

Surgical Expert Systems:

Thrombotic Complications

Venous thromboembolism (VTE) is a condition that occurs when a blood clot forms in a vein¹. VTE manifests as either deep vein thrombosis (DVT) or pulmonary embolism (PE), with PE being the more severe complication². DVT occurs when a blood clot forms in a deep vein, typically in the lower leg, thigh, or pelvis, while PE occurs when a clot breaks loose and travels through the bloodstream to the lungs¹. Both acquired and hereditary risks factors contribute to VTE, including male sex, diabetes, obesity, smoking, infection, and pregnancy³.

Venous thromboembolism (VTE) is the 3rd most common cause of death worldwide³.

VTE risk scores provided by Stream Care™ are selected based on a thorough and extensive review of existing literature, incorporating:

- ✓ 88 Peer Reviewed Papers
- ✓ 9 Systematic Reviews
- ✓ 6 Textbooks



Impact

VTE is a highly prevalent and devastating complication for General and GI surgical populations⁴. Following bariatric surgery, 2.9-13.7% of patients present with VTE^{5,6}. Likewise, incidence in esophageal and colorectal surgical populations is 2.1-7.5% and 5.0-10.2%, respectively⁷⁻¹⁰.

Due to its association with high morbidity and weighty financial outcomes, VTE presents an overwhelming burden to patients, hospitals, and governments². Affecting 1/1000 patients, VTE is a common and dangerous complication that claims 100,000 lives annually in the US¹¹. Its downstream clinical implications are significant as well, since the complication is the third leading cardiovascular diagnosis after a heart attack and stroke¹². Overall, VTE poses an estimated total US expense between \$13.5 and \$69.5 billion¹¹.

Proactive VTE risk prediction that supports informed postoperative decision making.

Dynamic DVT Risk Scores

Wells' Criteria for DVT

The Wells' Criteria for Deep-Vein Thrombosis (DVT) **predicts risk of DVT** starting at the **time of initial patient evaluation**¹³ and updates **every 24hrs with new vitals**.

Source

The Wells' Criteria for DVT was developed by [Wells et al.](#) and validated by [Sartori et al.](#) and [Sartori et al.](#)

Patient Population

The Wells' Criteria for DVT was developed using outpatients with suspected DVT¹³.

Data Set

Henderson General Hospital and McMaster University Medical Centre¹³

Sample Size

529¹³

Inputs

- Active Cancer
- Recent Major Surgery/Bedridden
- Calf Swelling
- Pitting Edema
- Immobilization
- Prior DVT
- DVT is Likely Diagnosis
- Collateral Superficial Veins
- Swollen Leg
- Localized Tenderness Along Deep Venous System
- Paralysis, Paresis, or Recent Plaster

Static DVT Risk Scores

Geneva Risk Score for VTE Prophylaxis

The Geneva Risk Score for Venous Thromboembolism (VTE) Prophylaxis **predicts the need for VTE prophylaxis** upon **initial patient admission**¹⁴.

Source

The Geneva Risk Score for VTE Prophylaxis was developed by [Chopard et al.](#) and validated by [Nendaz et al.](#) and [Xiong et al.](#)

Patient Population

The Geneva Risk Score for VTE Prophylaxis was developed using non-surgical hospitalized patients¹⁴.

Data Set

Eight Swiss Hospitals¹⁴

Sample Size

1,097¹⁴

Inputs

- Cardiac Failure
- Recent Stroke
- Recent MI
- Hypercoagulable State
- Nephrotic Syndrome
- Acute Rheumatic Disease
- Dehydration
- Pregnancy
- Acute Infectious Disease
- Respiratory Failure
- Myeloproliferative Disease
- Prior VTE
- Immobilization
- Recent Travel
- Age
- Hormonal Therapy
- Chronic Venous Insufficiency
- Active Cancer

Dynamic PE Risk Scores

Wells' Criteria for PE

The Wells' Criteria for Pulmonary Embolism (PE) **predicts risk of PE** starting at the **time of initial patient evaluation**¹⁵ and updates **every 24hrs with new vitals**.

Source

Wells' Criteria for PE was developed by [Wells et al.](#) and validated by [Tsimogianni et al.](#) and [Ye et al.](#)

Patient Population

Wells' Criteria for PE was developed using hospitalized patients with suspected PE¹⁵.

Data Set

The Ottawa Civic Hospital, the London Health Sciences Centre, the Queen Elizabeth II Health Sciences Centre, and St. Paul's Hospital¹⁵

Sample Size

930¹⁵

Inputs

- DVT Signs and Symptoms
- PE is Likely Diagnosis
- Heart Rate
- Immobilization
- Prior VTE
- Hemoptysis
- Active Cancer

Geneva Score (Revised) for PE

The Geneva Score (Revised) for Pulmonary Embolism (PE) **objectifies the risk of PE** starting at the **time of clinical assessment**¹⁶ and updates **every 24hrs with new vitals**.

Source

The Geneva Score (Revised) for PE was developed by [Le Gal et al.](#) and validated by [Wong et al.](#) and [Abolfotouh et al.](#)

Patient Population

The Geneva Score (Revised) for PE was developed using ED patients suspected of having acute PE¹⁶.

Data Set

Geneva University Hospital, University Hospital, and Angers University Hospital¹⁶

Sample Size

965¹⁶

Inputs

- Age
- Surgery/Fracture
- Active Cancer
- Prior VTE
- Unilateral Lower-Limb Pain
- Hemoptysis
- Heart Rate
- Deep Venous Palpitation and Edema
- PE is Likely Diagnosis
- Recent Immobilization/Surgery

DVT Score Performance Metrics

Risk Score	Cited By	Reference	Validation Type	AUC	Specificity	Sensitivity	NPV	PPV
FluidAI Recommended Geneva Risk Score for VTE Prophylaxis	93	Chopard et al.	Internal	-	-	-	-	-
		Nendaz et al.	External	-	0.353	0.90	0.993	0.028
		Häfliger et al.	External	-	0.362	0.821	0.988	0.013
Wells' Criteria for DVT	1,127	Wells et al.	Internal	-	0.98	0.78	0.98	0.91
		Sartori et al.	External	-	0.73	0.47	0.91	0.20
		Sartori et al.	External	-	0.40	0.75	0.92	0.15

PE Score Performance Metrics

Risk Score	Cited By	Reference	Validation Type	AUC	Specificity	Sensitivity	NPV	PPV
FluidAI Recommended Wells' Criteria for PE	1,904	Wells et al.	Internal	-	0.60	0.784	-	-
		Ye et al.	External	0.872	0.90	0.638	-	-
		Tsimogianni et al.	External	0.86	0.82	0.75	-	-
Geneva Score (Revised) for PE	1,680	Le Gal et al.	Internal	-	0.65	0.85	-	-
		Ye et al.	External	0.734	0.786	0.553	-	-
		Turedi et al.	External	0.659	0.512	0.736	-	-

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