Radiotherapy in an upright position: A new paradigm?

Interview with Sophie Boisbouvier, research radiation therapist, Léon Bérard Centre, Lyon, France

1. Could you please provide an overview of your research on the upright position for radiotherapy? What inspired you to explore this approach, and what are the potential advantages it offers compared with traditional radiotherapy setups?

The concept of upright radiotherapy is not new. For many years, teams have used chairs that they have developed to treat patients in sitting positions, mainly in particle therapy centres (1,2). However the importance of imaging (CT, MRI, …) in radiotherapy and the fact that these exams are performed in recumbent positions have limited the development of upright radiotherapy. However, several recent publications have indicated that patient setup in an upright position could be beneficial for the treatment of some tumour locations, as the modification of the patient's position leads to alterations in the relationship between the target volume and the surrounding normal tissue (3-5). Moreover, setting up a patient for radiotherapy in an upright position can make them more physically, psychospiritually, socially and environmentally comfortable. In addition, the use of rotating upright patient positioning systems and fixed treatment beams is being proposed as a way to reduce the need for shielding and the size of equipment and room required, which could reduce the room cost and improve the accessibility of radiotherapy.

In this context, Vincent Grégoire, head of the radiotherapy department at the Léon Bérard Centre in Lyon, France, offered me this opportunity to collaborate with the company Leo Cancer Care, which had developed a chair and a vertical CT. The chair was installed at the centre in 2021 and we have begun to research how we should seat a patient in this chair. Now, we are working on the different treatment locations to define the patient position and to develop the immobilisation devices required. The upright position for pelvic s and breast cancer patients has already been studied and two publications are available for reading (6,7). The next steps include working out the positions for head-and-neck cancer patients, assessment of organ positions and motion in upright and supine positions, and the consequences of using the upright positions on the dose distribution through the acquisition of CT scan images. Finally, the patient and radiation therapist's experiences of the upright position will be studied.

2. One of the key aspects of your research is the patient experience in the upright position during radiotherapy. Could you share some insights into how patients have responded to this approach? What has been their feedback regarding their overall comfort levels compared with conventional treatments?

In our first study with pelvic cancer patients, the patient's physical comfort and satisfaction were evaluated through the use of a five-point Likert scale (on the different parts of the body and how easy the patients found it to get into and out of the device, the ease of breathing and the stability). We found that patients were at least as comfortable and as satisfied in upright compared with supine positions and in some cases they preferred the upright position (they found it better for the arms, shoulders, back and neck, more stable, and easier during setup and to get out of the chair). I think we can continue to improve this physical comfort with some modifications to the chair and some better immobilisation devices. We also need to work on other factors in the patient experience, which include other aspects of patient comfort, with a comparison in upright and supine positions. For this part of the project, we are working on the translation, adaptation and validation of the "radiotherapy experience questionnaire" (8). As soon as the CT scanner has been installed and the questionnaire has been validated, we will be able to start this comparison with patients who have been treated in supine positions and who will have several experiences of the upright position.

3. What technological advancements or adaptations are necessary to facilitate radiotherapy in the upright position? Are there any challenges or limitations associated with implementing this approach in clinical settings, and how do you propose to address them?

Several companies have developed chairs and some have already been commercialised. The main limitation on the development of upright radiotherapy is the availability of vertical CT machines and therefore, the limited knowledge that people have regarding the clinical benefits of upright radiotherapy. However, this is changing with manufacturers that innovate and research and clinical teams who support this new paradigm and push research in this direction. Recently, the team of Thomas R Bortfeld at Massachusetts General Hospital in Boston, USA, described gantry-less proton therapy, which is associated with the upright position, as a development towards democratisation of proton therapy (9). This stance indicates the need to support and contribute to research on this topic.
There are several challenges in the application of upright radiotherapy. From a radiation therapist's point of view, the upright position may be challenging for breast cancer patients. We studied this topic and published a paper regarding our investigation of

whether women could be positioned on a robotic rotating chair, in a manner that might be suitable for upright breast radiotherapy (7). Our results are promising but I remain a little doubtful regarding patient position reproducibility and the patient experience.

4. In terms of clinical outcomes and treatment effectiveness, could you discuss any preliminary findings or significant results from your research? How might these findings change the way of treating patients in the future?

For now, we do not have any clinical outcomes, firstly because the CT scanner has not been installed and, secondly, because we do not treat patients in this position. Fortunately, as soon as the CT is installed, we will be able to acquire images in this position, study organ position and motion, and compare the dose distribution in upright and supine positions. We plan to run a clinical trial that will comprise five patient cohorts: head-and-neck, breast, lung, cervical, and prostate cancer patients. We expect a benefit in terms of protection of healthy surrounding tissues for these treatment locations and this positioning may become a new way to treat patients.

5. Are you planning on presenting your results, and if so, when can we expect to hear more about your findings?

I was invited to the ESTRO 2023 congress in Vienna to talk about the study with pelvic cancer patients. At ESTRO 2024, I will talk about the hard facts of and our achievements with upright radiotherapy. In the meantime, I will share my findings on the study with pelvic cancer patients during a TipsRO webinar (link below).

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Interview by Cécile Hardon-Villard, ESTRO communications manager.

Register here for the *TipsRO* webinar on 25 October 2023

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