EClinicalMedicine 18 (2020) 100244

Contents lists available at ScienceDirect

EClinicalMedicine

journal homepage: https://www.journals.elsevier.com/eclinicalmedicine

Commentary

Predicting scoliosis progression: a challenge for researchers and clinicians

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ARTICLE INFO

Article History:
Received 12 December 2019
Accepted 12 December 2019
Available online xxx

Idiopathic Scoliosis (IS) is a three-dimensional deformity of the spine with a prevalence ranging between 1 and 4 % [1,2]. IS treatment during growth is secondary prevention with the primary aim to reduce the trunk deformity and avoid progression over 30° Cobb; the secondary aim is to avoid surgery whose threshold is above 45–50° [3]. It has been shown that ending growth below 30° allows preventing progression, disability and pain in adulthood [4].

IS has a multifactorial aetiology [4] showing a wide range of different forms: anatomical (single or multiple curves and different localization), aesthetical (milder curves with visible changes and severe hiding perfectly), and prognostical (from highly to non-progressive).

One of the major challenges faced by clinicians is related to IS prognosis and to making decisions on which would be the best treatment for every single patient [4,5]. In this context, experts use some known clinical risk factors, the most important being residual growth: the more it is, the more the risk [6]. Other factors include the deformity in sagittal and transversal planes (rotation and flat back), familiarity and joint laxity [4]. Genetics investigations have recently highlighted the heterogeneity of IS and the major role of non-genetic factors [7].

Considering the involvement of a multifactorial pathomechanism, in this article of *EClinicalMedicine* Zhang and colleagues developed a clinically applicable composite model using quantitative factors including circulating markers to predict the probability of progression to 40° [8]. The test of the accuracy of the model showed 80% of specificity and 92% of sensitivity, thus meaning that the model is good in discriminating patients at high risk for progression to 40°. According to the model, there is a 20% risk of overtreating patients with less aggressive IS. Is this enough? It depends on the treatment used to avoid progression. The SOSORT Guidelines recommend that "for each patient, it is mandatory to choose the correct step of treatment, where the most efficacious is also the most demanding" [4]. Expert clinicians should always choose the option they think is the most likely to reach the goals agreed with the patient but also the less invasive in the attempt to balance between undertreatment (that leads to little or no efficacy) and overtreatment (too much burden on the patient, without further benefit). Moreover, goals of treatment may vary according to patients' perspectives, with aesthetics being one of the most important goals for patients, sometimes underestimated by researchers [5]. That means that we cannot define over- and undertreatment only according to the Cobb angle. Surgery remains the last treatment option; it exposes to higher risks, and it is the most invasive treatment [9].

The introduction of a composite model, including genetic factors, is the novelty of this study, but some clinical questions remain open. The type and quality of treatment applied, the compliance to treatment and the dosage of brace-wear have not been included in the model, although they are recognised as determinants of final results [10]. The chosen threshold of 40° is questionable, though justified by the authors. Surgery is indicated for curves exceeding 50° [2]. The 30° degrees threshold is the most important for patients' future [2]. From a clinical point of view, the 40° threshold is too low for surgery indication and too high for the best achievable result from patients' perspective.

A prognostic model should help clinicians in their choices after risks estimation, but according to the Evidence Base Practice principles, in clinical decision-making patients' attitudes towards the treatment option should always be considered [4]. The currently developed composite prediction model for progression over 40° showed that the major predictor is Cobb degrees at start. In the logistic regression equation, only weight reaches significance level, while the other factors seem to work more as confounders than covariates: delayed menarche, lower body weight, Risser sign and genetic factors play a marginal role, as shown in the comparison of the predictive power. The relatively small sample of subjects used to develop the model exposes to some risk of overfitting. The authors managed this limitation by reducing the alpha level to 0.01 and validated the model in a real sample, thus increasing the external validity of their results.

The fact that Cobb at start is the major predictor, confirms the key-role played by screening and conservative care: exercises and bracing to prevent progression should be started at early stages of the deformity when it is early diagnosed. Composite models, including genetic factors, showed to offer promising improvement to the

DOI of original article: http://dx.doi.org/10.1016/j.eclinm.2019.12.006.
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https://doi.org/10.1016/j.eclinm.2019.100244

prediction of IS progression, but need to be validated in larger samples and with more complex validation techniques.

Declaration of Competing Interest

SD nothing to disclose. FZ nothing to disclose. SN owns ISICO stocks.

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