



Topic Exploration Report

This report summarises the results of a brief exploration to establish the quantity and quality of existing high-level evidence on the procedure of interest.

Topic:	Volumetric Modulated Arc Radiotherapy (VMAT) for people with lung cancer
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Purpose

On behalf of Health Technology Wales, Cedar researchers conducted a rapid review of evidence on the implementation and use of volumetric modulated arc radiotherapy for people with lung cancer. This exploratory summary will inform the prioritisation of radiotherapy procedures to be introduced at Velindre Cancer Centre (VCC), alongside expert opinion and other considerations. It could also be used to clarify the scope of an evidence appraisal. Some of the background information and resource impact considerations was submitted by clinical teams at VCC.

Background

SCLC - small cell lung cancer; NSCLC - non-small cell lung cancer; VMAT - Volumetric Modulated Arc Radiotherapy; IMRT - Intensity Modulated Radiotherapy

The current RT treatment is 3D CRT (Conformal Radiotherapy) in which multileaf collimators (MLCs) on the linac output shape the beam to match that of the tumour (planned treatment volume, PTV). This is done for several orientations of the beam, so that the shape is matched in 3 dimensions. Each beam is delivered whilst the gantry is static, and then the linac is moved to a new position.

In IMRT, the beam intensity is altered (modulated) in addition to the MLC movement, to deliver different doses across the PTV. In VMAT, the MLC and beam intensity are altered dynamically as the linac gantry moves around the patient, delivering a beam whose shape and intensity is continuously altered. Treatment may be completed in a single arc, or in several.

IMRT and VMAT may have additional planning and quality assurance burdens over 3D CRT. The planning techniques differ between 3D CRT and IMRT/VMAT (forward versus inverse planning).

However, this may reduce as experience with the technology increases, and is probably lower for each additional patient.

UK surveys indicate that use of IMRT and VMAT are increasing. The percentage of radically irradiated patients treated with VMAT went from 0.6% in 2010 to 6.0% in 2012 (Mayles et al. 2012), and the number of centres using VMAT increased from 34% in 2012 to 74% in 2014 (Abolaban et al. 2016).

Proposed PICO

Population	Non-small cell and small cell lung cancer
Intervention	Volumetric modulated arc radiotherapy
Comparator	3D Conformal Radiotherapy
Outcome measures	Dose to organs at risk (OAR), delivery time, planning time, proportion of treatable cancers

Summary of findings

The Medline search returned 195 references, which were not further sifted although most of these do not appear to be relevant. At least 50 refer to stereotactic radiotherapy (SBRT). One systematic review was identified, on the use of radical RT in malignant pleural mesothelioma (Ashton et al. 2017), and one RCT comparing IMRT with VMAT in NSCLC. No further assessment of the evidence was possible given the time constraints.

Economic impact

No economic analyses were identified, either as separate publications or within the abstracts of the retrieved references. We understand that no additional equipment or software is required. Local clinical teams have indicated training impact of 150 hrs for physics staff and the possibility of planning both 3D CRT and VMAT for some patients. An increase in quality assurance times are also likely, at least initially, which are not included in this proposal. The need to develop local selection and treatment criteria is noted. A reduction in delivery time is claimed which may increase patient throughput, but this is not identified as an economic impact. This change may increase the number of patients for RT treatment if it means more cancers become treatable. No indication of the number of patients is provided. Physics: complete class solutions/training → 150 hrs x £23.41.

Prioritisation criteria

Clinical impact (Potential for the technology to have an impact on patient-related health outcomes):

Unknown

Budget impact (Impact of the technology on health care spending):

Potential for increased patient throughput in delivery, but maybe longer planning. Small increases in training costs and planning time.

Population impact (The size of the population that would be affected by the technology):

In 2015 7,436 people were diagnosed with lung cancer in Wales¹. No estimate of the number of patients for this treatment is given.

Equity (The technology has the potential to introduce, increase, or decrease equity in health status):

No equity issues identified.

Questions for researcher

Based on the sources you have identified, is your impression that the evidence is likely to:

- favour implementation of the procedure?
- favour standard care?
- be inconclusive?

Unknown. Movement error is likely to be a significant factor in radiotherapy for lung cancer. Due to the large number of apparently irrelevant references a search focussed on particular outcomes may be useful. (These need to be identified by the proposer.)

Questions for topic proposer

- The patient population could be better defined. E.g. inclusion of metastatic disease, use of other therapies.
- Why are IMRT examples included in the proposal? Are chemotherapy and brachytherapy relevant?
- How does this proposal relate to SBRT? Is this in or out of scope?

References

Abolaban F, Zaman S, Cashmore J, et al. (2016). Changes in patterns of intensity-modulated radiotherapy verification and quality assurance in the UK. *Clinical Oncology*. 28(8):e28-34.

Ashton M, O'Rourke N, Currie S, et al. (2017). The role of radical radiotherapy in the management of malignant pleural mesothelioma: a systematic review. *Radiotherapy and Oncology*. 125(1):1-2.

Mayles WP, Cooper T, Mackay R, et al. (2012). Progress with intensity-modulated radiotherapy implementation in the UK. *Clinical Oncology*. 24(8):543-4.

¹ <http://www.wcisuwales.nhs.uk/dashboard-data>

Appendix - Brief literature search results

Resource	Results
UK guidelines and guidance	
NICE	NICE Clinical Guideline 121 (2011) "Lung cancer: diagnosis and management" does not mention any specific form of RT.
Healthcare Improvement Scotland	N = 0
Guidelines International Network	N = 0
SIGN	SIGN137 (2014) "Management of lung cancer" - 7.1.4 One systematic review found insufficient evidence for the efficacy of IMRT compared to conventional CRT. (No mention of VMAT.)
Secondary literature and economic evaluations	
e.g. Cochrane library ; Medline <i>systematic reviews, meta-analyses, economic evaluations</i>	No Cochrane reviews of VMAT or IMRT in lung cancer. No comparisons of VMAT with 3D CRT in Cochrane Trials database, but 3 comparisons of IMRT and VMAT: Rosas et al (2018), Kim et al (2014) and Zhang et al (2015).
Primary studies	
Medline <i>RCTs; observational studies</i>	Medline search returned 195 references.
Cochrane <i>trials database</i>	N = 32
Ongoing secondary research	
Clinicaltrials.gov	N = 10, although none look relevant
Date of search:	29 th November 2018
Concepts searched:	("Volumetric modulated arc radiotherapy" OR "VMAT") AND "lung cancer", limited to 'human' and 'english language' in Medline