Successful Correction of Sagittal Imbalance can be Calculated on the Basis of Pelvic Incidence and Age

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Introduction

Sagittal imbalance is an independent predictor of outcome in adult degenerative spinal deformity. Restoration of sagittal spinopelvic parameters correlates with a better postoperative outcome. Several methods of preoperative calculation for sagittal correction have been proposed, most of them geometrical. A nongeometrical method, based on data of spinopelvic relationships in normal subjects, that uses the patient's pelvic incidence and age to calculate target lumbar lordosis and thoracic kyphosis is proposed. The goal of this study is to describe and validate this nongeometrical method in terms of sensitivity and specificity to predict satisfactory spinopelvic alignment.

Materials and Methods

A retrospective cohort study of patients operated for sagittal imbalance with pedicle subtraction osteotomies (PSO). Two calculation algorithms (method a: $LL = -[32.56 + PI \times 0.54]$, method b: $LL = -[PI + 10$ degrees$]$); in both $TK = PI/r$ (see text for definitions) obtain theoretical lumbar lordosis (LL) and thoracic kyphosis (TK) solely based on pelvic incidence and age, for surgical planning. The sample is categorized according to two parameters: planning goals (LL and TK) achieved or not and satisfactory alignment ($SVA < 50$ mm and $PT < 20$ degrees) achieved or not. Two × two tables are built and odds ratio, sensitivity and specificity and PPV/NPV are calculated for each planning method. Different levels of tolerance for undercorrection are analyzed to refine the use of the method.

Results

Of the 50 patients included in the study, 23 presented satisfactory alignment postoperatively. With a tolerance of hypocorrection of 10 degrees (LL) and 30 degrees (TK), correction target was achieved in 23 patients according to method a ($S = 0.89$, $Sp = 0.87\%$, $OR = 53.33$ [95% CI: 9.677–293.931]; $p < 0.001$), 23 patients according to method b ($S = 0.93$, $Sp = 0.91$, $OR = 131.25$ [95% CI:17–1013]; $p < 0.001$). The best prediction of satisfactory alignment was obtained with method b and tolerance 0 degrees (LL) and 10 degrees (TK). All patients with complete correction of LL (both methods) achieved good alignment. Overall, 22 of the 24 (91%) patients with less than 10 degrees of undercorrection of LL (method b) achieved good alignment.

Conclusion

Calculation of the target lordosis based only in the value of PI and age is a reliable method that can predict good outcomes in terms of alignment. The rule $LL = -(PI + 10$ degrees$)$ is an easy to calculate and very effective method of planning for lumbar lordosis and good alignment can be expected with high confidence when the final lordosis is within 10 degree of undercorrection. Including TK in surgical planning can improve the results in terms of restoration of the less known "spinopelvic balance" parameter.