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Prevalence Socio-Demographic Characteristics, Risk Factors and Clinical Presentation of Rickets in Children

[1]Chirag Sethi and [2]Swati Agrawal

[1]*Department of Orthopedics, AFSMS and RC, Dhauj, Faridabad, Haryana, India*

[2]*Department of Pediatrics, AFSMS and RC, Dhauj, Faridabad, Haryana, India*

ABSTRACT

Rickets is the disease of growing bone commonly affects in young children. It commonly occurs due to inadequate sunshine exposure, vitamin D deficiency, dietary deficiency of calcium and phosphorus. Aim: to determine the prevalence, socio-demographic characteristics, associated risk factors and clinical presentation of rickets in children This was a cross sectional study. A total of 500 suspected children of 0-14 yrs of age were enrolled in this study. Socio-demographic information, risk factors, clinical and radiological signs were collected from all the participants. Diagnosis of rickets was made by radiological and biochemical laboratory findings. The prevalence of rickets was 16%, more prevalent in 0-5 year's age group males. Most of the participant (60%) residing in rural area and 48.7% belong to lower socio-economic class. Overall, 58.7% were born to cesarean delivery and 63.7% children with low birth weights. 72.5% of participants reported to have good sun exposure, 67.5% had exclusive breast feeding for at least six months and 60% of mother received calcium/vitamin d supplementation during pregnancy. Rachitic rosaries and widened wrists were the most prominent sign amongst all. Vitamin d deficiency was found in 72.5% of children with rickets. Rickets is a major health problem mainly caused by deficiency of vitamin D. Rachitic rosaries and widened wrists are the most common clinical signs. Since Rickets are a disease which can be prevented, vitamin D should be supplemented.

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Key Words
Prevalence, rachitic rosaries, rickets, vitamin-D, children

Corresponding Author
Chirag Sethi,
Department of Orthopedics, AFSMS and RC, Dhauj, Faridabad, Haryana, India

Author Designation
[1,2]Associate Professor

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INTRODUCTION

Rickets is a common disease of growing bone that is unique in children. It is caused by inadequate mineralization or failure of osteoid to calcify bone in a growing person[1]. Failure of osteoid to calcify bone in adult is called osteomalacia[2]. Most common cause of rickets was nutritional deficiency mainly Vitamin D or dietary calcium deficiency, low exposure to sunlight other factors like celiac disease, inherited syndromes, renal disease and drug use also responsible for rickets[3,4]. Clinical presentation of rickets were Bone pain, leg deformations, easy fracture, early bone deformity, delayed closure of fontanelles and softening of skull bones (craniotabes) and sometimes endangering hypocalcaemia are characteristic for nutritionary rickets[5].

Nutritional rickets are common in many developing countries and are also more frequent in wealthy countries[6]. Nutritional rickets is more prevalent in ages 3-18 months. children in this age group are breast-fed and young infants who do not receive adequate sunlight exposure, vitamin d supplements or vitamin D-fortified foods and whose mother's vitamin D deficiency and darkly pigmented skin[7]. The risk factors associated with rickets can be classified into two main categories: environmental and genetic. Environmental risk factors include low exposure to sunlight, poor nutrition, Malabsorption disorders and certain medications, genetic risk factors include inherited disorders that affect vitamin D metabolism, such as hypophosphatemic rickets and X-linked hypophosphatemia[8,9].

Despite the availability of vitamin d and the role of sunlight for prevention and cure of rickets, vitamin D deficiency and nutritional rickets remain significant problem in developing countries and still rising in several developed countries of the world[10]. Early diagnosis and treatment of rickets is critical because if children are treated before age 8 months, morbidity can be reduced.

Aims and objectives: The aim of this study is to determine the prevalence of rickets, socio-demographics characteristics and associated risk factors in children.

MATERIALS AND METHODS

This was a Cross sectional observational hospital based study conducted in department of orthopedics with collaboration of department of pediatrics in a tertiary care hospital, India. A total of 500 children suspected of rickets attending Outpatient department during the study period were enrolled in the present study.

Inclusion criteria:

- Children aged between 0 - 14 years
- Children suspected rickets based on clinical findings and radiological and laboratory investigations
- Children whose parents or guardian provided consent for the study

Exclusion criteria:

- Patients above 14 yrs of age
- Patients with significant congenital abnormalities, chronic hepatic disorder, chronic renal disease or with anti-consultant medication
- Children whose parents or guardian not provided consent for the study

Socio-demographic information regarding age, gender, breast-feeding (exclusive, non-exclusive and duration), mother and child's history of calcium and vitamin D intake and sun exposure and infant and mother's nutrition history were collected from all the participants.

- Diagnosis of rickets was made by radiological and biochemical laboratory findings
- Clinical findings of rickets included wide fontanel, delayed teething, rosary rickets, craniotabes, enlargement of wrists, carious teeth, bowing of the legs develop once the infant starts walking and kyphoscoliosis is observed after two years of age
- Radiological investigations included wrist joint x ray or other joint x rays. Positive when there was radiological changes in X ray joints like widening, fraying and cupping

Laboratory investigations included alkaline phosphatase, calcium, phosphate level, 25(oh) D levels, white blood cell count (WBc), platelet count and other investigations according to the presentation of the patients. Serum levels of the biochemical parameters were determined according to standard laboratory procedures.

Statistical analysis: Data were presented in the form of statistical Tables and charts. SPSS software version 22 was used for statistical analysis. Statistical comparisons will be performed using Fischer's exact test. $p<0.05$ will be considered statistically significant.

RESULTS

A total of 500 suspected children of rickets were enrolled and analyzed in the present study. The prevalence of nutritional rickets was 80/500 (16%). The

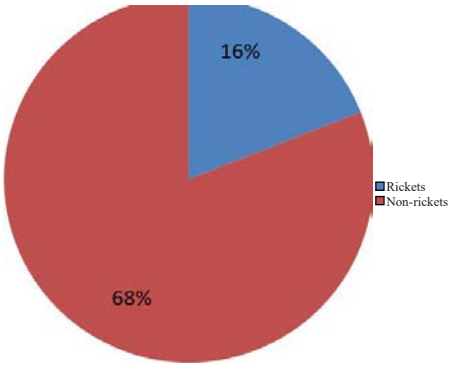

Fig. 1: Prevalence of nutritional rickets

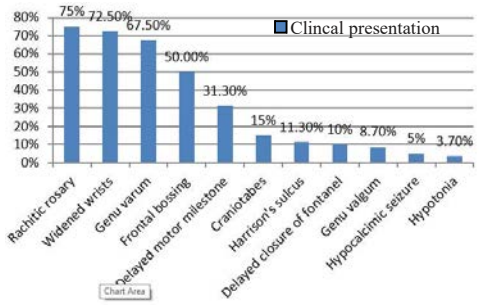

Fig. 2: Clinical presentation of rickets children

Table 1: Socio-demographic characteristics of study participants

Socio-demographic characteristics		Frequency
Age group	0-5 years	65 (81.3%)
	6-10 years	13 (16.2%)
	>10 years	2 (2.5%)
Gender	Male	53 (66.2%)
	Female	27 (33.8%)
Area of residence	Rural	48 (60%)
	Urban	32 (40%)
Family history of rickets	Yes	20 (25%)
	No	60 (75%)
Socio-economic status	Lower	39 (48.7%)
	Middle	31 (38.7%)
	Upper	10 (12.6%)

Table 2: Predisposing/risk factors for rickets among children

Predisposing/risk factors		Frequency
Mode of delivery	Normal vaginal delivery	33 (41.3%)
	Cesarean section	47 (58.7%)
Birth Gestation age	Term	75 (93.7%)
	Prematurity	5 (6.3%)
Birth weight	<2.5 kg	51 (63.7%)
	>2.5 kg	29 (36.3%)
Exclusive breastfeeding	Yes	54 (67.5%)
up to 6 months	No	26 (32.5%)
Exposure to the	Yes	58 (72.5%)
sunlight every day	No	22 (27.5%)
Vitamin d and calcium	Yes	48 (60%)
intake during pregnancy	No	32 (40%)
Prior Admissions	Yes	20 (25%)
	No	60 (75%)

prevalence of rickets was found to be more prominent in males (66.2%) than in females (33.8%). The age group of 0-5 yrs was the most prominent with 81.3% of the cases, most of the participant (60%) residing in rural area, majority of the them (48.7%) belong to lower socio-economic class and 25% had family history

Table 3: Radiological Signs among Children with Rickets at the Diagnosis (N = 80)

Radiological signs	Frequency	Percentage
Cupping	80	100
Splaying	79	98.7
Fraying	77	96.3
Epiphysealwidening	70	87.5
Thickenedepiphysis	17	21.3
Osteopenia	23	28.7
Fracture	14	17.5
Marfan's sign	10	12.5

Table 4: Laboratory Findings of Children with Rickets at the Diagnosis (N = 80)

Investigation		Frequency
Serum calcium level (mmol/L)	Low	17 (21.3%)
	Normal	57 (71.2%)
	High	6 (7.5%)
Serum Phosphate level (mmol/L)	Low	9 (11.3%)
	Normal	38 (47.5%)
	High	32 (40%)
Serum PTH level (pg/ml)	Low	1 (1.25%)
	Normal	3 (3.75%)
	High	76 (95%)
Vitamin D level (ng/ml)	Deficient	58 (72.5%)
	Insufficient	20 (25%)
	Sufficient	2 (2.5%)

of rickets. Table 1. Among predisposing or risk factors of rickets in children, overall, 58.7% were born to cesarean delivery, 93.7% had full term and 63.7% children with low birth weights. 72.5% of participants reported to have good sun exposure. Exclusive breast-feeding for at least six months was reported in 67.5% of the participants: only 25% of them had prior admission and 60% of mother received calcium/vitamin d supplementation during pregnancy. The most frequent sign was rachitic rosaries 75%, followed by widened wrists (72.5%), genu varum (67.5%) and half of the children had delayed motor milestone (Fig. 2). The radiological changes of rickets including fraying, widening and cupping of metaphysic were considered as rickets found in more than 90% of children. Nutritional Rickets in this study was defined as the presence of any of the radiological changes of rickets on wrist X-ray.

The biochemical results that support the patient's diagnosis of rickets are shown in Table 4. It was observed that 72.5% of children were vitamin D deficient and 25% were insufficient. Serum calcium and phosphate levels were normal in most cases while PTH was high (95%).

DISCUSSIONS

Nutritional rickets remains a major health problem for children in many regions of our country. Its etiology and pathogenesis is thought to be multi-factorial. The common risk factors of nutritional rickets in infants are lack of vitamin d supplementation, maternal vitamin d deficiency and exclusive breast-feeding with limited sunlight exposure[11]. The prevalence of nutritional rickets was quite low (16%) in the present study, similar finding also reported by Kenenisa *et al*.[12] and Piloya *et al*.[13] reported prevalence of rickets were

10.5% and 16% respectively. The majority of patients in this study were male (66.2%), concordance with the Siddiqui *et al*.[14] and Nielsen *et al*.[15]. Rickets were the most prominent in this 0-5year group with 81.3% of cases, in agreement with the Reddy *et al*.[16].

Majority of the participant was residing at rural area and belong to lower socio-economic class, our results comparable with the Hatun *et al*.[17] and Ozkan et al [18], this may be due to changes of vitamin D deficiency was more in these population. In current study low birth weight, breast-feeding and lack of sun exposure were the dominant predisposing factors, consistent finding reported by many other studies: Mohanna *et al*.[19] and Abdulwahab *et al*.[20]. Prolongation of exclusive breast-feeding until the age of one year or more without vitamin d supplement is an important factor leading to the development of rickets in the rapid growth period of infancy.

In our study the most common clinical signs of rickets were Rachitic Rosaries followed by widened wrist, genu varum, delayed motor milestone and frontal bossing, our findings coincides with the Thacher *et al*.[21] and Wondale *et al*.[22]. Current study found that Cupping, Splaying, Fraying and Epiphyseal widening are the most common radiological finding of rickets, our results comparable with the Shore *et al*.[23] and Jayawardana *et al*.[24]. The present study found that majority of the rickets children had vitamin D deficiency, correlate with the other studies conducted by Akram *et al*.[25] and Alamoudi *et al* [26].

CONCLUSION

The prevalence of nutritional rickets among children was low and was more prevalent in 0-5 yrs of age predominantly in males. Common risk factors of nutritional rickets in children were limited sun exposure, exclusive breast-feeding infant and vitamin D deficiency. Rachitic rosaries and widened wrists were the common clinical signs whereas cupping, splaying and Epiphyseal widening were common radiological findings. Health education and rickets awareness are critical as it can help curtail rickets.

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