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CADTH RAPID RESPONSE REPORT: SUMMARY OF ABSTRACTS

Chest Immobilization and Positioning Devices for Patients Receiving Radiotherapy Treatment: Clinical and Cost-Effectiveness and Guidelines

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Acknowledgments:

Research Questions

1. What is the clinical effectiveness of chest immobilization and positioning devices for patients receiving radiotherapy treatment?
2. What is the cost-effectiveness of chest immobilization and positioning devices for patients receiving radiotherapy treatment?
3. What are the evidence-based guidelines regarding the use of chest immobilization and positioning devices for patients receiving radiotherapy treatment?

Key Findings

Two randomized controlled trials and four non-randomized studies were identified regarding the clinical effectiveness of chest immobilization and positioning devices for patients receiving radiotherapy treatment. No economic evaluations or evidence-based guidelines 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), 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. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2013 and November 13, 2018. 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

Population	Patients with a diagnosis of cancer who require radiation therapy treatment to the chest or upper abdomen
Intervention	Chest immobilization and positioning devices (e.g., Sabella Flex, CIVCO breast and thorax positioning, Orfit AIO, Bionix RT MAX 3, in-house constructed devices)
Comparator	Q1-2: Any other chest immobilization device Q3: No comparator
Outcomes	Q1: Clinical effectiveness (e.g., accuracy of treatment, safety, quality of life [patient comfort], ease of use) Q2: Cost-effectiveness Q3: Guidelines
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines

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, economic evaluations, and evidence-based guidelines.

Two randomized controlled trials and four non-randomized studies were identified regarding the clinical effectiveness of chest immobilization and positioning devices for patients receiving radiotherapy treatment. No relevant health technology assessments, systematic reviews, economic evaluations, or evidence-based guidelines were identified.

Additional references of potential interest are provided in the appendix.

Overall Summary of Findings

Two randomized controlled trials[1,2] and four non-randomized studies[3-6] were identified regarding the clinical effectiveness of chest immobilization and positioning devices for patients receiving radiotherapy treatment.

The authors of one randomized controlled trial compared chest jigs or vacuum bags to no immobilisation and concluded that there were no benefits gained on set-up errors, local control, and overall survival with immobilisation.[1]

A second randomized controlled trial reported on three immobilisation devices (Q fix arm shuttle, BodyFIX without wrap, and BodyFIX with wrap) and the authors observed that BodyFIX without wrap was favoured for its clinical accuracy, efficiency in set up and set down time, in addition to being preferred by staff and being acceptable to patients.[2] This contrasts with a non-randomised study comparing full-length BodyFIX immobilisation to a thermoplastic S-frame whose authors observed no difference in local control; however, initial setup was more consistent with the S-frame method.[6]

The authors of a second non-randomised study concluded that adequate setup accuracy could be achieved with either the Elekta Body Frame or the Civco Body Pro-Lok if image guidance is used.[5]

A third non-randomised study reported that the Body Pro-Lok system improved setup accuracy and minimised tumour movement due to respirations compared to using simple vacuum cushion immobilisation.[4] This is in agreement with another non-randomised study that measured the accuracy of patient immobilisation using vacuum couch with low pressure foil in comparison with abdominal compression (technique not further described). The authors observed that the latter was favoured.[3]

No relevant, economic evaluations or evidence-based guidelines were identified; therefore, no summary can be provided.

References Summarized

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

No literature identified.

Randomized Controlled Trials

1. Pulvirenti T, Agustin C, Tamas N, et al. Interfraction movement and clinical outcome of immobilization for thoracic irradiation: a randomized controlled trial. *Precis Radiat Oncol.* 2018;2(1):4-10. https://onlinelibrary.wiley.com/doi/pdf/10.1002/pro6.35. Accessed 2018 Nov 22.

2. Hubie C, Shaw M, Bydder S, et al. A randomised comparison of three different immobilisation devices for thoracic and abdominal cancers. *J Med Radiat Sci.* 2017 Jun;64(2):90-96.
PubMed: PM27998039

Non-Randomized Studies

3. Dreher C, Oechsner M, Mayinger M, et al. Evaluation of the tumor movement and the reproducibility of two different immobilization setups for image-guided stereotactic body radiotherapy of liver tumors. *Radiat Oncol*. 2018 Jan 30;13(1):15.
PubMed: PM29378624

4. Hu Y, Zhou YK, Chen YX, Shi SM, Zeng ZC. Clinical benefits of new immobilization system for hypofractionated radiotherapy of intrahepatic hepatocellular carcinoma by helical tomotherapy. *Med Dosim*. 2017 Spring;42(1):37-41.
PubMed: PM28126475

5. Ueda Y, Teshima T, Cardenes H, Das IJ. Evaluation of initial setup errors of two immobilization devices for lung stereotactic body radiation therapy (SBRT). *J Appl Clin Med Phys*. 2017 Jul;18(4):62-68.
PubMed: PM28503898

6. Sio TT, Jensen AR, Miller RC, et al. Influence of patient's physiologic factors and immobilization choice with stereotactic body radiotherapy for upper lung tumors. *J Appl Clin Med Phys*. 2014 Sep 8;15(5):4931.
PubMed: PM25207580

Economic Evaluations

No literature identified.

Guidelines and Recommendations

No literature identified.

Appendix — Further Information

Non-Randomized Studies

Alternative Population – Treatment Location Undefined

7. Hirata M, Monzen H, Tamura M, et al. Impact of the lok-bar for high-precision radiotherapy with tomotherapy. *Anticancer Res*. 2018 May;38(5):2733-2738. PubMed: PM29715093

Alternate Population – Alternative Intervention Sites

8. Yamoah K, Zaorsky NG, Siglin J, et al. Spine stereotactic body radiation therapy residual setup errors and intra-fraction motion using the stereotactic X-Ray image guidance verification system. *Int J Med Phys Clin Eng Radiat Oncol*. 2014 Feb;3(1):1-8. PubMed: PM29333353

Intervention Undefined

9. Andratschke N, Alheid H, Allgauer M, et al. The SBRT database initiative of the German Society for Radiation Oncology (DEGRO): patterns of care and outcome analysis of stereotactic body radiotherapy (SBRT) for liver oligometastases in 474 patients with 623 metastases. *BMC Cancer*. 2018 Mar 13;18(1):283. PubMed: PM29534687

Alternative Intervention – Full Body Immobilization Device

10. Wang X, Zhao Z, Luo D, et al. Submillimeter alignment of more than three contiguous vertebrae in spinal SRS/SBRT with 6-degree couch. *J Appl Clin Med Phys*. 2017 Sep;18(5):225-236. PubMed: PM28786235

Alternative Outcome

11. Fontana G, Riboldi M, Gianoli C, et al. MRI quantification of pancreas motion as a function of patient setup for particle therapy -a preliminary study. *J Appl Clin Med Phys*. 2016 Sep 8;17(5):60-75. PubMed: PM27685119

12. Navarro-Martin A, Cacicedo J, Leaman O, et al. Comparative analysis of thermoplastic masks versus vacuum cushions in stereotactic body radiotherapy. *Radiat Oncol*. 2015 Aug 20;10:176. PubMed: PM26289071

Clinical Framework Study

13. Meyer T, Quirk S, D'Souza M, Spencer D, Roumeliotis M. A framework for clinical commissioning of 3D-printed patient support or immobilization devices in photon radiotherapy. *J Appl Clin Med Phys*. 2018 Sep;19(5):499-505. PubMed: PM29984551

No Comparator

14. Rieber J, Abbassi-Senger N, Adebahr S, et al. Influence of institutional experience and technological advances on outcome of stereotactic body radiation therapy for oligometastatic lung disease. *Int J Radiat Oncol Biol Phys*. 2017 Jul 1;98(3):511-520. PubMed: PM27843031

15. Sonier M, Chu W, Lalani N, Erler D, Cheung P, Korol R. Evaluation of kidney motion and target localization in abdominal SBRT patients. *J Appl Clin Med Phys*. 2016 Nov 8;17(6):429-433. PubMed: PM27929514

16. Moore K, Paterson C, Hicks J, Harrow S, McJury M. Stereotactic ablative body radiotherapy for non-small-cell lung cancer: setup reproducibility with novel arms-down immobilization. *Br J Radiol*. 2016 Dec;89(1068):20160227. PubMed: PM27706946

17. Han Z, Bondeson JC, Lewis JH, et al. Evaluation of initial setup accuracy and intrafraction motion for spine stereotactic body radiation therapy using stereotactic body frames. *Pract Radiat Oncol*. 2016 Jan-Feb;6(1):e17-24. PubMed: PM26603596

18. Park JI, Ye SJ, Kim HJ, Park JM. Dosimetric effects of immobilization devices on SABR for lung cancer using VMAT technique. *J Appl Clin Med Phys*. 2015 Jan 8;16(1):5217. PubMed: PM25679178

19. Lovelock DM, Zatcky J, Goodman K, Yamada Y. The effectiveness of a pneumatic compression belt in reducing respiratory motion of abdominal tumors in patients undergoing stereotactic body radiotherapy. *Technol Cancer Res Treat*. 2014 Jun;13(3):259-267. PubMed: PM24206202

20. Siva S, Devereux T, Kron T, et al. Vacuum immobilisation reduces tumour excursion and minimises intrafraction error in a cohort study of stereotactic ablative body radiotherapy for pulmonary metastases. *J Med Imaging Radiat Oncol*. 2014 Apr;58(2):244-252. PubMed: PM24103219

Qualitative Studies

21. Daly ME, Perks JR, Chen AM. Patterns-of-care for thoracic stereotactic body radiotherapy among practicing radiation oncologists in the United States. *J Thorac Oncol*. 2013 Feb;8(2):202-207. PubMed: PM23222368

Clinical Practice Guidelines

Methods Not Systematic

22. De Ruysscher D, Faivre-Finn C, Moeller D, et al. European Organization for Research and Treatment of Cancer (EORTC) recommendations for planning and delivery of high-dose, high precision radiotherapy for lung cancer. *Radiother Oncol*. 2017 Jul;124(1):1-10. PubMed: PM28666551

23. Stereotactic ablative body radiation therapy (SABR): a resource. Brentford (GB): Sabre UK Consortium; 2016: https://sabr.org.uk/wp-content/uploads/2016/04/UKSABRConsortiumGuidelinesv51.pdf. Accessed 2018 Nov 22

Unspecified Methods

24. Immobilization and imaging for stereotactic body radiation therapy motion management. San Mateo (CA): the Radiosurgery Society; 2015: https://therss.org/docs/5ceb073a-aa0f-45e7-a232-a241e13a2359.pdf. Accessed 2018 Nov 22.

25. London Cancer radiotherapy guidelines for treatment of lung cancer. London (GB); London Cancer; 2014: http://www.londoncancer.org/media/84334/london-cancer-lung-radiotherapy-guidelines-2013-v1-0.pdf Accessed 2018 Nov 22.

Draft Guidance Document

26. Lung cancer update: evidence reviews for the clinical and cost effectiveness of different radiotherapy regimens with curative intent for NSCLC (DRAFT). London (GB): National Institute for Health and Care Excellence; 2018; https://www.nice.org.uk/guidance/GID-NG10061/documents/evidence-review-4 . Accessed 2018 Nov 23.

Review Articles

27. Gainey M, Carles M, Mix M, et al. Biological imaging for individualized therapy in radiation oncology: part I physical and technical aspects. *Future Oncol*. 2018 Apr;14(8):737-749.
PubMed: PM29521520

28. Riou O, Llacer Moscardo C, Fenoglietto P, et al. SBRT planning for liver metastases: A focus on immobilization, motion management and planning imaging techniques. *Rep Pract Oncol Radiother*. 2017 Mar-Apr;22(2):103-110.
PubMed: PM28490980

Additional References

29. Radiotherapy evidence update. Bristol (GB): University Hospitals Bristol; 2017: http://www.bristolcellulitis.org/media/2939148/radiotherapy_july_2017.pdf Accessed 2018 Nov 23.