

Obesity and Medical Imaging: Looking Beyond the Body Mass Index (BMI)



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Abstract

Obesity is a multifactorial pathology that affects a growing number of people throughout the world. It is frequently associated with major medical complications such as cardiovascular disease, type 2 diabetes and arterial hypertension. Clinical assessment is traditionally based on body mass index (BMI) and simple anthropometric measurements such as waist circumference. However, although these tools are accessible, they have significant limitations, particularly with regard to the distribution of fat and its effects on internal organs.

Medical imaging techniques offer a complementary and increasingly essential approach to a more detailed assessment of obesity. This article highlights their growing role in characterizing adipose tissue, their clinical implications and the limitations specific to each modality [1].

Keywords: Obesity; Medical Imaging; Body Mass Index

Introduction

Obesity is now a major public health issue, with significant repercussions on morbidity and mortality, particularly in terms of cardiovascular and metabolic diseases and certain cancers. Although BMI is used systematically to classify patients according to their build, it does not provide a complete assessment of body composition or fat distribution. This limitation is all the more problematic as studies have shown the importance of the location of fat deposits, particularly visceral fat deposits, in the genesis of metabolic complications [2].

In this context, medical imaging appears to be the tool of choice for going beyond conventional assessments, by providing a more precise anatomical and functional view of adipose tissue.

Discussion

BMI: a simple but incomplete indicator:

The BMI is defined as the body mass divided by the square of the body height, and is expressed in units of kg/m². BMI remains a quick and easy-to-use method for estimating body size. It provides a standardized classification (normal weight, overweight, obese), widely used in clinical practice. However, it does not distinguish between fat mass and lean mass, nor does it provide information on the distribution of adipose tissue [3].

As a result, BMI may underestimate obesity in muscular individuals (e.g. athletes) or overestimate it in elderly people with a loss of muscle mass (sarcopenic obesity). Obesity is not just a general accumulation of fat, but also includes profound changes in body composition, sometimes with lipid infiltration of organs (liver, muscles, heart), or a loss of lean body mass. This is where medical imaging comes into its own (Figure1).

The contribution of medical imaging to the assessment of obesity:

Imaging techniques enable a detailed characterization of adipose tissue, in terms of location, volume and sometimes even cell type (white, brown, beige fat). They also make it possible to assess the effects of obesity on internal organs, which is not possible with conventional tools:

Computed tomography (CT)

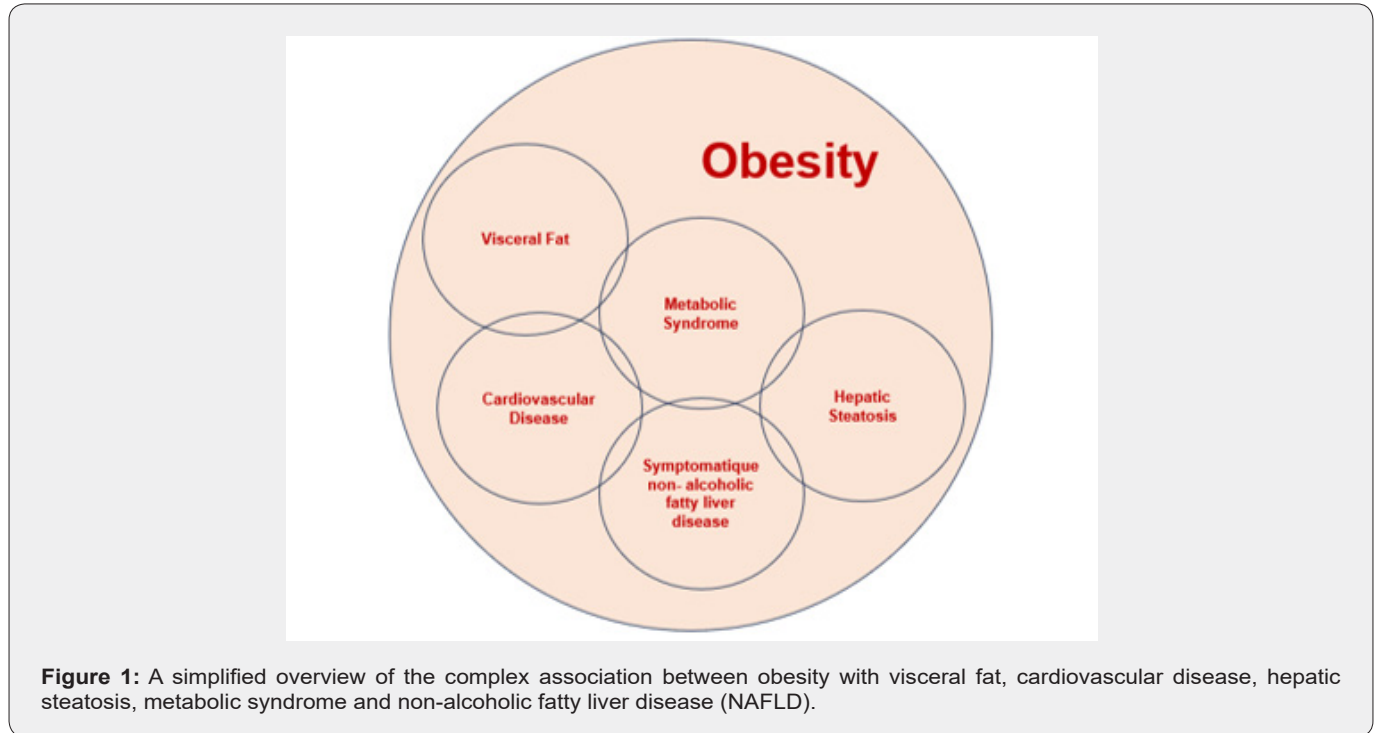
CT uses X-rays to obtain cross-sectional images of the body. It allows precise quantification of visceral and subcutaneous fat, thanks to the differences in density between the tissues [4]. The volumetric measurement of visceral adipose tissue makes it an important predictive tool for the risk of metabolic complications, particularly type 2 diabetes and cardiovascular disease. However,

exposure to ionizing radiation and its cost limit its routine use, particularly in a young population or for repeated assessments.

Magnetic resonance imaging (MRI)

MRI uses magnetic fields and radio waves to provide a highly detailed view of soft tissue, without irradiation. It allows different types of fat to be distinguished and their distribution to be assessed with great precision [5]. MRI is particularly

useful for assessing the effects of obesity on internal organs, including hepatic steatosis, cardiac or muscular fat deposits, and renal changes. Despite its many advantages, this technique has certain limitations: the examination takes a long time, there are contraindications linked to the presence of metallic devices, and it is relatively expensive. On the other hand, it provides a localized assessment, whereas BMI provides an overall, albeit summary, picture.



Ultrasound imaging

Ultrasound, which is accessible, non-irradiating and inexpensive, is an interesting alternative for assessing subcutaneous and visceral fat, as well as hepatic steatosis [6]. The speed with which it can be performed makes it suitable for routine clinical practice. However, its accuracy remains inferior to that of CT or MRI, and its reliability is highly dependent on the experience of the operator.

Dual-energy X-ray absorptiometry (DEXA)

Initially developed to measure bone mineral density, DEXA has become a benchmark for body composition analysis. It differentiates between three compartments: fat mass, lean mass and bone mass.

It offers a precise regional analysis (limbs, trunk, etc.) that is difficult to achieve with other techniques. Exposure to radiation is minimal, comparable to that of a short flight.

Table 1: Comparative Analysis of Medical Imaging Techniques for Obesity Diagnosis.

Imaging Method	Advantages	Disadvantages
CT Scan (Computed Tomography)	Precise for visceral fat assessment.	High radiation dose, Expensive.
MRI (Magnetic Resonance Imaging)	No radiation, excellent for visceral fat.	Expensive, time-consuming, limited access.
Ultra Sound Imaging	No radiation, portable, affordable.	Less precise, operator-dependent.
DEXA (Dual-Energy X-ray Absorptiometry)	Very accurate, differentiates tissue types.	Low X-ray exposure, expensive.

Although less expensive than CT or MRI, it is still more expensive than ultrasound and does not provide a detailed view

of internal organs [7] (Table 1).

Conclusion

Medical imaging adds an essential dimension to the assessment of obesity, going well beyond traditional indicators such as BMI. Each modality has its strengths and limitations, making their use complementary depending on the clinical context. The judicious integration of these tools in the management of obese patients could significantly improve the prevention, diagnosis and monitoring of associated complications.

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