Validation, Reliability, and Complications of a Tethering Scoliosis Model in the Rabbit

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Abstract

This study was conducted to refine a small animal model of scoliosis, and to quantify the deformities throughout its growth period. Subcutaneous scapula-to-contralateral pelvis tethering surgery was selected due to its minimally invasive nature and potential applicability for a large animal model. The procedure was performed in 7-week-old New Zealand white rabbits. Group A animals (n=9) underwent the tethering procedure with a suture that spontaneously released. Group B animals (n=17) had the identical procedure with a robust tether and pelvic fixation, which was maintained for 2 months during growth. All animals developed immediate post-operative scoliosis with a Cobb angle of 23° (range, 6–39°) in group A and 59° (range, 24–90°) in group B animals. During the 2 month post-tethering, group A animals lost their tether and scoliosis resolved, whereas all animals in group B maintained their tether until scheduled release at which time the mean scoliosis was 62°. Immediately after tether release, group B scoliosis decreased to a mean 53°. Over the following 4 months of adolescent growth, the scoliosis decreased to a mean of 43° at skeletal maturity; the decrease usually occurred in animals with less than 45° curves at tether release. Radiographs revealed apical vertebral wedging (mean 19°) in all group B animals. Sagittal spinal alignment was also assessed, and for group B animals, the scoliotic segment developed mild to moderate kyphosis (mean 28°) and torsional deformity, but the kyphosis resolved by 4 months after tether-release. Complications specific to this technique included a high rate of transient scapulothoracic dissociation and cases of cor pulmonale. In conclusion, this tethering technique in immature rabbits consistently produced scoliosis with vertebral wedging when the tether was intact through the first 2 months of the protocol. The transient exaggeration of kyphosis suggests that the production of scoliosis is not necessarily dependent on lordosis in this model. Because this technique does not violate thoracic or spinal tissues, it may be useful in the investigation of secondary physiologic effects of mechanically-induced scoliosis, and may be scalable to larger animal species.