Scores and Algorithms in Haemostasis and Thrombosis: a practical approach

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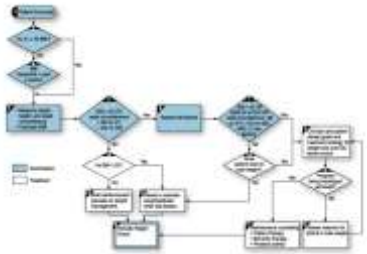
Algorithm definition



An algorithm is an effective method expressed as a finite list of well-defined instructions for calculating a function. Examples of medical algorithms:

- Calculators
- Flowcharts
- Nomograms

The intended purpose of medical algorithms is to improve and standardize decisions made in the delivery of medical care

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Medical algorithms

All the algorithms call on clinical probability estimation as a first step to guide the interpretation and subsequent diagnosis/treatment

Clinical Scoring Systems (CSSs) are tools that quantify the individual contributions that various components of the history, physical examination and basic laboratory investigation make toward a patient´s diagnosis/prognosis/therapy

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Algorithms in hemostasis and thrombosis

The field of Hemostasis and Thrombosis has not been immune to the proliferation of CSSs and algorithms used for diagnosis/prognosis/risk-tailored patient management:

- DVT/PE/Posthrombotic syndrome
- VTE recurrence
- DIC
- Thrombotic microangiopathies
- HIT
- Antiphospholipid syndrome
- Atrial fibrillation
- Risk of anticoagulant-associated bleeding
- Warfarin dosing and pharmacogenetic algorithms
- Bleeding scores

Many still requiring clinical validation
Could they change clinical practice?

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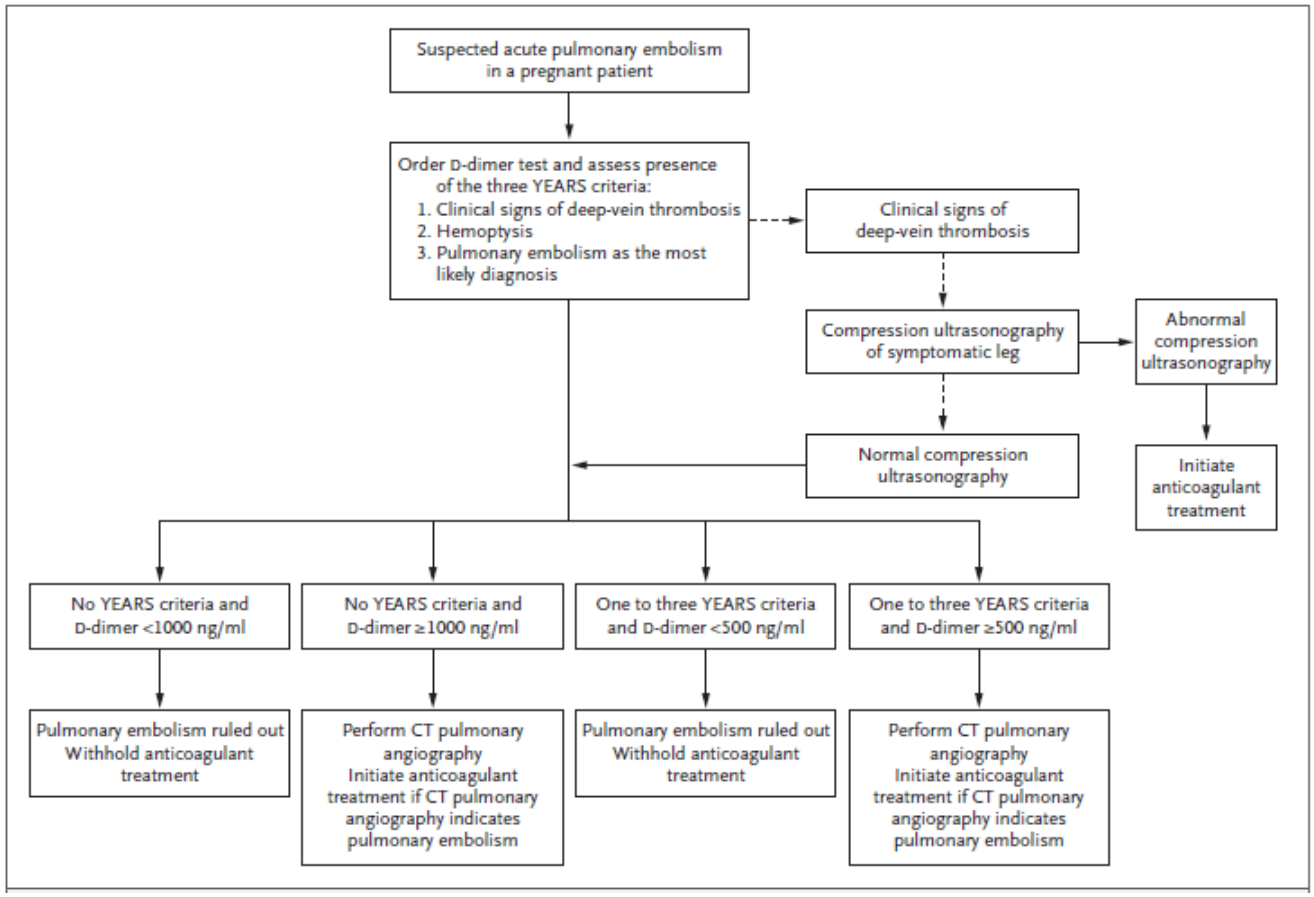
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Pregnancy-Adapted YEARS Algorithm for Diagnosis of Suspected Pulmonary Embolism

L.M. van der Pol, C. Tromeur, I.M. Bistervels, F. Ni Ainle, T. van Bemmel, L. Bertoletti, F. Couturaud, Y.P.A. van Dooren, A. Elias, L.M. Faber, H.M.A. Hofstee, T. van der Hulle, M.J.H.A. Kruip, M. Maignan, A.T.A. Mairuhu, S. Middeldorp, M. Nijkeuter, P.-M. Roy, O. Sanchez, J. Schmidt, M. ten Wolde, F.A. Klok, and M.V. Huisman, for the Artemis Study Investigators*

New Engl J Med 2019;380:1139



CT angiography avoided in 39% of patients (65% in the first trimester)

Solid evidence for the management of suspected PE with selective use of CT

Practical manual

Scores and Algorithms in Haemostasis and Thrombosis

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Marcel Levi
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Pascual Marco
Joan Carles Reverter
Alberto Tosetto

General schedule

Clinical probability model for Deep Vein Thrombosis

Indication

Clinically suspected Deep Vein Thrombosis (DVT)

Wells' score	
Feature	**Score**
Active cancer *(treatment ongoing, within previous 6 months, or palliative)*	1
Paralysis, paresis, or recent plaster immobilization of the lower extremities	1
Recently bedridden ≥ 3 days or major surgery *(within the previous 12 weeks requiring general or regional anesthesia)*	1
Localized tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling by ≥ 3 cm than that on the asymptomatic leg *(measured 10 cm below tibial tuberosity)*	1
Pitting oedema* *(confined to the symptomatic leg)*	1
Collateral superficial veins *(non-varicose)*	1
Previously documented DVT	1
Alternative diagnosis at least as likely as DVT	–2
Clinical probability	
Low probability *(unlikely)*	≤ 1
Intermediate/high probability *(likely)*	≥ 2

** The most symptomatic extremity is used in patients with symptoms in both legs.*

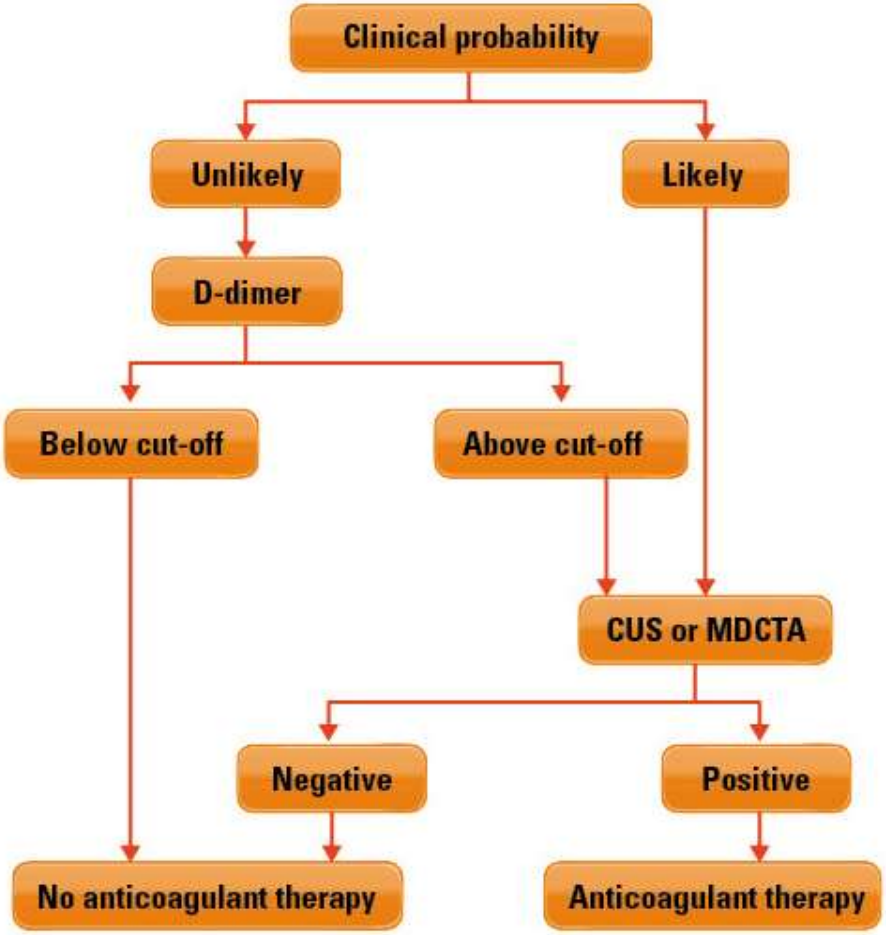
Interpretation

Useful clinical decision rule if incorporated into the algorithm. Combined with a D-dimer test result below a validated threshold and/or a negative ultrasound, a low clinical probability can safely exclude the presence of DVT.

References

- Wells PS. Integrated strategies for the diagnosis of venous thromboembolism. J Thromb Haemost. 2007;5(Suppl 1):41-50.
- Wells PS, Anderson DR, Bormanis J, et al. Value of assessment of pretest probability of deep-vein thrombosis in clinical management. Lancet. 1997;350:1795-8.

Diagnostic algorithm of Deep Vein Thrombosis and Pulmonary Embolism



ISTH bleeding assessment tool for the evaluation of bleeding severity

Bleeding Assessment Tool					
Symptoms (up to the time of diagnosis)	**Score**				
	0	**1**	**2**	**3**	**4**
Epistaxis	No / trivial	• > 5/year or • more than 10 minutes	Consultation only	Packing or cauterization or antifibrinolytic	Blood transfusion or replacement therapy (use of hemostatic blood components and rFVIIa) or desmopressin
Cutaneous	No / trivial	For bruises 5 or more (> 1 cm) in exposed areas	Consultation only	Extensive	Spontaneous hematoma requiring blood transfusion
Bleeding from minor wounds	No / trivial	• > 5/year or • more than 10 minutes	Consultation only	Surgical haemostasis	Blood transfusion, replacement therapy, or desmopressin
Oral cavity	No / trivial	Present	Consultation only	Surgical haemostasis or antifibrinolytic	Blood transfusion, replacement therapy or desmopressin
Gastrointestinal bleeding	No / trivial	Present *(not associated with ulcer, portal hypertension, hemorrhoids, angiodysplasia)*	Consultation only	Surgical haemostasis, antifibrinolytic	Blood transfusion, replacement therapy or desmopressin
Hematuria	No / trivial	Present *(macroscopic)*	Consultation only	Surgical haemostasis, iron therapy	Blood transfusion, replacement therapy or desmopressin
Tooth extraction	No / trivial or none done	Reported in ≤ 25% of all procedures, no intervention	Reported in > 25% of all procedures, no intervention	Resuturing or packing	Blood transfusion, replacement therapy or desmopressin
Surgery	No / trivial or none done	Reported in ≤ 25% of all procedures, no intervention	Reported in > 25% of all procedures, no intervention	Surgical haemostasis or antifibrinolytic	Blood transfusion, replacement therapy or desmopressin

Clinical example

A 69-year-old male with a history of mild chronic obstructive pulmonary disease presents to the emergency department with acute onset dyspnea. He does not report coughing, fever, or symptoms of DVT. On physical examination, he is hemodynamically stable and no abnormalities at auscultation of the heart and lungs are observed. His electrocardiogram (ECG) reveals a sinus rhythm of 60 beats/min, and the chest radiograph is normal. The attending physician considers acute PE as a possible explanation for his symptoms.

Question

What would be the next diagnostic step?

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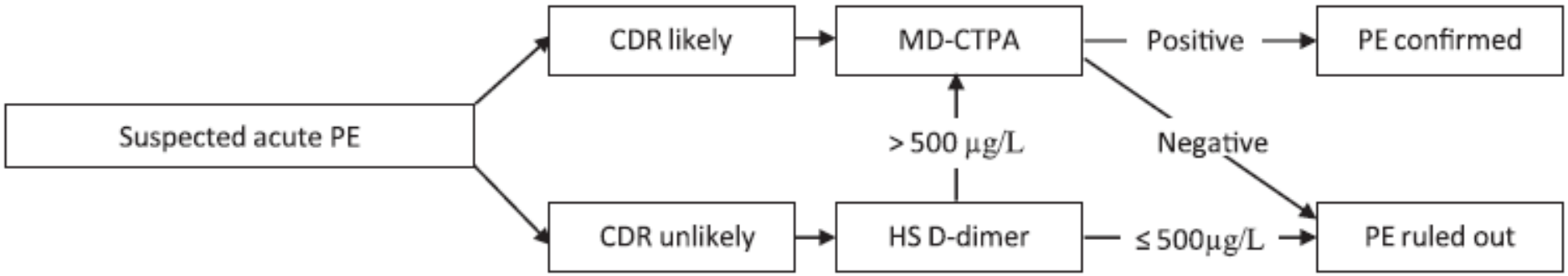
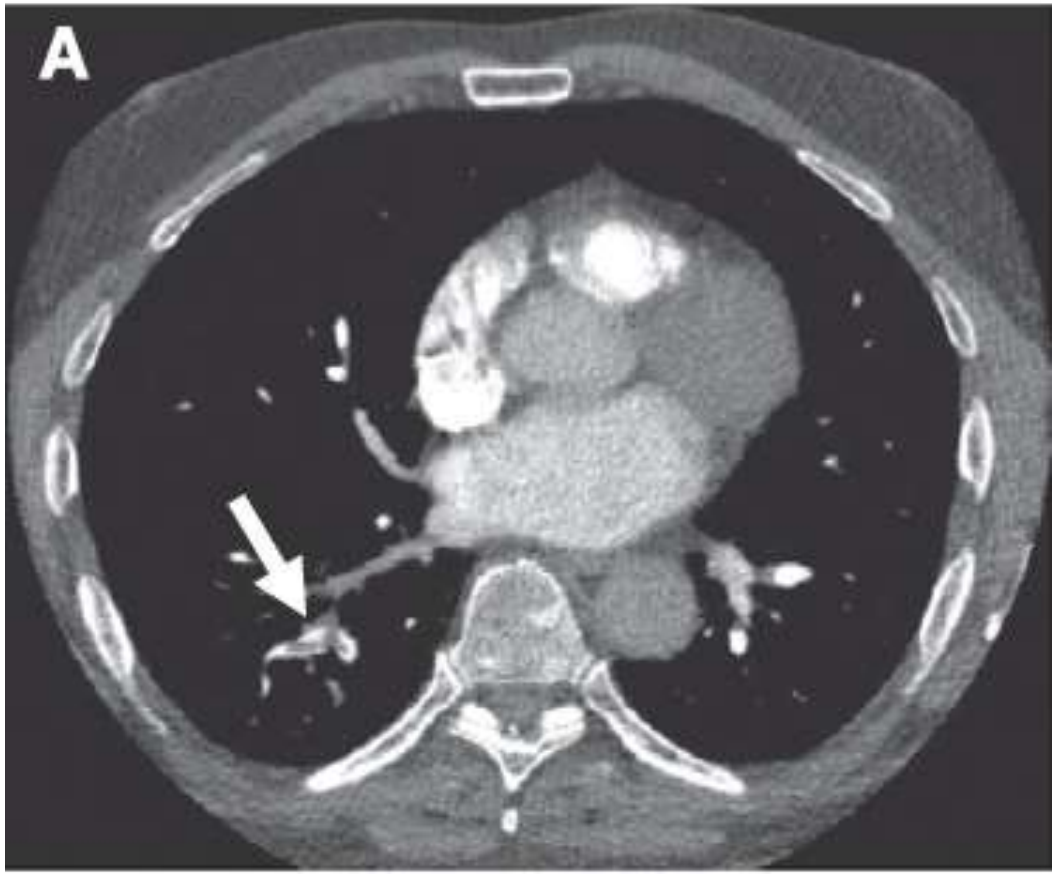
Diagnostic algorithm for clinically suspected PE

(Huisman MV, Blood 2013)



As for our patient, both the Wells rule and the revised Geneva score indicated an unlikely probability (Wells score: 3 points for PE as the most likely diagnosis; revised Geneva score: 1 point for age .65 years). Subsequent laboratory testing revealed an elevated D-dimer level of 2200 mg/L. Even when an age-dependent cutoff was applied (age 69, adjusted D-dimer cutoff 69x10= 690 mg/L), this concentration was well above the normal threshold.

Consequently, the patient was subjected to CTPA that confirmed a fresh embolus in the segmental artery to the right lower lobe



Don’t stop searching…

- A 77 years old male, suffering from polymyalgia rheumatica
- While taking VKA because of AF, he develops a large flank hematoma requiring blood transfusion to control anemia
- On admission, INR=1.9, PTT ratio=3.2; Hb=6.9 gr/dL

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Don’t stop searching…

SYMPTOM	SCORE				
	1. 0	1	2	3	4
Muscle hematomas	Never	Post trauma, no therapy	Spontaneous, no therapy	Spontaneous or traumatic, requiring desmopressin or replacement therapy	Spontaneous or traumatic, requiring surgical intervention or blood transfusion

- Bleeding Score abnormal (4)
- One may dismiss the case as «Bleeding in VKA»
- FVIII:C 0.6 U/dL; FVIII inhibitor 18 BU
- Acquired Hemophilia diagnosed in the patient

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Evaluating the Effects of an Evidence-Based Hemostasis and Thrombosis Treatment Algorithm on Medical Practitioner and Trainee Clinical Decision-Making

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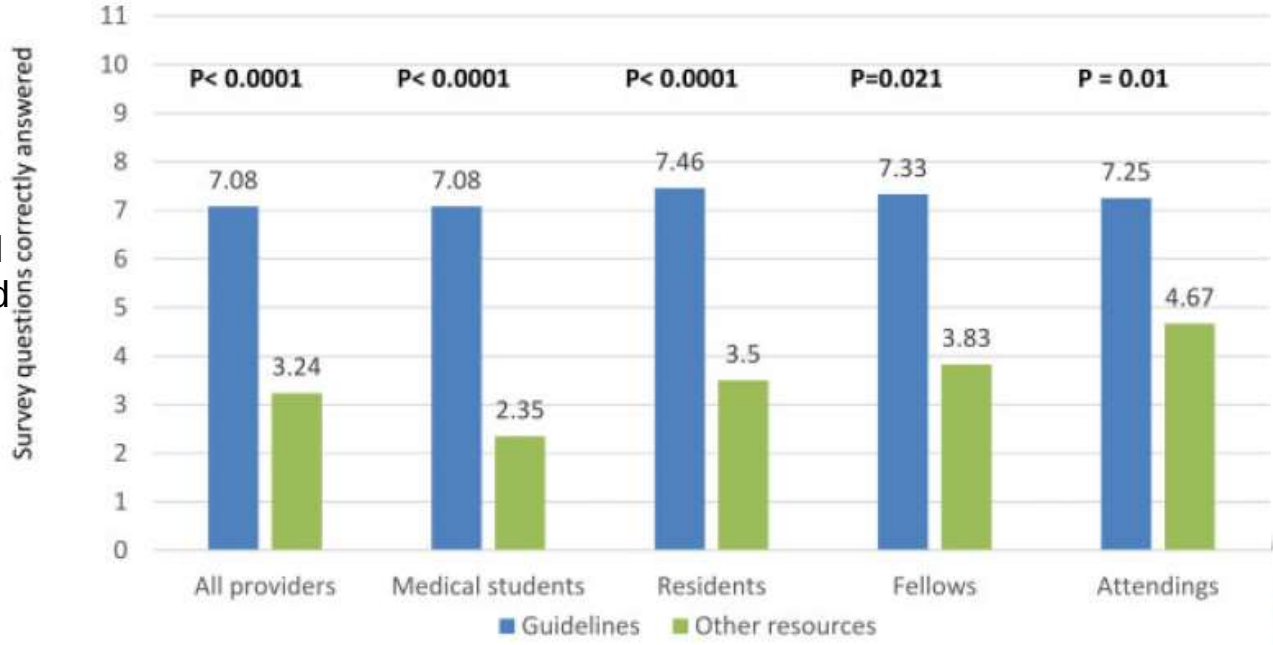
11 clinical questions describing commonly and uncommonly encountered clinical scenarios pertaining to Thrombosis and Hemostasis



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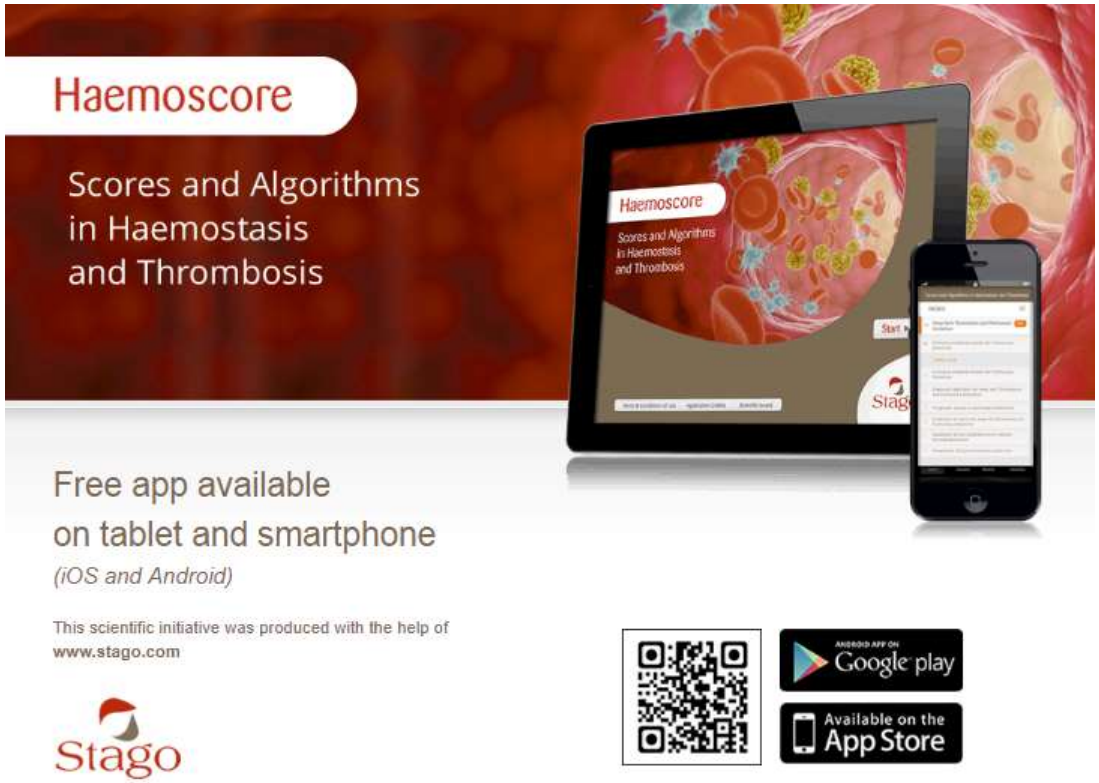
Coming next



New algorithms have been incorporated:

- PERC
- YEARS
- Bridging therapy
- PLASMIC
- PRECISE-DAPT

Conclusion

An evidence-based algorithmic tool significantly improves clinical decision-making abilities and confidence of all medical providers in the areas of thrombosis and hemostasis

The new apps (Stago) facilitates an easy and rapid access, visually appealing, for improved clinical decision-making

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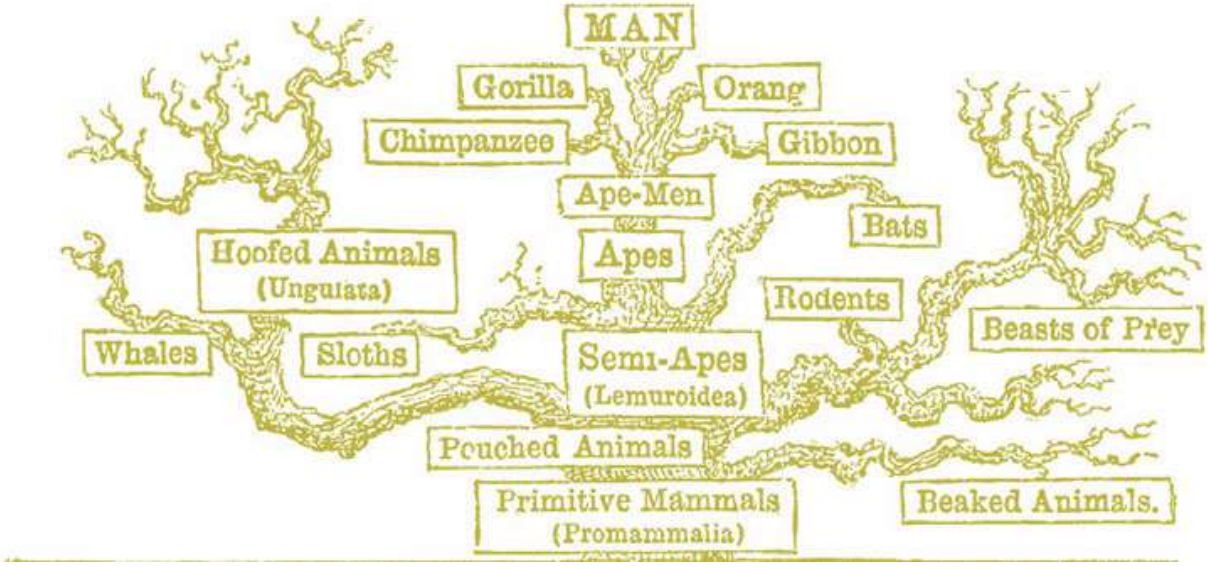
Algorithm of life



C. Darwin. On the origin of Species (1837)