

## Preface

## Recent Advances in Thrombosis and Hemostasis—Part X

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Some people worry that artificial intelligence will make us feel inferior, but then, anybody in his right mind should have an inferiority complex every time he looks at a flower.—

Alan Kay, Computer Scientist

There is no doubt that artificial intelligence has a lot to offer in medicine, supporting physicians in diagnosis, prediction of prognosis, personalized treatment, and in general organization of our medical care system. It will not make physicians or allied health professionals obsolete. The human interaction with patients is an important part of the care, empathy is irreplaceable. The publications on the use of machine learning in medicine are increasing exponentially, and it is therefore not surprising that the first contribution to this theme issue is a systematic review of the performance of various machine learning models to predict risk of thrombosis in patients with cancer. El-Sherbini et al identified eight studies, some of those evaluating many different models.<sup>1</sup> The best model reached an accuracy of 0.84, and in the studies that used the Khorana score<sup>2</sup> as a comparator, the machine learning model was consistently better.

Although less frequent than cancer, antiphospholipid syndrome is also associated with a high risk for thrombosis, which can be refractory to standard anticoagulant therapy. Aguirre Del-Pino et al have here reviewed risk factors for the development of antibodies against phospholipids and associated proteins.<sup>3</sup> In the second half of their article, the risk of thromboembolic events and other clinical manifestations is discussed, taking into account a large variety of comorbidities, including other autoimmune conditions and traditional cardiovascular risk factors.

The risk of thromboembolism in coronavirus disease 2019 (COVID-19) is well described and clinical practice guidelines on prevention and management of thrombosis have been published.<sup>4</sup> Lippi et al are here addressing the question whether the risk of thromboembolism is higher with

COVID-19 than with other airborne virus infections.<sup>5</sup> The answer is Yes and No, depending on the strain of the influenza virus and how ill the patient gets. Regarding COVID-19, the absolute number of patients developing thromboembolism has decreased, but for the few with severe illness, typically managed in a critical care setting, the risk is still high.

Continuing on the COVID-19 theme, Bozzani et al have studied three periods of the pandemic (February–April in 2021, 2022, and 2023) and analyzed the risk for post-COVID syndrome among patients who were hospitalized with severe COVID-19 and complicated by symptomatic thromboembolism.<sup>6</sup> Residual physical and/or emotional/mental symptoms were common in this subset of patients, but the prevalence and severity seemed to diminish in the latter 2 years.

One contribution deals with the diagnosis of pulmonary embolism. The standard diagnostic tool today in most places is computed tomographic pulmonary angiography (CTPA). When CTPA is contraindicated (advanced nephropathy, allergy to contrast agent), lung ultrasound might have a place, as reviewed by Boccattonda et al.<sup>7</sup> This approach identifies peripheral lung infarctions, and contrast-enhanced ultrasound with microbubbles enhances the imaging.

A very large group of authors, led by Behnood Bikdeli, has systematically reviewed the entire literature on congenital and acquired vena cava interruptions.<sup>8</sup> They address both epidemiology and management, complementing the latter part with a Delphi process. One important conclusion is that a young patient presenting with bilateral leg vein thrombosis should be suspected to have agenesis of the inferior vena cava.

Continuing down in age, Spiezia et al provide here a review of all the trials and registries with rivaroxaban for treatment of venous thromboembolism in children and adolescents.<sup>9</sup> The formulation of rivaroxaban for the young children is in granules that are mixed with accompanying water and dispensed orally with a dosing syringe. The data from clinical practice observational studies support those from the randomized clinical trials regarding good efficacy and safety.

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Even further down in age is the retrospective study on prothrombin complex concentrate (PCC) within an institutional protocol for pediatric cardiac surgery, reported by Kiskaddon et al.<sup>10</sup> The median age of the 86 patients was 0.37 years and the median dose of the four-factor PCC was 25 units/kg with only 7% requiring a second dose. There was reassuringly only one thrombotic event during the hospitalization and a total of two during 30 days. The blood product utilization after the PCC dose was generally low.

A Spanish interdisciplinary group has utilized the Delphi process for 31 recommendations regarding venous stenting, although for 8 of those there was no agreement.<sup>11</sup> They present here their work and their conclusions regarding indications for stenting, as well as when stents should be avoided, considerations on stent selection, evaluations needed before stent placement, precautions during the placement, and management after the procedure.

Next, we have two letters to the Editor. The first is a case report by Pengo et al on a 40-year-old patient with myocardial infarction due to thrombus in the left anterior descending artery following orthopaedic surgery for traumatic femoral and pelvic fractures.<sup>12</sup> The patient had a history of antiphospholipid syndrome and the activated partial thromboplastin time was prolonged, which possibly caused administration of more hemostatic drugs than necessary.

The second letter by Fan et al describes two patients with “vacuoles, E1 enzyme, X-linked, autoinflammatory, somatic” = VEXAS syndrome, who developed venous thrombosis.<sup>13</sup> There were several markers of a hypercoagulable state and the management in such cases seems to require anti-inflammatory and immunosuppressive drugs together with anticoagulation.

Finally, we are excited to reprint as part of our celebrational historic series the paper by Baskurt and Meiselman on blood rheology and hemodynamics.<sup>14</sup> This is followed by a new commentary by Simmonds et al.<sup>15</sup>

These briefly described contributions to the current issue of *Seminars in Thrombosis and Hemostasis* may lead the reader from prediction and risk factors, via diagnosis, to treatment of thrombosis in a variety of age groups. Alternatively, if time is a limitation, pick and choose the most interesting articles.

#### Conflict of Interest

None declared.

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