Halcyon Radiotherapy System for Patients Receiving Cancer Treatment: Clinical Effectiveness and Cost-Effectiveness
Research Questions

1. What is the clinical effectiveness of the Halcyon radiotherapy system for patients receiving cancer treatment?

2. What is the cost-effectiveness of the Halcyon radiotherapy system for patients receiving cancer treatment?

Key Findings

Three non-randomized studies were identified regarding the clinical effectiveness of the Halcyon radiotherapy system for patients receiving cancer treatment. No economic evaluations were identified.

Methods

A limited literature search was conducted on key resources including PubMed, the Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. No date or language limits were applied. Internet links were provided, where available.

Selection Criteria

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

<table>
<thead>
<tr>
<th>Population</th>
<th>Patients with a diagnosis of cancer who require radiation therapy treatment</th>
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<tbody>
<tr>
<td>Intervention</td>
<td>Halcyon radiotherapy system</td>
</tr>
<tr>
<td>Comparator</td>
<td>Gantry-based linear accelerator</td>
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<td>Outcomes</td>
<td>Q1: Clinical effectiveness (e.g., dosimetric comparison, plan quality, planning target volume coverage, organ-at-risk sparing, treatment efficiency, time to treatment) Q2: Cost-effectiveness</td>
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<tr>
<td>Study Designs</td>
<td>Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations</td>
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</table>
Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, and economic evaluations.

Three non-randomized studies were identified regarding the clinical effectiveness of the Halcyon radiotherapy system for patients receiving cancer treatment. No health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, or economic evaluations were identified.

Additional references of potential interest are provided in the appendix.

Overall Summary of Findings

Three non-randomized studies\(^1\)\(^-\)\(^3\) were identified regarding the clinical effectiveness of the Halcyon radiotherapy system for patients receiving cancer treatment. Detailed study characteristics and conclusions are provided in Table 2.

<table>
<thead>
<tr>
<th>Fist Author, Year</th>
<th>Study Characteristics</th>
<th>Intervention and Comparators</th>
<th>Outcomes</th>
<th>Conclusions</th>
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</table>
| Cozzi, 2018\(^1\) | In silico planning study N = 90  
- n = 30 (advanced HNC)  
- n = 30 (breast cancer)  
- n = 30 (high-risk prostate) | Halcyon linear accelerator vs TrueBeam linear accelerator | Generation of plans of high clinical quality | “….the new delivery system can generate treatment plans for volumetric modulated arc therapy with the same dosimetric quality of what is achievable with other systems routinely used in the clinics without significantly changing the current practice."\(^1\) |
| Li, 2018\(^2\) | Anthropomorphic thorax phantom imaging study | Halcyon linear accelerator (all imaging techniques; MV-CBCT and MV-MV, both with high-quality and low-dose modes) vs Eclipse treatment planning system | Measure and compare the mega-voltage imaging dose from the Halcyon with measured imaging doses with the dose calculated by Eclipse treatment planning system | • “The in-target doses due to MV imaging using the Halcyon ranged from 0.59 to 9.75 cGy, depending on the choice of imaging technique. Extra-target doses from MV-MV technique ranged from 0 to 2.54 cGy.”\(^2\)  
• “The MV imaging dose was accurately calculated by Eclipse, with maximum differences less than 0.5% of a typical treatment dose (assuming a 60 Gy prescription).”\(^2\)  
• “Therefore, the cumulative...” |
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<tr>
<td>Michiels, 2018³</td>
<td>Prospective study N=30 with HNC</td>
<td>Halcyon fast-rotating O-ring linac (using dual-arc [HA2] and triple-arc [HA3] VMAT vs dual-arc VMAT on a TrueBeam C-arm linac (TB2)</td>
<td>Plan quality Delivery time</td>
<td>“For VMAT of HNC, the fast-rotating O-ring linac at least maintains the plan quality of two arcs on a C-arm linac while reducing the image acquisition and plan delivery time.”³</td>
</tr>
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</table>

HNC = head and neck cancer; MV-CBCT = MV cone-beam computed tomography; MV-MV = orthogonal anterior-posterior/lateral pairs; VMAT = volumetric modulated arc therapy.

References Summarized

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses
No literature identified.

Randomized Controlled Trials
No literature identified.

Non-Randomized Studies

Economic Evaluations
No literature identified.
Appendix — Further Information

Non-Randomized Studies

No Comparator


Validation Studies


Additional References