Symptomatic rickets in adolescence

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Abstract

Aim—To describe 21 cases of symptomatic rickets in adolescents.

Methods—The setting was a primary and secondary care hospital in Saudi Arabia providing medical care to Saudi Arab company employees and their families. Cases of symptomatic rickets diagnosed between January 1996 and December 1997 in adolescents aged 10 to 15 years were assessed with respect to clinical presentation, biochemical and radiological evaluation, dietary assessment, and estimation of sun exposure.

Results—Symptomatic rickets developed in 21 adolescents (20 females), with a prevalence rate of 68 per 100 000 children years. Presentation included carpopedal spasms (n = 12), diffuse limb pains (n = 6), lower limbs deformities (n = 2), and generalised weakness (n = 1). Biochemical findings included hypocalcaemia (n = 19), hypophosphataemia (n = 9), raised serum alkaline phosphatase (n = 21) and parathormone (n = 7), and reduced 25-hydroxyvitamin D concentrations (n = 7). Radiological studies were suggestive of rickets in only eight children. All children had an inadequate dietary calcium and vitamin D intake. All but one had less than 60 minutes sun exposure per day.

Conclusion—Even in sunny climates, adolescents, especially females, can be at risk of rickets. Hypocalcaemic tetany and limb pains were the most common presenting symptoms. Radiological evidence was not present in every case.

Keywords: rickets; hypocalcaemia; nutrition; sun

In developing countries nutritional rickets is common in infancy and the practice of routine vitamin D supplementation in this age group is well established. In those countries, although infants and adult women are at increased risk, no affected adolescents have been reported. The development of nutritional rickets during rapid growth in puberty has been reported in adolescent Asians and North Africans living in developed countries with a colder climate. This was attributed to low vitamin D intake, lack of sunlight, skin pigmentation, and a possible genetic disability to synthesise cholecalciferol or to convert it to its more active metabolites, combined with increased metabolic demands as a result of rapid growth at puberty.1

We report the unexpected development of symptoms of rickets in a series of Saudi Arab adolescents living in a sunny environment. The clinical presentation, and biochemical and radiological findings are discussed, as well as the risk factors for the development of rickets.

Materials and methods

Our institution provides free primary and secondary medical care to a population of Saudi Arab company employees and their families, all of whom are registered in our institution where they receive curative and preventive care, including mandatory immunisations. We report all cases of symptomatic rickets diagnosed in adolescents (aged 10 to 15 years) in our institution between January 1996 and December 1997 (n = 21); this constituted the numerator for prevalence calculation, with the denominator being the total number of adolescents in the same age group who were registered and eligible for care in our institution during that same two year period (n = 30 880).

Symptomatic rickets was defined as symptoms or signs attributable to rickets (tetany, convulsions, bone deformities or pain, muscle weakness). Rickets was diagnosed on the basis of abnormal biochemical results (raised serum alkaline phosphatase, with or without raised parathormone concentration, low serum 25-hydroxyvitamin D concentration, or raised serum 1,25-hydroxyvitamin D concentration); supported in some cases by radiological signs, together with evidence of clinical and biochemical normalisation after vitamin D and calcium supplemental therapy. Children with renal or hepatic disease, malabsorption, or on anticonvulsant therapy were excluded.

The clinical, anthropometric, biochemical, and radiological data were collected. Standard deviation scores (z scores) for height and weight were calculated according to the World Health Organisation 1985 standard. The average daily dietary intake of calories, calcium, and vitamin D was estimated using the seven day recall method in an interview with a dietician. Estimation of the average daily duration of sun exposure (uncovered face and hands at least) was based on information given during an interview with a social worker. The average daily duration of sun exposure during school term, weekend, and holidays, and also four trimesters with wide temperature variations (as sun exposure is reduced in the hottest seasons) was determined. The mean daily exposure was a weighted average of the values obtained for a one year period. All affected children received standard therapy, dietary advice, and follow up visits.

Results

A total of 21 patients were identified with rickets: 20 females and one male. The median age was 13 years (range 11 to 15 years). All came from families with equivalent socioeconomic background (based on the employment grade code of the father). All were between Tanner pubertal stage 2 and 4, and all had a height
Table 2 Biochemical results at presentation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values expressed as mean (SD).</th>
</tr>
</thead>
</table>

Table 1 Demographic and clinical findings at presentation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>All n = 21</th>
<th>Tetany n = 12</th>
<th>Pains n = 6</th>
<th>Weakness n = 1</th>
<th>Deformities n = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>13 (11–13)</td>
<td>12.5 (11–15)</td>
<td>13.5 (12–14)</td>
<td>12 (12)</td>
<td>13.5 (13–14)</td>
</tr>
<tr>
<td>Duration of symptoms (days)</td>
<td>7 (1–720)</td>
<td>2 (1–120)</td>
<td>195 (2–700)</td>
<td>7 (7)</td>
<td>710 (700–720)</td>
</tr>
<tr>
<td>z score for weight</td>
<td>−0.3 (−2.63 to 0.78)</td>
<td>−0.93 (−2.54 to 0.78)</td>
<td>−0.64 (−2.13 to 0.23)</td>
<td>−2.63</td>
<td>−1.1 (−1.84 to −0.53)</td>
</tr>
<tr>
<td>z score for height</td>
<td>−1.4 (−3.47 to 0.58)</td>
<td>−1.63 (−2.57 to 0.58)</td>
<td>−1.1 (−3.6 to −0.66)</td>
<td>NA</td>
<td>−2.4 (−3.47 to −1.4)</td>
</tr>
<tr>
<td>Daily dietary calcium intake (mg)</td>
<td>490 (43–1040)</td>
<td>502 (43–870)</td>
<td>380 (574–1040)</td>
<td>NA</td>
<td>385 (395)</td>
</tr>
<tr>
<td>Daily dietary vitamin D intake (µg)</td>
<td>2.8 (1–15.5)</td>
<td>2.8 (1–15.5)</td>
<td>1.8 (1–3)</td>
<td>NA</td>
<td>13.5 (13.5)</td>
</tr>
<tr>
<td>Daily exposure to sun (min)</td>
<td>15 (10–60)</td>
<td>20 (10–60)</td>
<td>15 (15–20)</td>
<td>NA</td>
<td>15 (15)</td>
</tr>
</tbody>
</table>

Results expressed as median (range).
However it was the best method available for this study because home and school visits to assess dietary intake or sun exposure would have been culturally unacceptable.

More than half of the cases presented with acute hypocalcaemic tetany, a potentially life threatening problem. Limb pain was also common as a presenting symptom. Lower limb deformity suggestive of rickets occurred in only two cases. The duration of symptoms prior to diagnosis varied for a number of reasons. Eight families (out of 12) initially attributed tetany to hysterical reactions in adolescent females. Most families did not immediately seek medical attention regarding vague or non-specific symptoms such as weakness or pain. Although lower limb deformity is a frequent reason for families seeking medical advice, the diagnosis of rickets was delayed in our patients. This can be explained by the fact that adolescent Saudi Arab patients of both sexes dress traditionally with a long garment, so that lower limb deformities may be easily overlooked.

Of interest is that the product of serum calcium and phosphorus was reduced in all but one patient, reflecting the inability of the secondary parathyroid response to normalise calcium in children with rickets. In association with a raised serum phosphatase concentration, this product constituted a useful diagnostic parameter for rickets, as reported previously. Unlike the study by Moncrieff et al in which all the reported adolescents had radiologically active rickets, this occurred in less than half of all the reported adolescents. In addition, with hot temperatures throughout most of the year, outdoor development of rickets is rare. Therefore, with hot temperatures the best method available for this study because home and school visits to assess dietary intake or sun exposure would have been culturally unacceptable.

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