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POSTER NUMBER **P78**

Clinic-based anthropometric measurements of lipodystrophy and associations with antiretroviral therapy in HIV-infected adolescents

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INTRODUCTION

• Lipodystrophy (LD; lipoatrophy, lipohypertrophy and mixed phenotypes) and lipid abnormalities are increasingly observed in HIV-infected patients, and have been linked to cardiovascular risk.
• In adults, LD is associated with antiretrovirals (ARVs), including protease inhibitors (PIs), notably ritonavir, and nucleoside reverse transcriptase inhibitors (NRTIs), especially stavudine.
• However, there is conflicting evidence for this association in adolescents. Objective methods of assessing fat distribution in this population are also required.

AIMS

To undertake observational research in HIV-infected adolescents to determine :
1) any association between doctor-diagnosed lipodystrophy and antiretroviral therapy, and
2) the use of anthropometric measurements in detecting doctor-diagnosed lipodystrophy and dyslipidaemia.

METHOD

A single-centre cross-sectional study of HIV-infected adolescents was performed.
• Patients aged 12-18 were recruited from the paediatric HIV outpatient clinic at St. Mary's Campus, Imperial College NHS Trust, London, UK between February – May 2011.
• Anthropometric measurements were collected by one of two observers (HS, RC) and included BMI, waist and hip circumferences, mid-upper arm circumference (MUAC) and triceps skinfold thickness (TSF).
• History of antiretroviral exposure and recent non-fasting total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and triglycerides (TG) were obtained
• Anthropometric and lipid data is expressed as age and sex adjusted percentiles according to National Health and Nutrition Examination Survey (NHANES) reference data.
• Participants were classified as with or without doctor-diagnosed LD. This was defined as the presence of thinning of the face or limbs, or increased central adiposity, as observed by a doctor.
• Mann Whitney U and chi-squared tests were used to detect differences in antiretroviral exposure and anthropometry between the two groups and associations between anthropometry and lipid abnormality

RESULTS **40 patients**

Demographics: 21 (52.5%) were female. The median age was 14.1 years (IQR 12.9, 15.4). 34 (85.0%) were Black African or Caribbean. The remainder were Caucasian/ other.

Lipodystrophy: 6 (15.0%) had doctor-diagnosed LD;3 had lipoatrophy, 2 lipohypertrophy and 1 had mixed phenotype.

ARV exposure: 37 (92.5%) were currently taking ARVs. 36 (90.0%) were taking an NRTI, although none were currently or recently on stavudine,15 patients (37.5%) had been exposed to stavudine, for a median duration of 2.9 years (IQR 0.1, 5.4). Twenty-two (55.0%) were taking a PI, with 19 (47.5%) boosted with ritonavir. 21 (52.5%) had been exposed to ritonavir, with a median duration of exposure of 3.0 years (IQR 1.5, 5.2).

Lipid data: 11 patients (27.5%) had at least one abnormal lipid level. The median TC was 4.1 (IQR 3.5,5.0). 5 (12.5%) were ≥ 95th percentile; median HDL was 1.3 (IQR 1.1, 1.5) and 5 (12.5%) were ≤5th percentile; median LDL was 2.3 (IQR 1.9,3.0) and 4 (10.0%) were ≥95th percentile. Median TG was 1.0 (IQR 0.7, 1.3) and 2 (5.0%) were ≥ 95th percentile.

Anthropometry: Eleven patients (27.5%) had BMI ≥ 91st percentile, with four (10.0%) ≥ 98th percentile. Nine (22.5%) had a BMI ≤9th percentile. Twenty-two patients (55.0%) had at least one abnormal anthropometric measurement, excluding BMI. One patient (2.5%) had a waist circumference ≥90th percentile and one (2.5%) had a waist hip ratio ≥90th percentile (2.5%). Nine (22.5%) were ≤10th percentile for hip circumference, 15 (37.5%) for mid-upper arm circumference and 2 (5.0%) for triceps skin fold thickness.

Variable		Lipodystrophy (n=6)	No lipodystrophy (n=34)	p-value
Demographics				
Female		4 (66.7%)	17 (50.0%)	0.66
Age	*Median (IQR)*	15.6 (14.7, 16.2)	13.7 (12.7, 14.8)	**0.02**
Age > 15 years		4 (66.7%)	7 (20.6%)	0.04
Black African/Caribbean		4 (66.7%)	30 (88.2%)	**0.03**
Caucasian		1 (16.7%)	1 (2.9%)	0.28
Current Antiretroviral Use				
On treatment		6 (100.0%)	31 (91.2%)	1.0
Current PI		6 (100.0%)	16 (47.1%)	**0.02**
Current ritonavir		6 (100.0%)	13 (38.2%)	**0.01**
Current NRTI		5 (83.3%)	31 (91.2%)	0.16
Duration of current regime (years)	*Median (IQR)*	1.3 (0.5, 2.4)	2.0 (0.9, 3.7)	0.43
History of Antiretroviral Use				
Total duration of treatment (years)	*Median (IQR)*	9.7 (6.2, 11.6)	9.8 (6.3, 10.9)	0.59
Any use of stavudine		3 (50.0%)	12 (35.3%)	0.65
- duration (years)	*Median (IQR)*	3.8 (1.9, 4.4)	5.3 (1.2, 6.4)	0.87
Any use of ritonavir		6 (100%)	15 (44.1%)	**0.02**
- duration (years)	*Median (IQR)*	2.7 (1.8, 7.3)	3.3 (1.5, 5.3)	0.51
Lipid Levels				
Total cholesterol percentile	*Median (IQR)*	62.5 (7.75, 95.0)	37.5 (10.0, 75.0)	0.45
Total cholesterol ≥95th percentile		2 (33.3%)	3 (8.8%)	0.15
HDL cholesterol percentile	*Median (IQR)*	37.5 (7.75, 75.0)	50.0 (21.3, 75.0)	0.80
HDL cholesterol ≤ 5th percentile		1 (16.7%)	4 (11.8%)	1.00
LDL cholesterol percentile	*Median (IQR)*	50.0 (19.0, 91.3)	50.0 (10.0, 56.3)	0.52
LDL cholesterol ≥95th percentile		1 (16.7%)	5 (14.7%)	0.50
Triglyceride percentile	*Median (IQR)*	62.5 (21.3, 78.6)	50.0 (21.3, 75.0)	0.51
Total cholesterol ≥95th percentile		0 (0.0%)	2 (5.9%)	1.00
Anthropometry				
BMI percentile	*Median (IQR)*	50.0 (21.0, 79.0)	50.0 (21.0, 91.0)	0.88
BMI ≤9th percentile		1 (16.7%)	8 (23.5%)	1.00
BMI ≥91th percentile		1 (16.7%)	10 (29.4%)	1.00
BMI ≥98th percentile		0 (0.0%)	4 (11.8%)	1.00
WC percentile	*Median (IQR)*	10.0 (5.0, 31.3)	20.0 (5.0, 50.0)	0.66
WC >90th percentile		0 (0.0%)	1 (2.9%)	1.00
HC percentile	*Median (IQR)*	20.0 (10.0, 56.3)	25.0 (15.0, 75.0)	0.29
HC <10th percentile		2 (33.3%)	7 (20.6%)	0.60
WHR percentile	*Median (IQR)*	37.5 (21.3, 56.3)	25.0 (10.0, 50.0)	0.41
WHR >90th percentile		0 (0.0%)	1 (2.9%)	1.00
MUAC percentile	*Median (IQR)*	12.5 (5.0, 31.3)	25.0 (5.0, 50.0)	0.44
MUAC <10th percentile		3 (50%)	12 (35.3%)	0.65
TSF percentile	*Median (IQR)*	50.0 (43.8, 50.0)	50.0 (25.0, 56.3)	0.92
TSF <10th percentile		0 (0.0%)	2 (5.9%)	1.00

Table 1: Characteristics of patients with and without LD. WC, waist circumference; HC, hip circumference; WHR, waist-hip ratio; MUAC, mid-upper arm circumference; TSF, triceps skin fold thickness.

Variable	Any lipid abnormality (n=11)	No lipid abnormality (n=29)	p-value
BMI ≤9th percentile	3 (27.3%)	6 (20.7%)	0.67
BMI ≥91th percentile	2 (18.2%)	9 (31.0%)	0.70
BMI ≥98th percentile	1 (9.1%)	3 (10.3%)	1.00
WC ≥90th percentile	1 (9.1%)	0 (0.0%)	0.23
HC ≤10th percentile	3 (27.3%)	6 (20.7%)	0.69
MUAC ≤10th percentile	4 (36.4%)	11 (37.9%)	1.00
TSF ≤10th percentile	0 (0.0%)	2 (6.9%)	1.00
WHR ≥90th percentile	1 (9.1%)	0 (0.0%)	0.23

Table 2: Anthropometric characteristics of patients with and without lipid abnormality. WC, waist circumference; HC, hip circumference; WHR, waist-hip ratio; MUAC, mid-upper arm circumference; TSF, triceps skin fold thickness

Doctor-diagnosed LD was associated with increasing age (p=0.02), current use of any PI (p=0.02) and any use or current use of ritonavir (p=0.02 and p=0.01, respectively). There was no association with current use of NRTIs or any use of stavudine. There were no anthropometric differences between the two groups and anthropometry was not associated with lipid abnormalities (p>0.05).

CONCLUSION

Lipodystrophy was associated with exposure to PIs, particularly when boosted with ritonavir. Single collection of anthropometric measurements was not useful in detecting clinical lipodystrophy in this adolescent cohort.