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The Role of Modern Technologies (Diagnostic PET Image) on Public Health

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Abstract: The scientific novelty of the study lies in the fact that for the first time the organizational aspects of introducing a new, high-tech and currently most effective diagnostic method into the practice of oncology service - positron emission tomography, organization and functioning of the PET department, methods for improving the efficiency and rationality of the department were identified. For the first time, a comparative analysis of the medical and statistical characteristics of the groups of cancer patients examined using the PET method and the MRI method was carried out. New is the analysis of the channels for referring patients with oncological diseases to high-tech methods for diagnostic studies and the sources of funding for such studies. For the first time, the structure and frequency of various radio diagnostic methods currently used for the detection of oncological diseases in a group of patients examined using PET and MRI methods, as well as an economic analysis of the use of various methods of radiodiagnostics are presented and carried out. New is the analysis of the social and health characteristics of patients examined using PET and MRI, taking into account their socioeconomic status, as well as the degree of completeness of patient reporting prior to high-tech research methods (PET).

Keywords: PET, diagnostic, diseases, analysis, socioeconomic.

INTRODUCTION

The changes that the medical practice has undergone mainly during the last thirty years in the world are amazing [Adams, B.K. *et al*., 2006] and The contribution of scientific knowledge during the second half of the 20th century was a fundamental element in the evolution of clinical medicine, which favored both the conceptual transformation of medical radiology, as well as its general acceptance [Alavi, A. *et al*., 1994].

Scientific discoveries of great importance, such as those obtained from the genetic makeup of living organisms with the description of DNA and RNA during the 1950s and 1960s, contributed not only to the biomolecular explanation of disease but also to the development of innovative technologies [Alavi, A. *et al*., 1986]. The emergence of related fields such as biotechnology, genetic engineering and robotics. These remarkable developments have also led to changes in the use of X-rays and in techniques derived from various modalities for the practice of therapeutic diagnosis in conventional radiology [Alavi, A. *et al*., 1990].

In the case of diagnostic radiology, at the end of the 1970s and 1980s, access to the first generations of axial tomography (CAT) was granted. This has led to amazing progress by describing images of different shades of gray in anatomical wounds with millimeter precision to show the presence of the disease, as has not happened since the discovery of X-rays. The development of the so-called first generations of CT scans created by Hounsfield in 1971, the availability of a whole-body topographic study in 1974 and the advent of the so-called third and fourth generation of this imaging method in 1977 radically changed the way diagnosis was made until then. This marked the transition from the conventional flat and finite X-ray radiograph to the two-dimensional shapes with accurate identification of anatomical structures, providing abundant information for accurate diagnosis of morphology. Hounsfield and Cormak were awarded the Nobel Prize in Medicine in 1979, which led to worldwide recognition of CT's role as a sample of technology applied to medicine and definitively marked the beginning of this revolutionary decade of radiology [Alavi, A. *et al*., 2004].

The active participation of other technologies in radiology, such as magnetic resonance since 1980, has allowed the development of invasive and non-invasive diagnostic techniques. MRI has a higher degree of complexity in creating images that depend on the movement of hydrogen atoms at the cellular, tissue and organ levels, allowing access to anatomical places that are almost impossible to use with other techniques, such as those obtained in a specific vascular region As in the case of vascular resonance techniques [Alavi, A. *et al*., 1993]. This made it possible to carry out increasingly less invasive studies, reduce the risk to the patient under clinical evaluation and take an accurate diagnostic approach.

Another astonishing development in the world during the 1990s was the inclusion of helical tomography, 3D and 4D technologies in tomography and resonance imaging (with the so-

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called multi-surface reconstruction) and in ultrasound (with great commercial impact). Such as obstetrics and gynecology), as well as the use of virtual endoscopy. Multi-panel reconstruction is a technical process that allows for more detailed analysis of images by including 3D reconstructions at different angles, with greater image definition thanks to graphics programs with color contrast and definition [Alavi, A. *et al*., 2002].

PET Systems Update

A PET-CT study is a diagnostic technique that provides a combination of a PET image (positron emission tomography) with a cross-sectional image (computed tomography). These technologies provide different information about the human body. The pet test is a test that allows obtaining images of cell function to show the differences between healthy and diseased tissues, while a CT scan provides images that allow the exact location of abnormalities observed in pets. This type of technology is an essential tool in the field of diagnostic imaging, giving rise to the subspecialty of molecular imaging in nuclear medicine [Alavi, A. *et al*., 1982]. The only limitation is the price of studies. In Ecuador, the diagnostic equipment "PetScan or Pet-CT" is managed at the National Institute of Oncology Dr. Juan Tanca Marengo SOLCA in Guayaquil, and Carlos Andrade Marín HCAM Hospital in Quito. The Ministry of Public Health, in order to optimize the use of the PET-CT technology available in the country for the benefit of the health of the population, has identified the need to conduct a cost study, in order to determine the cost of care with this type of technology and also to standardize the crossing of accounts between the different institutions of the comprehensive public health network. In order to meet this obligation, and neither SOLCA nor HCAM have information on the costs of this diagnostic equipment, an approach has been established with Viennatone Group, the only company licensed in the state to provide supplies to SOLCA. And to HCAM for the correct performance of this technology [Allen, S. *et al*., 2005; Andrews, J. *et al*., 2007].

The use of information technology was a crucial element in the development of the so-called modern radiology. The inclusion of these computerized information systems in radiological diagnostic equipment has facilitated the simplification of the processes of information conversion, coding and storage. Images from PET that used to take so long to show results can now be processed within seconds. Providing extremely sharp images in minutes enables not only a detailed analysis of anatomical structures, but also the valuable ability to store these images indefinitely for comparison now or later. Given the power of computer systems, it's relatively easy to get files with hundreds of images for one case in particular. Thanks to the efficiency of software and the storage capacity of graphic information, these related applications in medical radiology have multiplied astonishingly [Aydin, A. *et al*., 2005; Basu, S. *et al*., 2007; Bennink, R.J. *et al*., 2004]. A direct result of advances in diagnostic imaging has been a reduction in the time taken to perform each PET study, as well as a reduction in the delay in diagnosing each clinical case, and thus a reduction in the number of disease states [Bhargava, P. *et al*., 2006; Biggar, R.J. *et al*., 1996].

CONCLUSION

We can conclude that the effect of the PET / CT unit is very small and that under normal operating conditions, the doses received as a result of the studies do not imply an increased risk. In addition, compared to that derived from a natural radiation background, there is no appreciable dose for a citizen who does not participate in the study as a patient, companion, or family member.

Due to the continuous increase in the use of imaging techniques, the dose received by patients which should be taken into account as a component of judgment in the justification of studies has been the subject of intense interest in the literature.

Positron emission tomography (PET) is the imaging technique that has made the greatest impact in the management of cancer patients in the past decade. The three strengths of PET-FDG in clinical oncology are: 1) the possibility of studying the whole body in the same exploratory act, which makes it possible to determine the distant extension of malignancies; 2) high detection sensitivity, even when infiltrating adenopathies are of normal size or organs do not present structural alterations on computed tomography (CAT) scans and 3) high contrast resolution, allowing easy identification of lesions. Several studies show that PET has greater sensitivity and better specificity than computed tomography for detecting tumor disease, especially in cases of recurrence.

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