

The impact of the treatment planning IGRT lead radiographer on the radiotherapy service

Introduction

The treatment planning IGRT lead radiographer performs an advanced practitioner role using knowledge and skills informed by past clinical experience in treatment delivery and treatment planning. This role involves working across the traditional boundaries of the IGRT specialist treatment radiographer, the dosimetrist and the physicist. The treatment planning IGRT lead radiographer assists the development of the IGRT service and has a particular focus on the development of the adaptive radiotherapy service.

The role of the treatment planning IGRT lead

As outlined by Benner (1984), the treatment planning IGRT lead, as an expert, possesses an in depth knowledge base which is informed by past clinical situations. In addition, as recommended by NRG (2012), the treatment planning IGRT lead has performed MSc modules in treatment planning, IGRT and expert practice to develop a deep understanding of their area of expertise. Experience in the author's department has shown that the treatment planning IGRT lead radiographer is best placed to analyse on-treatment changes, to investigate the impact on the dosimetry and to decide if the changes necessitate a re-plan. The treatment planning IGRT lead draws on their knowledge of the geometric errors which can occur on treatment, their image analysis and treatment planning skills and their knowledge of radiation dosimetry and treatment planning techniques to make an informed decision on the most appropriate course of action.

The treatment planning IGRT lead uses knowledge of the treatment plan to provide imaging guidance

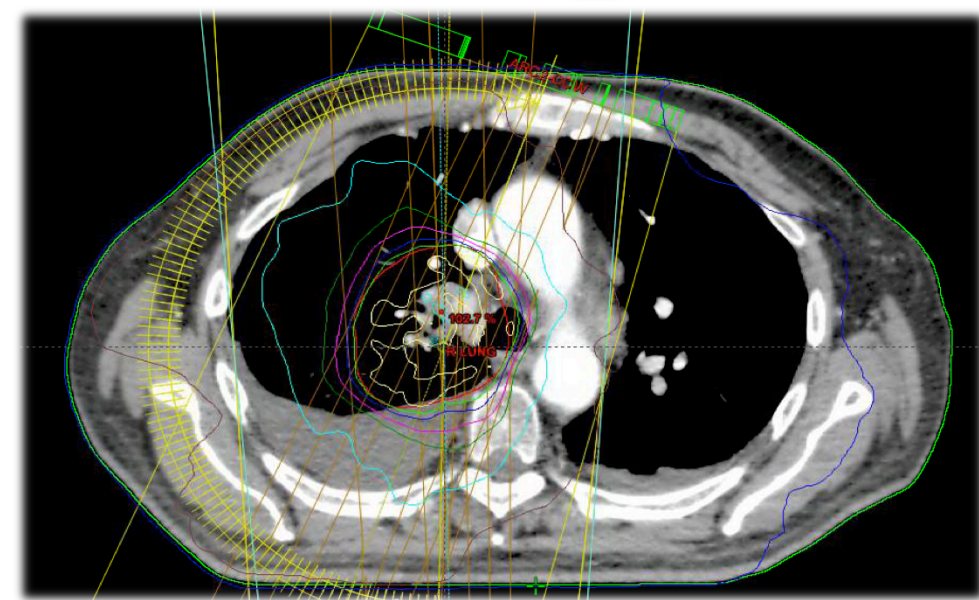


Figure 1: Treatment plan for a lung patient, lung collapsed at time of planning CT scan

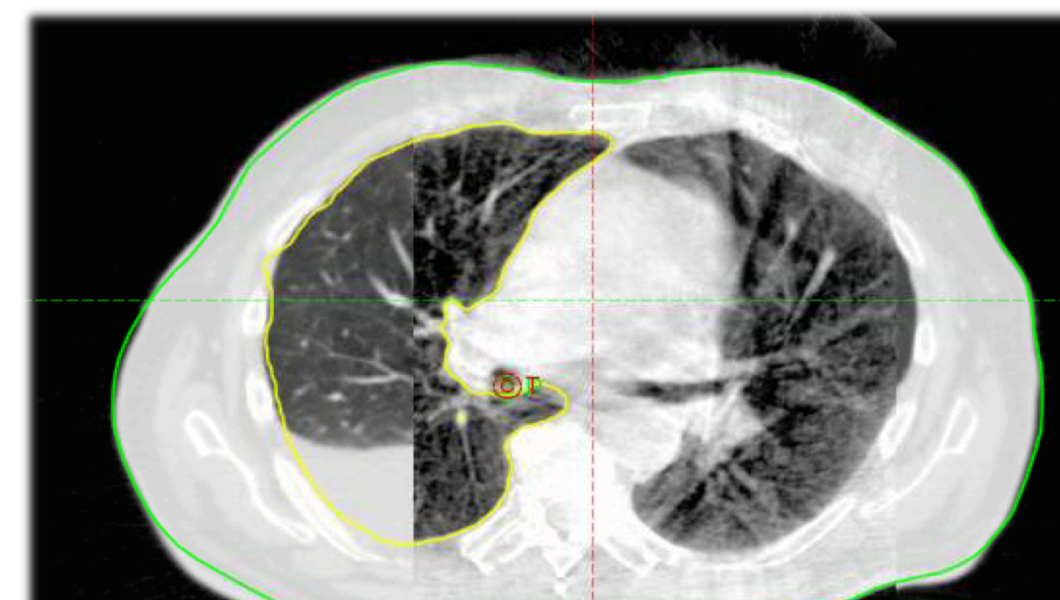


Figure 2: CBCT showing re-inflation of the lung, referred to the treatment planning IGRT lead to assess

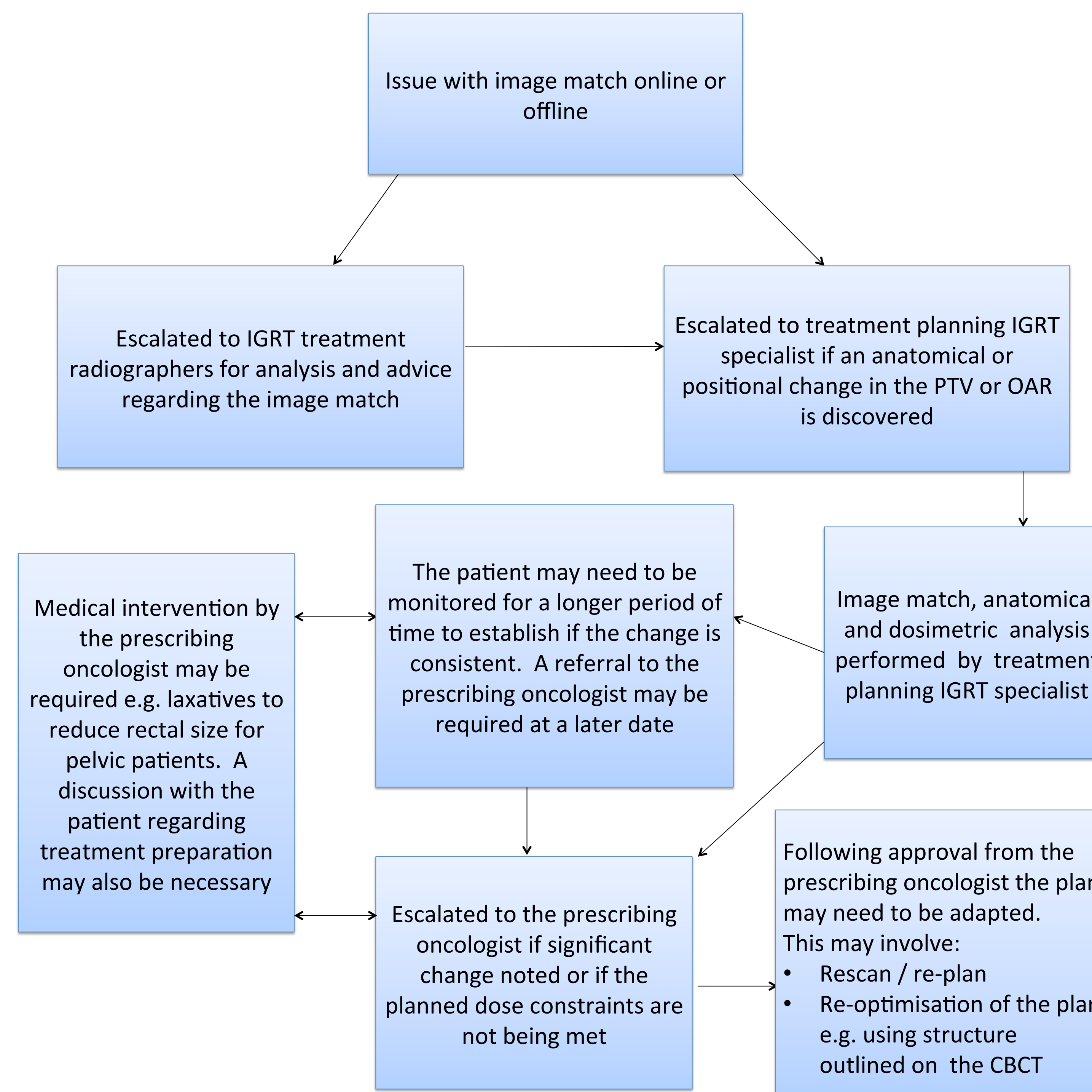
The treatment planning IGRT lead uses image analysis and treatment planning knowledge to determine the impact of on treatment changes on the dosimetry adapting the radiotherapy plan when appropriate

The treatment planning IGRT lead radiographer role involves:

- Analysing on-treatment changes using treatment verification images and assessing the impact of the changes on the plan dosimetry.
- Developing and managing the imaging training for dosimetry staff.
- Developing protocols and work instructions for imaging related treatment planning procedures.
- Providing imaging training for radiographers in conjunction with IGRT lead treatment radiographers.
- Auditing the on-treatment imaging information to ensure that PTV margins are accurately informed for all treatment sites.
- Independently auditing image review decision making by taking random samples of imaging data and verifying the decisions made, as recommended by the NRG (2012).
- Providing individualised image guidance for complex treatment plans to aid decision making on treatment.
- Acting as a liaison between treatment delivery and treatment planning to assist with image matching for complex image matching issues which require in-depth knowledge of the treatment plan and image matching procedures.
- Auditing the number of re-plans performed.

Management of imaging issues by the treatment planning IGRT lead radiographer

Issues with online and offline image matches are escalated to the treatment planning IGRT specialist radiographer using our appointment scheduling system. An appointment is added to the treatment planning list by the radiographers to raise concerns relating to a change in a volume. The impact of the change on the plan dosimetry can be determined and/or additional image guidance can be provided for online and offline image matching. When the dosimetric impact has been determined a decision on the most appropriate remedial action is required. Advice on the most appropriate course of action will be discussed with the radiation oncologist. Re-planning or re-optimising the patient's treatment plan may be necessary and the treatment planning IGRT lead radiographer coordinates the safe implementation of the re-plan.



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- This role is instrumental in the development of 4a and 4b adaptive image guided radiotherapy as discussed and recommended by NRG (2012).
- The treatment planning IGRT lead radiographer enhances the IGRT service by independently auditing image matches and decision making and by providing recommendations for IGRT protocol improvement.
- The role of the treatment planning IGRT lead radiographer helps to ensure that the imaging dose delivered to patients is justified by utilising the information provided to ensure that treatments are delivered as planned and the service is continually improved.
- The re-plan audit performed in the author's department has shown that the number of re-plans has reduced in the last year possibly due to improved communication, training and intervention by the treatment planning IGRT lead.

Case Study – An investigation by the treatment planning IGRT specialist into on-treatment changes for a prostate cancer patient

This patient was referred to the treatment planning IGRT specialist by the radiographers because there was more bowel than planned in the PTV on treatment. On analysis of the daily CBCT it was established that this patient's bladder (yellow contour) was consistently smaller than planned, allowing more small bowel (pink contour) than planned to move into the PTV (blue contour). This can be clearly seen in figure 3 and figure 4.

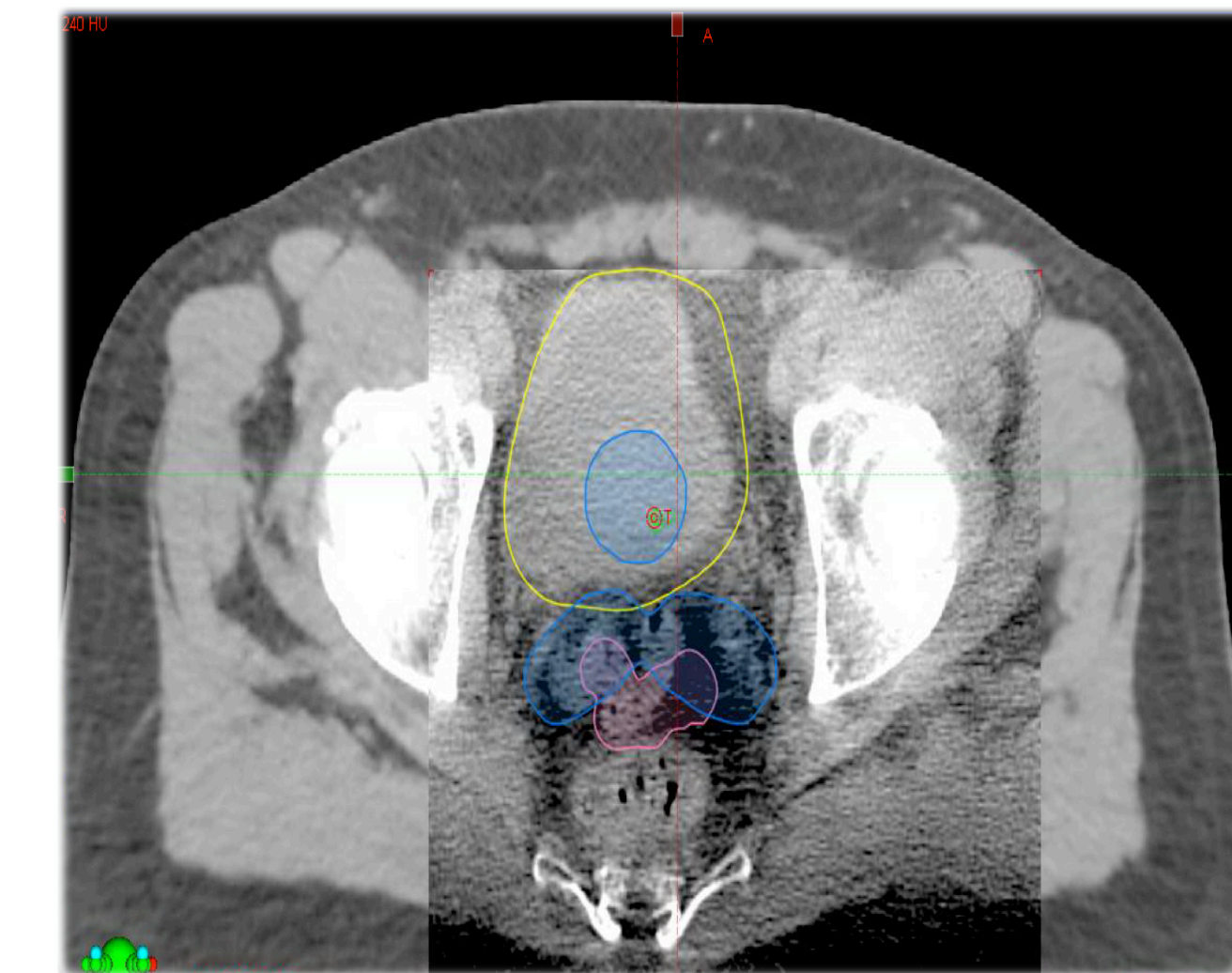


Figure 3: More bowel than planned in the PTV (blue), planned bowel outlined shown in pink

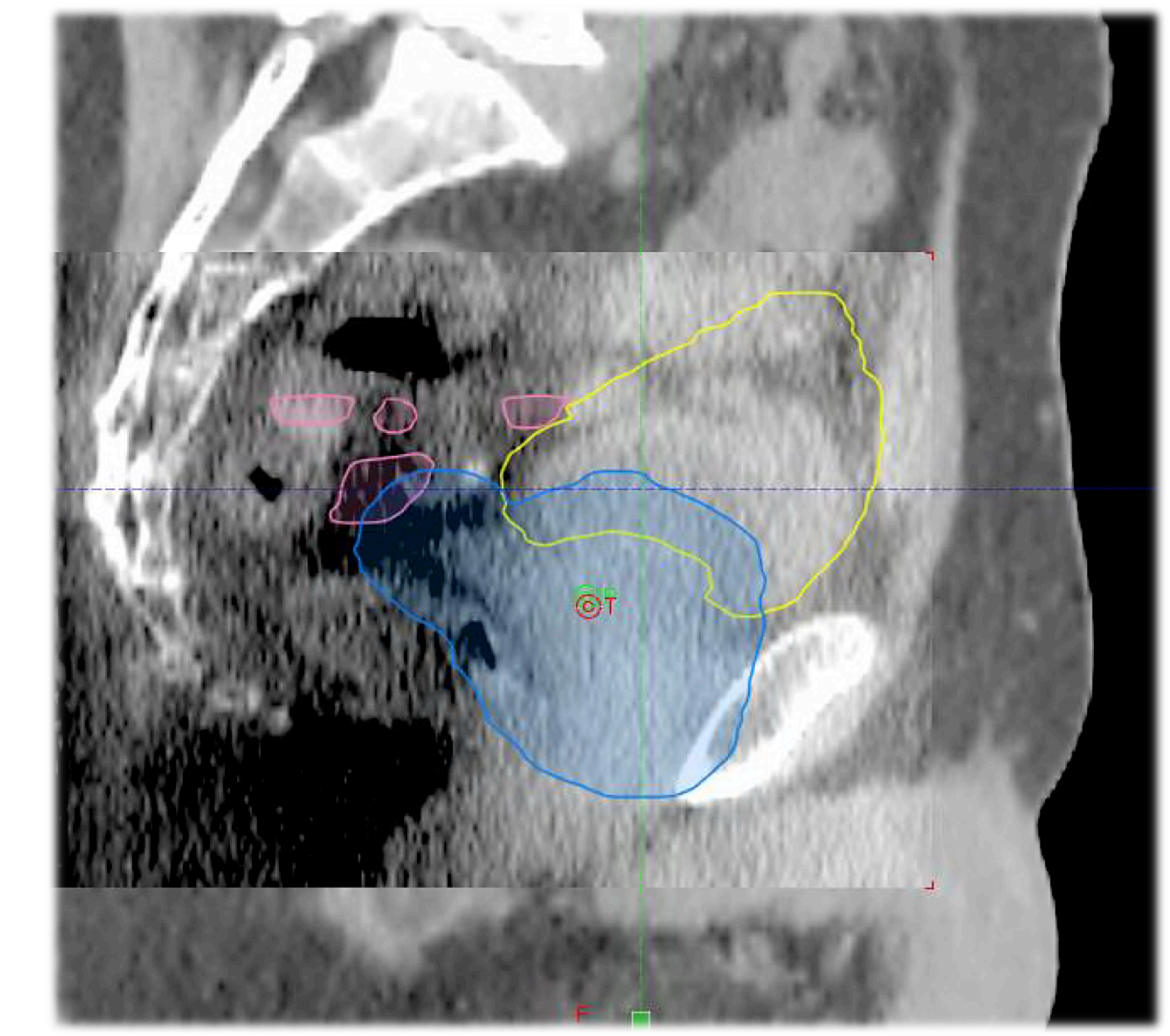
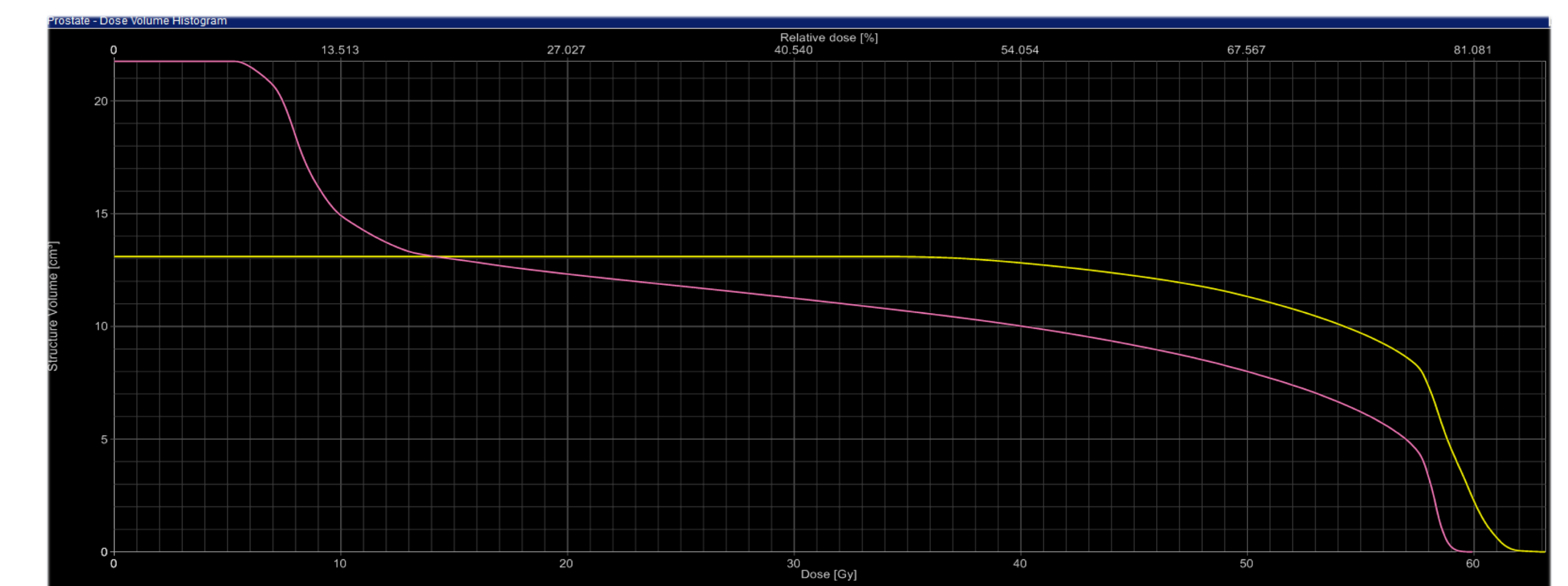


Figure 4: shows that the bladder smaller than planned allowing the bowel to fall inferiorly into the PTV

The treatment planning IGRT lead outlined the small bowel and the bladder on a representative CBCT. Following analysis of all treatment verification CBCTs an estimate of the actual dose delivered to the bowel and bladder on treatment could then be determined. The DVH below shows that the planned bowel dose in pink and an estimate of the actual bowel dose delivered to the bowel in yellow. This on-treatment bowel structure failed the V60Gy<0.5cc constraint used in the author's department. V60Gy= 2.24cc. The bladder was also outlined on the CBCT. This structure still achieved the bladder constraints.



The treatment planning IGRT specialist decided that the most appropriate action for this patient was to perform a rescan and re-plan with a more achievable bladder size, minimising the stress for the patient caused by bladder filling. The aim of this was to allow some bowel to fall into the PTV for the re-plan. The bowel PRV structure was then optimised to minimise the dose in this region of the PTV. The coverage of the PTV was not compromised to achieve this. However, the dose to the bowel PRV was reduced to within tolerance for the remaining treatments. The work of treatment planning IGRT specialist allowed the re-plan to be safely implemented for this patient, reducing the dose to the bowel and possibly reducing the resulting side effects for this patient.

References

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