A NEW METHOD TO PREDICT THE COMPLICATIONS RATE DURING BONE LENGTHENING

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Bone lengthening by distraction osteogenesis in contemporary practice is based on Ilizarov's principle of tension stress. Distraction osteogenesis is a powerful tool for addressing segmental defects and limb-length discrepancies. However, in many cases the difference in leg length is enormous and consequently the treatment time in the external fixator is long. Moreover, this method is associated with many problems and complications. Complications arising from limb-lengthening procedures such as joint contractures and subluxations, traction injuries to the nerves and vessels leading to neuropathies and hypertension, broken pins leading to fixation failure and axial malalignment of the bone are often severe leading to long-term residuals. The aim of this study was to determine whether the complication rate and complexity could be predicted using a distraction index for bone lengthening in children.

MATERIALS AND METHODS
This study retrospectively reviewed a series of 116 lower limbs lengthening in 88 consecutive patients (mean age 13.5). Mean follow up 3.8 years. Lengthening percentage, lengthening index, distraction regenerate length, additional surgeries, and complications rate were used to evaluate the results of limb lengthening. The correlation between lengthening percentage and complication rate was particularly analyzed and its practicability illustrated. Scatter plots of complication rate (%) against lengthening percentage were constructed, and linear regression was used to investigate mathematical relationship between the variables.

RESULTS
The lengthening index was 33±2.1 days/cm. The length of distraction regenerate was 62±0.4 cm. The lengthening percentage was 21±2.1. The scatter plots of neurologic complication rate (Figure 1), residual deformities rate (Figure 2), broken pins rate (Figure 3), joint contractures rate (Figure 4), and hypertension rate (Figure 5) against lengthening percentage showed a positive linear relationship with r = 0.8.

DISCUSSION
Although new bone formation is the most identifiable and remarkable effect of limb lengthening, the observations made by Putti in 1934 about soft tissues around the bone as presenting the greatest difficulty encountered in obtaining a successful result, are still actual today. Scatter plots (complication rate against lengthening percentage) showed a positive linear relationship with r = 0.8, which is a strong positive correlation. This implies that the lengthening percentage correlates very well with the complication rate and can be used to predict the complication rate. Thus, during planning a lengthening procedure the lengthening percentage should be a useful tool to predict the complications rate, and discuss the risks and benefits with patients and their families. A detailed analysis of complications in our study provided evidence that the number of complications increased considerably with the increase in lengthening percentage (Figures 1, 2, 3, 4, 5). The Distraction osteogenesis is capable to achieve remarkable increase in the bone length, however the price is increased treatment time and complications rate. The knowledge about predictable complications should help prevent and early detect expected complications. Gradual predicted increase in complication rate allows us to work on their appropriate prediction and treatment.