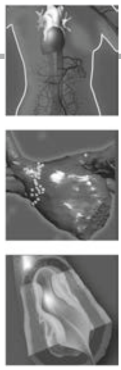

Scoring the risk in cardiovascular disease

"*Clinical predication rules are important tools for individual risk assessment of a patient. However, risk scores are only clinically useful if they are simple, comprehensible and easily reproducible.*"

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Establishing a clinical applicable risk score is a challenging endeavor. Based on recent scientific data and experience, potential risk factors need to be evaluated and validated on the basis of a stringent statistical selection in the context of a prospective risk assessment. Parameters under investigation should be reproducible and comprehensible. Overall, a risk score should facilitate clinical assessment of a patient and help to identify patients at high risk for certain end points.

Established risk scoring systems

Several risk scores have been reported during the last years, but only a few are generally appreciated. In this context, it has to be pointed out that it certainly depends on the underlying disease if a risk score is well established or if only a certain peer group is aware of a specific score. The SYNTAX-Score and Euro-SCORE, respectively, are prediction models often used by specialists in cardiology and cardiac surgery in the setting of coronary artery disease and cardiac operative-risk evaluation [1,2]. The complexity of these latter scores certainly impacts their utility in a general medical setting.

By contrast, a well appreciated clinical prediction rule is the CHADS2 score, estimating the risk for stroke in patients with atrial fibrillation (AF), and helping physicians to decide whether a patient would benefit from anticoagulant or antiplatelet therapy [3]. It is a cost-effective score that can be easily computed by hand without the use of complex algorithms. The CHA2DS2-VASc score is a refinement of the latter score including additional risk factors for stroke, such as pre-existing vascular disease, allowing a better risk stratification of low-risk patients [4]. Based on current guidelines, bleeding risk assessment in AF is recommended. The European Society of Cardiology proposes the HAS-BLED score, a simple and well-established predication rule, to quantify a patient's risk for future bleeding events [5]. The score is a simple prediction tool to assess the individual risk for bleeding in patients with AF in a real-world setting, supporting clinicians in their decision-making regarding anti-thrombotic therapy in AF patients.

In vascular medicine, a popular and widely used risk prediction model is the Wells score in the diagnosis of venous thromboembolism [6,7]. It facilities the diagnosis of deep venous thrombosis and pulmonary embolism, respectively. The calculation of the score is simple and makes it generally applicable.

Scoring systems for cardiovascular risk

The Framingham risk score is a well known prediction model for coronary heart disease [8]. The simplicity of the score makes it not only valuable for health professional; almost everybody can estimate their 10-year cardiovascular risk by entering only six parameters (i.e., age, sex, total and HDL cholesterol, smoking history, systolic blood pressure and current medication with antihypertensives) into the equation. The first 'edition' of the score only predicted the risk for coronary artery disease, a fact that was often criticized until a revised model also considered other important end points, such as stroke or heart failure [9]. Overall, the Framingham prediction rule is an important scoring system supporting physicians and patients in the decision whether lifestyle modification and preventive medical treatment should be performed in order to prevent future cardiovascular events.

Prediction rules in peripheral vascular disease

Risk prediction models for patients with peripheral atherosclerotic disease are not well established.

Only a few clinical applicable models with respect to clinical outcome are available. This is remarkable, since patients with severe vascular damage are at increased risk for adverse events. Recently, a risk prediction model with respect to total and cardiovascular mortality in patients after carotid artery stenting (CAS) has been established [10]. Age, heart failure, diabetes, relative lymphocyte count, prothrombin time, peripheral artery disease and contralateral carotid occlusion were identified as strong and independent risk factors for long-term mortality after CAS. The multimarker risk score outperformed the prognostic value of single risk factors and was validated in an independent cohort. As risk scores with a superior predictive value should also be applicable in a real-world setting and are underused owing to their complex application, an easily applicable score optimized for clinical routine was calculated [11]. For this purpose, variables were categorized. The final optimized risk score can be easily computed by hand and is cost effective, as no measurements in addition to routine measurements are required. Despite being simple to use, this optimized score discriminated between low- and high-risk patients very well after CAS. However, does this latter score facilitate clinical management of patients undergoing CAS? Senescence certainly cannot be influenced by any kind of intervention but adequate treatment of chronic heart failure obviously improves survival [12]. Thus, patients undergoing CAS may benefit from routine screening for heart failure and subsequent, adequate treatment. Inadequate glycemic control in patients with diabetes seems also to be associated with poor survival after CAS. Screening for inadequate glycemic control by measuring HbA_{1c} and a more stringent glycemic control may be another very effective measure in CAS patients to improve long-term mortality. Screening for concomitant peripheral artery disease may be another important tool to improve risk prediction in addition to its importance for the vascular access in patients undergoing endovascular therapy. Peripheral artery disease was associated with a twofold increased risk for death after CAS compared with patients without peripheral artery disease. However, since peripheral artery disease is a chronic degenerative disease, treatment is difficult but patients may benefit from lifestyle modifications, such as exercise training. This intervention might not only extend their walking distance, but it might also keep the patient physically active, which could reduce the cardiovascular risk. In conclusion, awareness of the individual mortality risk after CAS may have an important impact on the management of the patient including closer clinical visits and a more aggressive modification of modifiable risk factors, such as diabetes mellitus or chronic heart failure.

> "*Peripheral artery disease was associated with a twofold increased risk for death after carotid artery stenting compared with patients without peripheral artery disease.*"

The latter described score estimates the risk for death in patients after CAS. It does not compare different treatment alternatives for carotid stenosis, such as endarterectomy or conservative treatment. A prediction model for identifying the best individual treatment option for patients with severe carotid stenosis would certainly facilitate their clinical management.

Conclusion

Clinical predication rules are important tools for individual risk assessment of a patient. However, risk scores are only clinically useful if they are simple, comprehensible and easily reproducible.

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References

1 Sianos G, Morel MA, Kappetein AP *et al.* The SYNTAX Score: an angiographic tool grading the complexity of coronary artery disease. *EuroIntervention* 1(2), 219–227 (2005).

2 Roques F, Michel P, Goldstone AR, Nashef SA. The logistic EuroSCORE. *Eur. Heart J.* 24(9), 881–882 (2003).

3 Gage BF, van Walraven C, Pearce L *et al.* Selecting patients with atrial fibrillation for anticoagulation: stroke risk stratification in patients taking aspirin. *Circulation* 110(16), 2287–2292 (2004).

4 Lip GY, Nieuwlaat R, Pisters R, Lane DA, Crijns HJ. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the euro heart survey on atrial fibrillation. *Chest* 137(2), 263–272 (2010).

5 Pisters R, Lane DA, Nieuwlaat R, de Vos CB, Crijns HJ, Lip GY. A novel user-friendly score (HAS-BLED) to assess 1-year risk of major bleeding in patients with atrial fibrillation: the Euro Heart Survey. *Chest* 138(5), 1093–1100 (2010).

6 Bates SM, Jaeschke R, Stevens SM *et al.*; American College of Chest Physicians. Diagnosis of DVT: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 141(Suppl. 2), e351S–e418S (2012).

7 Wells PS, Anderson DR, Rodger M *et al*. Excluding pulmonary embolism at the bedside without diagnostic imaging: management of patients with suspected pulmonary embolism presenting to the emergency department by using a simple clinical model and d-dimer. *Ann. Intern. Med.* 135(2), 98–107 (2001).

8 Wilson PW, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. Prediction of coronary heart disease using risk factor categories. *Circulation* 97(18), 1837–1847 (1998).

9 D'Agostino RB Sr, Vasan RS, Pencina MJ *et al*. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. *Circulation* 117(6), 743–753 (2008).

10 Hoke M, Ljubuncic E, Steinwender C *et al*. A validated risk score to predict outcomes after carotid stenting. *Circ. Cardiovasc. Interv.* 5(6), 841–849 (2012).

11 Wang TJ. Multiple biomarkers for predicting cardiovascular events: lessons learned. *J. Am. Coll. Cardiol.* 55(19), 2092–2095 (2010).

12 The Consensus Trial Study Group. Effects of enalapril on mortality in severe congestive heart failure. *N. Engl. J. Med.* 316(23), 1429–1435 (1987).