excluded as they did not meet the inclusion criteria for abdominal radiotherapy. After identifying the eligible studies, a backward and forward citation search was conducted to identify any additional relevant studies.

**Results:**

Results: The database search results can be seen in Figure 1. A total of 36 studies met the inclusion criteria and were analysed to provide key findings. The eligible studies were then categorised based on the method of data acquisition. The studies were grouped into the following categories: 23 articles were identified in the category of 4D MRI reconstructed from 3D MRI data acquisition, and 13 articles were identified in the category of 4D MRI reconstructed from multi-slice 2D MRI data acquisition.

**Conclusion:**

Conclusion: Key findings from this review are: (1) 4D MRI has the potential to improve abdominal radiotherapy treatment planning for patients by providing more accurate tumour definition and motion assessment compared to 4D CT. (2) 4D MRI reconstructed from 3D MRI acquisition is feasible, has an appropriate spatial resolution, and shows promise as an approach for motion management in abdominal radiotherapy planning. (3) The large slice thickness currently achieved on 4D MRI reconstructed from multi-slice 2D acquisition is unsuitable for clinical purposes. (4) The current barriers to the clinical implementation of 4D MRI in radiotherapy are the limited availability of validated commercial solutions and the lack of larger patient cohort studies that directly compare it to 4D CT. These comparisons are essential to highlight the potential clinical benefits of 4D MRI, particularly concerning target volume delineation and radiotherapy plan optimisation.

**Keywords:** 4D MRI, motion management, abdomen

**References:**

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Poster Discussion

**Delineation variability for rectal boost RT: the role of RTTs in CBCT-guided online-adaptive RT**

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**Purpose/Objective:**

Since the total neo-adjuvant treatment trials and the watch-and-wait era for locally advanced rectal cancer, a radiotherapy (RT) boost to the primary tumour can be considered during the long-course radio-chemotherapy [1, 2]. Cone-beam computed tomography (CBCT)-guided online-adaptive RT (ART) can be an interesting strategy to allow safely this dose escalation. In the meantime, CBCT-ART workflows are increasingly developed, involving sometimes radiation therapists (RTTs) on the front line at each step of the procedure [3]. Among these steps, the daily delineation of target volumes on CBCT is crucial because of its significant dosimetric impact [4]. The objective of this study was to quantify and compare the interprofessional rectal boost delineation variability with a special focus on the RTT group.

**Material/Methods:**

Four expert radiation oncologists (RO) in pelvic RT, 7 non-expert ROs, and 4 RTTs delineated the rectal boost target volume (GTVboost) on 10 CBCTs from 5 patients irradiated for rectal cancer. The GTVboost volume was defined as the circumferential rectal wall at the level involved by the tumour. To guide their delineation on the CBCTs, operators could use the planning-CT with the primary tumour volume delineated by an expert and a T2-weighted planning magnetic resonance imaging with transversal and sagittal reconstructions. In addition, we extracted all the daily automatic GTVboost contours proposed by the ETHOS® (Varian Medical Systems, Palo Alto, Calif., USA), a linear accelerator dedicated to online-ART, during virtual online sessions performed in an emulator environment. ETHOS® automatically generates a GTVboost of the day using a structure-guided deformable image registration of the planning-CT based on the daily rectum anatomy.

The delineation variability was computed in the six directions between each professional group (experts, non-experts, and RTTs) by comparing the individual volumes to the group's generated average GTVboost volume. For each CBCT slice, we reported the distance between the operator's and the average volumes as the measure of the delineation error (Figure 1).

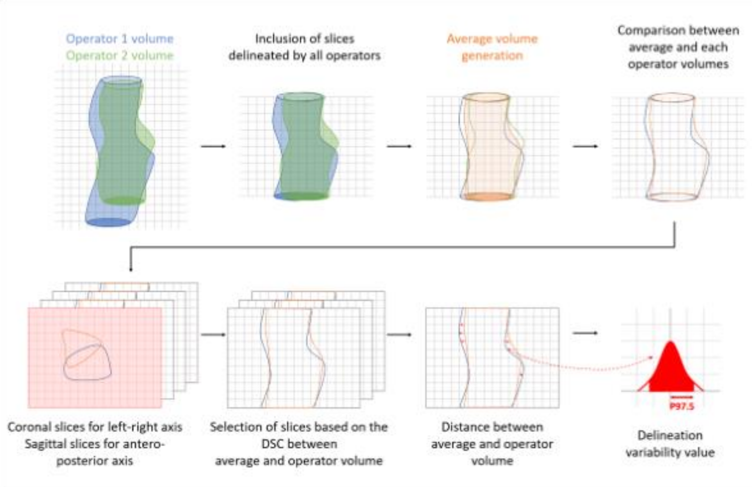


**Figure 1:** Delineation variability assessment methodology in left-right and antero-posterior directions. For a better visualization, we present here the volumes of 2 operators whereas the analysis was made on the volumes of the 15 operators.
DSC: Dice similarity coefficient.

This was calculated for all operators and CBCTs. The professional group for which the mean distance from the average volume was the lowest was chosen as the reference group (two-sided Student's t-test).

Afterwards, we computed the deviation between the remaining operator's and ETHOS®' volumes with the reference average volume. We compared the mean of these deviation values between groups (two-sided Student's t-test).

**Results:**

The interprofessional delineation error values are reported in Table 1.

| **Direction** | **Expert ROs** | **RTTs** | **Non-expert ROs** |
|---|---|---|---|
| **Left** | 1.28 +/- 1.17 | 4.56 +/- 8.94 | 1.35 +/-1.64 |
| **Right** | 1.09 +/- 1.01 | 2.22 +/- 1.58 | 1.17 +/- 0.92 |
| **Anterior** | 1.26 +/- 1.26 | 2.85 +/- 2.81 | 1.76 +/-1 .71 |
| **Posterior** | 1.64 +/- 1.63 | 3.06 +/- 2.30 | 2.65 +/- 2.60 |
| **Superior** | 3.23 +/- 2.82 | 4.28 +/- 2.78 | 3.67 +/- 2.90 |
| **Inferior** | 2.93 +/- 2.30 | 4.78 +/- 4.73 | 4.42 +/- 4.83 |

**Table 1:** Interprofessional delineation variability values in all directions.

Each value is expressed in millimetres and is the mean of delineation errors from all volumes delineated by each operator of the professional group +/- standard deviation.

Globally, the delineation variability of the expert group was the lowest (= reference group). It was significantly lower in the right ($p < 0.001$), anterior ($p = 0.002$), and posterior ($p = 0.006$) directions compared to RTTs, and in the posterior direction ($p = 0.041$) compared to non-experts.

When using the average volume of the experts as the reference volume, delineation errors of the RTT group were 3.3 +/- 6.3 mm in the left, 1.6 +/- 1.4 mm in the right, 2.1 +/- 2.2 mm in the anterior, 2.8 +/- 3.0 mm in the posterior, 4.9 +/- 4.0 mm in the superior, and 6.0 +/- 6.6 mm in the inferior direction. These values were not significantly different than those of the non-experts and the ETHOS® ($p>0.05$, Figure 2).

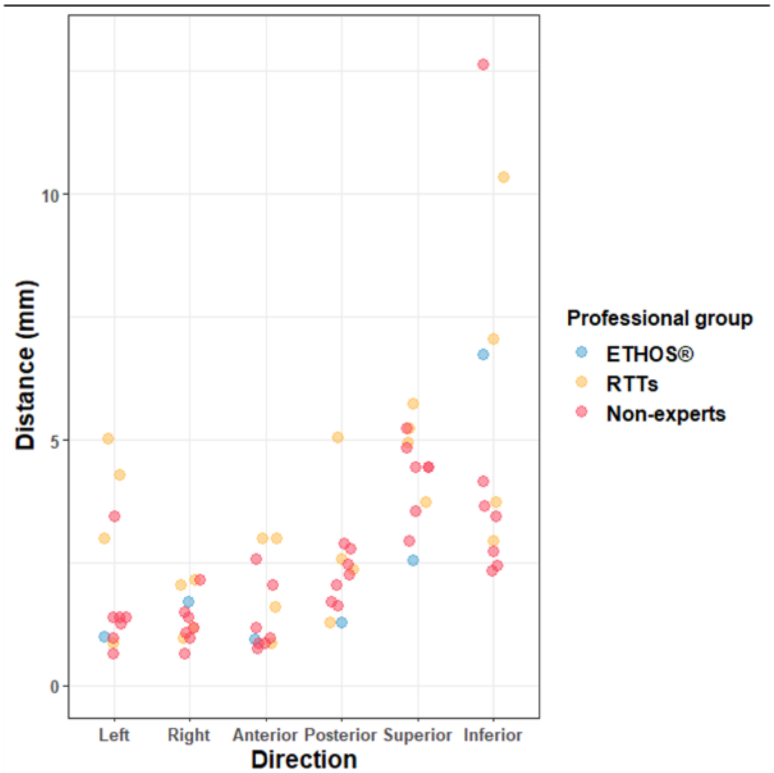


**Figure 2:** Delineation variability of ETHOS®, RTTs, and Non-expert ROs volumes compared to the Experts' average volume.

**Conclusion:**

In this study, we evaluated the magnitude of the interprofessional delineation errors of the rectal boost volume on CBCTs between expert, non-expert ROs, RTTs, and the ETHOS®. Delineation errors in the cranio-caudal direction were higher than in other directions. The ROs with an expertise in pelvic RT demonstrated the lowest delineation variability. Compared to the experts' average volume, the delineation error of RTTs and non-experts ROs was similar.

These results allow us to continue with the RTTs in the front line during the delineation step in ART workflows, just as well as non-experts ROs, considering a PTV margin encompassing this delineation error. Also, volumes automatically generated by the ETHOS® could be helpful since they were comparable to those of RTTs and non-experts.

**Keywords:** CBCT-guided RT, Rectum RT, Delineation variability

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