contribution of vascular risk factors, the majority of stroke in cancer has undetermined source of embolism, the hypothesis is that a hypercoagulable state or inflammatory vascular changes play an important role in the mechanism of stroke associated cancer, therefore the approach for ischemic stroke management would be different to reduce the risk of thromboembolism.

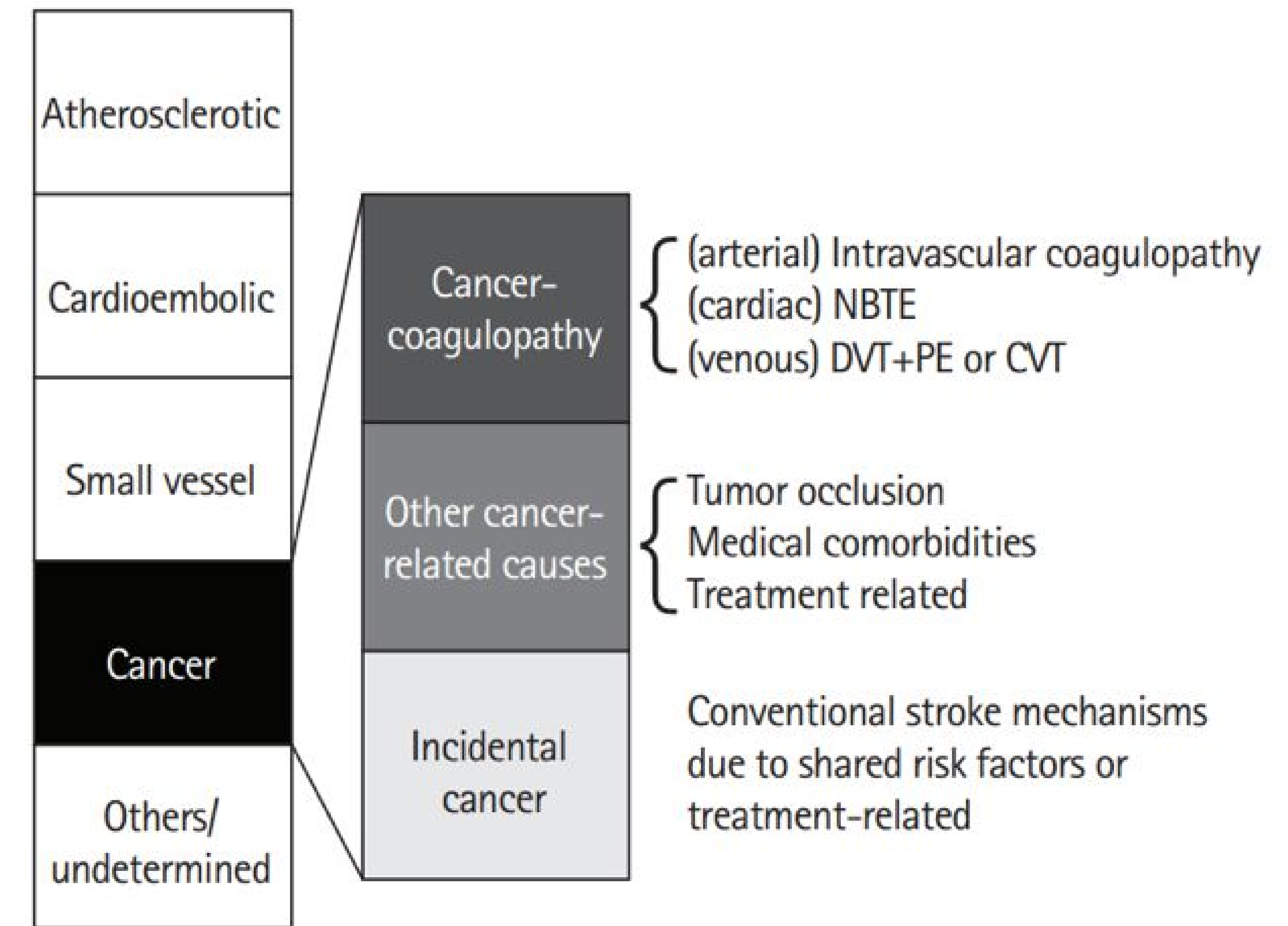
TOAST Classification



Cancer types with ischemic stroke



## Stroke associated cancer mechanism





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