



## PET/CT in senior patients: “cui prodest?”

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Twenty years after the diffusion of clinical PET/CT in the western countries, it is wise to explore the demographic and social factors associated with the increase of PET/CT examinations in senior patients and to determine whether they changed over time. The potential benefits of using PET/CT include early diagnosis, accurate staging, but, above all, prevention of unnecessary and aggressive treatments, which might be harmful in frail or elderly patients.

Due to an efficient health system, and the continuous improvement of living conditions, the number of older adults in Europe is rising and will continue to increase. Forty years ago, the elderly were not candidates for innovative procedures, such as organ transplantation and advanced, sophisticated surgery. Today, age alone can no longer be considered a reason to deny the necessary care for the elderly: age has become irrelevant in therapeutic decisions. A reasonable goal of modern medicine would be to maintain a high quality of life within a limited life expectancy. Ageing is a gradual process, not a disease, and living longer is naturally associated with more costs. Therefore, the demand for medical services dedicated to the elderly is expected to rise exponentially.

Over the past years, nuclear medicine departments have seen an increase in investigations performed in the elderly. The use of PET/CT has increased for several indications in clinical practice, particularly in cancer and elderly. Dinan et al. calculated the number of PET scans performed in patients over 80 years of age in three different periods (1998–2000,

2001–2004 and 2005–2007). The percentage of examinations performed on these patients gradually increased by 18.4, 21.3 and 24.4%, respectively, demonstrating a significant increase in elderly patients [1]. The increase in nuclear medicine examinations of elderly patients cannot be referred only to demographic changes, but to extended access to the technology for patients in senior patients.

On the other hand, it is well known that more imaging does not necessarily result in better medical care. In a previous report, it was confirmed that more than 7% of patients received inappropriate scans. Moreover, 69% of patients, judged moribund on admission, had an imaging investigation requested [2, 3].

Being an elderly is not and never should be an absolute contraindication to nuclear medicine investigation. Because of forced immobility and frailty of some patients, the resulting images might not be of optimal quality and might occasionally be non-diagnostic. Today, frailty is a condition occurring in one of twenty patients over 60 years of age. These patients present multiple deficits that can be physiological, psychological or social. The condition usually predicts an adverse outcome, such as social decline, lack of daily activities, hospitalization and death. It may be necessary to frame the patient using a frailty scale, as some authors suggest [4]. Older people require more time to understand clinical information, but respect for patient autonomy is the ethical principle that underlies informed consent. Ethical dilemmas arise because of inadequate elderly patient-doctor communication. In geriatric patients, there might be relevant difficulties to obtain informed consent because of cognitive decay or end-stage conditions. Some older persons have impaired decision-making capacity and insufficient social or familiar support. However, even patients with MMSE scores as low as 10–20 range can give valid consent. Helping any subject to understand as fully as possible, many authors have emphasized the importance of visual and hearing aids (pictures or audiotapes). Moreover, in different European countries, different codes and guidelines for obtaining informed consent are available [5].

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Usually, the guiding model for practical diagnostic imaging refers to young individuals more than to the older ones. These are due to a high frequency of comorbidity, changes in the disease symptoms with age and alteration or compromise of the physiological activities of ageing. The high prevalence of chronic diseases and the consequent alteration of the onset of the disease in older patients might lead to attribute a symptom to an incorrect condition. Furthermore, the frequency of adverse extrinsic events increases with age and complicates the early stages with atypical presentations of the disease. The high prevalence of comorbidities requires the development of a reliable model for diagnosis, recognizing causal relationships. Older patients tend to have multiple comorbidities. Diabetes and dementia are the comorbidities with the most critical impact on PET/CT; transfer, isolation, noises and request of immobility are factors likely to contribute to anxiety and, therefore, possible causes of pitfalls in imaging.

In western countries, up to 40% of end-stage patients received chemotherapy in the last month of life. Extensive use of diagnostic imaging for a complete diagnosis of end-stage patients is not necessary when there are no specific therapeutic goals or possible improvements in the quality of life. Supportive care health professionals should improve patient's quality of life, avoiding aggressive treatment and limiting diagnostic examinations. This concept is essential when the stage of the disease is too advanced to expect any improvement in the condition and when the advanced age does not allow a correct execution of the examination [6].

One has to consider that not more than 20 years ago the neologism "overtreatment" was created, meaning medical or surgical interventions that are unnecessary. Patient age is identified as one of several factors associated with multiple examples of inappropriate care. Overdiagnosis, as overtreatment, represents a significant increase in healthcare costs. However, even where money has not been invested, overdiagnosis represents a problem: although some patients cannot benefit from unnecessary treatment, they can still be harmed. Overdiagnosis occurs in a patient only if the person is not treated or dies of another cause. A method for assessing the presence or absence of overdiagnosis was proposed by Welch, evaluating two different graphic patterns of a rapid increase in the diagnosis rate. If there is a proportional relationship between the increase in new cancers and the increase in deaths, it is highly probable that we are in the case of a real increase in the amount of cancer. If an increase in new diagnoses of cancer does not correspond to a parallel increase in deaths, we are in the case of cancer overdiagnosis [7].

Furthermore, overdiagnosis is a self-sustaining phenomenon because it determines the request of a series of tests to confirm the diagnosis. Researchers must work to find reliable limits on the extent of overdiagnosis. A potential method of mitigating overdiagnosis is to increase a test's standard threshold. Sometimes, it might be better to ignore the small

abnormalities: this has already been taken into account in imaging for the management of metabolically inactive small lung nodules and adrenal lesions accidentally detected by CT.

Even though human longevity represents a result of advances in medical research until the 1980s, people over age 65 years do not enter in clinical trials. Nowadays, only 15% of the studies exclude older patients without due justification. Comorbidity, cognitive impairment, reduced life expectancy and drug use are considered the main criteria of exclusion. Usually, the clinicians prescribe treatments untested in older patients and without significant evidence of efficacy and toxicity in the elderly [8].

Nuclear medicine exams at the end of life have not received adequate consideration. More than 33% of patients in the last month of life underwent at least one high-cost imaging procedure (PET, CT or MRI) [9]. It is also stated that about 30% of annual Medicare costs are spent on caring for people in their last year of life [10]. The evaluation of the number of tests performed and patients examined seems to configure a form of diagnostics obstinacy, with high costs for public health. The idea that the behaviours of healthcare professionals should aim to improve the quality of life in elderly patients rather than prolonging life itself should also be applied to imaging examinations.

The choice of nuclear medicine examinations according to possible future therapies should be the responsibility of multidisciplinary boards, taking into consideration the patient's condition and the relationship between risks and benefits. Each patient has the right to be evaluated and treated individually, based on the standard of care in medicine. New methodologies and guidelines should be provided to facilitate future measurement activities that could identify additional rules and unnecessary services. Because of demographic trends, it is reasonable to expect that clinicians will care for an increasing number of elderly persons with challenging diagnostic problems.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interests.

**Informed consent** Not applicable.

**Ethical approval** Institutional review board approval was not required because the paper is an editorial.

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