

# Pseudo fat-saturation and orbital lipolysis in cancer cachexia: a diagnostic trap

SM Yu \*, William KM Kwong, Yan YY Law, Ann D King

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A 59-year-old woman was diagnosed in June 2022 with locally advanced nasopharyngeal carcinoma. She declined standard chemoradiotherapy and opted to pursue traditional Chinese Medicine. In May 2023, she presented with bilateral sixth nerve palsy, poor oral intake, and progressive weight loss from 32 kg to 20 kg over 6 months.

The restaging positron emission tomography–computed tomography showed that she was extremely emaciated and had locoregionally advanced nasopharyngeal carcinoma without distant metastases (Fig 1). Magnetic resonance imaging (MRI) of the head and neck revealed diffuse loss of T1 hyperintense signal in the fat of the subcutaneous and deep soft tissues and in the bone marrow of the cervical spine and skull vault giving the images a pseudo fat-saturated appearance (Fig 2). The scanning parameters were verified to ensure the correct repetition time and echo time (568 ms

and 7 ms, respectively) had been selected. Compared with the earlier MRI performed in November 2022, there was complete loss of normal T1-weighted hyperintense signals in the retrobulbar fat with development of diffuse oedema and enhancement in the post-septal orbits (Fig 3); similar changes with bilateral enophthalmos and diffuse symmetric enhancement of post-septal orbits were seen on computed tomography (Fig 4). Overall, this picture was that of pseudo fat-saturation and orbital lipolysis in a patient with cancer cachexia. Following assessment, the patient agreed to undergo palliative radiotherapy.

Long-term cachexia, a wasting syndrome common in cancer patients, is marked by extreme weight loss and malnutrition and can lead to severe metabolic disturbances that cause excessive lipolysis and lipid peroxidation. Characteristic imaging features are often found in severe cases.<sup>1–4</sup> Pseudo fat-saturated appearance is seen on T1-weighted images due to complete loss of subcutaneous adipose tissue, similar to the fat-saturated T1-weighted image.<sup>1</sup> Diffuse loss of normal T1-weighted hyperintense bone marrow signal was a result of bone marrow fat atrophy and deposition of extracellular gelatinous substance, a process known as ‘gelatinous transformation of bone marrow’.<sup>2</sup> This loss of fat signal gives the images an appearance similar to that of a fat-saturated T1-weighted image. Orbital fat is typically preserved until the late stages of severe cachexia during which a condition called orbital lipolysis may develop.<sup>3,4</sup> This condition is related to endothelial injury and increased permeability of vessel walls resulting in diffuse oedema and contrast enhancement in the post-septal orbits.

Cachexia is common in patients with longstanding cancer and malnutrition. Doctors should recognise this phenomenon to prevent attributing these imaging findings to incorrect scanning parameters or alternative diagnoses. The diffuse hypointense T1-weighted bone marrow signal might be misdiagnosed as widespread metastatic disease or other bone marrow–infiltrating diseases such as myelofibrosis or haematological malignancies, while diffuse orbital oedema and enhancement may be misdiagnosed as orbital inflammatory conditions such as idiopathic orbital inflammation.

Understanding the characteristic imaging features of long-term cachexia is crucial for

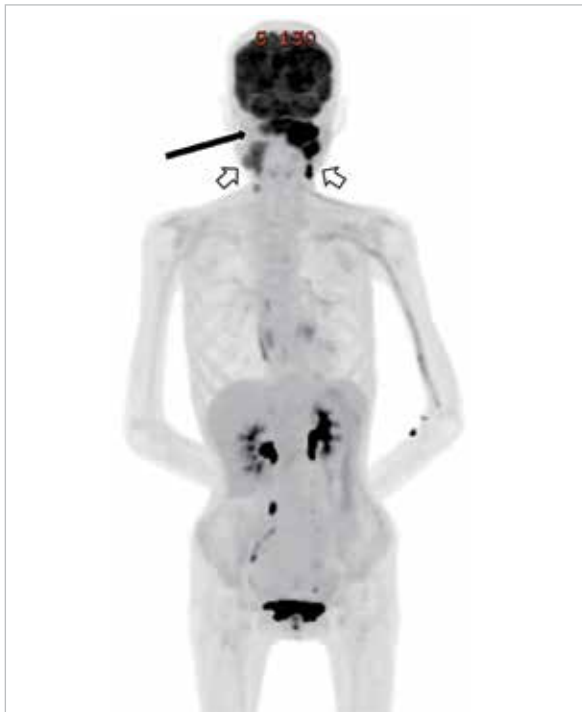
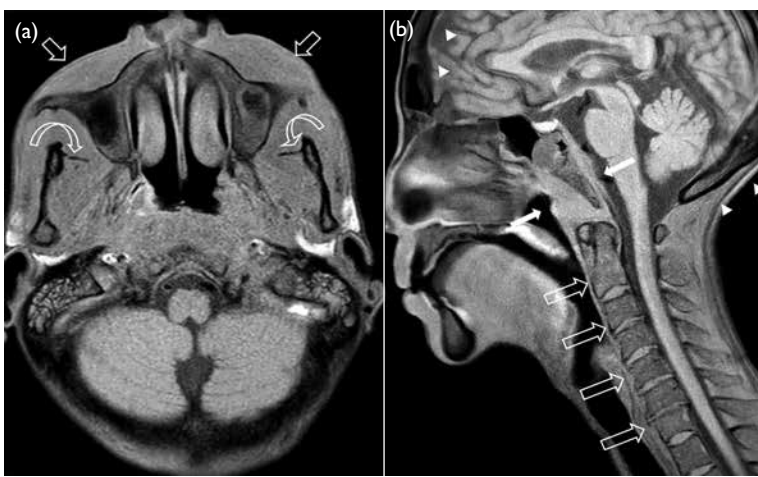


FIG 1. Maximum intensity projection coronal image of positron emission tomography of the patient. It shows a very emaciated condition with a huge nasopharyngeal carcinoma (black arrow) and bilateral bulky cervical node metastases (open arrows). There was no evidence of distant metastatic deposits



**FIG 2.** Magnetic resonance imaging (MRI) of the head and neck of the patient. (a) Axial T1-weighted MRI showing complete loss of fat signal in the cheeks (open arrows) and infratemporal fossae (curve arrows). (b) Sagittal T1-weighted MRI showing a locally advanced nasopharyngeal carcinoma with full-length clival invasion and dural invasion at the retroclival region (solid arrows), diffuse loss of normal fat signals within the bone marrow of the skull vault (arrowheads) and cervical spine (open arrows), compatible with pseudo fat-saturated appearance

doctors to avoid diagnostic pitfalls and unnecessary additional investigations or invasive procedures.

**Author contributions**

All authors contributed to the concept or design, acquisition of data, analysis or interpretation of data, drafting of the manuscript, and critical revision of the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

**Conflicts of interest**

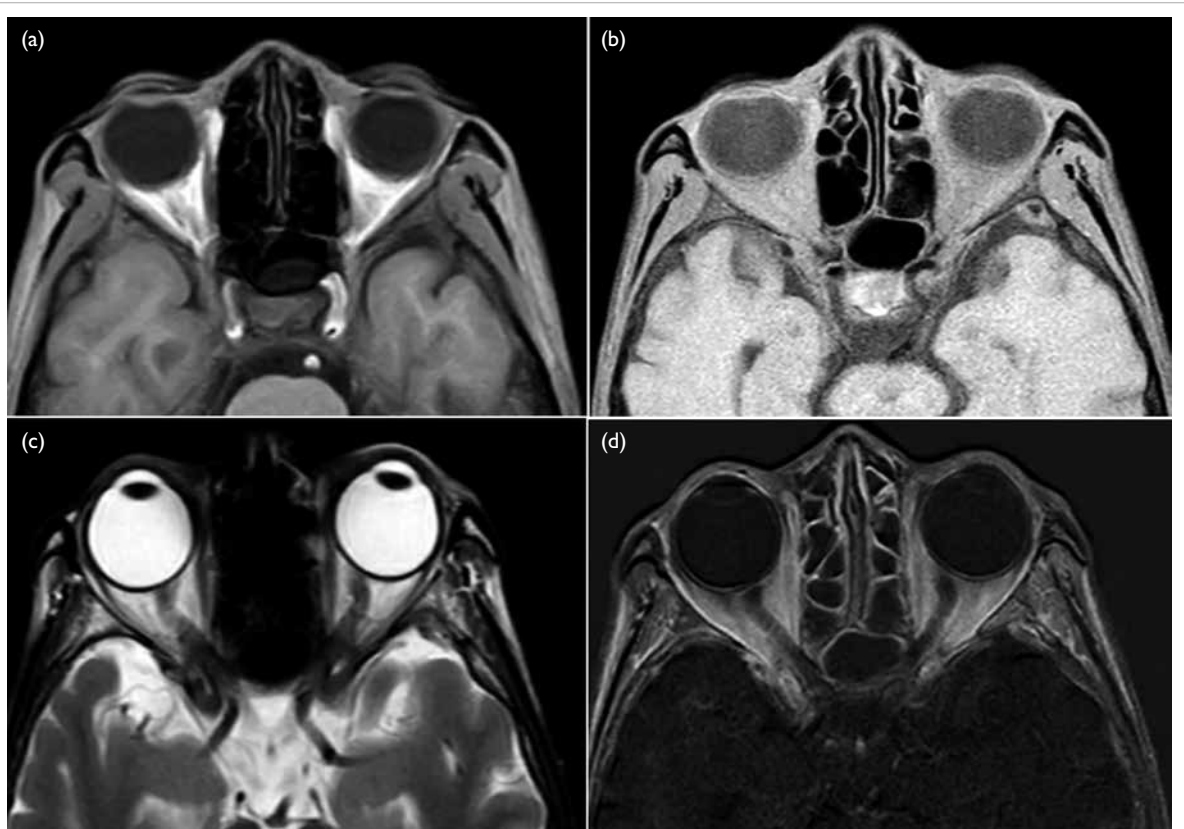
All authors have disclosed no conflicts of interest.

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**Ethics approval**

This study was conducted in accordance with the Declaration of Helsinki. The patient provided written informed verbal consent for the publication of this case report.



**FIG 3.** Axial magnetic resonance imaging (MRI) showing the development of orbital lipolysis. (a) T1-weighted MRI (gradient echo) in November 2022 showing expected T1-weighted hyperintensity in bilateral retrobulbar fat. (b-d) Subsequent MRI in June 2023. (b) T1-weighted MRI (spin echo) showing complete loss of fat signal in bilateral retrobulbar fat. The imaging appearance mimics a fat-saturated T1-weighted image. (c) T2-weighted MRI with fat saturation showing oedema in bilateral retrobulbar fat. (d) T1-weighted subtraction post-gadolinium MRI showing diffuse, symmetrical contrast enhancement in the retrobulbar fat

**SM Yu** \*, MB, BS, FRCR  
**WKM Kwong**, BAS, MHithSc (MRS)  
**YYY Law**, BSc, MSc  
**AD King**, MD, FRCR

Department of Imaging and Interventional Radiology, Prince of Wales Hospital, Hong Kong SAR, China

\* Corresponding author: fayeyupwr@gmail.com

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