

Early experience with MR-guided radiotherapy

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Introduction

MR guided radiotherapy (MRgRT) offers the advantage of superior soft tissue definition. Furthermore, online adaptive radiotherapy (ART) has the potential to improve the therapeutic ratio of RT by enhanced sparing of normal organs and facilitate safe dose escalation in disease sites where high-dose RT has been limited. A clinical service allowing access for NHS patients to the state-of-the-art MRgRT opened in March 2021. We report our early experience and future plan.

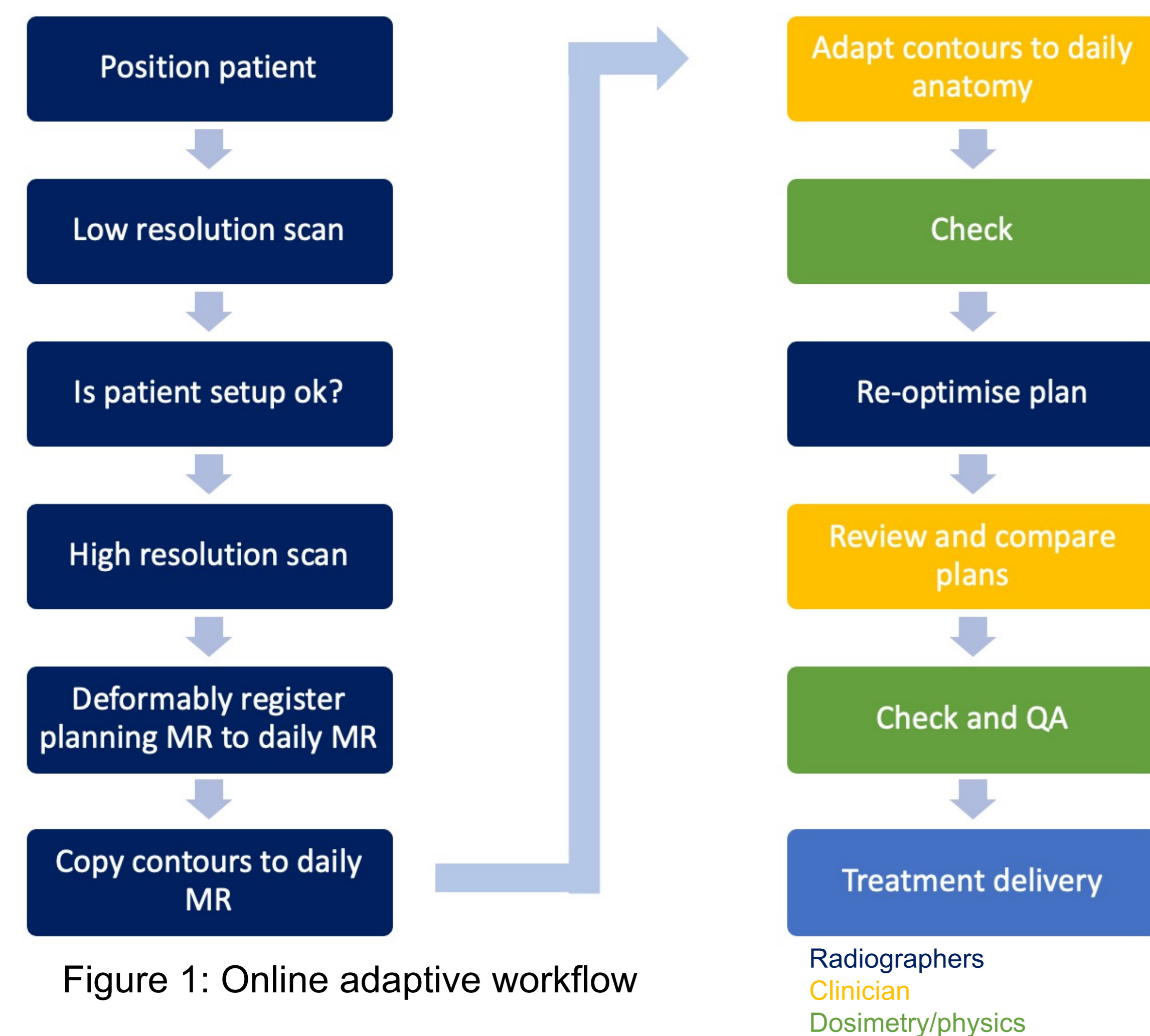


Figure 1: Online adaptive workflow

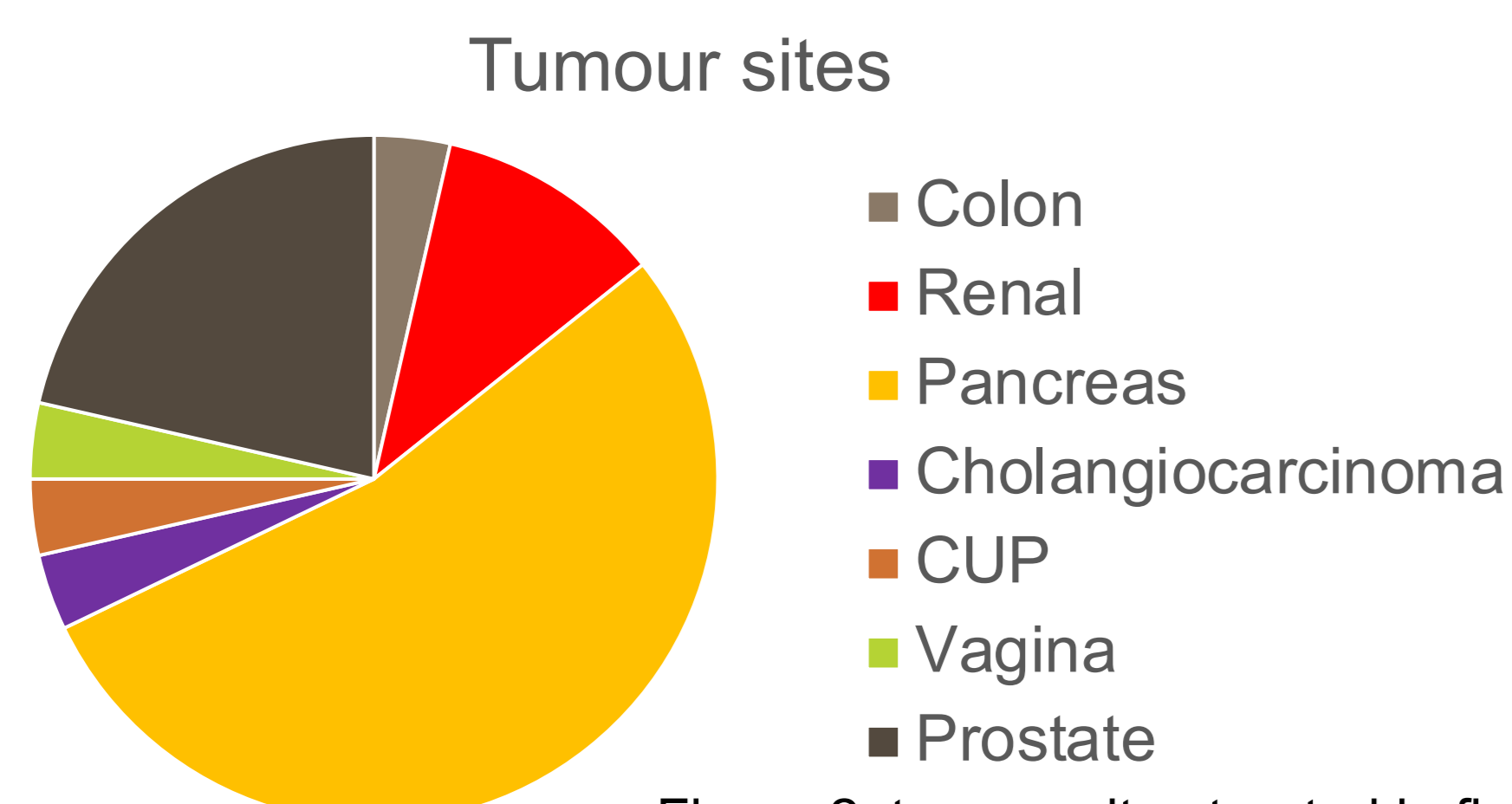


Figure 2: tumour sites treated in first 6 months

Methods

Retrospective audit of the clinical workflow and patient outcome treated on the MR-linac under the Oxford University, Oxford University Hospitals NHS Foundation Trust and GenesisCare collaboration.

Results

27 patients (130 fractions) have been treated using 0.35T MRgRT in the first 6 months of the service opening. All had hypofractionated radiotherapy (30-40Gy in 3-5 fractions). ART and real-time tracking was used in all fractions. 78% (21/27) were complex breath-hold treatments. The most common tumour types were pancreas (44%), prostate (22%), cholangiocarcinoma (11%) and renal (11%) (see Figure 2).

There were 8 rescheduling events due to unplanned machine breakdowns affecting 7 patients – 1 cancelled simulation, 7 fractions re-scheduled (5%).

In the first 4 months, median vault times for complex breath-hold and pelvic treatments were 82 minutes (range:60-125 minutes) and 76 minutes (58-141 minutes) respectively. Vault time was more than 90 minutes in 10% of fractions.

Overall, grade 3+ toxicity rate within 3 months of RT was 11%.

Plan type	Positioning	Total contour	Contour QA	Plan Optimisation	Plan QA	Beam On Time	Total
Complex abdo	21	24	3	6	3	19	82
pelvis	20	22	4	8	4	16	76

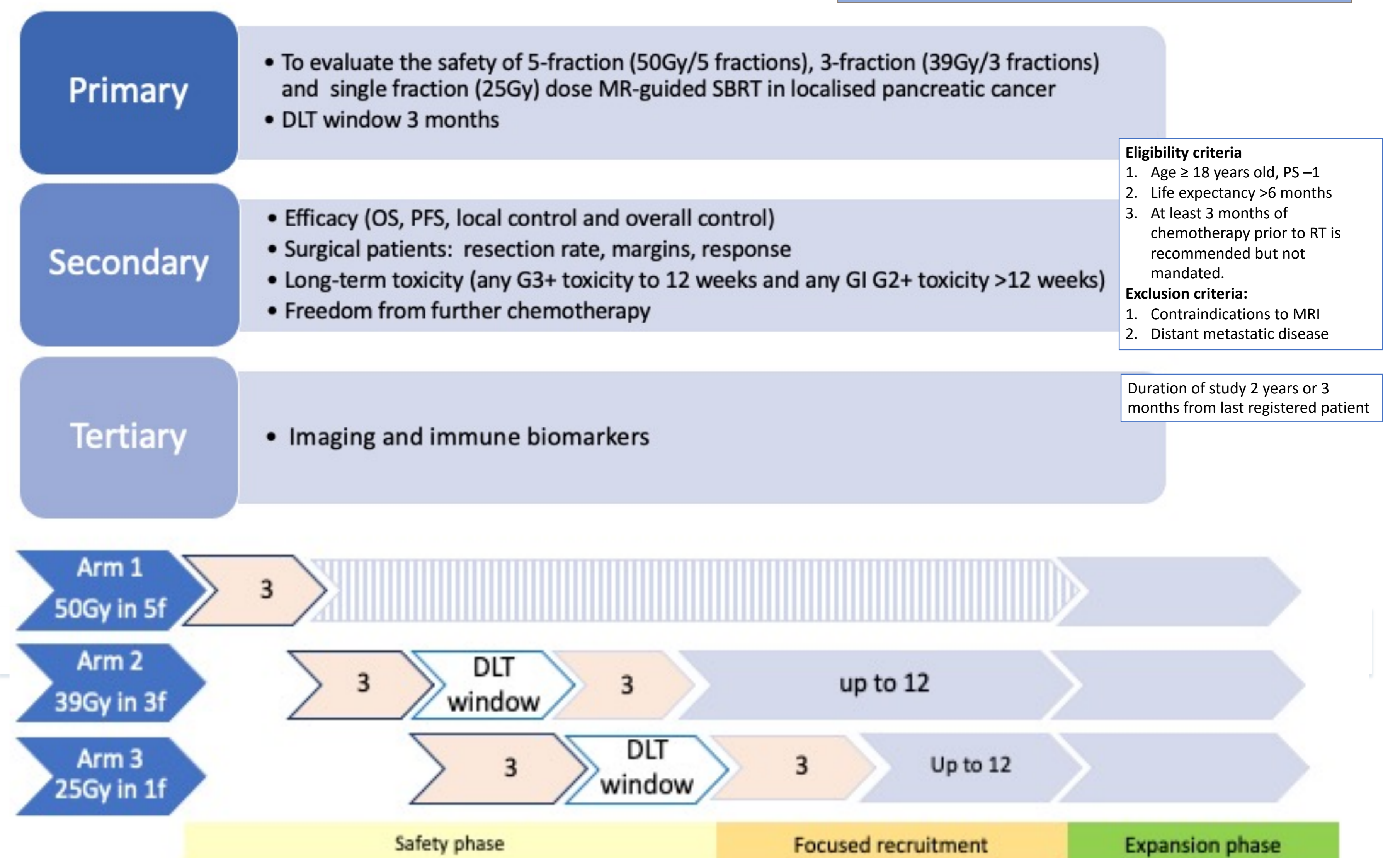
Table 1: Median time (minutes) taken to complete online adaptive workflow

Discussion

- MRgRT with daily online adaptation has been successfully implemented within a clinically acceptable timeframe. It provides unique advantages in the treatment of multiple malignancies.
- On-going data collection to collect longer term outcome data
- Our plan is to open a phase I hypofractionation trial – Emerald Pancreas in localised pancreatic cancer in 2022.

Phase I - Emerald-Pancreas study

Patient Population
Localised pancreatic cancer: LAPC, inoperable on medical grounds, patient declines surgery, locally recurrent pancreatic cancer



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