Musculoskeletal Manifestations of Rickets: An Eighteen- month Observational Study

Bafor A[1] & Ogbemudia AO[1]

Abstract

Objectives: to determine the pattern of presentation of musculoskeletal features of rickets in a large urban health care facility.

Study design: prospective

Setting: University of Benin Teaching Hospital, Orthopaedic Unit.

Subjects: Children aged 16 or less who present at the out-patient clinic with features of rickets.

Outcome measurements: Age at presentation, sex, type of angular knee deformity, time of onset of angular knee deformity, family history of knee deformity, weight, height, body mass index (BMI), serum calcium, serum phosphate and serum alkaline phosphatase levels.

Results: Thirty seven (37) patients aged between birth and 16 years with clinical and radiological evidence of rickets were evaluated during the study period. The mean age at presentation was 3.7±2.08 years and the male: female ratio was 2.4:1 (26 male and 11 female). Windswept deformity was found to be the commonest mode of presentation in our environment, making up 51.4% of all cases seen.

Conclusion: Rickets is a relatively common cause of angular deformity of the knee. In this environment, it is commoner in males and windswept deformity of the knees is the commonest mode of presentation.

Keywords: *Rickets, angular knee deformity*

[1]*Department of Orthopaedics & Trauma, University of Benin Teaching Hospital, Benin City, Nigeria*

Correspondence: Bafor A, Department of Orthopaedics & Trauma, University of Benin Teaching Hospital, PMB1111, Benin City, Nigeria. +234 802 474 4856, anirebafor@yahoo.com

Introduction

Rickets is the clinical manifestation of a failure of calcification of bone matrix in growing children. Its most common aetiology is a dietary lack of vitamin D[1]. Other causes include a dietary lack of calcium and phosphate among other things[1].

Its most dramatic presentation involves changes in the musculoskeletal system. Indeed, it represents an important cause of angular deformity of the knee in children with several studies showing it to be the commonest cause of angular knee deformity in children[2,3]. Knee deformity in rickets is thought to result from the effects of axial loading on bones that have been weakened by the disease. It is, however, not generally known which type of deformity represents the more usual presentation of angular knee deformity in patients with rickets.

This paper is aimed at providing some epidemiological statistics for the musculoskeletal

manifestations of rickets and in particular defining the most common form of presentation in patients who have suffered angular knee deformity resulting from rickets.

Materials and methods

This was an observational study involving patients who were aged between birth and 16years, presenting with clinical, laboratory and radiological features of rickets at the Orthopaedic outpatient clinic of the University of Benin Teaching Hospital between December 2005 and May 2007. They were evaluated clinically at the first visit. They were seen two (2) weeks later with results of blood chemistry and radiographs for biochemical and radiological evaluation.

Clinical evaluation included relevant medical history and physical examination. This involved determination of the presence of swollen wrists or ankles (evidence of epiphyseal overgrowth), ricketty rosary, Harrison's sulcus, frontal bossing, dental defects and/or the presence of a protuberant abdomen as well as the presence of angular deformity of the knee. The type of deformity was also recorded. Weight and height measurements were taken using a bathroom scale and a wall mounted chart respectively. For patients younger than 2 years, a paediatric weighing scale was used to determine their weights while height measurement was taken in the supine position with a simple tape measure. The Body Mass Index was determined using the Johan Van Hespen BMI calculator[4].

Radiological criteria for the diagnosis of rickets included widening/cupping of the metaphyses, fraying and widening of the physes and generalized bone rarefaction.

Laboratory evaluation consisted of determination of full blood count, genotype, serum calcium, phosphate and alkaline phosphatase.

Criteria for the diagnosis of rickets were based on the clinical and radiological parameters.

The results obtained were subjected to statistical analysis using Microsoft excel statistical package. The range as a representation of a measure of dispersion was determined with variance expressed as standard deviation. Measures of central tendency, which included the mean, were also determined.

The study was approved by the hospital's ethics committee prior to its commencement.

Results

There were 37 patients whose ages ranged from 1 to 10years presenting with rickets. The mean age at presentation was 3.7±2.08 years and the median age was 3years. There were 26 males and 11 females, giving a male: female ratio of 2.4:1(fig. 1). Thirty six (36) patients had their deformities noticed after the commencement of walking. Windswept deformity was the commonest type of deformity in this group of patients accounting for 19 of the 37 cases seen (51.4%) with knock-knees accounting for 17 cases (45.9%) and bow-legs accounting for only 1 case (2.7%) (fig. 2). Majority of the patients in this group had bilateral affectation (32 patients or 86.5%). Only 6 (16.2%) of the 37 patients reviewed had a positive family history of knee deformity. The mean weight for patients in this group was 15.46±4.93kg, the mean height was 96.73±15.03centimeters and the mean BMI was 16.49±3.97. The mean serum calcium, phosphate and alkaline phosphatase in this group were 7.95±1.19mg/dl, 4.27±1.09mg/dl and 124.22±66.06iu/L respectively (Normal reference values 8.6 – 10.2mg/dl, 2.4 – 4.4mg/dl and 60 – 250i.u/L for serum calcium, phosphate and alkaline phosphatase respectively).

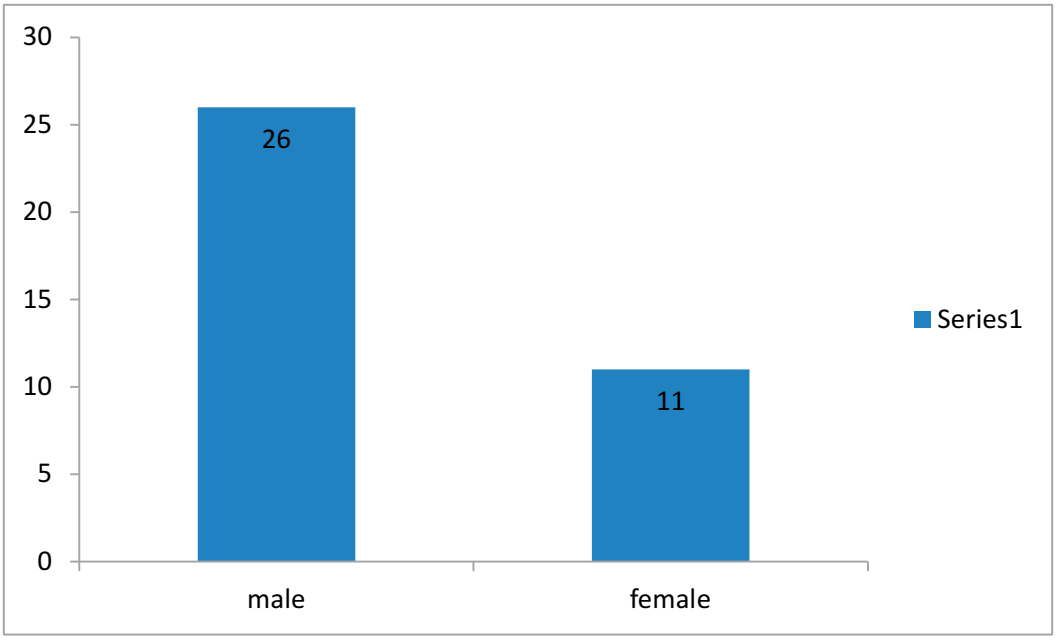

Figure 1: *Sex distribution in patients with rickets*

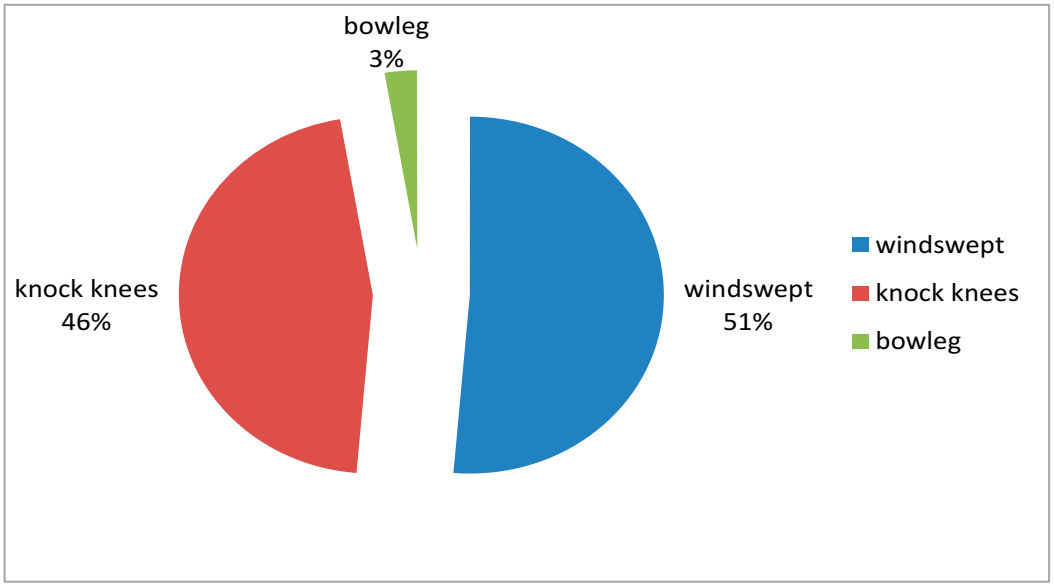

Figure 2: *Distribution of knee deformity in patients with rickets*

Discussion

Rickets is one of the metabolic conditions affecting bone[1]. It is characterized by a failure of calcification of osteoid to osseous bone. The classic cause is a dietary lack of vitamin D, however it may be a consequence of other pathologies like steatorrhoea, renal osteodystrophy, and liver disease[1].

Several studies in Nigeria have shown rickets to be the commonest cause of angular deformity of the knee in children and indeed the commonest cause of pathologic knee deformity in Nigeria[2,3]. Bafor[2] et al found a 46% incidence of rickets among 78 patients with angular knee deformity in Southern Nigeria. Salawu[3], evaluating 103 children with angular knee deformities in Northern Nigeria, found a 70% incidence of rickets. Oyemade[5] in his study in western Nigeria, found a 41% incidence of rickets among 114 subject studied. In these three studies, rickets was found to be the commonest aetiology for angular knee deformity. Solagberu[6] in contrast found a 25% incidence of rickets among 72 patients with angular deformity of the knee, making it the second most common cause of angular knee deformity in that study. The reason for these discrepancies is not evident. Oyemade[5] had determined that 35 of 47 children with clinically proven rickets where children of women living in purdah. It was not however determined if the consequent deprivation of exposure to the ultra-violet rays of the sun brought on by the cultural practice of purdah in that environment was responsible for the relatively high incidence of rickets in Oyemade's study. Indeed in Salawu's study, a very high rickets rate in Northern Nigeria suggests that the practice of purdah may be a determining factor in the aetiology of ricket but Salawu did not attribute the high incidence of rickets to this practice. In the study by Bafor et al, none of the patients evaluated came from homes where the practice of purdah is rife. Akpede[7] *et al*, reviewing children less than 5 years of age in 461 households in Northern Nigeria, found significantly higher rates of rickets in infants who had been exclusively breastfed for 6 months, children of working class mothers and Christians from the southern part of Nigeria. They surmised that the aetiology of rickets was more likely to be linked to environmental and dietary factors, rather than cultural practices and religion.

Studies from the USA have shown that, exclusively breastfed infants have an increased risk of developing vitamin D deficiency rickets, particularly if they are African-American[8-13]. It has been suggested that in Nigeria, the commonest aetiology for rickets is a dietary lack of calcium[14,15]. Indeed, there is literary evidence of resolution of symptoms of rickets with treatment with calcium replacement only[16,17]. This finding has been corroborated by other workers from developing countries[18,19]. Oginni[14] et al in his evaluation of 26 Nigerian children with active rickets, found statistically higher levels of plasma 1,25-dihydroxyvitamin D levels and low levels of 25-hydroxyvitamin D when compared with normal children. This argument seems plausible especially since Nigeria has an abundance of sunlight and gives less credence to the argument that underexposure to the ultra-violet rays of the sun is the major aetiology for rickets in the tropics. In this study, we found the mean serum calcium below the mean average for our population. The significance of this, however, was not evaluated.

The male: female ratio of 2.4:1 in rickets found in this study is at variance with findings by Solagberu[6], who reported a female preponderance in his own study. He did not however ascribe any significance to it. Just as Solagberu opined, the significance of gender in the aetiology of rickets remains yet to be ascertained, more so with variation in results from different studies.

There were 32 patients with bilateral affectation amongst patients with rickets, accounting for

86.5% of all patients with rickets in this study. This suggests a contribution by weight bearing in the aetiology of rickets. The mean BMI in patients with rickets was 16.49±3.97. This represents underweight using the Johan Van Hespen BMI chart.

We found windswept deformity to be the commonest type of angular knee deformity in this group of patients with only 3% of the population presenting with bilateral bowleg deformity. We had imagined however that the age at the onset of the pathology may be a major determining factor in the type of deformity that results. The natural history of the evolution of the knee angles in children has been defined in various races[20-24]. It is generally agreed that beyond the age of 2 years, a valgus tibio-femoral knee alignment is the norm. The mean age of onset of almost 4 years in this study suggests that most patients would already have physiologic valgus alignment of the tibio-femoral angle at the onset of rickets. Axial loading against a background of structurally weakened skeleton is the cause of angular knee deformity in these patients. Against this background, we expected that genu valgum would be the most common mode of presentation of angular knee mal-alignment and not windswept deformity which was observed in this study. The reason for this is not known. Perhaps biomechanical studies may shed more light on this.

Conclusion

We found that in this environment, rickets is more than twice as common in male patients, bilateral lower limb affectation is present in more than 80% of patients seen and that windswept deformity is the commonest mode of presentation of angular knee deformity.

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