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Theodoros B. Grivas

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LETTER TO THE EDITOR

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Theodoros B. Grivas

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Abstract In this letter to the Editor, an additional radiological thoracic deformity parameter is described, which was not included in the review, namely the rib index (RI). The index and its usefulness of its application are described, both in the clinical praxis and in the aetiology of idiopathic scoliosis. The pertinent literature is also sited.

Keywords Rib index · Idiopathic scoliosis · Conservative treatment · Surgical treatment · Aetiology of IS

Dear Editor,

We would like to compliment the authors for their work, which is a very good review.

The reason of this communication is that one of the pertinent reported parameters is missing in this review, namely the rib index (RI). RI assesses the transverse plane deformity of the thorax in IS. The inclusion of RI and the pertinent published studies for this parameter may provide better insight in idiopathic scoliosis (IS) aetiology.

All lateral spinal radiographs in IS show a double rib contour sign (DRCS) of the thoracic cage, a radiographic expression of the rib hump (RH). The outline of the convex overlies the contour of the concave ribs. The RI method was extracted from the DRCS to evaluate RH deformity in IS patients, in other words, the transverse plane deformity (TPD) of the thorax in IS. The RI was calculated by the ratio of spine distances $d1/d2$, where $d1$ is the distance between the most extended point of the most extending rib contour and the posterior margin of the corresponding vertebra on the lateral scoliosis films, while $d2$ is the distance from the least projection rib contour and the posterior margin of the same vertebra. In a symmetric thorax, the "rib Index" is 1 [1, 2].

The DRCS and RI were presented in 1999 [3] and published in 2002 [2]. This publication focused on the implications of DRCS on the aetiology of idiopathic scoliosis [2].

The reliability study of the RI revealed that this index is a reliable method to evaluate the thoracic deformity [2]. Additionally, the validity study of DRCS, that is how the RI is affected by the distance between the radiation source and the irradiated child, showed that the RI is not practically affected by the distance between the radiation source and the irradiated child [2].

Therefore, the RI is a reliable and valid method serving the evaluation of the deformity [2], the effect of conservative (bracing or application of physiotherapeutic specific scoliosis exercises) [4–6] or surgical treatment [7–10] on the rib cage TPD (RH) in children with IS. It is noted that RI is a simple method and a safe reproducible way to assess the RH deformity based on lateral radiographs, without the need for any other special radiographs and exposure to additional radiation. One additional benefit of this method is its implementation not only in prospective but also in retrospective studies, using the existing initially obtained spinal radiographs of IS patients, provided that the radiography is performed in a standard way.

The authors wisely note that uncovering the complex relationships of spinal deformity, rib cage development and pulmonary function will optimise the treatment of IS children and improve their quality of life. In this context, the use of RI has important implications on aetiology and screening policies for IS, and this is an additional benefit from its introduction. Its use resulted in a very important

T. B. Grivas (✉)
Orthopaedic and Traumatology Department, "Tzaneio" General Hospital of Piraeus, Piraeus, Greece
e-mail: tgri69@otenet.gr

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knowledge derived from the correlation of Cobb angle with the RI in radiographs from the screening programmes referrals. Approximately, 30 % of younger referred girls, aged equal or less than 13 years old with an Angle of Trunk Rotation (ATR) $\geq 7°$, were found to have either a straight spine or a spinal lateral curve under 10°. In this age group, the correlation between thoracic deformity in terms of RH (the thoracic TPD) assessed using the RI and the radiographic spinal measurement in terms of Cobb angle is not statistically significant, while in older referred girls, aged 14–18 years old, it is [11]. Thus, all younger individuals, referred to scoliosis clinics from screening programmes, who are identified with a surface deformity (RH) but without a typical scoliotic curve (that is children having Cobb angle less than 10°) are at risk to develop IS. All these children should be followed and not discharged from regular follow-up. In line with this statement are the Nissinen et al. [12] 1993 school screening longitudinal study findings.

Furthermore, the way the RI correlates with the Cobb angle by age shows that growth has a significant effect in the correlation between the thoracic and the spinal deformity in girls with IS. Therefore this fact should be considered when trying to assess the spinal deformity from surface measurements. The findings of this study [11] implicate the role of the thorax, as it shows that the rib cage deformity precedes the spinal deformity in the pathogenesis of IS. This is in line with the interesting finding that in the spinal radiographs of the mild scoliotic curves, the wedging (the deformity) appears only in the intervertebral disc level (intervertebral discs), while the vertebra are not yet wedged. This information was reported for the first time in 2006 [13] and confirmed three years later [14].

In conclusion, the published review could be elaborated and completed including this thoracic deformity radiological parameter (RI) in IS.

Conflict of interest None.

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