ISSUE N1 DECEMBER 2025

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Georgian International Oncology Journal

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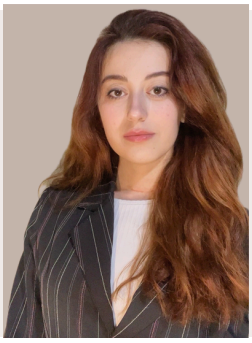


Tinatin Alaverdashvili

Founder and Editor-in-Chief
Radiation Oncology Resident
Tbilisi State Medical University
Tbilisi, Georgia

Welcome to Oncospace X — an oncology space without limits

This inaugural issue marks the launch of the first Georgian international, bilingual, biannual oncology journal, to be published every June and December in both electronic and print formats.

As a resident, creating this journal on my own has been a valuable learning journey. My hope is that **OncoSpace** grows into a useful, informative resource and an open space without boundaries, dedicated to sharing insights and advancing knowledge in oncology.

I sincerely thank all the respondents for their time and trust. Asking them to participate in something that did not yet exist was a challenging step, but thankfully, none of them hesitated. Without their contributions, this journal would not have come to life.
I also extend my gratitude to the authors from Science Space for their valuable contributions.

I am deeply grateful to my mentors, wonderful people and exceptional professionals, who inspire me and have taught me that persistence, curiosity, and self-belief can turn ideas into reality.

www.oncospacex.com
email: oncospacex@gmail.com
phone: +995 575 753857

Cancer on the Rise, Workforce Under Strain: Urgent Action Needed

Steven Petit

The editorial "Increasing cancer incidence and workforce shortages - It is time to act now", authored by Steven Petit, Pierfrancesco Franco, Jolien Heukelom, and Dylan Callens, was recently published in Radiotherapy and Oncology (the Green Journal). It highlights a critical challenge in global healthcare: the growing gap between rising cancer cases and the limited oncology workforce.

The authors emphasize that without immediate, coordinated action, patient care will increasingly suffer, underscoring both the human and systemic consequences of inaction.

Dylan Callens

Today, we are honored to present an interview with two of the authors: Professor Steven Petit, a medical physicist and associate professor at Erasmus MC Cancer Institute in Rotterdam, and Dylan Callens, RTT and PhD researcher at University Hospital Leuven, Belgium.

Prof. Petit, you highlighted the urgency of coordinated action in the article. Which stakeholders—hospitals, governments, or professional societies—do you believe are best positioned to lead this change, and how should they do it?

I think it is a combination of hospitals, governments, professional societies, health insurances and industries. Hospitals and individual departments should allocate time and resources to run projects around workload reduction, to put sufficient effort into recruitment and to understand why staff leave and what would keep them. Needless to say, involving the employees affected by the changes is key, e.g., through cocreation. Governments should allocate financial resources/incentives for hospitals to allocate staff for projects around workload reduction. Professional societies should create an active stage to share experiences, ideas, outcomes and best practices around initiatives for workload reduction, staff retention, and recruitment—both in efforts that have succeeded and those that have failed. Increasing awareness of radiotherapy is also critical, as exemplified by campaigns like Targeting Cancer in Australia and New Zealand. Health insurance systems should be designed to incentivize workload reduction and remove structural barriers that discourage it. For example, in several countries, hypofractionated treatments are reimbursed less than conventional fractionation, which can create a disincentive for adopting more efficient approaches. Industry should work together with hospitals to develop technology for workload reduction.

Prof. Petit, how do workforce shortages affect the mental health, job satisfaction, and patient care in radiotherapy, and which workforce areas—training, retention, or workflow—should be prioritised if resources are limited?

I do not have hard numbers on correlations between the three. If I were to speculate, I would say there is a risk of a vicious circle where staff shortages would lead to a higher workload, potentially more stress, potentially more people leaving the field, an even higher workload, etc. That would lead to an increase in waiting lists for patients. Moreover, workforce shortages may lead to more focus on organizational values such as efficiency and a task-oriented culture. From a study by Abravan (2023), we learned that when these organizational values dominate over personal values such as self-development and a people-oriented culture, employees may become less engaged, which could increase the speed of the vicious circle. Given this, if resources are limited, we need to focus on the combination of training new staff, retaining experienced staff, and improving workflow to make sufficient impact.

In analysing workforce and cancer incidence trends, what was the most surprising or unexpected finding that challenged your assumptions?

Dylan: In 2023, we launched an Opinion Panel within the ESTRO Early Career Committee because, based on the personal experiences of several committee members, we sensed that workforce challenges were becoming an increasingly urgent problem. At the same time, international literature clearly indicated that the incidence and prevalence of cancer continue to rise.

My own experience in Belgium was that the issue is particularly pronounced among RTTs. Historically, radiotherapy departments in Belgium have mainly relied on nurses. Radiographers with dedicated radiotherapy training joined much later, and their numbers are far too small to compensate for the shortage in the field. On the other hand, continuing to rely heavily on nurses creates additional challenges: these professionals must make significant efforts to keep up with rapidly evolving technological and imaging developments, which is not straightforward for this group as they do not have the thorough educational background. Moreover, employing nurses in radiotherapy removes them from hospital wards that are also facing severe staffing shortages.

Such issues may seem primarily managerial in nature, but through our Opinion Panel, a brief ten-question survey, we wanted to understand how young colleagues themselves perceive the problem. Do they also feel the impact? How do they view their own retention in the field? The questionnaire should be interpreted mainly as a scoping exercise, a quick exploration of the situation in practice.

"When organizational values dominate over personal values, such as self-development and a people-oriented culture, employees may become less engaged, potentially accelerating the vicious circle."

And indeed, 80% of the multidisciplinary participants in the published abstract (Callens et al., RO, 2024) indicated that staff shortages negatively affect oncological care. Most also reported that the issue is clearly noticeable within their own departments, with high turnover rates. Despite this, we wanted to approach the topic from a positive angle and explore which protective factors contribute to the intention to stay in the profession. Of our sample, 80% stated that access to professional development opportunities is a protective factor for their retention. This was a very important finding, especially since salary is often

mentioned as a reason for leaving for other hospitals or industry positions; however, only 31% of respondents considered a competitive salary as a protective factor.

In my presentation during the conference, I suggested that departments should work towards creating their own "retention PTV volume": Professional development opportunities, transforming work-life balance, and valorization of individual contributions. Is this the ideal formula for success? That remained uncertain, as this was only a scoping study with limited statistical power, a relatively small respondent pool, and a group likely enriched with individuals already seeking challenge or connection within the community since they signed up for the Opinion Panel pool.

Therefore, we decided to continue this work more in-depth and established a task force that formed the basis of the ESTRO Retention Survey, supported by an HR expert in retention. Understanding exactly what contributes to retention within our community enables us to translate the positive narrative into clear guidance and actionable messages on how to strengthen retention.

The ESTRO Retention Survey has now been analyzed for the first time, with nearly 1,000 participants, offering many insights that will be published in the coming months.

"80% of young colleagues reported that access to professional development opportunities was essential for staying in the profession; however, only 31% considered a competitive salary to be a protective factor"

How could the way we retain oncology professionals be reimagined to prevent future workforce crises?

Dylan: Personally, I don't think we need to completely reimagine retention. It is reality that fewer people are choosing careers in healthcare and that many (especially younger) individuals now prioritize work-life balance and therefore make different career decisions. Of course, we should wait for the detailed outcomes of the ESTRO Retention Survey, but we should also avoid examining radiation oncology in isolation.

A strong framework is the Job Demands-Resources (JD-R) Model by Bakker and Demerouti (2007, 2017, 2022). The model views work as a dynamic system shaped by:

· Job demands, which take energy (e.g., workload, bureaucracy, emotional labor), and

· Job resources, which support or energize people (e.g., autonomy, support, feedback, opportunities for growth).

What makes the JD-R model so useful is that it shows how the balance between demands and resources strongly influences well-being, motivation, engagement, and ultimately retention! It emphasizes that these dynamics are not static: resources and personal strengths (like optimism, self-efficacy, and resilience) reinforce each other and encourage proactive behaviours such as job crafting. Over time, this can create positive cycles where people gain more resources and become more engaged.

The opposite can unfortunately also occur: when demands are too high and resources insufficient, people may experience strain, fatigue, or burnout, which in turn can lead to self-undermining behaviours (mistakes, conflicts, poor communication). This can create negative cycles, where demands continue to increase, eventually leading to high turnover rates.

The model highlights that these processes operate at multiple levels, from the organization to the department to teams and individuals. Colleagues also shape each other's demands, resources, and emotional climate. Understanding this at an organizational and departmental level makes it possible to identify what each employee needs and to adapt support accordingly.

The JD-R model shows clearly that there is no one-size-fits-all solution and that retention strategies must be tailored to the specific conditions of the departmental workforce and the individual rather than generic. Most HR experts are familiar with this, but educating departmental management teams is essential if we want to put these insights into practice.

Are there countries or healthcare systems that are successfully managing workforce shortages in oncology, and what can others learn from them?

Dylan: That is a difficult question, because not every country has published data on this topic, so I don't think I can give a fully accurate answer.

What I can say, on a personal level, is that the strong emphasis on work-life balance in Scandinavia has always intrigued me. Unfortunately, there were not many Scandinavian participants in the ESTRO Retention Survey, so meaningful comparisons simply aren't possible.

However, in May 2025 I completed a research visit at Aarhus University Hospital in Denmark, and what stood out to me was their focus on team cohesion, on strengthening professionalism within the group, and on having very clear structures regarding working hours, including reasonable working days that ended early. They did work on Saturdays, but everyone agreed to that arrangement, and it was considered part of a viable schedule.

I couldn't determine whether they had stronger or weaker retention intentions compared to other countries, but the way they organized their work really appealed to me. Personally, I found it an inspiring example.

The full potential of FDG PET/CT in the management of lung cancer

Prof. Baramia, thank you very much for taking the time to speak with us.
Could you tell us what role FDG PET/CT plays in the diagnosis and staging of lung cancer, and in which cases you consider this examination essential?

Thanks for inviting. Lung cancer is one of the most common and serious oncological diseases, making timely and accurate diagnosis extremely important — a fact that is beyond dispute. Precise assessment of the extent of disease is a critical prerequisite for effective cancer treatment in general, and for lung cancer in particular. According to the literature, PET/CT findings change the treatment strategy in approximately 30% of cases by revealing additional lesions that were not detected with other methods. This technique is valuable for all types of lung tumours, especially non-small cell lung cancer.
PET/CT provides informative data for both locoregional and distant disease assessment, giving oncologists the necessary information to select the most appropriate treatment strategy.

How important is FDG PET/CT in radiotherapy planning, and what advantages does it offer over planning based solely on CT imaging?

As I mentioned earlier, PET/CT often provides additional information about the locoregional spread of the disease. For example, areas of increased metabolic activity can help differentiate tumour tissue from massive atelectasis, allowing us to better preserve healthy tissue. Additionally, when assessing mediastinal lymph nodes, where morphological verification can be technically challenging,

Mikheil Baramia

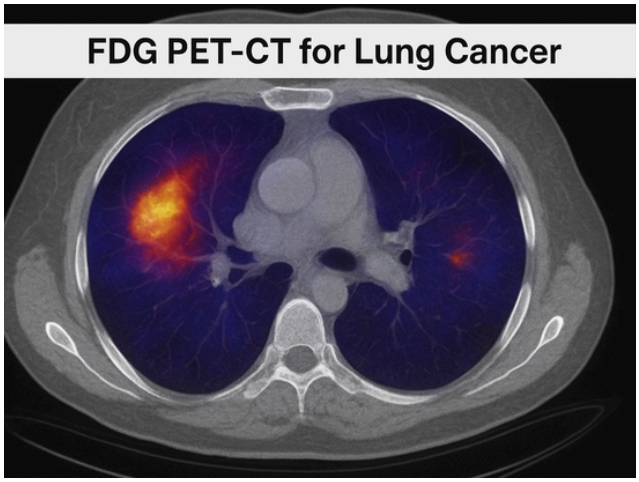
MD, PhD
Professor, Head of Nuclear Medicine Department, Radiation Oncologist, Todua Clinic, Tbilisi, Georgia

PET/CT is sometimes essential for evaluating metastatic nodes, enabling precise delineation of the radiation target volume.

How reliable is FDG PET/CT in assessing treatment response, whether for radiotherapy or systemic therapy? What challenges can arise in interpreting the results?

The value of FDG PET/CT in assessing treatment response is undeniable — in some cases, changes in metabolic activity are the only criterion, even when the tumor shows no significant change in size.
Of course, there are certain limitations, which we take into account to minimise potential

errors. For example, it is generally recommended to perform this scan at least two weeks after the completion of chemotherapy. In the case of radiotherapy, this interval is extended to 10–12 weeks to reduce the risk of false-positive results caused by ongoing metabolic changes during treatment. Occasionally, there are exceptions when these intervals must be shortened for urgent clinical reasons, but the influence of recent treatment on PET/CT findings must always be considered. This also applies to the phenomenon of pseudoprogression, which is frequently observed during the first follow-up scan in patients receiving immunotherapy.



"The value of FDG PET/CT in assessing treatment response is undeniable — in some cases, changes in metabolic activity are the only criterion, even when the tumor shows no significant change in size."

And lastly, which current innovations in nuclear medicine do you consider most promising for improving lung cancer management in the near future?

There is ongoing development of new radiopharmaceuticals. However, for lung cancer, FDG PET/CT remains the primary radiotracer nowadays. In certain cases, DOTA PET/CT can be valuable, particularly when a neuroendocrine component is suspected. I am confident that in the future, more specific radiopharmaceuticals will become available, potentially tailored to particular morphological or molecular tumour types, further facilitating the diagnostic proces.

EMBRACE II: Tumor Regression and Target Volume Adaptation in Locally Advanced Cervical Cancer

Insights from Dr. Johannes Knoth

The EMBRACE II trial was a prospective, multicenter study designed to evaluate and refine radiotherapy approaches for locally advanced cervical cancer (LACC). Building on EMBRACE I, the study focused on incorporating advanced imaging, adaptive planning, and modern delivery techniques to improve treatment precision and reduce toxicity. More than 1,300 patients were enrolled across multiple international centers. The trial investigated the use of MRI and PET-CT for staging, adaptive target volume definition, and conformal radiotherapy techniques such as Image-Guided Radiation Therapy–Intensity-Modulated Radiation Therapy (IGRT-IMRT), Lymph Node–Simultaneous Integrated Boost (LN-SIB), Para-Aortic Radiation Therapy (PAO-RT), and Magnetic Resonance–Image-Guided Adaptive Brachytherapy (MR-IGABT). The study generated detailed data on clinical outcomes, treatment-related toxicity, and tumor response dynamics in LACC. Its findings have contributed to shaping current standards of care and emphasize the value of personalized, image-guided treatment strategies.

In this interview, Dr. Johannes Knoth, radiation oncologist at the Medical University of Vienna, member of the EMBRACE group, and one of the study's authors, shares insights from his presentation "Target Volume and Tumour Regression Dynamics in Locally Advanced Cervical Cancer: Report from the Prospective EMBRACE II Study" delivered at the ESTRO Congress 2025.

Johannes Knoth

MD, Radiation Oncologist at Medical University of Vienna Vienna, Austria

Dr. Knoth, thank you for taking the time to speak with us. For readers less familiar with it, how would you briefly describe the goals and design of the EMBRACE II trial, and how it builds on the original EMBRACE study?

EMBRACE II is a large, prospective, international multicenter cohort study that enrolled more than 1,300 patients with locally advanced cervical cancer across 49 institutions worldwide. It was designed to formalize a modern image-guided workflow that integrates IGRT-IMRT with risk-adapted nodal boosts and para-aortic options, concurrent cisplatin chemotherapy, and MRI-guided adaptive brachytherapy (BT). The protocol specifies a well-defined hierarchy of target volumes, beginning with the gross tumor volume and extending to tight 5 mm margins supported by daily image guidance. Compared with EMBRACE I, the second trial codified the

systematic use of MRI and PET-CT, adaptive planning, and multiparametric dose constraints for External Beam Radiation Therapy (EBRT) and brachytherapy, with the overarching aim of improving treatment precision, reducing morbidity, and setting new international benchmarks for outcomes in this disease.

"With its reproducible and reliable protocol, EMBRACE II has already set a new standard of care"

Your recent ESTRO 2025 presentation focused on tumor regression and target volume dynamics. What were the key messages you hoped to share with the radiation oncology community?

The presentation emphasized that EMBRACE II has for the first time provided robust, multicenter reference values for EBRT volumes and nodal boosts, along with detailed data on primary tumor regression. The median elective PTV45 Gy for the large pelvis was approximately 1,400 cm^3, while patients with para-aortic involvement reached a median of around 1,750 cm^3. Nodal target volumes were also quantified, with a median of 3.3 cm^3 for gross nodal disease and about 14 cm^3 per boosted node. Perhaps most strikingly, the study documented the dramatic regression of primary tumors during treatment, with the gross tumor volume shrinking from a median of 37 cm^3 at baseline to only 5 cm^3 at the time of brachytherapy, corresponding to nearly a 90% reduction overall. The high-risk CTV decreased from around 59 to 27 cm^3 in the same interval. These regression dynamics were strongly stage-dependent, being less pronounced in more advanced tumors, and have direct consequences for brachytherapy planning.

Together, these quantitative benchmarks serve to harmonize practice, reduce inter-institutional variability, and provide clinicians with reference values for both planning and quality assurance.

Based on your analysis, how do tumor shrinkage patterns during treatment affect target volume definition and adaptive planning strategies?

The shrinkage patterns observed in EMBRACE II underline the importance of an adaptive strategy that anticipates change. In the majority of patients, the marked regression of tumor volume allows for a tighter, MRI-based delineation of the high-risk CTV at brachytherapy, thereby enabling highly conformal dose delivery while sparing adjacent organs. In contrast, patients with very advanced disease, particularly T3b and T4 stages, show more limited proportional regression. For these women, substantial residual disease often remains in the parametria or vagina, and brachytherapy planning must account for this with broader and frequently interstitial implants. In other words, the study demonstrates that adaptive radiotherapy in cervical cancer is not only possible but necessary: it improves conformity in smaller, regressing tumors while ensuring comprehensive coverage of persistent disease in more extensive stages.

In practice, how often should clinicians consider re-evaluating volumes during treatment, and what are the main criteria or triggers for adaptation?

Within EMBRACE II, two re-evaluation points proved universal: the initial EBRT planning, which integrates MRI and PET-CT for accurate

staging and target definition, and the re-imaging at the time of brachytherapy, when tumor regression is explicitly assessed and translated into adapted volumes and implant strategy. Additional imaging during EBRT may be justified in selected cases—for example, when bulky baseline disease or an advanced stage predicts limited shrinkage, when rapid anatomical changes such as uterine position or organ filling may threaten coverage, or when early assessment is needed to prepare a complex brachytherapy implant. While not mandatory in every patient, these mid-course checks can provide valuable information, particularly in high-risk cases, and reflect the adaptive ethos that EMBRACE II has established as a standard of care.

What advice would you give to departments that want to implement adaptive strategies from EMBRACE II but have limited access to MRI or advanced planning tools?

Even in resource-limited settings, much of the EMBRACE II concept can be implemented.

A first step is to adopt the explicit target hierarchy defined in the protocol, with gross tumor and nodal disease leading to risk-adapted elective fields and carefully margin-reduced planning target volumes justified by daily image guidance. A single high-quality MRI before treatment can provide a critical anatomical reference, even if MRI is not available for brachytherapy. In such cases, clinicians may rely on the combination of diagnostic MRI, careful clinical examination, and CT-based planning to approximate the regression-adapted high-risk CTV.

EMBRACE II also provides quantitative benchmarks for EBRT and nodal volumes, which can serve as internal quality assurance references, ensuring that volumes and doses remain within expected ranges.

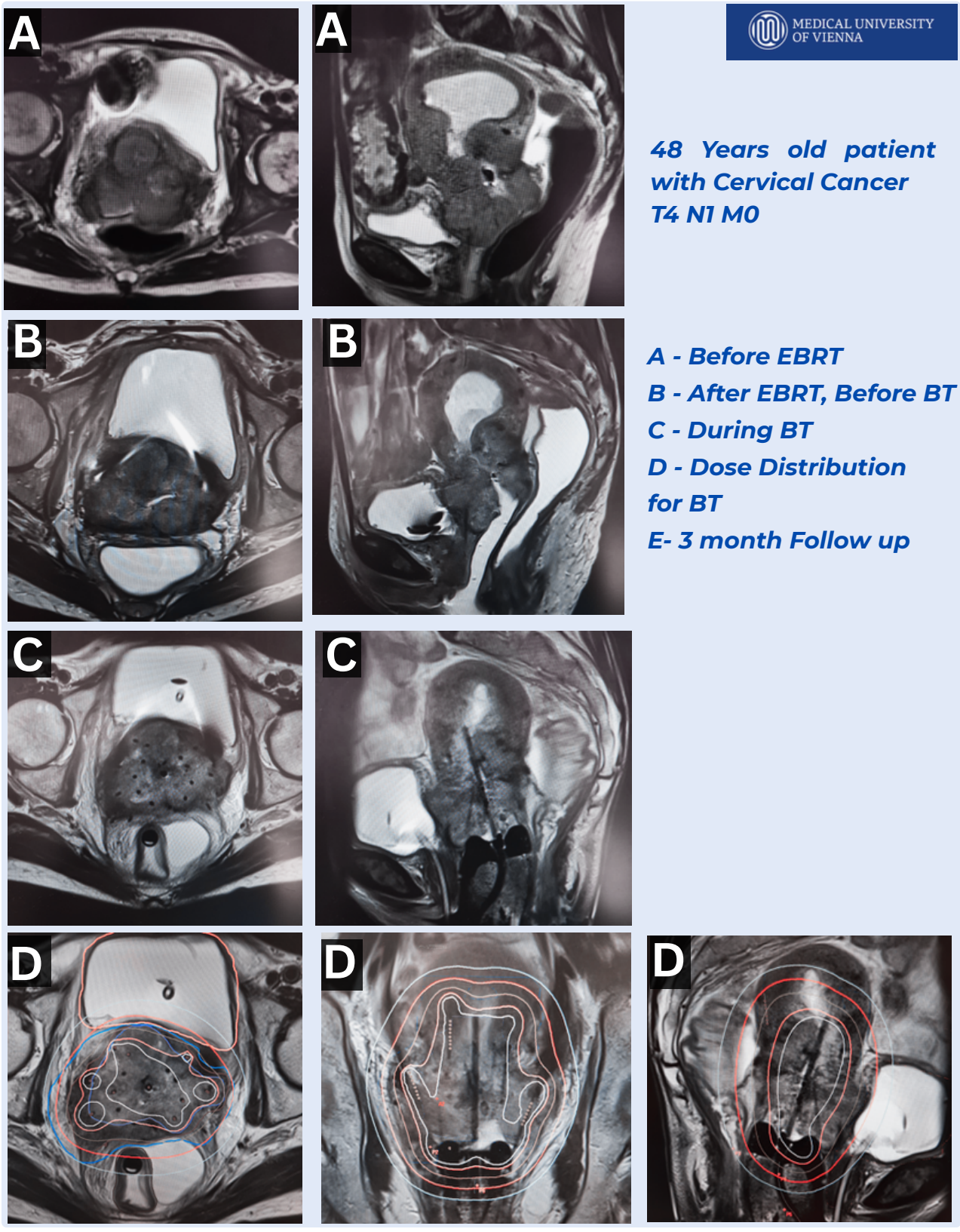
Finally, building collaborative referral pathways to centers with MRI-based brachytherapy expertise can help patients with complex disease benefit from advanced adaptive implants. Step by step, these measures allow departments to align with EMBRACE II principles even before achieving full MR-guided capability.

To conclude, what do you see as the next important research questions or developments in adaptive radiotherapy for cervical cancer, and how do you imagine the field evolving in the coming years?

Looking ahead, several developments appear particularly promising. One area is the prognostic role of regression metrics: EMBRACE II has shown that shrinkage differs significantly by stage, and building on this, JC Lindegaard and colleagues have proposed a continuous T-score, which integrates both initial tumor size and regression dynamics as a potential prognostic marker. This approach could allow clinicians to stratify patients not only by categorical stage but also by quantitative tumor biology and to adapt dose concepts accordingly.

Another important direction is the integration of automation and artificial intelligence, which can facilitate adaptive workflows, reduce inter-observer variability in contouring, and make EMBRACE II principles more accessible even in centers without routine MRI.

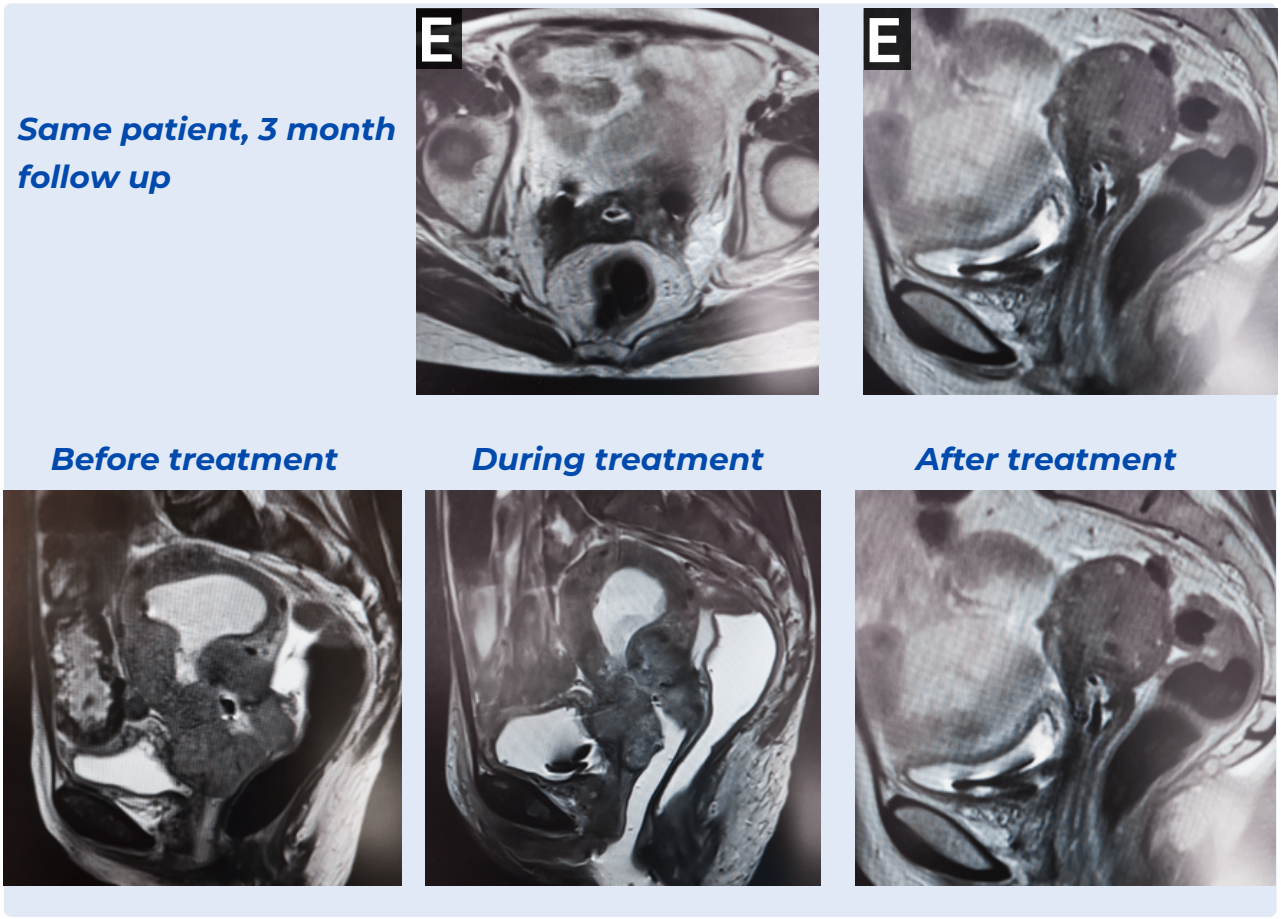
Finally, a more intelligent integration of EBRT and brachytherapy is on the horizon: by using early regression patterns and nodal burden, clinicians may individualize EBRT field designs,



MEDICAL UNIVERSITY OF VIENNA

48 Years old patient with Cervical Cancer T4 N1 M0

A - Before EBRT
B - After EBRT, Before BT
C - During BT
D - Dose Distribution for BT
E- 3 month Follow up



nodal boosts, and implant strategies earlier in the pathway. Taken together, these advances point to a future where adaptive, image-guided, and data-driven radiotherapy becomes the norm, building on EMBRACE II's demonstration of excellent survival, high local control, and very low morbidity. With its reproducible and reliable protocol, EMBRACE II has already set a new standard of care; the next steps will refine personalization even further.

Rethinking Radiotherapy: 5-Day Ultra-Hypofractionation for DCIS Shows Promising Results

Angel Montero-Luis

MD, PhD
Radiation Oncologist
at HM Sanchinarro
University Hospital,
Madrid, Spain

Professor Angel Montero-Luis and colleagues recently presented compelling data at the ESTRO Congress on a streamlined radiotherapy approach for ductal carcinoma in situ (DCIS). Their study evaluated the safety and efficacy of ultra-hypofractionated (UHF) irradiation delivered over just five treatment sessions. A total of 101 women with DCIS received 26 Gy in five fractions, with a simultaneous integrated boost (SIB) to the tumor bed delivering a total of 29–31 Gy.

Most patients (90%) were treated post–breast-conserving surgery, while 10 had undergone mastectomy. Additionally, adjuvant hormonal therapy was administered in 79% of cases. With a median follow-up of 37 months, the outcomes are excellent: no locoregional or distant recurrences and only mild acute and early-late toxicities.

Interestingly, patients with smaller planning target volumes (PTVs) showed a statistically significant reduction in both acute and late toxicities, highlighting the importance of personalized treatment planning.

In this interview, Professor Montero shares the motivation behind this study, how these results could reshape treatment for DCIS, and what lies ahead for ultra-short-course radiotherapy.

Professor Montero, What motivated your team to investigate ultra-hypofractionated radiotherapy for DCIS, and what unmet clinical needs did you hope to address with this study?

Ductal carcinoma in situ (DCIS) is a non-invasive breast lesion that may precede, but does not inevitably progress to, invasive breast cancer. Before the advent of population-based breast cancer screening programmes, DCIS accounted for fewer than 5% of all new breast cancer diagnoses. Its incidence rose markedly following the implementation of screening—rising in the United States from 1.87 per 100,000 women in 1973 to 32.5 per 100,000 in 2004, and in Europe from 4.9 per 100,000 in 1989 to 20.68 per 100,000 in 2011—before reaching a plateau.

Although DCIS is non-invasive, approximately 15% of women treated with surgery alone will develop ipsilateral invasive recurrence and 6% contralateral breast cancer within 15 years; around 3% will die from breast cancer within that time.

Adjuvant radiotherapy has been shown not only to reduce the risk of local recurrence and progression to invasive carcinoma but also to improve cause-specific survival. Five large

randomised trials, each with more than 12 years of follow-up, demonstrated that radiotherapy in DCIS reduces the 10-year risk of local recurrence by up to 48% and the risk of invasive recurrence by up to 42%, with consistent benefit across all patient subgroups regardless of age, tumour size, histological grade, or margin status. Additionally, a SEER-18 registry analysis of 140,366 patients found that lumpectomy followed by radiotherapy was associated with lower 15-year breast cancer-specific mortality (1.74%) compared with lumpectomy alone (2.33%) or mastectomy (2.26%).

"We hope our results will help support UHF as a valid treatment option for DCIS"

As with invasive breast cancer, hypofractionated radiotherapy schedules are recommended as standard practice in DCIS, with or without a tumour bed boost, and moderate hypofractionation in 15 fractions is the current norm.

In recent years, ultra-hypofractionated (UHF) regimens have gained popularity for early-stage invasive breast cancer and are considered a viable alternative for both whole-breast irradiation (WBI) and chest wall irradiation. However, DCIS remains under-represented in studies assessing the feasibility and safety of 1-week UHF schedules.

While some prospective UHF trials have included DCIS patients, their numbers have been limited, and major randomised trials comparing moderate and ultra-hypofractionation (e.g., FAST-Forward, HYPORT, MC1635) have explicitly excluded this subgroup. This limits the applicability of current evidence to in situ disease, although retrospective data suggest that UHF may also be safe and effective for selected DCIS patients, paralleling the earlier adoption pattern seen with moderate hypofractionation.

Our aim was to address this evidence gap by evaluating the feasibility and safety of delivering whole-breast UHF in just five fractions, with outcomes comparable to those reported for invasive tumours. Acknowledging the need for long-term follow-up in breast cancer to capture late recurrences and treatment-related complications, we reported only patients with at least 12 months of follow-up to minimise attrition. We hope our results will help support UHF as a valid treatment option for DCIS.

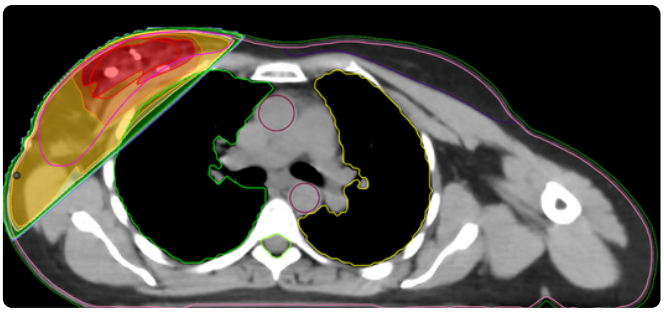
Your study reports almost no locoregional or distant recurrences with a median follow-up exceeding three years. How do these results challenge traditional views on radiotherapy fractionation for DCIS?

The prognosis for DCIS is generally excellent, with 10-year breast cancer-specific survival rates approaching 98%. The primary treatment goal is to prevent local recurrence and potential progression to invasive disease. Options include mastectomy or breast-conserving surgery (BCS), with or without radiotherapy and/or endocrine therapy.

In our updated analysis (median follow-up: 44 months), only one of 100 patients experienced a true local recurrence - new DCIS in the lumpectomy bed - three years post-treatment. This was successfully salvaged with repeat BCS and partial-breast re-irradiation (30 Gy in 5 fractions). The fact that all BCS patients received a tumour bed boost - an approach still under debate - may partly explain the low recurrence rate, though longer follow-up is needed.

The necessity of adjuvant radiotherapy after DCIS surgery remains an area of ongoing debate.

The indolent nature of some DCIS cases has fuelled interest in omitting RT in selected low-risk patients, but results have been mixed. For example, the RTOG 9804 trial, which enrolled small, low/intermediate-grade, clear-margin DCIS, showed sustained local recurrence reduction with RT at both 7 and 12 years (2.8% vs 11.4%, p = 0.0001) with minimal grade ≥ 3 toxicity. Similarly, ECOG-ACRIN E5194 demonstrated that recurrence risk continued to rise for up to 15 years after surgery alone, even in low-risk cases. Pending final results from ongoing de-escalation trials, adjuvant WBI remains the standard for most BCS-treated DCIS.



While omission may be reasonable in carefully selected very-low-risk cases after shared decision-making, accepting a modest but real increase in ipsilateral breast events, UHF offers a compelling compromise—providing short, well-tolerated schedules without compromising outcomes. UHF is now a standard for early-stage invasive breast cancer per ESTRO-ACROP guidelines, and our findings, along with other groups' results, support extending its use to DCIS.

The results indicate that smaller planning target volumes are significantly associated with reduced acute toxicity, while larger breast PTVs correspond to fewer late complications. Could you provide further insight into these observations and their potential clinical implications?

Although early results hinted at differences in acute and late toxicities based on treated volumes (breast and/or boost), we now believe these initial findings were due to chance.

In the final analysis with longer follow-up, no statistically significant differences in toxicity were observed related to PTV size. However, patients who had post-surgical complications before starting RT, particularly seromas, tended to have higher rates of RT-related effects, though this was not statistically significant.

A notable feature of our study is that all BCS patients received a protocol-mandated simultaneous integrated boost (SIB), with the dose adapted to margin status. While the boost's benefit in DCIS is debated, given modern improvements in baseline control and concerns about cosmesis, evidence supports its role in reducing recurrence.

A large pooled analysis found a 3.6% absolute 15-year reduction in ipsilateral breast tumour recurrence with a boost in DCIS, similar to the 4.4% benefit in the EORTC trial for invasive cancer. This was consistent across ages, tamoxifen use, and other factors, but more pronounced in younger patients.

Likewise, BIG 3-01/TROG 07.01 reported a drop in 5-year IBTR from 7.3% to 2.9% with a boost, and a 4% reduction in salvage mastectomy rates. These gains came at the cost of more grade ≥ 2 toxicity, mainly mild acute dermatitis and moderate late fibrosis/pain, though delivered with older techniques and schedules.

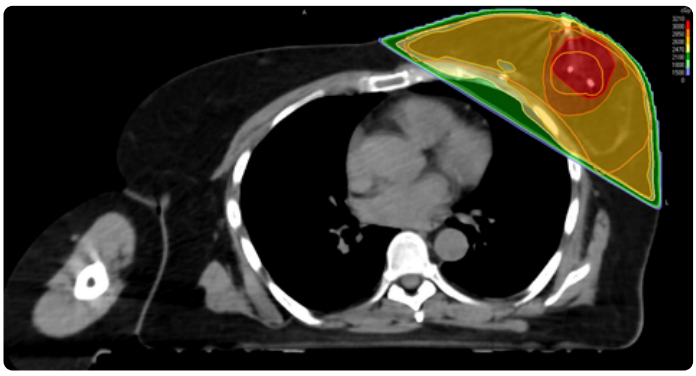
Given the inclusion of post-mastectomy patients in your cohort—a group not commonly treated with radiotherapy for DCIS—could you explain the clinical considerations and decision-making process that led to their inclusion in this study?

The role of post-mastectomy radiotherapy (PMRT) in DCIS is poorly defined, and randomised trials are unlikely. Local recurrence after mastectomy for DCIS is rare (0–7.5%), but when it occurs, it is often invasive and carries a worse prognosis. As several studies suggested administering post-mastectomy radiation therapy (PMRT) to patients with DCIS harbouring "high risk" factors for local recurrence, identifying these risk factors is currently one of the main challenges in optimal DCIS management. The main risk factors for Locoregional failure (LRF) after mastectomy in DCIS, as identified in the various studies, were the presence of close/positive margins, high nuclear grade, and young age at diagnosis. Some authors also correlated the risk of LRF after mastectomy with tumour size or skin-sparing mastectomy. There are not, nor are there likely to be, randomized studies on the role of PMRT in DCIS, but the combined presence of different risk factors, including age under 50 years, the presence of close/positive surgical margins, or a large tumor size, could warrant consideration of PMRT in selected DCIS patients.

In our study, PMRT was offered to selected patients meeting these criteria after multidisciplinary discussion.

"The evolution of modern RT aligns with the principles of Citius, Altius, Fortius-faster, higher, stronger—while embracing the Less is More philosophy"

Looking ahead, how do you envision ultra-hypofractionated radiotherapy evolving over the next decade, and what are the key research questions or challenges that must be addressed to establish this approach as a new standard of care for DCIS?



The evolution of modern radiotherapy aligns seamlessly with the principles of Citius, Altius, Fortius—faster, higher, stronger—while embracing the Less is More philosophy.

In recent years, the 5-fraction radiotherapy regimen has emerged as a transformative approach, offering shorter treatment durations, higher precision, and enhanced therapeutic efficacy, all while optimizing healthcare resources.

The COVID-19 pandemic caused significant hardship but also spurred rapid advancements, including in cancer care. In radiotherapy, it led to broader acceptance of shorter treatment regimens, particularly the 5-fraction schedule, which proved equally effective for breast cancer and many other tumors.

The adoption of the 5-fraction regimen in breast cancer radiotherapy has also been influenced by technological advancements over recent decades.

Developments include the use of advanced imaging techniques for more accurate definition of irradiation target volumes and the implementation of dose delivery systems that improve homogeneity within the target area while reducing exposure to surrounding healthy tissues via steep dose gradients. Imaging advances have also enabled more precise, image-guided treatments and consistent daily reproducibility during therapy. These

improvements have supported the wider use of the 5-fraction regimen in clinical settings.

Embracing 5 fractions for all breast cancer treatments as a standard for 21st-century radiotherapy is no longer the vision of a few pioneering oncologists but a tangible reality that is gaining widespread acceptance. Perhaps it is time to redefine what we consider the "standard fractionation" regimen as 15–16 fractions, while reserving the term "hypofractionation" exclusively for the 5-fraction regimens currently labeled as "extreme hypofractionation."

However, widespread implementation may also depend on other factors, such as evolving clinical evidence and institutional preferences. Adoption is often hindered by reimbursement models still prevalent in many countries, which are based on a fee-for-service system. Under these models, payment per fraction results in decreased financial compensation for physicians and healthcare institutions, creating a disincentive for transitioning to shorter regimens. To overcome this barrier, some experts advocate for the implementation of an Alternate Payment Model (APM) in these countries, which establishes a fixed reimbursement rate regardless of treatment technique, number of fractions, or fraction size. This approach could promote broader adoption of 5-fraction regimens by aligning financial incentives with clinical efficiency. Conversely, in countries with universal healthcare systems and bundled payment structures, such as Spain and several other European Union nations, enthusiasm for 5-fraction regimens has been greater. In these settings, such protocols have already become the standard of care for many indications, offering the advantages of reduced treatment duration, cost savings, and more efficient resource utilization.

Thank you, Professor Montero, for such an engaging and insightful discussion!

Thank you for your interest in our work and for the opportunity your journal offers us to present and elaborate on our study findings.

Radiation Therapy for Head and Neck Cancers: Challenges and Practical Approaches

Prof. Jankarashvili, thank you very much for taking the time to speak with us.
Could you explain the role of radiotherapy in the treatment of head and neck cancers?

Radiotherapy (RT) is a cornerstone in the treatment of head and neck cancers. In many cases, it can be used as the primary treatment on its own. It may also be combined with chemotherapy or administered after surgery to minimize the risk of recurrence.
RT is usually delivered on an outpatient basis. Each session, called a fraction, typically lasts 7 to 10 minutes. The procedure is straightforward and generally well tolerated, causing little to no discomfort.
Patients come to the clinic daily for their sessions and return home the same day, making the treatment both convenient and manageable.

Natalia Jankarashvili

MD, PhD, Professor, Radiation Oncologist, Head of Radiation Oncology Department, Todua Clinic, Tbilisi, Georgia

What are the most common side effects or complications of RT in patients with head and neck cancers?

The course of RT for head and neck cancers is usually long, typically lasting around 6 to 7 weeks. This is because high doses of radiation are required to effectively target the cancer in this area, which results in a prolonged treatment period.
In general, the side effects of RT can vary depending on several factors: which part of the body is being treated, the daily and total radiation dose, whether other treatments such as chemotherapy are given concurrently, and each patient's individual response to therapy.
For head and neck cancers, the most common side effects after RT involve the skin and mucous membranes in the treated area.
Patients may experience irritation, which can make chewing and swallowing more difficult, as well as discomfort on the skin where the radiation is applied. Hair loss may occur in the treated area; commonly in men, this affects the beard region. Other frequent effects include changes in taste and dry mouth.
When RT is combined with chemotherapy, these side effects can be more pronounced and may be accompanied by general symptoms such as fatigue, nausea or vomiting, reduced appetite, and, in some cases, changes in blood test results. The combination of treatments can intensify the side effects of RT.
It is important to note that although these side effects can be uncomfortable, they are generally

not dangerous and are usually reversible if the patient carefully follows the doctor's recommendations.

Before starting RT, patients are given guidance on nutrition and are prescribed products to protect the skin and the mucous membranes of the mouth and throat. These measures help prevent or minimize side effects. Patients are also advised to avoid smoking and drinking alcohol during treatment.

During this period, it is essential for patients and their families to understand the importance of proper care and to strictly follow medical instructions. Failure to adhere to the prescribed regimen can worsen the patient's condition and may even necessitate interrupting treatment, which can negatively affect the overall prognosis.

In most cases, side effects can be managed at home. However, in rare situations where it becomes difficult to monitor the patient's condition at home, the patient may be admitted to the hospital for a few days to stabilize their condition and ensure that treatment can be completed successfully.

When would a patient require re-simulation and replanning of their RT treatment?

Most head and neck cancers are highly sensitive to RT. One of the main reasons a new treatment plan, or replanning, may become necessary during the course of RT treatment is a significant reduction in tumor size.

RT requires millimeter-level precision, which is achieved with cutting-edge technology. When the tumor shrinks, it alters the patient's anatomy and the radiation target area.

To maintain the highest possible accuracy, a new treatment plan is made, and RT continues according to the new plan.

In some cases, it may be necessary to replan the treatment more than once during the course of RT.

Another reason for replanning can be weight loss, which also changes anatomical structures and necessitates a new treatment plan.

"Most head and neck cancers are highly sensitive to radiotherapy, and active patient involvement and awareness can significantly improve treatment outcomes"

Could you please share your experience with the use of nasogastric tubes?
In what circumstances are they typically indicated, and are there strategies to minimize the duration of their use?

As is well known, nasogastric tubes are required for patients with impaired oral intake. In oncology patients, this may be due to a tumor obstructing the swallowing pathway or treatment-related side effects that make swallowing difficult or cause severe loss of appetite.

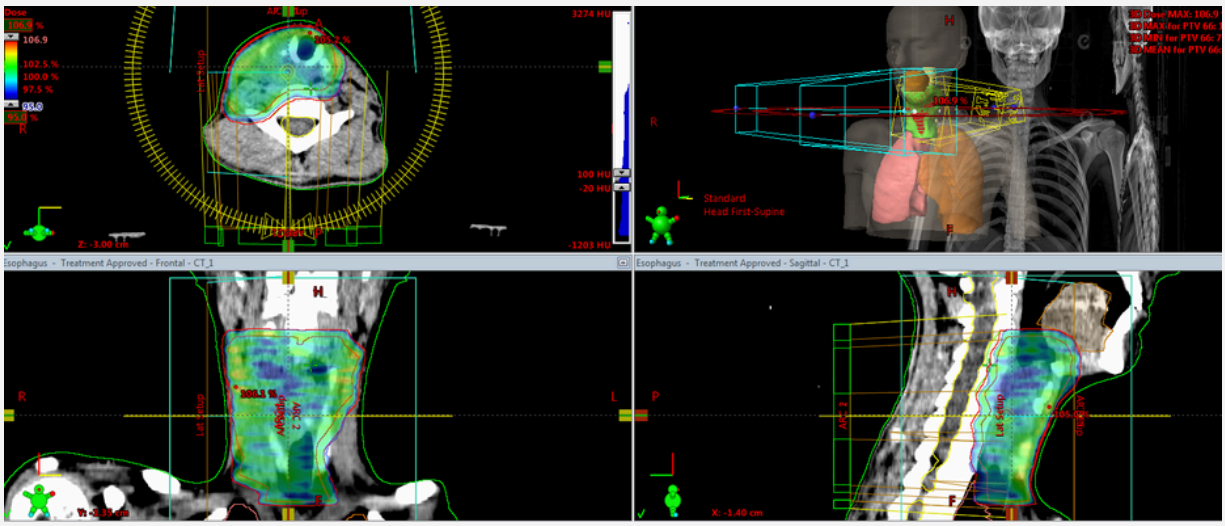
As I mentioned earlier, RT is a long course of treatment, typically lasting around 6 to 7 weeks. Its side effects can persist for some time even after treatment ends, usually for 2 to 6 weeks.

Nasogastric tubes can cause significant discomfort in daily life, especially for patients experiencing RT side effects, so we don't use them unless there is a clear medical indication or absolute necessity. Instead, patient care is managed through various infusions and orally administered medications whenever possible.

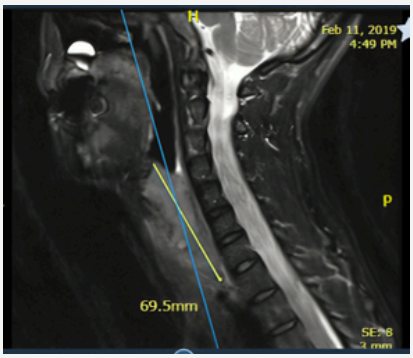
How important is it to educate patients about the potential side effects of their treatment, and how does their active involvement contribute to better therapy outcomes?

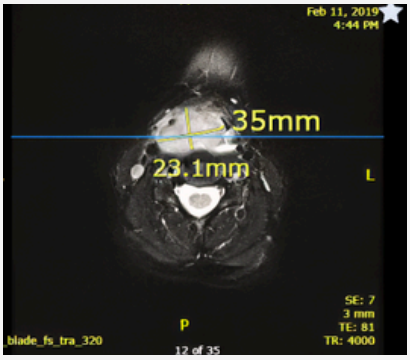
38-year-old female patient with Squamous cell laryngeal cancer, G3, cT4N0M0.

Radiation dose distribution according to the treatment plan

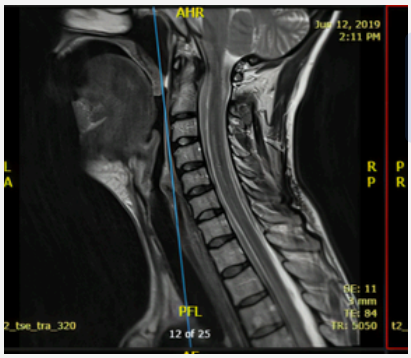


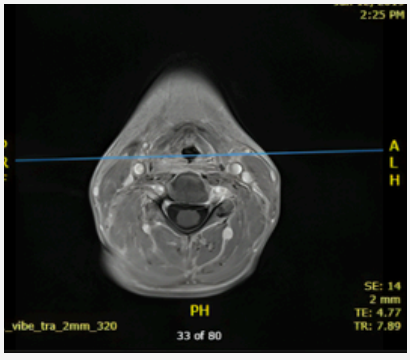
Baseline MRI prior to radiotherapy





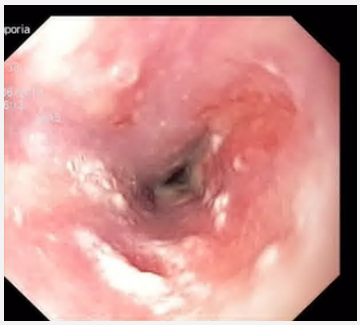
MRI at 2-month follow-up after RT





Complete Response to RT

Endoscopy at 2-month follow-up after RT



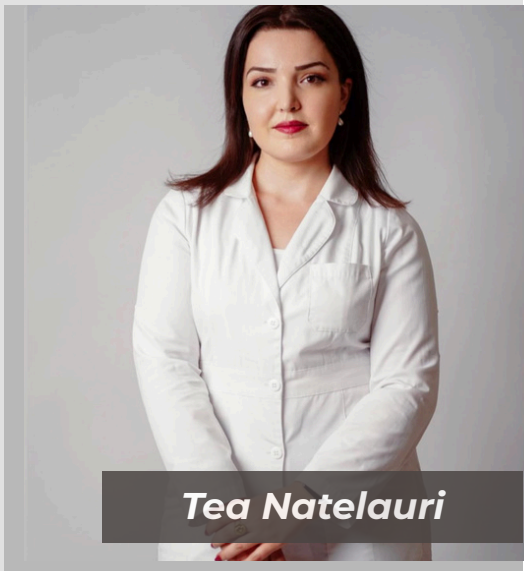
თოდუას კლინიკა

This is one of the most important aspects of treatment. The physician is responsible for providing the patient with complete information about the duration of RT, potential side effects, and strategies for managing them.

At the same time, the patient and their family share the responsibility of following all medical instructions to ensure that treatment proceeds as smoothly and effectively as possible.

Of course, there are cases in which patients do not adhere to medical recommendations. In such situations, it can be difficult, or sometimes even impossible, to carry out treatment safely and effectively.

The Role of Genetic Testing in Cancer Prevention



Dr. Natelauri, thank you for taking the time to speak with us. Please share your perspective: What role does genetic testing play in the prevention and early detection of cancer?

The role of genetic testing in modern medicine, including oncology, has increased significantly. Through genetic testing, it is possible to assess the risk of developing oncological diseases.

Hereditary cancer syndromes, which account for approximately 10% of all cancer cases, can be detected through genetic testing even before the disease manifests clinically. Identifying a genetic predisposition to disease (for example, BRCA1/2 mutations or Lynch syndrome) enables both clinicians and patients to plan preventive measures. These may include intensive screening or other types of interventions, such as prophylactic surgical procedures or chemoprevention (in specific cases).

Furthermore, when a pathogenic variant is detected, genetic testing often helps protect the patient's family members as well—it makes cascade testing necessary, which is crucial for determining their individual risk.

In addition, genetic testing plays an important role in treatment personalization: certain genetic mutations determine the effectiveness of specific therapeutic agents, such as in the use of targeted therapy.

How easy is it to integrate genetic testing into everyday clinical practice, and what challenges do you see in this process?

There are quite a few problems; however, the main barrier is the high cost of genetic testing and the fact that insurance companies do not cover these expenses.

An additional challenge is the limited laboratory infrastructure and the reliability of local testing — there is a shortage of highly reliable, internationally accredited laboratories.

A significant problem also remains the shortage of specialists: the number of genetic counselors and oncogeneticists in the country is very limited.

Moreover, another difficulty lies in the proper interpretation of genetic testing results by other medical professionals.

How informed are patients in Georgia about genetic testing, what is the level of

their engagement, and what steps could be taken to increase awareness?

Unfortunately, the level of awareness among Georgian patients remains low; however, we are making efforts to raise awareness of this issue.
It is also noteworthy that limited financial accessibility leads to lower levels of patient engagement.
To increase awareness, we carry out various activities in collaboration with MegaLab. These include presenting our services to colleagues at scientific conferences so that they can share this information with patients, as well as conducting public information campaigns, distributing brochures, and sharing videos through social media.
The active involvement of foundations and partner civil society organizations is also crucial.

"Detecting early traces of neoplasia in the blood could become a simple and potentially widely accessible method of early detection"

Are there ethical or social challenges associated with the use of genetic testing, and how can they be addressed?

One of the main challenges is ensuring confidentiality and preventing discrimination, which remain significant concerns globally. It is essential to establish a clear legal framework that explicitly prohibits insurance companies and employers from discriminating on the basis of genetic testing results.
In addition, the psychological impact must be taken into account: if a pathogenic variant is detected, the patient may experience uncertainty and fear, making psychosocial support particularly important.
Furthermore, genetic testing—or its misinterpretation—can influence a patient's decisions regarding family planning or create a negative perception of their existing risk, which constitutes a significant social and ethical concern.

What future innovations or advances in genetic testing do you expect to enhance the effectiveness of cancer prevention?

In the future, we anticipate that the issue of funding for genetic testing will be reconsidered, which would help increase demand for local testing—particularly for next-generation sequencing (NGS) in Georgia—eliminating the need to send samples abroad.
As a result, the cost of locally conducted NGS testing is also expected to decrease. However, at this stage, the price of such tests unfortunately still reaches four-digit amounts.
In the long term, in addition to NGS panels, we plan to introduce the use of polygenic risk scores (PRS)—a multi-gene risk assessment tool that, when integrated with clinical factors, can be translated into personalized recommendations.
The use of liquid biopsy is also expected to expand. Currently, it is primarily employed for disease monitoring—in cases of metastasis and minimal residual disease detection—but in the future, it could also serve as a screening tool. Detecting early traces of neoplasia in the blood could become a simple and potentially widely accessible method of early detection.
There will also be greater automation in result interpretation and increased support from artificial intelligence (AI), particularly in variant classification, clinical significance assessment, and the development of risk-based

recommendations.
In addition, tele-genetics and remote consultations are expected to become more widely accessible, expanding the availability of genetic services to a broader population.

Sustained Benefits of Neoadjuvant Immunotherapy in Resectable Melanoma

Recent 2025 data confirm that neoadjuvant immunotherapy provides durable benefits in patients with resectable stage III or IV melanoma. The phase III NADINA trial showed that preoperative nivolumab plus ipilimumab significantly improved 2-year event-free survival (EFS) (77.3% vs 55.7%; HR 0.40) and distant metastasis-free survival (DMFS) compared with adjuvant-only therapy, particularly in high-risk patients. Similarly, updated results from the SWOG S1801 trial demonstrate superior 3-year event-free survival (EFS) (68% vs 56%) and relapse-free survival (RFS) (80% vs 60%) with neoadjuvant-adjuvant pembrolizumab.

Emerging biomarker analyses, including the NeoPredict model combining clinical, RNA, and DNA features, are beginning to identify patients most likely to benefit from neoadjuvant therapy, supporting more personalised strategies. These findings reinforce a paradigm shift, positioning neoadjuvant immunotherapy as a central approach for eligible patients with resectable melanoma.

New Recommendations from ESTRO on Preoperative Radiation Therapy for Breast Cancer

The 2025 ESTRO recommendations, endorsed by ASTRO, highlight the evolving role of preoperative radiation therapy (RT) in breast cancer management. Preoperative RT can optimise tumour downstaging, potentially improve surgical outcomes, and allow for better integration with systemic therapies. Current guidance emphasises careful patient selection, multidisciplinary planning, and integration with breast-conserving surgery, particularly in locally advanced or high-risk tumours.

Emerging evidence and ongoing trials are exploring optimal timing, fractionation, and combination strategies with systemic treatments, as well as identifying biomarkers to predict response and minimise toxicity. These recommendations underscore a shift toward more individualised, neoadjuvant approaches in breast cancer, positioning preoperative RT as a promising component of contemporary treatment strategies.

The Main Oncology Events in 2026
January - June

Date	Event	Location	Organisation
08–10 January	ASCO Gastrointestinal (GI) Cancers Symposium 2026	San Francisco, CA, USA	ASCO
19–21 February	2026 Multidisciplinary Head and Neck Cancers Symposium	Palm Desert, CA, USA	ASTRO
26–28 February	27th European Gynaecological Oncology Congress	Copenhagen, Denmark	ESGO
01–04 March	IMRT and VMAT: Best Practices and New Trends	Zagreb, Croatia	ESTRO
12–14 March	ESMO Sarcoma and Rare Cancers Congress	Lugano, Switzerland	ESMO
15–19 March	Particle Therapy	Malaga, Spain	ESTRO
16–18 March	ESMO Targeted Anticancer Therapies Congress	Paris, France	ESMO
19–21 March	ICHNO 2026	Seville, Spain	ICHNO 2026
22-25 March	Comprehensive and Practical Brachytherapy	Ljubljana, Slovenia	ESTRO
23–25 March	Immunotherapy 2026	Ghent, Belgium	ESTRO
25–28 March	European Lung Cancer Congress 2026	Copenhagen, Denmark	ESMO
15–18 April	Haematological Malignancies	Lisbon, Portugal	ESTRO
19–22 April	Advanced Physics for Brachytherapy	Vilnius, Lithuania	ESTRO
06-08 May	ESMO Breast Cancer 2026	Berlin, Germany	ESMO
15-19 May	ESTRO Congress	Stockholm, Sweden	ESTRO
29 May – 02 June	ASCO Annual Meeting 2026	Chicago, USA	ASCO
17–19 June	ESMO Gynaecological Cancers Congress	Copenhagen, Denmark	ESMO

Management of HER2-Positive AEG Type III Adenocarcinoma Complicated by Recurrent Perforated Diverticulitis: A Case Report

Sadunishvili Aleko[1§]

[1] *Allgemein- und Viszeralchirurgie, Klinikum Chemnitz, Chemnitz, Deutschland*

[§]*Corresponding author: Sadunishvili Aleko, alekosadunishvili@gmail.com*

Case Presentation

A 58-year-old male presented in March 2025 with progressive dysphagia, epigastric pain, and a 17 kg unintentional weight loss over ten months. Due to severe stenosis at the esophagogastric junction, he was able to tolerate only soft or puréed food. Initial evaluation with gastroscopy, endoscopic ultrasound (EUS), and computed tomography (CT) of the thorax and abdomen identified a stenosing lesion consistent with esophagogastric junction (AEG) type III adenocarcinoma staged as uT3 with suspected regional lymph node involvement *(Figures: 1 and 2).*

Staging with positron emission tomography–CT (PET-CT) demonstrated hypermetabolic activity in the primary lesion and in regional lymph nodes dorsal to the gastric fundus, without evidence of distant metastases *(Figure 3).*

Diagnostic laparoscopy excluded peritoneal carcinomatosis. Tumour markers revealed a mildly elevated carcinoembryonic antigen (CEA) of 13.5 µg/L, with normal CA 19-9 and CA 72-4 levels. Following multidisciplinary tumour board review and confirmation of human epidermal growth factor receptor 2 (HER2) overexpression, the patient received four cycles of neoadjuvant 5-fluorouracil, leucovorin, oxaliplatin, and docetaxel (FLOT) combined with trastuzumab between April and May 2025. Follow-up CT in June showed significant tumour regression but also identified a contained

Fig. 1 Esophagogastroduodenoscopy demonstrating the tumorous lesion

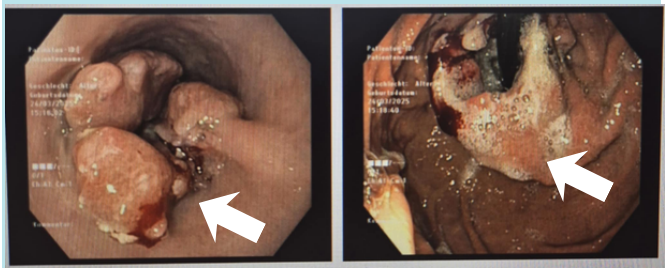


Fig. 2 CT demonstrating the tumorous lesion

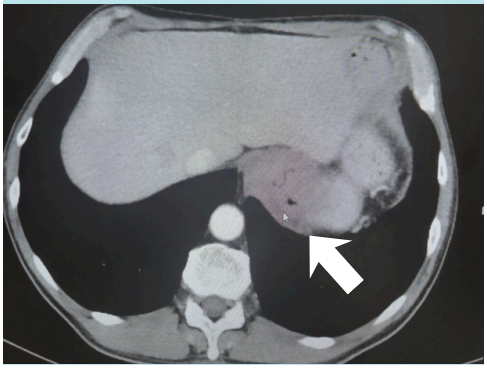
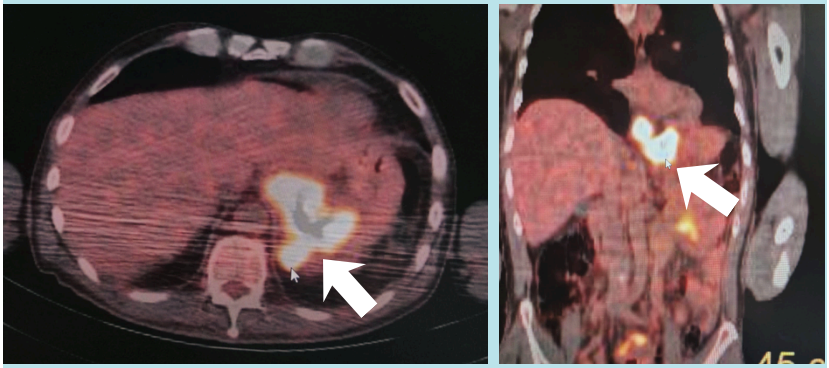


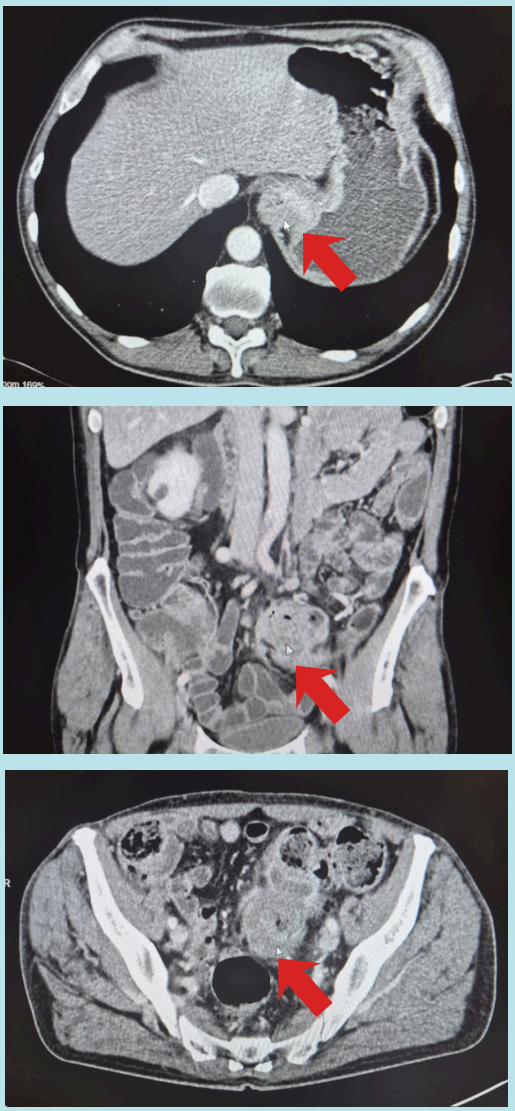
Fig. 3 PET/CT demonstrating the tumorous lesion



perforation of the sigmoid colon with perisigmoidal abscess secondary to diverticulitis, consistent with the patient's intermittent left lower abdominal pain *(Figure 4).*

The diverticulitis was managed conservatively with antibiotics, resulting in clinical improvement. After repeat tumour board evaluation, he was deemed suitable for curative-intent surgery.

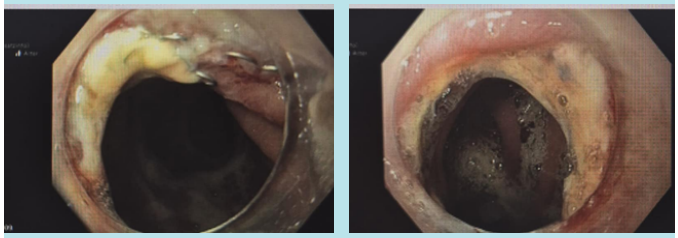
Fig. 4 CT demonstrating perisigmoidal abscess



In July 2025, the patient underwent minimally invasive robotic Ivor-Lewis esophagogastric resection with extended lymphadenectomy and intrathoracic anastomosis *(Figure 5).*

Preoperative pyloric dilatation was performed to facilitate postoperative gastric emptying. Histopathology revealed ypT3, ypN0 (0/28), L0, V0, Pn0, R0, G3, and HER2-positive adenocarcinoma, confirming complete resection.

Fig. 5 postoperative Esophagogastroduodenoscopy



Postoperatively, recurrent left lower abdominal pain prompted CT imaging, which confirmed recurrent sigmoid diverticulitis with perisigmoidal abscess.

Conservative management was continued, followed by two additional cycles of FLOT plus trastuzumab between late August and early September 2025. Due to persistent recurrence, elective laparoscopic rectosigmoid resection was performed in October 2025. Intraoperatively, a suspicious lesion in the ileocecal region warranted extension to right hemicolectomy. Histopathology of both specimens demonstrated only purulent inflammation and abscess, with no malignancy.

After the final tumourboard review in November 2025, with all curative-intent treatment completed, the patient was enrolled in structured oncologic follow-up, including periodic CT imaging, endoscopy, and clinical assessment. At the time of this report, there was no evidence of residual or recurrent disease.

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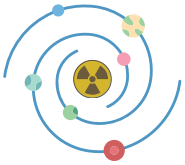

Artificial Intelligence in Lung Cancer: Advances in Screening, Diagnosis, and Treatment Planning

Eliashvili Giorgi[1§], Apkhadze Mariami[2], khvedelidze Khatia[3], Lashkhia Ana[2], Shvelidze Megi[4] Alaverdashvili Tinatin[2]

[1]*David Tvildiani Medical University, Tbilisi, Georgia,* [2]*Tbilisi State Medical University, Tbilisi, Georgia,* [3]*Tbilisi State Medical University, Department of Endocrinology, Tbilisi, Georgia,* [4]*MediClubGeorgia, Department of Emergency Medicine, Tbilisi, Georgia*

[§]Corresponding author: Eliashvili Giorgi, Giorgi.Eliashvili@dtmu.edu.ge

Abstract

Lung cancer remains the leading cause of cancer-related death worldwide, with late-stage diagnosis being a major factor in poor survival rates. In recent years, advances in artificial intelligence (AI) have created new opportunities to improve early detection, diagnosis, prognosis, and treatment planning in lung cancer care. AI tools, especially those based on machine learning (ML) and deep learning (DL), have shown promise in increasing the accuracy of screening methods like low-dose computed tomography (LDCT), as well as in interpreting radiological and histopathological images. By integrating imaging, clinical, and genomic data, AI can help stratify patients by risk and support personalised treatment approaches. However, challenges such as algorithm bias, lack of transparency, data variability, and ethical concerns about privacy and accountability continue to limit widespread adoption.

This review explores the current and emerging applications of AI in lung cancer screening and diagnosis, evaluates its potential impact on patient outcomes, and highlights the key obstacles that must be addressed for broader clinical integration.

Keywords: *: lung Cancer, artificial Intelligence, machine learning, early detection of cancer, positron emission tomography*

Introduction

According to the Global Cancer Statistics 2022 (GLOBOCAN), approximately 20 million new cancer cases and 9.7 million cancer-related deaths occurred worldwide in 2022. Among these, lung cancer accounted for 12.4% (2.5 million) of all new cases and 18.7% (1.8 million) of cancer-related deaths [1]. Lung cancer has two histological subtypes: small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC), with NSCLC being more prevalent, comprising 85–90% of all lung cancer cases. NSCLC includes squamous cell carcinoma, large-cell carcinoma, and adenocarcinoma, while SCLC is less common but more aggressive, classified as pure (with neuroendocrine features) or combined SCLC [2].

Lung cancer is associated with high mortality, largely due to its late-stage diagnosis. Early detection, especially in high-risk populations, is critical: stage I patients have a 5-year survival exceeding 75%, versus below 10% for stage IV [3,4].

Artificial intelligence (AI), capable of simulating human cognition and analysing large datasets, has emerged as a promising tool for early lung cancer detection [5,6].

The increasing application of AI in radiology is primarily driven by two developments: machine learning (ML) and deep learning (DL). ML uses statistical methods to learn rules from training data autonomously and is effective in identifying patterns within large datasets—often outperforming manual evaluation. DL, a subfield of ML, processes raw data without human-designed feature extraction, learning key representations directly from input data [7].

AI in Lung Cancer Screening

Low-dose computed tomography (LDCT) is the standard screening modality for lung cancer; however, its effectiveness is limited by high false-positive rates, missed diagnoses, and inter-reader variability [8]. Artificial intelligence (AI), particularly deep learning (DL) techniques, can help overcome these limitations by minimising human error in image interpretation and enhancing diagnostic accuracy [9]. DL models are capable of detecting subtle malignant patterns, including small pulmonary nodules that may be overlooked by radiologists, as demonstrated by the LUNA16 model [4].

By rapidly analysing large volumes of imaging data, AI augments radiologist performance, reduces diagnostic fatigue, and improves consistency in radiological assessments—an advantage that is especially relevant for large-scale lung cancer screening programmes [10]. In addition, AI algorithms can integrate clinical, radiological, and biological data, including electronic medical records, fluid biomarkers, and metagenomic information, to further improve the precision and personalisation of lung cancer screening [11].

AI also improves reporting systems like Lung-RADS, aiding risk stratification, distinguishing benign from malignant nodules, and reducing unnecessary biopsies and scans [8, 11].

Although AI has much to offer, key challenges remain. The main one is generalisability: as most AI models are trained on datasets that may not reflect global diversity, factors such as age, ethnicity, comorbidities, and regional practices can affect performance [6]. Another challenge is interpretability—many AI systems act as "black boxes", and clinicians may hesitate to trust outputs without understanding the reasoning [5].

AI in Lung Cancer Diagnostics

Early diagnosis is critical in lung cancer, yet over 70% of patients are diagnosed at advanced stages and are often ineligible for surgery [6]. CT scans and biopsies are standard but have limits —CT risks misdiagnosis, and biopsies are invasive—so better noninvasive methods are needed.

Tumour location, pathology, metastasis, and complications add challenges. AI aids not only detection but also staging, typically based on positron emission tomography-computed tomography (PET-CT) [12]. Various machine learning algorithms—such as logistic regression, support vector machines, neural networks, Bayesian models, K-nearest neighbours, decision trees, and random forests—have been applied in this field. These AI systems can autonomously analyse clinical data, identify relevant variables, and provide decision support for diagnosis and treatment. DL techniques, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), generative adversarial networks (GANs), and transformers, have shown considerable clinical value in lung cancer screening, diagnosis, and prognosis [5].

AI in Prognosis and Treatment Planning in Lung Cancer

In digital histopathology, AI models process H&E-stained whole-slide images to segment cellular morphology, characterise the tumour microenvironment (TME), and extract survival-predictive features, enabling rapid tumour classification and prognosis assessment; however, performance is limited by data quality, nonstandard protocols, and incomplete datasets [12,13]. By combining histopathological, PET, and CT features, machine learning and deep learning models can predict survival, recurrence, and treatment response in lung cancer, improving clinical decision-making and personalised treatment planning [14,15,16].

Biomarkers with clinical data improve prognostic accuracy [17]. Radiomic nomograms and CNNs trained on radiotherapy datasets identify high-risk patients and predict 2-year post-surgery survival [18,19,1]. Tumour microenvironment cell organisation is another key prognostic factor [20].

AI has shown promise in forecasting responses to chemotherapy, targeted therapy, immunotherapy, and radiation therapy [21]. Radiomics-based models can predict pathologic complete response to chemoradiation in NSCLC [10], as well as responses to frontline epidermal growth factor receptor tyrosine kinase inhibitor (EGFR-TKI) and Programmed Death-1 (PD-1)/Programmed Death-Ligand 1 (PD-L1) immunotherapies [22]. Deep learning algorithms can estimate EGFR mutation likelihood and response to EGFR-TKIs and checkpoint inhibitors. By identifying specific radiomic features, AI supports personalised treatment planning and can anticipate outcomes such as local failure and chemotherapy effectiveness [23].

In risk stratification, AI models—including CNNs using chest X-rays and minimal EHR data—predict long-term cancer risk more accurately than traditional criteria, identifying individuals for targeted screening [24, 25].

In the pre-treatment setting, AI predicts prognosis to guide therapy intensity—high-risk patients may receive intensive care, while lower-risk patients avoid overtreatment. After surgery, AI identifies recurrence risk to guide adjuvant chemotherapy decisions [18].

Examples of Case-Based Models

Several case-based studies have demonstrated the potential of AI in guiding prognosis and treatment planning. Table 1 summarises key examples, including radiomics-based response prediction [10], EGFR mutation identification [23], early failure prediction after SBRT [18], and integration of genomic data for adjuvant therapy decisions [16].

Conclusion

Despite rapid progress, AI adoption in lung cancer care remains limited by several challenges. Model bias from unrepresentative training data can reinforce health disparities, while the “black box” nature of deep learning reduces clinician trust. Ethical concerns around data privacy, consent, and accountability further

complicate implementation. Standardisation of imaging protocols and data formats is also essential to improve model generalisability. Looking ahead, AI's ability to integrate imaging, clinical, genetic, and biomarker data offers promise for early detection, risk stratification, and personalised treatment. Efforts to improve interpretability, data quality, and clinician training are critical for implementing AI in routine practice. Addressing these barriers through collaboration among clinicians, researchers, and developers will enable AI to realise its full potential in improving lung cancer screening, diagnosis, and outcomes.

Table 1. Case-based studies demonstrating AI's potential in prognosis and treatment planning

Study	AI Application	Clinical Context	Key Outcome
Binczyk F, et al. (2021)	Radiomics-based AI model	Prediction of treatment response to nivolumab, docetaxel, gefitinib	Accurately predicted response based on CT radiomic features
Khorrami M, et al. (2020)	Prognostic AI model	Early-stage NSCLC treated with SBRT or chemoradiation	Predicted early death and treatment failure
Mobadersany P, et al. (2018)	Integrated AI model (genomic + clinicopathological data)	Adjuvant therapy decision-making	Identified patients at recurrence risk who may benefit from adjuvant treatment

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From Bench to Bedside and Beyond: Gil Morgan, Oncologist and OncoAlert Founder, on Transforming Oncology Connections

"OncoAlert began as a simple idea among friends and became a global network. That wouldn't have happened if I hadn't taken a chance"

Gilbert Morgan, MD

Clinical Oncologist from Texas, Director and Founder of Oncoalert Network

Doctor Morgan, You began your career with a fellowship at the National Institutes of Health (NIH). What encouraged you to make these transitions, and what did you learn about yourself and your career through this process?

My time at the NIH was formative; I was immersed in cutting-edge molecular biology and surrounded by brilliant minds. Yet even amid all of that excitement, I felt a sense of incompleteness. I realized that if I stayed more concentrated on the laboratory research side, I might lose what drew me to medicine in the first place—the human connection. That insight was powerful enough to change my trajectory.

After a few years I found myself starting my clinical oncology residency at Karolinska and later working in clinical oncology in Lund, both world-class institutions brimming with intellectual energy. This taught me not only to listen to my gut, but also that there is no direct path and it might not look exactly like what you thought it would look like, but regardless, it will guide you to the right place.

The biggest lesson from these transitions was that leaving the "safe" path can open doors you didn't know existed. I discovered how resilient and adaptable I could be—learning a new language, integrating into a new medical system, and thriving in an unfamiliar culture. Those experiences gave me the confidence to later build something from scratch, like OncoAlert, because I had already proved to myself that stepping into the unknown can lead to tremendous growth.

OncoAlert started with zero followers and has grown into a global platform. What was your original motive when creating it, and did you ever doubt yourself?

The idea for OncoAlert came from countless conversations with colleagues across the US and Europe who were frustrated by how fragmented oncology information had become. There was so much innovation happening, but it was scattered across journals, conferences, and regions. At the same time, I had been experimenting with social media and saw its potential to bridge that gap.

In 2019, at the AACR Annual Meeting, we launched OncoAlert with a few targeted tweets. At that point it was truly grassroots—no followers, no budget, just a group of like-minded professionals sharing knowledge. The key was consistency: showing up every day, engaging with doctors, nurses, scientists, and patient advocates, and amplifying their voices as well as the science.

Of course there were moments of doubt. It's one thing to have a vision; it's another to sustain the energy when it's just you and a handful of people tweeting into the void. But the positive feedback—seeing colleagues in low- and middle-income countries access the same cutting-edge updates as those in big academic centers—convinced me we were onto something. That sense of purpose carried me through the uncertainty and ultimately led me to make OncoAlert my full-time focus.

You've mentioned in other interviews that working in oncology requires a 'special person.' What personal practices or perspectives have helped you sustain meaning, balance, and resilience through the toughest moments?

Oncology is a field of profound highs and lows. You witness breakthroughs that change lives, and, at the same time, you walk with patients and families through devastating diagnoses. That emotional intensity can be draining if you don't have a grounding force. For me, that anchor is my family. My wife and our two children give me perspective, joy, and a reason to step away from the screen or the hospital and just be present. It's become a running joke that OncoAlert is my third child—but spending time with my actual children is what replenishes me.

I also try to maintain a sense of purpose about why I chose this profession. Even though I've shifted from direct clinical care to running a nonprofit, I remind myself that every tweet, every educational event, and every partnership is ultimately about patients. Keeping that focus turns challenges into motivation. And on a very practical level, I decompress by doing ordinary things with my family—sharing meals, going to the movies, and being back in Texas a quarter of the year. Those small rituals create balance.

"leaving the "safe" path can open doors you didn't know existed"

What advice would you give to young colleagues just beginning their careers in oncology, especially those who want to make a real impact?

First and foremost, make sure you truly love what you're doing. Oncology is incredibly rewarding but also demanding—intellectually, emotionally, and psychologically. The lows can be tough, but the highs, the ability to help patients and their families in a meaningful way, make it all worthwhile.

Second, keep patients at the center of everything. The doctor-patient relationship in oncology is unique—deeper and more personal than in most other specialties. Cherish it, learn from it, and let it guide your decisions.

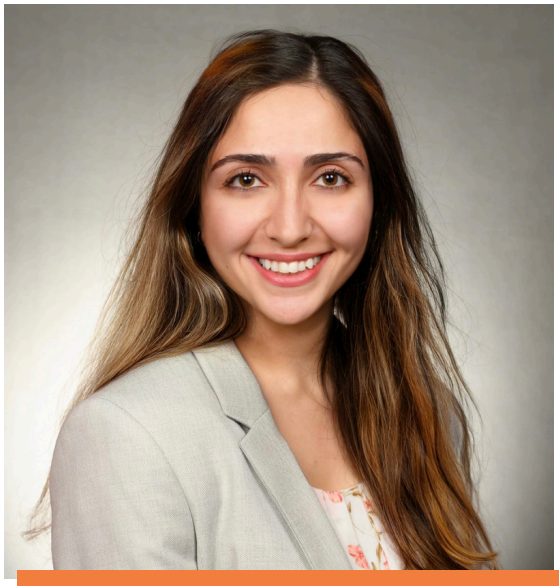
Finally, don't be afraid to innovate. Whether it's research, advocacy, or new ways of educating peers, there's room to make a difference. OncoAlert began as a simple idea among friends and became a global network. That wouldn't have happened if I hadn't taken a chance. So cultivate curiosity, stay open to new opportunities—even if they're outside your comfort zone—and build relationships. Those are the ingredients for making a real impact in this field.

Thank you very much, Dr. Morgan, for sharing your experiences, insights, and inspiring journey with us.

Overcoming Challenges and Achieving Dreams: Dr. Tinatin Muradashvili on Her Journey in Hematology

Tinatin Muradashvili, MD

Hematology fellow at Emory University in Atlanta, Georgia, USA

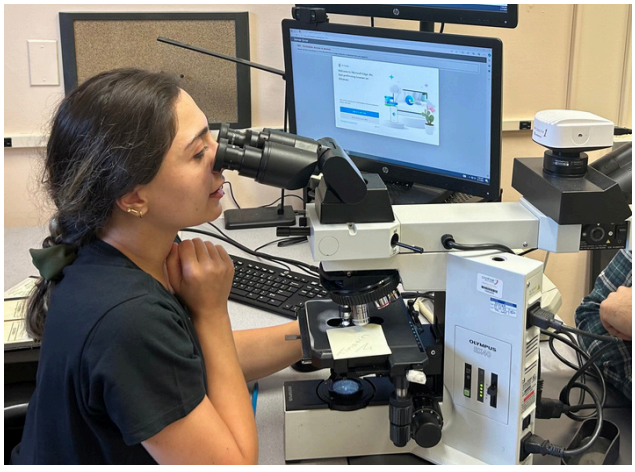


Believe in your potential, you can succeed with the right guidance and determination

Tinatin, Could you briefly introduce yourself and your current role in the United States?

My name is Tinatin Muradashvili, and I am currently a hematology fellow at Emory University in Atlanta, Georgia. I was born and raised in Gori, a city in the country of Georgia. Later, I moved to Tbilisi to complete medical school at Tbilisi State Medical University and started a hematology residency before relocating to the United States to pursue postgraduate training. I completed my residency at the Yale-Waterbury Internal Medicine Program in Connecticut, where I also served as a chief resident. I am now continuing my training in the Hematology Fellowship Program at Emory.

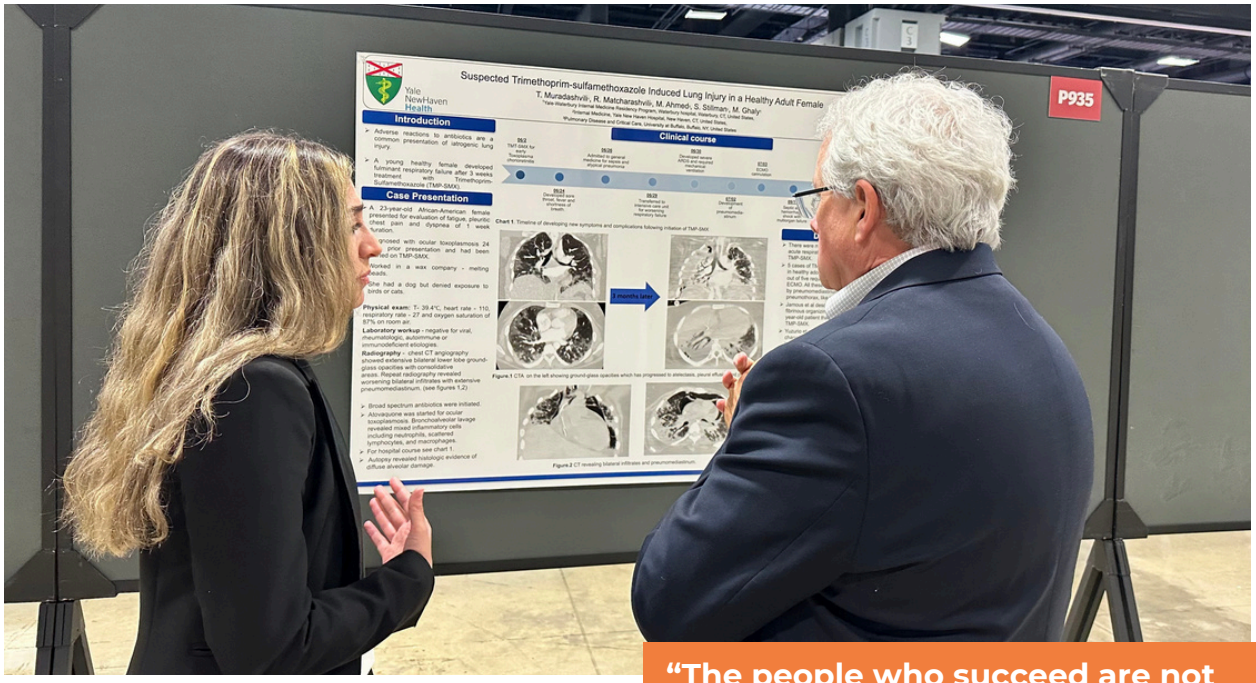
Although I enjoy all aspects of hematology, my particular focus is on bleeding and clotting disorders, such as hemophilia and thrombocytopenia.



Alongside my clinical training, I am pursuing a Master of Science in Clinical Research at Emory to strengthen my skills in epidemiology, data analysis, and study design. My current work includes patient care, clinical research on rare bleeding disorders, and mentoring medical trainees, as time allows. Ultimately, I aspire to become a physician-scientist at an academic center, contributing to research, education, and the advancement of equitable care for patients with rare hematologic conditions.

What inspired you to pursue a career in hematology?

I became interested in hematology during my clinical rotations in medical school. I found myself naturally drawn to the subject-perhaps because I was good at it-but also because it was intellectually stimulating.



"The people who succeed are not those who never doubt themselves, but those who keep going despite it"

Hematology is complex and deeply interconnected with nearly every organ system, which made it both challenging and fascinating to me. I also had a strong interest in biochemistry and molecular biology early on, and I think that was a major reason why I ultimately pursued a career in this field. The way hematologic diseases reflect cellular and molecular processes really spoke to my curiosity. Mentors also played a huge role in why I chose hematology.

What was the biggest challenge during the transition from Georgia to the US medical system?

The biggest challenge was adapting to a new medical culture, both clinically and socially. The pace, structure, and expectations in the US system were very different from what I was used to, and learning to navigate those differences while improving my communication skills in English took time and effort.

Fortunately, I was part of a very supportive residency program. The faculty and my co-residents were incredibly welcoming, which made the transition much easier.

I was also very lucky to have my best friends and some of my family members nearby, which provided both emotional support and a sense of familiarity in a new environment.

What do you enjoy most and least about working in the US healthcare system?

What I enjoy most is the emphasis on multidisciplinary teamwork and access to cutting-edge research and technology. What I enjoy least is the complexity of the insurance system, which sometimes delays or limits patient care.

What does a typical workday look like for you now?

My typical workday can vary significantly depending on the rotation. During inpatient blocks, which last for a full month with only one scheduled day off per week, my day usually starts around 7:30 a.m. I commonly reach 80-90 hours of work per week, depending on the patient census and service intensity.

Unfortunately, I still need to work most weekends, probably about 90% of the time. These inpatient weeks are intense and often physically and emotionally demanding, but they also provide some of the most valuable learning experiences. Outpatient clinic weeks and administrative or research blocks are generally more structured and allow for a better work-life balance. Across all rotations, my day includes a mix of patient care, teaching, research meetings, and administrative tasks. The diversity of responsibilities keeps the work dynamic, challenging, but extremely rewarding.

Have you ever doubted your ability to achieve what you have today? How did you overcome that, and what would you say to others who struggle with self-doubt?

Yes, many times. Self-doubt has come in different forms throughout my journey, especially during major transitions like moving to a new country, adapting to a different medical system, or applying for competitive programs. There were moments when I questioned whether I was good enough, whether I belonged, or whether I could meet the high expectations I had set for myself.

Over time, I learned that doubt doesn't mean I'm not capable; it means I'm growing.

What helped me the most was breaking big goals into small, manageable steps and surrounding myself with mentors, friends, and colleagues who reminded me of my strengths. For me, it was hard to learn to speak kindly to myself (and still is) and to view setbacks not as failures, but as part of the learning process.

To anyone struggling with self-doubt, I would say this: It is okay to feel uncertain; it's part of being human. But don't let that uncertainty stop you. Keep showing up, keep asking for help, and trust that consistent effort matters more than perfection. The people who succeed are not those who never doubt themselves, but those who keep going despite it.

Lastly, always make time to care for yourself; don't forget to find joy and meaning in your life.

"I learned that doubt doesn't mean I'm not capable; it means I'm growing"

What advice would you give to young oncologists who want to work or study abroad?

Be persistent and proactive. Seek mentors early, improve your English, and look for research or clinical opportunities abroad. Believe in your potential; you can succeed with the right guidance and determination.

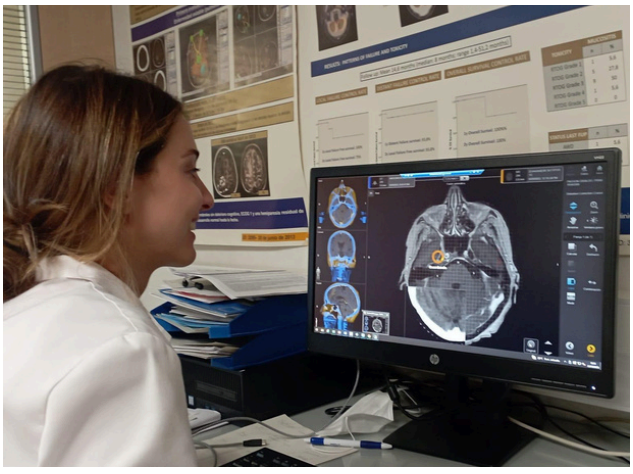
Crossing Borders and expanding Horizons: Dr. Carmen Saiz Guisasola's Journey in Radiation Oncology

Carmen Saiz Guisasola, MD

Radiation Oncologist, Clinical Oncology fellow in proton beam at University College London Hospitals NHS Foundation Trust, London, UK

Could you briefly introduce yourself and tell us what initially drew you to pursue a career in radiation oncology?

I am Carmen Saiz Guisasola, a specialist in radiation oncology, now doing a clinical fellowship in proton beam therapy at the UCLH in London. I did my training in Spain, Madrid, at a small but technically very advanced centre called Sanchinarro. When I finished my studies in medicine, I did not know that I would end up in this specialty, but I was really interested in oncology in general, as it is a really interesting field, always advancing at a really fast speed, with a lot of research and a really special relation with the patient. When the moment came to choose a specialty, my father, who is a neuroradiologist, told me to look radiation therapy up, as it had everything that I really loved and was a growing specialty with a lot of future, so I did, and I instantly fell in love with it.



During your residency, you completed an observership in Australia. What motivated you to choose Australia for this experience, and what did it contribute to your growth as a radiation oncologist?

First of all, I strongly believe that going abroad and getting to know other ways of working, how other departments work, a different job culture, and meeting new people, regardless of where you go, is always enriching.

My rotation in the Peter McCallum Cancer Centre in specific showed me a whole different way of working and living. The department was organized completely differently from mine in Spain. You could tell that in Australia they have so many resources, so they have amazing multidisciplinary teams with different specialists, that treat the patient from a really holistic, integrated point of view. Also, I could see that they are really committed to scientific research, and most of the doctors actively participated in studies, trials, research groups, etc. I could take part in some of them, go to research meetings, and get a grasp of how they work, the problems they encounter in their lab

work, etc., which I found inspiring. Moreover, moving abroad opens up your mind and your frontiers; you stop feeling like a Spanish doctor (in my case), and you realize you are a European doctor or just a global international one. And that should be our aim as young and early-career doctors, in my opinion.

You recently moved to London to continue your career. What motivated this decision, and what was the biggest challenge during the transition from Madrid to London?

Yes. I decided I wanted to keep learning and subspecialize a little bit more. I came to London to do a fellowship in proton beam therapy, which, as we know, is a growing branch of radiotherapy with more clinical indications every day due to the dosimetric benefit seen in different types of patients and anatomical locations.

Even though I am very happy and convinced that this experience is going to be very fulfilling and valuable for me, living abroad has its difficulties, or its cons. It always takes some time to adapt to a different culture and a different language. In the end, you are abandoning your family, friends, and the life you knew for a little while, so it's never easy. Getting here was not easy either, as I had to go through different processes and bureaucracy that were long and tedious. But with patience there is nothing impossible.

What does a typical workday look like for you now?

It depends on the day. My daily work hours range from 8am until 5pm or 10/11am until 7/8pm, depending on the shift that I am doing to cover the machine treatments.

There are different meetings, especially in the mornings, in which we try to organize the weekly job; we have pre-MDT meetings, peer review meetings, tumor boards of every tumor stream, imaging review meetings, etc. And depending on the day, I would have a clinic where I see either new patients that I need to consent and explain the treatment tomy on-treatment patients just to check and do a follow-up of the possible toxicities they could have throughout the treatment. And of course in the midst of all this I would have to contour in the spare time that I find (if I do), see the new patients, review dosimetries, write end-of-treatment letters, baseline flow sheets, etc. I think it is pretty much the same as in other countries.

"we are part of this amazing world that is cancer research, which is a never ending field, that combines so many specialties, technological advances, biological or molecular advances so you never get bored"

Radiation oncology sits at the intersection of advanced technology and deeply personal patient care. What aspects of the specialty do you find most fulfilling?

As I previously mentioned in the first question, balance is what I love about this specialty.
The relation between oncologist and oncologic patient is a very special one, and I find it to be really rewarding in general if you learn to cope with the sadness within. But there are patients that compensate others, as I always say, and overall it is amazing the job we do and how we get to know people really well, to grow a good relationship with them, learn about their lives, what they are afraid of, etc. While on the other hand, we are part of this amazing world that is cancer research, which is a never-ending field that combines so many specialties and technological and biological or molecular advances that you never get bored.

Have you ever doubted your abilities during your career? If so, how did you overcome those moments? What advice would you give to young colleagues who may be struggling with self-doubt?

Yes, of course, during the training there are always hard times and huge amounts of workloads.
bad night shifts, not much sleep, and you just try to push through. There are moments where I made mistakes, and so I doubted myself and my abilities to do what I am doing. But I think that is impossible to avoid in every job in general. I think doubting yourself is the beginning for self-growth. It is the moment you reflect and reconsider next steps and decide if you need to change something about yourself or what you are doing to adapt to the environment or the needs that you are facing. So in the end it is just part of the process of growing, learning, and adapting. Without that suffering that comes from stress or feeling overwhelmed, it's just the consequence of being outside of your comfort zone. With patience and perseverance, you overcome it, I guess. The negative side is that it is a never-ending cycle in this career (laughs). I would say that to someone, and also to take things less seriously.
You need to breathe, take it a step at a time, prioritize, think of the big picture, and enjoy it while at it. Enjoy the learning, the studying of the patients, etc. It is worth it.