Reproducibility of patient's setup in radiotherapy

Reprodutibilidade de posicionamento em radioterapia

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Developments in the fields of robotics and information technology have brought important advances in radiotherapy, allowing the delivery of increasing doses to the tumor target while maintaining low levels of complications in healthy adjacent tissues.

The computed radiotherapy plannings have benefited from such progress and today allow the fusion of different imaging modalities such as computed tomography, magnetic resonance imaging and positron emission tomography, for a better definition of target volumes and risk organs[1].

There has been an overall improvement in the accuracy in all the phases of the radiotherapy process, from the planning to the accurate beams administration, This has allowed the utilization of radiation therapy schedules in a reduced number of sessions or even in a single one, while traditionally, treatments would require from 10 to 40 sessions.

Delivering the correct dose accurately is of utmost importance, particularly in treatment schedules relying on a small number of sessions, because of the reduced possibility of compensating for small errors in subsequent sessions. Treatments utilizing modern techniques such as modulated intensity radiotherapy and radiosurgery also require a high degree of reproducibility of patient's setup, as high conformal doses are delivered to the target volumes.

The most common form of patient's setup for treatment is the utilization of portal films, which are radiographs acquired with the same radiation beam utilized for the treatment, and which are compared with digitally reconstructed radiographs (DRR) by planning systems based on tomographic images utilized for that purpose.

Currently it is possible to obtain high quality portal images by utilizing digital imaging devices, which allow a rapid visualization of the area to be treated, based mainly on bone references and with low radiation doses. Additionally, the substitution of films by digital images is also important, as it eliminates the use of developing chemicals. Digital images can be digitally superimposed over DRR images, making the localization process much easier by means of a process known as image-guided radiotherapy (IGRT)[2]. However, due to the intrinsic characteristics of the radiation energy used for such purpose, portal images made from the same radiation beam used for treatment present low contrast resolution, which impairs the clear visualization of structures at some anatomic sites, besides

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not allowing the visualization of the patient's physiological condition or the accurate target volume positioning when based on soft tissues[3,4].

New systems comprising a conventional X-ray tube and one or more digital detectors have been coupled to the linear accelerator or placed around it, allowing the utilization of localization modes with up to 6 freedom degrees, i.e., allowing the correction of displacements in three directions and angles in up to three axes. Fiducial markers made from small radiopaque material wires or seeds, implanted into the target volumes, allow the visualization of internal motion of the organs and a swift and accurate correction of their positioning[5].

The last technological frontier was the incorporation of tomography techniques performed on the treatment table utilizing conical radiation beams (CBCT). Such images allow the visualization of soft tissues, and three-dimensional fusion with reference computed tomography images, providing, additionally, a real time adaptation of the treatment planning.

The high cost of such technologies associated with the fact that both public and private healthcare insurance systems are yet to recognize such methods into their covered procedures lists constitute are important obstacles preventing their incorporation in the daily clinical practice.

The present issue of **Radiologia Brasileira** brings an article demonstrating easy and reproducible methods of improving the accuracy in the localization of the tumor target to be treated[6]. It is a relevant theme, with applicability in practically every radiotherapy center in the country.

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