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ACANTHOSIS NIGRICANS: A MARKER OF METABOLIC SYNDROME AMONG OBESE CHILDREN

Pediatrics

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ABSTRACT

This was a prospective case controlled study to determine the association of Acanthosis Nigricans (AN) and Metabolic Syndrome (MS) in obese children 10–16 years of age. We recruited 50 obese children with AN (cases) and 50 obese children without AN (controls) attending the Pediatric OPD from May 2013 to August 2014 after obtaining informed consent from their parents. Children were defined as obese if their BMI was ≥ 95th percentile for age and sex (CDC). International Diabetes Federation (IDF) 2007 criteria were used to define MS. Detailed history, physical examination, anthropometry and blood sampling were done in each case. Samples for High Density Lipoprotein Cholesterol (HDL-C), Fasting Plasma Glucose (FPG) and Triglycerides (TG) were evaluated at the in-hospital NABL certified SRL laboratory. MS was found in 64% of obese children with AN as compared to 30% of obese children without AN which was highly significant. Therefore, AN is a significant marker of MS.

KEYWORDS

Acanthosis Nigricans, Metabolic Syndrome, Obesity in children

Obesity among children is a major public health problem, both in developed and in developing countries. It was declared to be a disease by American Medical Association (AMA) in June 2013. The prevalence of obesity is estimated to be 17 % in the US (CDC 2011-2014). In developing countries it is reported to be 41.8 % in Mexico, 22.1 % in Brazil, 22.0 % in India and 19.3 % in Argentina (Gupta N., Goel K., 2012). In India the prevalence of obesity in children has more than doubled in the last 10 years from NFHS3 (2005-6) to NFHS4 (2014-15).

Obesity when associated with hypertension, low HDL-C, high TG and high FPG is defined by IDF as MS and is a well-recognized precursor of type-2 DM and CardioVascular disease (CVD) (Zimmet P., 2001), (Kong AS et al., 2012). Adults with MS have a twofold risk of developing atherosclerotic CVD and a fivefold risk of developing Type 2 Diabetes (Hadjiyannakis S., 2005). In a follow-up study of 771 children age 6–19 years, the Princeton Lipid Research Clinic found that children with clustering of MS risk factors were significantly more likely to have CVD 25 years later when compared with their peers (Morrison JA et al.,2007). Therefore it is important to identify high risk children early to be able to prevent MS and its complications later in life.

AN may serve as marker for identifying children at risk of developing MS. AN is characterized by dark, coarse, thickened skin with a velvety texture, symmetrically seen on the neck, axillae, antecubital and popliteal fossae and groin folds. The presence of AN is strongly associated with insulin resistance and obesity (Ice CL et al., 2009). Due to rising prevalence of obesity and Type 2 Diabetes, the prevalence of AN is increasing (Phiske M., 2014). The incidence of AN is reported in 35 % (Calderon Z., 2009), 43 % (Valery PC., 2009), 85% (Ice CL et al., 2009) and 54% (Ng HY YJ., 2014) of obese children.

METHODS

After approval of the Institutional Ethics Committee all obese children attending the Pediatric OPD from May 2013 to August 2014 whose parents gave consent were enrolled in the study. Sample size was determined using internet based PASW statistics 18 version n Master 1.0 calculator and assumptions from previous studies. A detailed history including diet, physical examination (with special reference to the presence of AN), anthropometry and results of the tests were recorded. TG, HDL-C and FPG were done at the in-hospital NABL accredited SRL laboratory.

In 2007 IDF proposed that MS be considered in children aged 10-16 years who are obese (waist circumference ≥ 90th percentile-Table 1) or adult cut offs, if lower, plus any two or more of the following:

1. Triglycerides ≥ 150 mg/dl (1.7 mmol/L)
2. HDL-Cholesterol < 40 mg/dl (1.03 mmol/L)
3. Blood pressure SBP (Systolic blood pressure) ≥ 130 mm Hg
   DBP (Diastolic blood pressure) ≥ 85 mm Hg
4. Fasting Plasma glucose ≥ 100 mg/dl (≥ 5.6 mmol/L)

We did not include children below 10 years of age because IDF recommends that MS should not be diagnosed below 10 years of age (Zimmet P.,2007).

Table 1: WC percentile for Indian children aged 10-16 years (Kuriyan R.,2011)

Age (years)	90th Percentile for boys (cm)	90th Percentile for girls (cm)
10	71.1	72.0
11	74.2	75.0
12	77.4	77.9
13	80.4	80.4
14	83.4	82.5
15	86.1	83.9
16	88.6	84.7

RESULTS

100 children (64 male, 36 female) age 10-16 years were included in the study. The correlation between AN and MS is shown in Table 2. MS was found in 64% of obese children with AN as compared to 30% of obese children without AN. Low HDL-C was found in 70% cases and 18% controls. Raised TG were found in 64% among cases and 24% among controls. These differences were highly significant. Elevated FPG was detected in 36% of cases and 22% of controls which was statistically insignificant. Hypertension was noted in 83.3% cases and 81% controls which was not statistically significant.

DISCUSSION

Cook S, Weitzman M et al (2003) reported MS in 4.2% of 12-19 years old obese children. Yashpal Singh et al (2013) reported MS in 46.4% obese children. A prevalence of 3.6% was reported by investigators from the Bogalusa heart study in adolescents of 8-17 years of age (Srinivasan SR et al., 2002). Ice Cl et al (2009) reported a prevalence of MS in 57% obese children and 67.9% of morbidly obese children. The prevalence of MS in the present study was 47% (64 % in cases and 30% in controls) which was comparable to studies by Yashpal Singh et al (2013) and Ice CL et al (2009)

In a study of 113 obese children in Hungary, 58 with AN and 57 without AN, hyperinsulinemia was more marked in those with AN than in those without AN. TG were higher and HDL-C concentrations lower in the obese children with AN compared with those without AN (Felszeghy E et al., 2009). Similar to that study we found a higher TG and lower HDL-C levels in cases compared to controls.

The prevalence of MS in obese Bolivian children with AN was reported to be 59% by Carceras M et al (2008). Santoro N et al (2013)

showed a strong association between AN and MS, odds ratio (OR) of obese Italian children with AN having MS being 1.87 at 95% confidence interval. Calderon Z et al (2009) showed a positive correlation between AN and MS in obese Mexican children. MS was present in 9% and AN in 35% children. The prevalence of MS in obese children with AN in our study was 64% which was statistically significant.

Conclusion:

With the growing prevalence of Obesity, Metabolic Syndrome and their Cardiovascular and type 2 DM risk later in life, screening for MS becomes essential particularly in obese children. AN is a reliable clinical marker of MS in obese children.

Table 2: Metabolic Syndrome in obese children with AN (Cases) and without AN (Controls)

MS parameters	Cases		Controls		
	N (%)	MS n (%)	N (%)	MS n (%)	P value
Number of children	50	32 (64)	50	15 (30)	0.0012
Waist Circumference (> 90th percentile)	44 (88)	23 (52.2)	21 (42)	8 (38.09)	0.00001
TG (≥ 150 mg/dl)	32 (64)	17 (53.12)	12 (24)	5 (41.66)	0.0001
HDL (< 40 mg/dl)	35 (70)	17 (48.57)	9 (18)	7 (77.77)	0.038
SBP (≥ 130 mm Hg)	13 (26)	11 (84.61)	7 (14)	6 (85.71)	0.334
DBP (≥ 85 mm Hg)	5 (10)	4 (88.89)	4 (8)	3 (75)	0.334
FBS (≥ 100 mg/dl)	18 (36)	7 (38.9)	11 (22)	3 (27.27)	0.186

Limitation:

This study has been performed at a private corporate hospital, hence the patient population may not be representative of the general population.

References:

1. Centers for Disease Control and Prevention Overweight and obesity 2012. 2013, https://www.cdc.gov/obesity/childhood/defining.html
2. Barlow SE and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics 2007;120 Supplement December 2007:S164—S192
3. Zimmet P, Alberti KG, Kaufman F, Tajima N, Silink M, Arslanian S, et al. The metabolic syndrome in children and adolescents - an IDF consensus report. Pediatr Diabetes. [Consensus Development Conference Research Support, Non-U.S. Gov't]. 2007 Oct;8(5):299-306.
4. AMA House of Delegates Resolution 420. Recognition of Obesity as a Disease. Available from: http://www.npr.org/documents/2013/jun/ama-resolution-obesity.pdf
5. Centre for Disease Control and Prevention Overweight and obesity 2011 -2014 https://www.cdc.gov/obesity/data/childhood.html
6. Gupta N, Goel K, Shah P, Misra A; Childhood Obesity in Developing Countries: Epidemiology, Determinants, and Prevention, Endocrine Reviews, Volume 33, Issue 1, 1 February 2012, Pages 48–70
7. Hadjiyannakis S. The metabolic syndrome in children and adolescents. Paediatrics & Child Health. 2005;10(1):41-47.
8. Phiske M. An approach to acanthosis nigricans. Indian Dermatology Online Journal. [Review article] 2014 July 1, 2014;5(3):239-49
9. Calderon Z, Bautista MV, Gil AA, Teresa MA, Saldana JR et al. Prevalence of metabolic syndrome and Acanthosis nigricans in students from 6 to 12 years that presents overweight and risk of obesity in elementary school, Hidalgo, Mexico. Canadian Journal of Diabetes. 2009;33(3):308
10. Valery PC, Moloney A, Cotterill A, Harris M, Sinha AK, Green AC et al. Prevalence of obesity and metabolic syndrome in Indigenous Australian youths. Obesity Reviews, 10: 255–261.
11. Ng HY YJ, Huen KF, Chan LT. Acanthosis nigricans in obese Chinese children. Hong Kong Med J. 2014 April 25;20
12. Kong AS, Laura V, Betty S, Leggott J, Sebesta E, Glew R et al. Acanthosis nigricans predicts the clustering of metabolic syndrome components in Hispanic elementary school-aged children. J Pediatr Endocrinol Metab. 2012(25):1095-8
13. Caceres M, Teran CG, Rodriguez S, Medina M. Prevalence of insulin resistance and its association with metabolic syndrome criteria among Bolivian children and adolescent with obesity. BMC Pediatr 2008;8(31)
14. Ice CL, Murphy E, Minor VE, Neil WA. Metabolic syndrome in fifth grade children with acanthosis nigricans: results from CARDIAC project. World J Pediatr 2009;5(1):23-30
15. Kuriyan R, Thomas T, Lokesh DP et al. Waist circumference and waist for height percentiles in urban south Indian Children aged 3 - 16 years Indian Pediatr. 2011;48(October):765 – 71
16. Cook S, Weitzman M, Auinger P, Nguyen M, Dietz W. Prevalence of a metabolic syndrome phenotype in adolescents: findings from the third National Health and Nutrition ExaminationSurvey, 1988 – 1994. Arch Pediatr Adolesc Med. 2003; 157:821– 7
17. Singh Y, Garg M, Tandon N, Marwaha RK. A Study of Insulin Resistance by HOMA-IR and its Cut-off Value to Identify Metabolic Syndrome in Urban Indian Adolescents. Journal of Clinical Research in Pediatric Endocrinology. 2013;5(4):245-251
18. Srinivasan SR, Myers L, Berenson GS. Predictability of childhood adiposity and insulin for developing insulin resistance syndrome (syndrome X) in young adulthood: the Bogalusa Heart Study. Diabetes. 2002; 51: 204-209
19. Morrison JA, Friedman LA, Gray-McGuire C. Metabolic syndrome in childhood predicts adult cardiovascular disease 25 years later: the Princeton Lipid Research Clinics Follow-up Study. Pediatrics. 2007; 120:340– 5
20. Felszeghy E, Kaposzta R, Juhasz E, Kardos L, Ilyes I. Alterations of carbohydrate and lipoprotein metabolism in childhood obesity – impact of insulin resistance and acanthosis nigricans. J Pediatr Endocrinol Metab. 2009; 22:1117– 26
21. Santoro N, Amato A, Grandone A, et al. Predicting Metabolic Syndrome in Obese Children and Adolescents: Look, Measure and Ask. Obesity Facts. 2013;6(1):48-56