

High predictability of impaired glucose tolerance by combining cardiometabolic screening parameters in obese children

Introduction

There is an ongoing debate about which overweight and obese children need to be tested by an oral glucose tolerance test (OGTT) for the presence of impaired glucose tolerance (IGT) and type 2 diabetes mellitus. The current Dutch Guideline suggests that children with impaired fasting glucose (IFG) should be tested by OGTT¹. Recent literature, however, states that IFG lacks sensitivity to predict IGT²⁻³. Therefore we hypothesize that combining anthropometric and metabolic parameters can improve sensitivity of IGT screening.

Methods

In this cohort study, patients with obesity underwent OGTT as a standard of care. All overweight and obese patients in whom OGTT was performed were enrolled in the study. We determined the association of parameters IFG, hypertension, elevated liver enzymes, dyslipidemia and HOMA-IR with IGT. Parameters associated with IGT were combined into a model, of which sensitivity and specificity of screening for IGT were determined.

Results

IGT was present in 11/145 patients, of whom 2 had impaired fasting glucose (IFG). Elevated blood pressure (p=0.025) and elevated liver enzymes (p=0.003) were associated with IGT, whereas IFG was not (p=0.067). The presence of any abnormal screening parameter predicted IGT with a high sensitivity of 1.00, a specificity of 0.56 and a number needed to screen of 5.7.

Table 1 Characteristics of the cohort and comparison of NGT and IGT subjects.

	Total n=145	NGT n=134	IGT n=11	p-value
Sex female (%)	77 (53)	72 (54)	5 (46)	p>0.10
Age	11.6 (8.1-14.4)	11.5 (8.0-14.2)	14.3 (11.9-15.3)	0.048
Ethnicity Caucasian (%)	96 (66)	87 (65)	9 (82)	p>0.10
BMI SDS	3.3 (2.9-3.8)	3.3 (2.9-3.8)	3.8 (3.2-4.3)	p>0.10
Waist circumference SDS	3.1 (2.8-3.5)	3.1 (2.8-3.4)	2.9 (2.9-3.9)	p>0.10
Acanthosis nigricans (%)	58 (41)	52 (40)	6 (60)	p>0.10
BMI category (%)	Overweight	23 (16)	1 (9)	p>0.10
	Obesity class I	56 (38)	3 (27)	
	Obesity class II	36 (25)	2 (18)	
	Obesity class III	30 (21)	5 (46)	
Pubertal subjects (%)	85 (63)	76 (61)	10 (91)	0.097
OGTT Glucose mmol/l t=0	4.4 (4.2-4.8)	4.4 (4.2-4.8)	4.6 (4.2-5.3)	p>0.10
OGTT Glucose mmol/l t=30	7.4 (6.3-8.3)	7.3 (6.3-8.3)	7.9 (7.3-8.4)	p>0.10
OGTT Glucose mmol/l t=60	6.2 (5.2-7.5)	6.1 (5.2-7.2)	9.3 (7.8-10.7)	<0.001
OGTT Glucose mmol/l t=120	5.8 (5.2-6.6)	5.7 (5.1-6.4)	8.5 (8.1-9.6)	<0.001
IFG (%)	6 (4)	4 (3)	2 (18)	0.067
IGT (%)	11 (8)	Na	na	na
Type 2 diabetes (%)	0 (0)	Na	na	na
HbA1c > 40 mmol/mol (%)	1 (1)	1 (1)	0 (0.0)	p>0.10
HOMA-IR > 3.4 (%)	45 (32)	41 (31)	4 (40.0)	p>0.10
Elevated BP (%)	88 (69)	33 (28)	7 (64)	0.035
Elevated liver enzymes (%)	31(23)	24 (19)	7 (64)	0.003
Dyslipidemia (%)	48 (35)	42 (33)	6 (55)	p>0.10

Table 1 Percentages are valid percentages. Data are expressed as median with IQR unless otherwise stated. Abbreviations: BMI: Body Mass Index BP: Blood Pressure, IFG: Impaired Fasting Glucose IGT: Impaired Glucose Tolerance, na: not applicable, NGT: Normal Glucose Tolerance, OGTT: Oral Glucose Tolerance Test, SDS: Standard Deviation Score.

Conclusions

The use of a model based on the presence of IFG, elevated blood pressure and elevated liver enzymes can improve the selection of patients at risk for IGT that need to be tested by OGTT, compared to the current practice of offering an OGTT to those with IFG. This could aid in selecting patients at high risk for developing IGT, who deserve more intensive follow up and treatment.

Table 2 Screening parameters associated with the presence of IGT.

Number of abnormal screening parameters ^b	NGT (n=134)	IGT (n=11)	p-value	Sensitivity (95% CI)	Specificity (95% CI)	NNS	IGT missed n (%)
≥0	82	0		na	na	13.2	0 (0)
IFG	4	2	<0.001	0.18 (0.05-0.48)	0.97 (0.93-0.99)	3.0	9 (82)
≥1	52	11		1.00 (0.74- 1.00)	0.56 (0.49-0.65)	5.7	0 (0)

Table 2 Abbreviations: NGT: Normal Glucose Tolerance, IGT: Impaired Glucose Tolerance, NNS: number needed to screen, IGT missed: number of cases missed if this parameter was used to assess the necessity to perform OGTT, na: not applicable. ^bscreening parameters: fasting glucose, blood pressure and liver enzymes.

References

- 'Guideline - Evaluation and treatment of obesity in adults and children'. CBO; 2010.
- Sinha R et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. *N Engl J Med* 2002; 346: 802-10.
- Cali' AM et al. Metabolic abnormalities underlying the different prediabetic phenotypes in obese adolescents. *J Clin Endocrinol Metab* 2008; 93: 1767-73.

Acknowledgements

The authors would like to express their gratitude to prof. dr. H.A. Delemarre-van de Waal for her efforts invested in setting up the obesity outpatient clinic in the Willem-Alexander Children Hospital and for facilitating the set-up of this study. Prof. Delemarre deceased 13th of February 2014. Furthermore, we would like to thank drs. A. Felius, for his support in the clinical part of this study.

Disclosure statement: All authors of this poster have nothing to disclose.



Erasmus MC
Universitair Medisch Centrum Rotterdam

