Abstract

The evaluation of pelvic obliquity in the transverse plane is important in children with severe neuromuscular scoliosis. The purpose of this study is to evaluate a recently described method of determining pelvic obliquity using radiographs in patients with cerebral palsy and scoliosis.

This was a retrospective review of a random sample of 40 neuromuscular scoliosis radiographs evaluating inter- and intra-observer error for a novel method of determining transverse plane pelvic obliquity.

None of the calculations were found to be statistically significant, demonstrating poor agreement. The amount of experience of the observer did not affect agreement.

The low correlation was likely due to our inability to consistently identify pelvic landmarks.

Introduction

The evaluation of pelvic obliquity in the transverse plane has not been thoroughly studied, but is important in children with severe neuromuscular scoliosis (see figures 1 and 2). Severe rotational pelvic deformities can lead to truncal imbalance and significant difficulty with seating for children who are mostly wheelchair ambulators.

A true appreciation of the magnitude of pelvic rotational obliquity is important for preoperative planning when one is considering surgery for these children with severe scoliosis. One technique of evaluating the rotational pelvic obliquity has been suggested in the literature.

The purpose of this study is to evaluate the utility of a recently described method of determining transverse plane pelvic obliquity using standard radiographs in patients with cerebral palsy and neuromuscular scoliosis.

Methods

Study Participants and Setting: Random sample of scoliosis radiographs of children with cerebral palsy at a tertiary-care, referral pediatric hospital

This was a retrospective review of neuromuscular scoliosis radiographs evaluating inter- and intra-observer error for a novel method of transverse plane pelvic obliquity. 40 radiographs were chosen from 10 patients with cerebral palsy and neuromuscular scoliosis. Radiographs included pre- and post-operative anterior-posterior and lateral images.

The radiographs were examined independently by four observers at different levels of training (faculty, fellow, postgraduate year 5, and medical student year 4). The measurements were taken on two dates at least one week apart. The measurements recorded by each observer were described by Lucas et al. (E, FR, FL, and F) (see figure 3). The β value was calculated by utilizing the following formula: β = (√(E2 - F2)) / F. The inter- and intra-observer error was determined by the concordance correlation coefficient (CCC). A CCC of 0.90 or higher was considered excellent agreement.

Analysis of variance was used to compare inter-observer error, with a alpha value of ≤0.05 considered significant. Reproducibility of the measurements were analyzed using the concordance correlation coefficient (CCC). A CCC of 0.90 or higher was considered excellent agreement.

Reproducibility of the observer error for a novel method of determining transverse plane pelvic obliquity was considered excellent agreement. The amount of experience of the observer did not affect agreement. None of the calculations were found to be statistically significant, demonstrating poor agreement. Even when using a modified version of the equation, eliminating the E variable, the CCC was only 0.51.

The inter-observer reliability was also poor (see table 2). There was no correlation between reliability and the level of training of the observer.

Discussion

The ability to reliably measure and calculate the degree of transverse plane rotation by radiographs in cerebral palsy patients with spino-pelvic deformity with currently described techniques is poor. The low correlations were likely due to our inability to consistently identify pelvic landmarks and was most compromised in the evaluation of the lateral x-rays.

The ranking of agreements did not correspond to the amount of experience of the observer, suggesting that further training would likely not improve the reliability of this method.

Anatomic landmarks can be difficult to identify in this patient population. More research is needed to determine if it is possible to accurately evaluate pelvic obliquity using radiographs for patients with neuromuscular scoliosis.

Results

There was low intra-observer reliability using this method (see table 1). The CCC between the first and second sets of measurements was lowest for E (distance measured on lateral radiographs between the ilium at the inferior part of the sacroiliac joint and the lateral edge of the anterior superior iliac spine). However, none of the CCC calculations were found to be statistically significant, demonstrating poor agreement. Even when using a modified version of the equation, eliminating the E variable, the CCC was only 0.51.

The inter-observer reliability was also poor (see table 2). There was no correlation between reliability and the level of training of the observer.

| Table 1 | The inter-observer reliability of the measured variables |
| --- | --- | --- |
| E | 16.5 | 0.48 |
| FR | 10.3 | 0.72 |
| FL | 9.7 | 0.80 |

| Table 2 | The reliability of the pooled measurements of E, FR, and FL |
| --- | --- | --- |
| E | 0.18 | |
| FR | 0.33 | |
| FL | 0.13 | |

Reference