# ADJUVANT PROTON RADIOTHERAPY IN SYNCHRONOUSLY DETECTED BILATERAL BREAST CANCER

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## References

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## Background and aims

Primary synchronously detected bilateral breast cancer (PSBBC) represents a rare and clinically challenging entity. Adjuvant radiotherapy is a cornerstone in the management of non-metastatic breast cancer; however, it is associated with potential long-term toxicities, including cardiovascular disease and secondary malignancies. Reducing radiation dose to organs at risk (OARs), particularly the heart, is essential to improving long-term outcomes. (1, 2)

## Methods

We conducted a retrospective analysis of 21 patients with PSBBC treated with proton radiotherapy between October 2017 and June 2023 at a single institution. Patients received either normofractionated (50 CGE in 25 fractions) or hypofractionated (42.72 CGE in 16 fractions) proton therapy, depending on the extent of the irradiated field. Dosimetric data and clinical outcomes were evaluated.

## Clinical Outcomes

At a median follow-up of 39 months, no patien experienced disease progression, corresponding to a PFS rate of 100%. 19% of patients (4 out of 21) died during the follow-up period; however, none of the deaths were attributed to disease progression or treatment-related toxicity. Causes of death included COVID-19–related complications (n=2), congestive heart failure (n=1), and age-related causes (n=1).

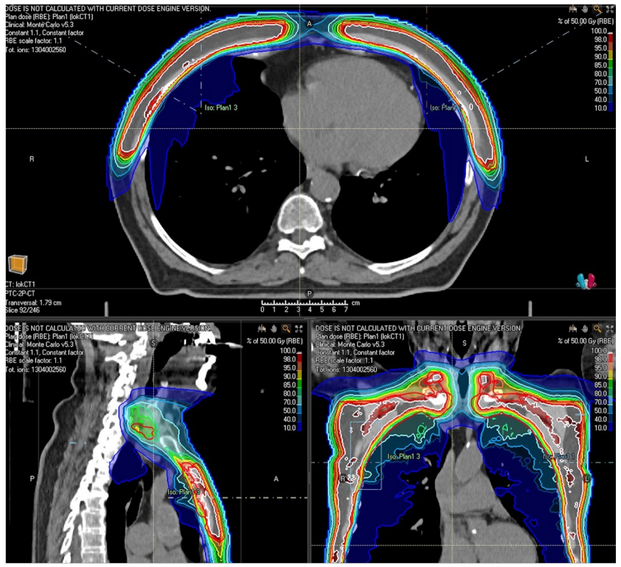

**Figure 1** Example of a clinical IMPT plan for bilateral chest wall including the lymphatic region and parasternal lymph nodes

| Stage | IA<br>5 | IIA<br>7 | IIB<br>4 | IIIA<br>4 | IIIC<br>1 |
|---|---|---|---|---|---|
| Histology & Genetic | Lobular<br>8 | NST<br>10 | TNBCa<br>3 | BRCA +<br>4 | |

**Table 1** Patient characteristics

## Conclusions

Proton radiotherapy demonstrates high suitability for the management of bilateral breast cancer, offering significant dosimetric advantages while maintaining a favorable toxicity profile. These findings support further prospective investigation into its long-term safety and efficacy.

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## Dosimetry Results

**Table 3** The attached table presents dosimetric parameters for the lungs (Dmean, V5, V20), heart (Dmean, D5%), cardiac substructures (Dmean), and coronary arteries (Dmean). Despite the considerable extent of the irradiated volume, all recorded doses were less than half of those typically observed with conventional radiotherapy techniques, highlighting the substantial sparing effect achieved with proton therapy. (3)

| VOLUME | MIN | MAX | MEAN | MEDIAN |
|---|---|---|---|---|
| $V_{PTVplan}$ [ml] | 768.00 | 3966.00 | 1889.81 | 1925.00 |
| Lung bilat. $D_{mean}$ [CGE] | 1.21 | 10.07 | 6.09 | 6.44 |
| Lungs bilat $V_{5\ CGE}$ [%] | 9.43 | 51.90 | 27.65 | 24.98 |
| Lungs bilat $V_{20\ CGE}$ [%] | 1.66 | 21.67 | 12.38 | 13.66 |
| Heart $D_{mean}$ [CGE] | 0.04 | 1.18 | 0.31 | 0.27 |
| Heart $V_{5\ CGE}$ [%] | 0.00 | 0.00 | 0.00 | 0.00 |
| Heart $D_{5\%}$ [CGE] | 0.22 | 7.26 | 1.32 | 0.99 |
| L. atrium $D_{mean}$ [CGE] | 0.00 | 0.31 | 0.03 | 0.00 |
| R. atrium $D_{mean}$ [CGE] | 0.00 | 0.49 | 0.10 | 0.06 |
| L. ventricle $D_{mean}$ [CGE] | 0.01 | 0.66 | 0.22 | 0.15 |
| R. ventricle $D_{mean}$ [CGE] | 0.00 | 1.78 | 0.22 | 0.11 |
| R. coronary artery $D_{mean}$ [CGE] | 0.00 | 1.05 | 0.23 | 0.15 |
| L. anterior descend artery $D_{mean}$ [CGE] | 0.12 | 7.44 | 2.62 | 1.47 |
| L. circumflex artery $D_{mean}$ [CGE] | 0.00 | 0.11 | 0.04 | 0.03 |
| L. main cor.art. $D_{mean}$ [CGE] | 0.00 | 0.46 | 0.07 | 0.04 |

## Toxicity Results

**Table 4** The incidence of acute and subacute toxicities including skin toxicity, rib fractures, pneumonitis, cardiovascular events, hypothyroidism, and lymphedema remained within acceptable limits and was comparable to that observed with conventional photon-based techniques.

| TOXICITY | G0 | G1 | G2 |
|---|---|---|---|
| Skin reaction | 16 | 5 | 0 |
| Fibrosis | 7 | 8 | 6 |
| Cardiovascular events | 21 | 0 | 0 |
| Pneumonitis | 20 | 1 | 0 |
| Hypothyroidism | 20 | 1 | 0 |
| Rib fractures | 18 | 3 | 0 |
| Lymphedema | 14 | 7 | 0 |