Dramatic of Physics in Diagnosis and Radiotherapy

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Abstract:

Radiotherapy scientists face the challenge of balancing routine clinical demands with the research and development ambitions of the field. At a time when scientists are working hard on radiation protection programs and looking for solutions to improve treatment and bring it to the required efficiency to overcome the associated clinical and technical problems and thus make prestigious and reliable contributions to patient care in cooperation with radiation oncologists. One of the classic problems that hinders radiation scientists and experts is their constant desire to discover new methods, tools and models, which led to innovation and growth of an extraordinary reality in this field that includes competent and multidisciplinary research scientists. Since the historical development of oncology for decades is based on applied physics, it was necessary to draw attention to the academic and professional role of medical physicists who have achieved great success represented by many complex techniques that have achieved tremendous success in .diagnosis and treatment

Through this study, we review what has been achieved during the recent period in the fields of radiotherapy, nuclear medicine, radiology, dosimetry, radiation protection, radiation biology, and finally what has been proposed in terms of protocols and methods of clinical practices

1-Introduction:

This study deals with an arrangement of what has been achieved in the field of medical physics and radiotherapy, academically and .clinically, recently

We know that since the discovery of X-rays, physicists have begun to develop techniques based on certain principles and theories with the goal of supporting physicians to formulate immediate diagnoses and improve clinical procedures for ionizing radiation and thus other emerging tools and materials that are most important. As effective and important as ultrasound in oncological practice. Logical neuroethologies, nanoparticles, artificial intelligence, and quantum medical imaging have been developed in therapeutic fields, and these are just a few examples of what physics is doing in medical fields .academically, research, and clinically

From the foregoing, it was necessary to pay attention to the scientific results that physics mainly affects, so through this study we describe the various physical developments in medicine to review the latest developments in medical physics that contributed to radiotherapy, nuclear medicine, radiation, dosimetry, radiation protection and radiation biology.

2-Discussion:

Our review addressed updates based on innovative physics-based approaches to oncology and others that establish protocols and suggest methods developed for clinical practice. and radiation .therapy applications

We draw attention to an important one

It evaluates the effect of radiation on adipose tissue [1] during the clinical practice of esophageal cancer patients receiving adjuvant chemotherapy after esophageal resection. It was found that the intensity of radiation exposure (EAT) is a good predictor for assessing the success of radiotherapy. With the necessity of following a special diet (OAR) during this stage of recovery. Lying treatment was taken mainly in the use of radiation [2], and the treatment was successfully highlighted and the extent to which changes in the distribution of local radiation doses were achieved after cervical surgeries. The biological effect was identified by a study dealing with eye treatment with protons [3]., compared the relative effectiveness (RBE) data In vitro with other values of predictions made by the computational Monte Carlo effect model and other semi-empirical models based on linearity. An experimental energy transfer (LET) measurement approach. The study relies on a treatment planning system (RBE) as well as successful predictability (LET) in developing a vital radiological response for the treatment of tumors as well as surrounding healthy tissues. In the field of nuclear medicine, another study [4] was conducted to investigate the potential role of the [99mTc] Tc-Sestamibi system in the ordering of radiation biological processes using the information available in this system related to the treatment of breast cancer, and thus the ordering of biological

treatment processes. Absorption and apoptosis, which indicates the potential role of the information system in arranging and regulating physiological processes associated with breast cancer, which prompted researchers to conclude evidence of the accumulation of radiation in cells that leads to note mitochondria, which will be a motive to open new clinical horizons about the use of treatment. Radiation in the diagnosis and treatment of breast cancer. In another recent study for the treatment of tumors using secondary inorganic particles and hybrids based on X-rays [5], it has been proven through this study that the physical and chemical properties of nanoparticles as well as the functions of the target surface for external radiation therapy, together have an impact on the strategies of operating devices parameters. X-ray equipment used for this purpose. It has also been observed that X-ray-activated phototherapy relies on the same characteristics in terms of energy deposition and the total .radiation dose to which the target tissues are exposed

These results were also a motivation for other researchers to study advanced methods and protocols to improve the procedures used in radiography and to characterize radiotherapy tools and methods in order to reduce doses, and in what context a study [6] conducted a comparison between radiation doses and medical imaging performance using the EOS system

With conventional radiography and computed tomography, names for detecting and quantifying cartilage tumors, it was found that the digital assessment of radiological accuracy in the EOS system has the same effect as conventional imaging for measuring and detecting chondrosarcoma-like inclusions, and this is thanks to the reduced radiation dose. This approach can also be used to follow up patients

with multiple chondrosarcomas. To confirm this result, we considered another study on reducing organ doses [7] when examining the pelvis, chest, and abdomen of children using pediatric computed tomography by modifying imaging protocols and using additional scanning effects such as tube voltage and tube current, and parallelism of slices, so that the modification of quality indicators was verified. Photos and organ doses proving the possibility of significant reductions in doses confirmed in personal examinations. It can be said that tomography needs a comprehensive characterization of noise reduction, which is a theoretical study conducted [8] using the algorithm (IR) for iterative reconstruction in order to evaluate the possibility of reducing the actual dose in addition to identifying potential limitations on clinical cases during practical application, and this prompted the researchers to Take the assessment On the basis of the noise characteristics of computed tomography with adaptive statistical iterative reconstruction showed different mixing levels of reconstruction and contrast entities, the results showed the potential for noise reduction compared to traditionally chosen back projection methods, confirming that the use of reconstruction may be substandard. Ideal for a particular clinic, this means the need to find noise-account-based characterization when dealing with a new (IR) algorithm or when comparing the performance of a different IR algorithm. It's also found that microanalysis of quantitative medical imaging is a great approach in optimizing diagnostic and treatment strategies as well as developing predictive models where tissue analysis [9] is performed to characterize the effect of angle of absorption or energy gain on digital images (DBT), so it is concluded that the angle of energy acquisition influences the Tissue must be observed This deviation when analyzing baselines in tissues

representative of tumors, DBT analysis of tissues by the technique was found to be a suitable surrogate for all other physical quantifications. Another study [10] focused on the model-control technique for recording and comparing DBT images and using quantitative analyzes in nuclear medicine for both diagnostic and therapeutic purposes. PVE analysis must necessarily be compensated .for, especially in small structures

This was required to be dealt with by another paper [11] that uses a novel approach to correcting PVE using a post-construction technique and practically starts from a mathematical calculation that requires knowledge of the maximum spread of points in an imaging system during low-field radiotherapy-guided MRI for cervical cancer, so that it provides a performance evaluation The biological radiation coefficient as an indicator of early regression ERITCP

In the full response distribution, the results showed that ERITCP can be calculated by combining the tumor volume measured on the MR images obtained in the simulation and during follow-up treatment. It is a biomarker of cervical cancer response, and the results were validated by applying this theory to a large cohort of patients. As a result, there is potential to use this indicator as a strategic tool for treatment in the context of overcoming cervical cancer and thus moving towards an anatomical and functional understanding. for radioactive tissues, IN another study [12] a semi-automated segmentation method for characterization when treating the lungs of COVID-19 patients and respiratory syndrome patients, this approach was based on the independent preparation of boundary values of the iterative apparatus histograms characterizing three regions of the lungs with a clear functional meaning taking into

account the automatic segmentation through Combine application method Comparison of quantitative CT atlas leading to analysis performed on device graphics repeatedly paved the way towards the development of prediction and it was found that the models that appeared in early clinical outcomes confirmed CT images as the basis for treatment success, and this method of prediction was followed in another study [13], where an action is proposed Classification when diagnosing COVID-19 with an artificial intelligence (AI)-based segmentation method, which focuses on segmenting regions of the lungs. This division is a combination of the natural division of the three regions and automated segmentation, and this is what enables the researcher to take advantage of stratification and develop more complex models, which was considered a real criterion to rely on in the event of an epidemic, and this also confirms the success of artificial intelligence in quantitative imaging, he added for many other medical fields. Artificial intelligence is indicated in a study [14] dealing with the role of medical physics and that it has a significant advantage in health care for hospital radiology personnel to help improve prevention and accurate assessment methods for outpatients. And internal radiation dose, and this was addressed by another research that evaluates the quality of control [15] IQM radiation protection, which is a program to detect the radiation balance and radiation dose in the body, as well as identify errors resulting from and during childbirth. issued irradiation. An important step in the clinical routine to increase the quality of external breast irradiation. And it was possible to measure doses in the body during radiation therapy with charged particles [16], which is examining the suitability of the relative dose detector for citizens, which is an internationally patented device. The connector that

touches the patient enables the device to work on monitoring the rays synchronized with the treatment. And the way for me to monitor radiation during proton therapy as well, and to check the correct dose, which proves that Gimpy is a detector developed to combine two values: a gaseous electron multiplier, an electromagnetic multiplier, and four Timex cards

for readings. And from his recent study [17], a proposal was made to review the Gimpy device

Where the researcher describes examples of the use of the device in different measurements of relative doses in radiation therapy with X-rays and hydro therapy. He performed some preliminary measurements to verify the device's capabilities in proton tomography. Another dosimetry study [18] focused on validating radioactive materials using a platform

MCID, it relies on images taken of patients and the platform is linked to a system

Monte Carlo (MC)

In the form of simulation of internal dosimetry in radiation embolization of liver tumors and microscopic images that allow rapid implementation through a storage folder in the MC dosimetry file based on patient imaging data as well as checking tissue heterogeneity as a result of non-radiation embolization, which leads us to say that treatment and optimization of The MC method is likely to provide the same strategy for liver diseases on the basis of resection and treatment. Micro processes embedded in a novel matrix [19] were able to assess the dose absorbed in each activity. This system is managed by a small electronic unit based on MC

calculations, considering functional analysis geometry derived from MC calculations that include all fractional numbers. Leads to the equation: It is automatically suggested in treatment planning and has been successful in tumors as small as 0.5 cm in diameter. This provides dosimetry estimates and is fully consistent with MC .calculations

It is noted that the practical protocol has been developed and showed results that were expected and emphasized the importance of follow-up in evaluation and prevention.

3-Conclusions and Recommendations:

From the foregoing, we note that medical physicists and radiotherapists face classic problems, the first of which is the difficulty of balancing ongoing scientific research with the clinical work that needs to be done on a daily basis. In the presence of widespread interest in medical physics, radiotherapy and related disciplines, which are making further progress in this science and interdisciplinary careers, we note that the research and discoveries completed and reviewed in this study are closely related to several techniques based on applied physics. Thus, this dramatic development was not born out of a moment, but rather grew out of decades of continuous scientific research and collaboration between medical physicists, radiotherapy specialists, technologists, and medical engineering professionals. This has led to more complex techniques, for which the demand has increased recently, and this is also why we recommend in this study that the qualifications of medical physicists and radiotherapists should be harmonized as researchers and academics at the same time. It is given the opportunity to perform clinical and clinical services due to its multiple capabilities, unique advantages, and its effective role in hospitals, medical universities and therapeutic research centers. From here, medical physics can be considered a specialty that performs many tasks, the first of which is health care, despite the professional pressures imposed on scientists and radiation experts. The strong scientific track that we have noted in the papers referred to in this study, which is carried out on medical physicists, is the basis for such appeals, thus adopting a framework that includes a system of academic recognition and research, as well as clinical studies in

hospitals for all specialties of medical physics and therapyHighly accurate radiation.

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