Asian Journal of Clinical Nutrition

ISSN 1992-1470

science alert

ANSInet
an open access publisher
http://ansinet.com

OPEN ACCESS Asian Journal of Clinical Nutrition

ISSN 1992-1470
DOI: 10.3923/ajcn.2016.9.13

Research Article
Prevalence and Clinical Characteristics of Rickets in Infants and Children Attending the Outpatient Clinic at Damietta University Hospital

Magdy Ashmawy Sakr, Mohamed Ibrahim Abdel-Aal, Mohamed Abdel-Salam Zannoun and Mohamed Mostafa Abo Al-Maaty

Department of Pediatrics, Faculty of Medicine, AL-Azhar University, New Damietta, Egypt

Abstract

Background: Rickets is a common health problem in Egypt and leads to frequent morbidities. There is insufficient information about its prevalence and risk factors. **Objective:** Studying the prevalence and clinical characteristics of rickets in the age group (6-36 months) in New Damietta city using a clinical score with x-ray as a gold standard. **Materials and Methods:** About 300 children, aged from 3-36 months, selected from the pediatric outpatient clinic at Damietta University hospital by systematic random sample (every 3rd child) on a day work (3 days/week) in the period from April, 2011 till December, 2012. Each child enrolled in the study was submitted to history taking, thorough clinical examination and radiographic examination. The studied cases were classified into two groups according to the presence of rickets by x-ray: Rachitic group and non-rachitic group. **Results:** Rickets was present radiologically in 35 cases (11.7%) out of 300 children. Rachitic group was younger than the non-rachitic group with the mean age (9.9±4.3, 16.5±7.4) respectively, p = 0.00. Most of rachitic children had spent little time under the sun and living in overcrowded houses. Most rachitic children had motor developmental delay (74.3%) with high statistical significant difference, p = 0.00. The most frequent sign was rachitic rosaries 74.3%, followed by thickened epiphysis and delayed closure of fontanel 62.9 and 60%, respectively. The most sensitive clinical signs were Harrison's sulcus and parietal bossing 100%. **Conclusion:** Rickets is a major health problem in Damietta governorate, as its prevalence is 11.7%, especially with young age, overcrowding and low social class.

Key words: Clinical characteristics, rickets, infants, children, outpatient clinic

Received: April 09, 2016 Accepted: May 14, 2016 Published: June 15, 2016

Citation: Magdy Ashmawy Sakr, Mohamed Ibrahim Abdel-Aal, Mohamed Abdel-Salam Zannoun and Mohamed Mostafa Abo Al-Maaty, 2016. Prevalence and clinical characteristics of rickets in infants and children attending the outpatient clinic at Damietta University Hospital. Asian J. Clin. Nutr., 8: 9-13.

Corresponding Author: Mohamed Ibrahim Abdel-Aal, Department of Pediatrics, Faculty of Medicine, AL-Azhar University, New Damietta, Egypt

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Rickets is failure of mineralization of growing bone which can occur only before fusion of the epiphyses[1]. Nutritional rickets is distinct from other types of rickets in that it is merely caused by a simple deficiency in vitamins and nutrition[2]. Nutritional rickets should be viewed as having a spectrum of pathogenic mechanisms, which lie between 3 milestones[3], classic vitamin D deficiency and pure calcium deficiency[4]. In between these 2 are those with marginal to low vitamin D stores and a diet deficient in calcium or high in phytates[5].

Accurate global information on the prevalence of rickets is necessary so as to be able to document high risk groups and to determine changes associated with efforts to reduce the risk of rickets in these at-risk groups and communities[6].

Understandably, much of recent literature on the prevalence of nutritional rickets has come from industrialized countries experiencing a resurgence of clinic presentations with rickets[4]. However, the greatest burden of disease world-wide appears to be in Africa, the Middle East and Asia[7]. In Egypt, rickets is multifactorial and rachitic children living in Egypt have some distinct characteristics[8].

Rickets is characterized by bony deformity and stunted growth[5], which is frequently encountered problem in our local community. There is a lack of researches, which studied the prevalence of rickets in Egypt. In order to estimate the magnitude of rickets in our local community and its relation to various epidemiological factors, the present study was conducted to find out the prevalence of rickets among infants and children aged from 3-36 months, attending the pediatric outpatient clinic at Damietta University Hospital.

MATERIALS AND METHODS

The present cross sectional study consisted of 300 children, aged 6-36 months, chosen from outpatient clinic, at Al-Azhar University Hospital (New Damietta) during the period from April, 2011 till December, 2012 on a day study (3 days/week). Patients with major congenital anomalies, chromosomal abnormalities, chronic liver disease, chronic renal disease or receiving anticonvulsant therapy were excluded from the study.

Each child enrolled in the study was submitted to detailed history, thorough clinical examination, anthropometric measurements and ratios. A standardized questionnaire was also used to gather social and demographic information. Each child was subjected to clinical scoring of rickets through the method of Opie *et al.*[9] (Table 1) which included 7 clinical signs. Each child with any clinical sign of Opie *et al.*[9] score is submitted to radiological examination through x-ray of both hands, which is considered as a "Gold standard" for diagnosing rackets. Rickets is considered radiological if these features are present: Broadening and cupping of the epiphyseal ends increased joint space, frying of the epiphyseal ends and zone of preparatory calcification[10].

The statistical analysis was performed using an IBM compatible computer and statistics for SPSS 16.0 statistical package. For qualitative data, frequency and percent distributions were calculated and for comparison between groups, the chi square (χ^2) test was used. For quantitative data, mean and standard deviation (SD) were calculated and for comparison between two groups, the independent samples t test was used. Sensitivity was calculated from the equation (true positive/true positive+false negative). Specificity was calculated from the equation (true negative/true negative+false positive). For interpretation of results, $p<0.05$ was considered significant[11].

RESULTS

Prevalence of definite (radiological) rickets in studied children was 11.7%. The mean age was (9.9±4.3 to 16.5±7.5 years) for rachitic and non-rachitic children, respectively ($p = 0.00$). Advanced birth order is a significant risk factor in rachitic children (Table 2). According to Opie *et al.*[9] method, 253 children (84.3%) had score 0 (no rickets), 21 children (7%) had score 1-3 (suspicious

Table 1: Guidelines for diagnosis of rickets according to Opie *et al.*[9] method

Signs	0	1	2	3
Craniotabes	Absent	Present	Pronounced	-
Frontal bossing	Absent	Present	Pronounced	-
Parietal bossing	Absent	Present	Pronounced	-
Delayed closure of fontanel	Absent	Slight	Definite	Pronounced
Enlarged costochondral junctions	Absent	Slight	Definite	Pronounced
Harrison's sulcus	Absent	Slight	Definite	Pronounced
Thickened epiphyses	Absent	Slight	Definite	Pronounced

0: No rickets, 1-3: Suspicion of rickets

Table 2: Age and birth order of studied cases

Group	Variables	Rachitic (n = 35)	Non rachitic (n = 265)	Total (n = 300)	Test	p-value
Age (mo.)	Mean±SD	9.9±4.3	16.5±7.4	15.8±7.4	t = 5.2	<0.001*
Birth order	First	5 (14.3%)	99 (37.4%)	104 (34.7%)	χ^2 = 8.6	0.04*
	Second	13 (37.1%)	80 (30.2%)	93 (31.0%)		
	Third	7 (20.0%)	43 (16.2%)	50 (16.7%)		
	Fourth	10 (28.6%)	43 (16.2%)	53 (17.7%)		

*Significant

Table 3: Rachitic scoring of the studied cases according to Opie *et al.*[9] method (n = 300)

Score	No.	(%)
0 (no rickets)	253	84.3
1-3 (suspicious rickets)	21	7.0
4-6 (mild rickets)	17	5.7
6+ (moderate to severe rickets)	9	3.0
Total	300	100

Table 4: Relative frequency of clinical diagnostic signs of rickets among rachitic group

Clinical signs of rickets	No.	(%)
Rachitic rosaries	26	74.3
Thickened epiphysis	22	62.9
Delayed closure of fontanel	21	60.0
Frontal bossing	13	37.1
Marfan's sign	12	34.3
Craniotabes	8	22.9
Harrison's sulcus	5	14.3
Parietal bossing	3	8.6

Table 5: Sensitivity and specificity of Opie *et al.*[9] scoring in relation to the x-ray

		x-ray			
Opie scoring		Rachitic (n = 35)	Non-rachitic (n = 265)	Sensitivity (%)	Specificity (%)
Opie 1+	Yes	35	12	74.5	100.0
	No	0	253		
Opie 2+	Yes	35	9	79.5	100.0
	No	0	256		
Opie 3+	Yes	35	2	94.6	100.0
	No	0	263		
Opie 4+	Yes	26	0	100.0	96.7
	No	9	265		
Opie 5+	Yes	19	0	100.0	94.3
	No	16	265		
Opie 6+	Yes	12	0	100.0	92.0
	No	23	265		

rickets), 17 children (5.7%) had score 4-6 (mild rickets) and 9 children (3.0%) had score 6+ (moderate to severe rickets) as shown in Table 3.

Table 4 shows relative frequency of clinical diagnostic signs of rickets among rachitic group, the most frequent sign was rachitic rosaries 74.3%, followed by thickened epiphysis and delayed closure of fontanel (62.9 and 60%), respectively. The marfan's sign was found in 34.3% of cases. The most sensitive clinical signs were Harrison's sulcus and parietal bossing 100% (Table 5).

DISCUSSION

Vitamin D deficiency and associated rickets are re-emerging as a major public health problem in some developed and developing countries[12]. Middle East is a region that registers some of the highest rates of rickets worldwide, this is in large part explained by limited sun exposure, cultural practices and by dark skin color and low calcium intake rather than vitamin D deficiency in several countries in Africa[13]. A recent global consensus on prevention and management of nutritional rickets recommended that implementation of international rickets prevention programs, including supplementation and food fortification is urgently required[14]. Thus, it is necessary to evaluate the prevalence of rickets in our community.

In the present study, rickets was reported radiologically in 35 cases out of 300 cases representing 11.7%. There are wide geographical variations in the frequency of rickets among children worldwide. There are no recent available data regarding the prevalence of rickets in Egypt. These results indicate that rickets continues to be a major local health problem, this it should be put into consideration for early intervention as well as stressing on prophylaxis against rickets through early vitamin D supplementation. Results of the present study were in agreement with Najada *et al.*[15] who reported that 47 infants (10.6%) out of the 443 were found to have nutritional rickets. On the other hand, this prevalence is slightly higher than that reported by Kabir *et al.*[16] and Thacher *et al.*[17] who reported that, in some places, nutritional rickets is merely reported sporadically, while in other areas, up to 9% of the childhood population is clinically affected. On the other hand, the prevalence of the present study was lower than that recorded in Qatar[18], as the prevalence of rickets was estimated as 23.9%. It must be emphasized that, there has been a lack of consistency globally in how rickets is diagnosed. Consequently, it has been difficult to compare rates of rickets longitudinally and from one country to another. It is hypothesized that clinical diagnostic criteria alone lead to over diagnosis of rickets[19]. Another explanation of those differences may attribute to difference of cultural practices and feeding habits between different places[20].

The rachitic group was younger than the non-rachitic group, which was expected as the prolongation of exclusive breast feeding until the age of 1 year without vitamin D supplementation is an important factor leading to the development of rickets in the rapid growth period of infancy[21]. Most of the rachitic cases had advanced birth order, which may explained by the fact that vitamin D deficiency in the pregnant and lactating mother predisposes to the development of rickets in the breastfed infant, which increase with repeated pregnancies[22].

The most frequent sign was rachitic rosaries 74.3%, followed by thickened epiphysis and delayed closure of fontanel (62.9 and 60%), respectively. In a retrospective study at Saudi Arabia included 283 infants diagnosed with nutritional rickets were between 6 and 14 months of age, the most common physical signs of rickets were wide wrist (29%), rachitic rosaries (28%) and frontal bossing (16%)[21]. The rachitic rosaries are among the early manifestations of nutritional rickets[23]. Thus, it is likely to be found in all cases presenting with rickets. Thickened epiphysis and rachitic rosaries are caused by disrupted endochondral ossification and mineralization at the epiphyses with accumulation of excessive disorganized hypertrophic (referring to zone of hypertrophy) cartilage the metaphysis widen and appear clinically as swollen joint. As this is the usual pathophysiology of rickets and it is expected to become more common manifestations[1].

Regarding the Opie *et al.*[9] scoring in relation to the x-ray for diagnosis of rickets, it was found that the most sensitive scores were 4 or more with the sensitivity (100%), this make this test valid to diagnose mild to severe rickets. The present study is a unique one in estimation of sensitivity and specificity of different clinical signs and different Opie scores in relation to radiological diagnosis of rickets.

In the present study, simple methods are used for evaluation of a very common local health problem without the need for extensive investigations, which might be troublesome for patients with low socioeconomic levels. The validity of Opie *et al.*[9] score is as a reliable tool, allowing physician for early diagnosis of rickets with subsequent early treatment.

CONCLUSION

Rickets continue to be a major health problem in Damietta governorate as its prevalence among infants was 11.7%. Young age, advanced birth order, overcrowding and low social class appears to be the most important risk factors. The most frequent clinical signs are rachitic rosaries and thickened epiphysis. Finally, both clinical signs and Opie score grading had a considerable values of sensitivity and specificity especially in moderate to severe cases, which makes clinical diagnosis of rickets a useful methods for rickets assessment.

REFERENCES

1. Shore, R.M. and R.W. Chesney, 2013. Rickets: Part I. Pediatr. Radiol., 43: 140-151.
2. Allgrove, J., 2015. Physiology of Calcium, Phosphate, Magnesium and Vitamin D. In: Calcium and Bone Disorders in Children and Adolescents, Allgrove, J. and N.J. Shaw (Eds.). Karger Publishers, Germany, Switzerland, ISBN: 9783318054668, pp: 7-32.
3. Pettifor, J.M., 2012. Nutritional Rickets. In: Pediatric Bone: Biology and Diseases, Glorieux, F.H., J.M. Pettifor and H. Juppner (Eds.)., 2nd Edn., Academic Press, London, UK., ISBN: 9780123820402, pp: 625-654.
4. Prentice, A., 2013. Nutritional rickets around the world. J. Steroid Biochem. Mol. Biol., 136: 201-206.
5. Elder, C.J. and N.J. Bishop, 2014. Rickets. Lancet, 383: 1665-1676.
6. Pettifor, J.M., 2015. Screening for nutritional rickets in a community. J. Steroid Biochem. Mol. Biol., (In Press). 10.1016/j.jsbmb.2015.09.008.
7. Fahed, A.C., A.K.M. El-Hage-Sleiman, T.I. Farhat and G.M. Nemer, 2012. Diet, genetics and disease: A focus on the middle east and North Africa region. J. Nutr. Metabol. 10.1155/2012/109037.
8. Baroncelli, G.I., A. Bereket, M. El-Kholy, L. Audi and Y. Cesur *et al.*, 2008. Rickets in the Middle East: Role of environment and genetic predisposition. J. Clin. Endocrinol. Metab., 93: 1743-1750.
9. Opie, W.H., C.J. Muller and H. Kamfer, 1975. The diagnosis of vitamin D deficiency rickets. Pediatr. Radiol., 3: 105-110.
10. Greenbaum, L.A., 2015. Rickets and Hypervitaminosis D. In: Nelson Textbook of Pediatrics, Kliegman, R., B. Stanton, N.F. Schor, J.W. St Geme and R.E. Behrman (Eds.). 20th Edn., Saunders, Philadelphia, PA., ISBN: 9781455775668, pp: 331-341.
11. Armitage, P., G. Berry and J.N.S. Matthews, 2002. Statistical Methods in Medical Research. 4th Edn., Blackwell Science Ltd., Oxford, UK., Pages: 817.
12. Uush, T., 2013. Prevalence of classic signs and symptoms of rickets and vitamin D deficiency in Mongolian children and women. J. Steroid Biochem. Mol. Biol., 136: 207-210.
13. Pettifor, J.M., 2008. Vitamin D and/or calcium deficiency rickets in infants and children: A global perspective. Indian J. Med. Res., 127: 245-249.
14. Munns, C.F., N. Shaw, M. Kiely, B.L. Specker and T.D. Thacher *et al.*, 2016. Global consensus recommendations on prevention and management of nutritional rickets. J. Clin. Endocrinol. Metab., 101: 394-415.

15. Najada, A.S., M.S. Habashneh and M. Khader, 2004. The frequency of nutritional rickets among hospitalized infants and its relation to respiratory diseases. J. Trop. Pediatr., 50: 364-368.
16. Kabir, M.L., M. Rahman, K. Talukder, A. Rahman and Q. Hossain *et al*., 2004. Rickets among children of a coastal area of Bangladesh. Mymensingh Med. J., 13: 53-58.
17. Thacher, T.D., P.R. Fisher, M.A. Strand and J.M. Pettifor, 2006. Nutritional rickets around the world: Causes and future directions. Ann. Trop. Paediatr., 26: 1-16.
18. Bener, A. and G.F. Hoffmann, 2010. Nutritional rickets among children in a sun rich country. Int. J. Pediatr. Endocrinol. 10.1155/2010/410502.
19. Strand, M.A., J. Perry, M. Jin, D.P. Tracer and P.R. Fischer *et al*., 2007. Diagnosis of rickets and reassessment of prevalence among rural children in Northern China. Pediatr. Int., 49: 202-209.
20. Pettifor, J.M., 2004. Nutritional rickets: Deficiency of vitamin D, calcium, or both? Am. J. Clin. Nutr., 80: 1725S-1729S.
21. Al-Atawi, M.S., I.A. Al-Alwan, A.N. Al-Mutair, H.M. Tamim and N.A. Al-Jurayyan, 2009. Epidemiology of nutritional rickets in children. Saudi J. Kidney Dis. Transplant., 20: 260-265.
22. Pettifor, J.M., 2013. Nutritional rickets: Pathogenesis and prevention. Pediatr. Endocrinol. Rev., 10: 347-353.
23. Thacher, T.D., P.R. Fischer and J.M. Pettifor, 2002. The usefulness of clinical features to identify active rickets. Ann. Trop. Pediatr., 22: 229-237.