The first cancer operation room with a navigator is created

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This shows cancer operation. Credit: UC3M

The system, presented at Gregorio Marañón Hospital, permits real-time interaction with the body of the patient (with its different tissues and cancer) as well as the radiotherapy applicator used to radiate the area affected by the tumor. This innovation will be used in the surgery of cancers treated with intraoperative radiotherapy in the hope of achieving

greater precision in the radiation of potentially cancerous tissues after the removal of the tumor.

The installation of this new equipment has entailed a complete remodeling of the operating room. The new room, reinforced for this type of procedure, incorporates high-definition screens of high diagnostic quality to visualize the image of the patient in 3-D, three video monitoring cameras and a group of eight infrared cameras for real-time navigation placed in the area of the surgery that enables the surgeon to capture the movement of objects throughout the entire procedure. This technology shares the same principles of movement capture that are used in cinema and in video games to transfer the movement of actors to animated characters.

Medical personnel will have a 3-D representation of the patient and the applicator that conducts the radiation so that it can be guided into the patient via the high-definition screens of the operating room. On this representation, reconstructed from a previous scan, the placement of the applicator over the tumor bed is observed so that only tissues with cancerous residue or risk predetermined in each patient are radiated. Moreover, the area, the depth and the dose that any tissue (like skin, bone, muscle, intestines or bladder) will receive can be predetermined and adjusted on-site and healthy tissues can be checked for any additional risk.

This device, developed by scientists within the framework of research projects financed by the Autonomous Region of Madrid, the Ministry of Economy and Competitiveness and FEDER funds, makes the Madrid hospital an international point of reference in technological innovation and the application of research results to daily clinical practice. Dr. Javier Pascau, professor in the Bioengineering and Aerospace Engineering Department at the UC3M and part of the BIIG research group led by Dr. Manuel Desco, is the head researcher of several

research projects that include this development. As he explains, the system employs multiple cameras to locate objects in three-dimensional scenarios like the intraoperative radiotherapy applicator. This information is sent to the planning system, which updates the real position of the applicator over the CAT (Computed Axial Tomography) of the patient and shows it on the screen. Thanks to this navigation system, the oncologist will be able to compare the current position and orientation of the applicator to the one previously planned and, if necessary, repeat the estimation of the distribution of the dose to adjust the treatment to the actual surgical scenario. The precision of the system, the first stereotactic navigator available in the field of intraoperative radiotherapy, has been evaluated by university researchers and was recently published in *Physics in Medicine and Biology*.

Intraoperative radiotherapy is an anti-tumor treatment which, after the removal of the cancer, allows doctors to radiate the areas affected by the tumor or parts that could not be eliminated with a high degree of precision. Through this procedure, it is hoped that the cancer then does not reproduce. In addition, "another advantage of this procedure is that all tumors can receive this treatment, although most of the ones that have been treated—and with very convincing results—were cancers of the digestive system and sarcomas," asserts Felipe Calvo, head of the Oncology Department at Gregorio Marañón Hospital.

Furthermore, Dr. Calvo adds that intelligent systems, like the intraoperative radiotherapy radiance simulator (developed and patented by Marañón Hospital researchers and practitioners and the company GMV) and this new navigator "will make it possible to cut treatment time thanks to the use of large single doses on a very well-defined tumor, protecting healthy tissue at the same time. Intraoperative radiotherapy does not compete with but instead complements chemotherapy and the administration of biological medicines."

Intraoperative radiotherapy has been incorporated into advances in laparoscopic oncological surgery with obvious benefits for the patient, like the reduction of the biological impact of the postoperative period from between 4 and 7 days to 48 hours, and a procedure which requires less invasive surgery. In premature breast cancer, instead of lasting six to eight weeks in the case of conventional treatment, radiation therapy treatment and surgery can be done in only 24 hours.

More information: Feasibility of integrating a multi-camera optical tracking system in intra-operative electron radiation therapy scenarios, V García-Vázquez. E Marinetto. J A Santos-Miranda. F A Calvo. M Desco. J Pascau. *Physics in Medicine and Biology*. Volume: 58. Number: 24. Published 4 December 2013 DOI: 10.1088/0031-9155/58/24/8769