

Title: Motion mitigation for abdominal cancers

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Background: For this work tumours in the abdominal region will include the lower oesophagus, liver, and pancreas. Currently, 50% of people diagnosed with cancer in England will survive their disease for 10 years or more (1). However, in oesophageal cancer only 12% of people will survive their disease for 10 years (2), in liver cancer, only 13% of people will survive their disease for 5 years (3) and in pancreatic cancer, only 5% of people will survive their disease for 10 years (4).

Radiotherapy is a radical treatment option as part of the multi-disciplinary management of these cancers (5–7). However, considering the anatomical location of these tumours the optimal delivery and personalisation of radiotherapy remain a challenge. There is a high degree of variability in this anatomical region including continuous changes in position and shape due to:

Respiratory motion (8)

Physiological motion e.g., cardiac motion (9)

Physiological deformation e.g., intestinal peristalsis (10)

And deformation due to motion management interventions, e.g. utilising a compression device (11).

Additionally, the visibility of the target and organs at risk (OARs) can be limited, especially on cone-beam computed tomography's (CBCTs). The SABR consortium guidelines recommend a pre-treatment MRI scan is undertaken in the treatment position (12); however, there is sparse evidence of its utilisation.

Finally, cancers in this region are defined as being cancers with a substantial unmet need (13) thus, data is more limited and patient factors/preferences and subsequently radiotherapy guidance is not as defined as more common tumours.

From a Therapeutic Radiographer perspective, there is a unique opportunity to review the common challenges in terms of visibility, motion and deformation and thus allowing for the identification of differences to be considered e.g., if the organ is a target or an OAR or patient-specific factors.

However, in reviewing this anatomical region as a whole and not in isolation, all the lessons to be learnt can be collated and better personalisation may be ultimately possible for all. This may also be the most pragmatic approach in terms of resources (financial, staffing, training etc.) as delivering radiotherapy to this region often requires advanced imaging and motion management.

Aim: To personalise the pre-treatment, planning, and treatment delivery of radiotherapy to tumours in the abdominal region

Objectives:

1. Complete systematic review
2. Complete retrospective review of abdominal patients treated with and without compression
3. Review and update pre-treatment process:

Undertake 4DCT and introduce planning MRI (4D/cine and breath-hold) scan in the treatment position, i.e., with motion management

4. Review and assess appropriateness treatment:

Optimise CBCTs

Validate utilisation of SGRT in abdominal patients

Introduce additional MRI scan(s) throughout the course of patient's radiotherapy

Introduce SGRT

Combine data from planning MRI, 4CDT, CBCT and SGRT utilising MRI for better visualisation and CBCT for better set-up positioning

5. Assess patient factors for better personalisation e.g., patient preference, tolerability etc.