INTERNATIONAL MEDICAL PRESS

7th International Workshop on Adverse Drug Reactions and Lipodystrophy in HIV

13–16 November 2005, Dublin, Ireland

Objective measurements of body composition *in vivo* using magnetic resonance imaging

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***Antiviral Therapy* 2005; 10:L1 (abstract no. P1)**

Over the past 10 years, the availability and application of imaging techniques has had a profound effect on understanding soft-tissue distribution and changes in human health and disease. Their use in body composition has significantly advanced the field allowing for 1) quantification of soft tissue volumes (adipose tissue, skeletal muscle, multiple organs); 2) distribution of adipose tissue (visceral, subcutaneous, and intermuscular); 3) within compartment sub-depots: visceral sub-depots of omental, mesenteric, and retroperitoneal; subcutaneous sub-depots including facial and dorsocervical; and 4) organ volumes including pancreas, spleen, kidneys, heart, liver, and brain.

Limitations associated with ionizing radiation in computerized tomography have made magnetic resonance imaging a more desirable method for human body composition assessment, since it provides a safe, noninvasive, *in vivo* measurement approach. Quantitative measurements of ectopic lipids within tissues and organs are another important advancement. Intrahepatocellular lipids and intramyocellular lipids in muscle using magnetic resonance spectroscopy contribute to a better understanding of lipid metabolism under normal and pathological metabolic conditions. Both magnetic resonance imaging and magnetic resonance spectroscopy can be performed in infants through elderly, with applications to better understanding growth, pubertal maturation, ageing, sarcopenia, weight gain, weight loss and disease states.

HIV related lipodystrophy is one area where imaging for body composition assessment is contributing significantly to understanding the pathophysiology of the disease and effects of treatment. Increased visceral and decreased subcutaneous adipose tissues, and increased intramyocellular lipids are recognized in HIV antiretroviral therapy-treated

individuals. Associations exist between the aforementioned adipose tissue/ectopic lipid states and impaired insulin dynamics and glucose metabolism, and hepatic insulin resistance in this adult population. An ongoing line of investigation in children and adults is whether the alterations in adipose tissue/lipid distribution are as a result of antiretroviral therapy effects or HIV infection.

In summary, the use of MRI continues to provide insights into the relationship between adipose tissue distribution, ectopic lipids and the pathophysiology of different disease states that may have a positive impact on patient treatment and clinical care. Recognized limitations of MRI include access to available scanners and high cost of image acquisition and image/compartment analyses. However, no other currently available, radiation free, body composition technique can quantify soft-tissue depots *in vivo*.

Supported by NIH PO1-DK42618; RO1-HD42187; RO1-DK72507.


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