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Spinal Deformity in Russell–Silver Syndrome

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Abstract

Study Design: Cross-sectional analysis.
Objectives: To evaluate the prevalence of scoliosis and kyphosis in patients with Russell–Silver syndrome (RSS).
Summary of Background Data: Russell–Silver syndrome was described by Silver and Russell in the 1950s and 1960s and is characterized by body asymmetry and other growth abnormalities. To the authors' knowledge, this is the first study to evaluate the prevalence of scoliosis and kyphosis in patients with Russell Silver Syndrome.
Methods: The authors performed a cross-sectional analysis of 163 persons, identified through a national RSS foundation, who consented to be included in the study and responded to a general survey questionnaire. Subjects who reported a diagnosis of scoliosis and/or kyphosis were subsequently asked to submit copies of prior spinal radiographs for evaluation at the authors' center. For evaluation of scoliosis and kyphosis on the radiographs, the researchers reviewed posteroanterior and lateral standing radiographs to measure coronal and sagittal Cobb angles.
Results: Of 163 respondents, 24 (14%) reported scoliosis, 5 (3.1%) reported kyphosis, and 6 (3.8%) reported both kyphosis and scoliosis, with average age of diagnosis of 8 years (range, 1–43 years). Of these respondents, 6 reported a history of bracing for scoliosis and/or kyphosis and 3 braced respondents reported having had surgery for scoliosis and/or kyphosis. An additional 3 respondents reported that corrective spinal surgery was "planned for the future."
Conclusions: Persons with RSS have a high prevalence of spinal deformity (21%) and a significant number of these patients will undergo corrective surgery (6 of 34; 18%).
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Keywords: Russell–Silver syndrome; Scoliosis; Kyphosis; Spinal deformity; Prevalence

Introduction

Russell [1] and Silver [2] independently described characteristics in children with low birth weight, asymmetry of the body, and growth restriction among other abnormalities. This syndrome is referred to as Russell–Silver syndrome (RSS) or Silver–Russell syndrome; both names are frequently used.

The incidence of RSS is largely unknown, although it is estimated to be 1 in 50,000–100,000 births [3,4]. To date, there are few published data on the prevalence of scoliosis and kyphosis in this syndrome. Two articles reported that children with RSS may have an increased risk of scoliosis, primarily if they have concomitant body asymmetry [3,5]. One study on the musculoskeletal manifestations of RSS reported scoliosis in 9 of 25 subjects (36%) [6]. The goal of the current study was to determine the prevalence of scoliosis and kyphosis in the general population of persons

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with RSS. The authors hypothesized that the prevalence of scoliosis and kyphosis is high in persons with RSS.

Materials and Methods

Before initiation of this study, the authors obtained institutional review board approval and followed all policies. The study consisted of 2 parts: a cross-sectional survey of RSS patients and review of radiographs of patients who reported scoliosis or kyphosis.

Subjects were contacted with the help of the RSS division of the Major Aspects of Growth in Children (MAGIC) Foundation, which works closely with families of RSS children and provides an annual family medical convention. Subjects and/or parents were contacted at the MAGIC Foundation convention or via e-mail through the MAGIC Foundation's contact database. Those who agreed to participate in the study gave informed consent and completed a survey with questions concerning the diagnosis of RSS, genetic testing medical history, diagnosis of scoliosis and/or kyphosis, non-spinal musculoskeletal problems, and history of surgical and nonsurgical treatments. Genetic testing included report of loss of methylation of the 11p15 imprinting center region 1 (11p15 LOM) or maternal uniparental disomy for chromosome 7 (mUPD 7), which have been demonstrated to correlate with RSS [7-12]. Over 400 RSS families were initially contacted with complete study information, with a patient age range from infancy through adulthood. The MAGIC Foundation communicated the study as important to the overall RSS community, encouraging all to participate.

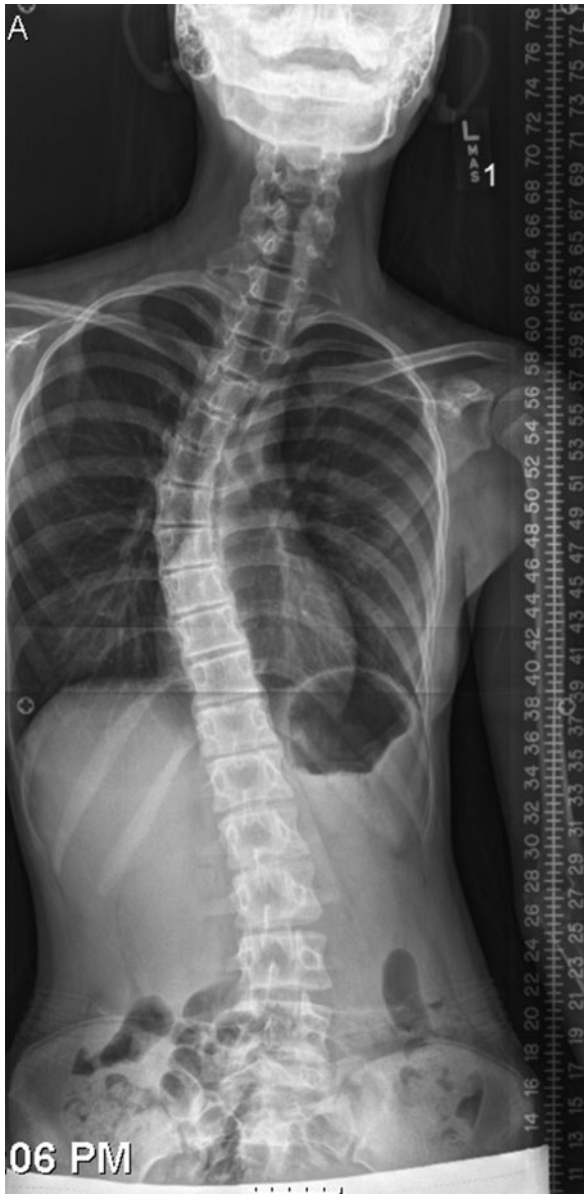

Fig. 1. Standing posteroanterior radiograph of subject demonstrating scoliosis.

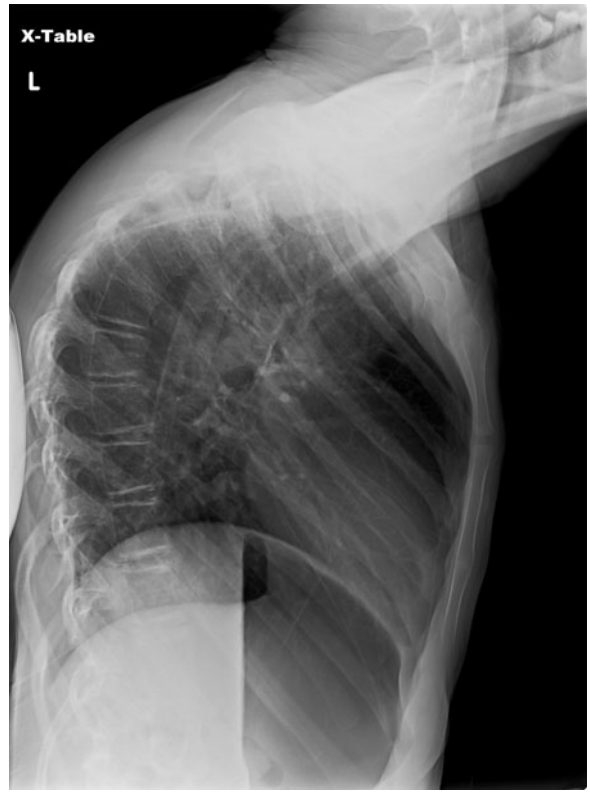

Fig. 2. Cross-table lateral radiograph of subject demonstrating kyphosis.

Subjects who reported scoliosis and/or kyphosis were asked to submit radiologic images for review at the authors' institution for confirmation of the diagnosis (Figs. 1, 2). Evaluation of the radiographs included Cobb angle measurements in the coronal and sagittal planes. Chi-square test was used to compare observed values.

Results

Of the estimated 400 families who were contacted, 163 subjects (41%) responded to the survey. All 163 reported physician-diagnosed RSS. Mean age at the time of the survey was 11 years, with a median of 10 years (range, 1–43 years).

An evaluation of reported genetic testing results correlating with RSS demonstrated that 44 subjects reported

positive testing for 11p15 LOM and 23 reported positive testing for mUPD; 96 subjects reported clinical diagnosis by experienced physicians in the field of RSS. Thus, 41% of subjects (67 of 163) reported positive genetic testing for RSS in addition to clinical diagnosis by a physician.

Of the 163 respondents, 35 subjects (21.5%) reported a history of spinal deformity. Twenty-four (14.7%) reported scoliosis only, 5 (3.1%) reported kyphosis only, and 6 (3.7%) reported both scoliosis and kyphosis. Of the 35 subjects who reported spinal deformity, radiographs were received from 21. Radiographic measurements of subjects with scoliosis demonstrated a mean coronal Cobb angle of 23.8° (range, 10° to 54°) in 18. Radiographic measurements of subjects with kyphosis demonstrated a mean maximum kyphosis of 66.7° (range, 53° to 83°) in 6.

Of the 18 subjects with scoliosis verified by radiographs, 6 (33%) reported limb shortening of the contralateral lower extremity relative to the convexity of the scoliotic curve, 8 (44%) reported limb shortening of the ipsilateral extremity, and 4 (22%) reported no body asymmetry. Comparison of the laterality of lower extremity limb shortening and the direction of the scoliotic curve demonstrated no statistically significant difference between ipsilateral and contralateral lower extremity shortening and the direction of the scoliotic curve ($p = .59$).

Of the 35 subjects with spinal deformity, 7 (20%) reported a history of brace wear for spinal deformity, 3 (8.6%) reported having had surgery for spinal deformity, and 3 (8.6% reported that surgery was planned for the future. In total, 11 of 35 subjects with spinal deformity (31.4%) reported bracing or surgical therapy.

Discussion

To the authors' knowledge, this is the largest study in the English literature to report on spinal deformity in RSS and the first study to report on the prevalence of kyphosis in RSS.

The first report of scoliosis in RSS was described by Silver [2] in 1964, when he reported scoliosis in 5 of 29 RSS subjects (17%), similar to the results of the current study showing that 30 of 163 subjects had scoliosis (18.4%). However, the current study also examined the prevalence of kyphosis. Scoliosis and/or kyphosis were present in more than 1 in 5 patients with RSS. In addition, the current authors found that 6 of 34 subjects (18%) with spinal deformity had or were scheduled to have corrective surgery for spinal deformity.

Strengths of this study are that it analyzed a large population of subjects with RSS in a manner that minimized bias toward having more subjects with skeletal deformity in the results. By recruitment through the MAGIC Foundation, the authors theoretically obtained a representative sample of subjects with RSS, not strictly limited to subjects with orthopedic symptoms. Furthermore, by using a general questionnaire that was not specific for spinal deformity, the researchers believe they were able to reduce reporting bias toward spinal deformity.

One disadvantage of the study is that the authors were unable to identify the true prevalence of scoliosis within the RSS population because they were only able to evaluate radiographs of 21 subjects, relying on self-reporting to determine prevalence. Although they had a large number of respondents to the survey, those who did not submit surveys may be a cause of selection bias, possibly causing the reported prevalence of 21.5% to be inaccurate. Although radiographs from nearly half of the persons with self-reported scoliosis and/or kyphosis confirmed a spinal deformity in all but 1 case, the prevalence might have been as low as 12% for spinal deformity if only subjects with spinal deformity confirmed by radiograph were included (20 of 163 subjects with confirmed radiographs demonstrating spinal deformity).

The presence of spinal deformity is high in patients with RSS, especially those with leg length discrepancies. Increased awareness of this deformity in this population may lead to earlier detection and earlier intervention.

Key points:

- To the authors' knowledge, this is the largest study to report on spinal deformity in Russell–Silver Syndrome (RSS).
- Of the 163 subjects with RSS, the researchers found that scoliosis and/or kyphosis was present in >1 of 5 subjects (21.5%).
- Persons with RSS have a high prevalence of spinal deformity (21%) and a significant number of these patients will undergo corrective surgery (6 of 34; 18%).

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