Background

Radiotherapy (RT) in breast cancer patients reduces the rate of local relapse and improves long-term survival. However, three-dimensional (3D) conformal radiation techniques often result in significant dose inhomogeneity throughout the treatment volume and are associated with toxicity to the heart and lung. However, using volumetric-modulated arc therapy (VMAT), we can acquire excellent homogeneity throughout the target volume and acceptable doses to normal structures. Thus, this study aimed to examine the dosimetric effect on breast cancer patients treated with adjuvant radiotherapy via VMAT at our institution.

Methods

This retrospective study enrolled 53 women with invasive breast cancer (left and right-sided) who underwent surgery and then received radiotherapy via VMAT between October 2013 and November 2018. The fractionation schedules were within the range of 40-50 Gy in 15-25 fractions. Dosimetric parameters, homogeneity index (HI), and conformity index (CI) were evaluated. The mean heart dose and doses to the ipsilateral lung and contralateral breast were analyzed.

Results

The treatment was generally well tolerated, dosimetric results showed that for patients treated with standard fractionation dose of 50 Gy/25 fractions, the planning target volume (PTV) D98% (mean ± standard deviation [SD]) was 47.5± 0.8 Gy, PTV D2% was 53 ± 0.4 Gy, and D50 was 51 ± 0.3 Gy. V95 was 98 ± 1.18%. The HI and CI were 0. 11 ± 0.02 and 0.1 ± 0.07, respectively. The average mean dose to the heart was 10.6± 3.3 Gy, and V25Gy and V5Gy were 6.8 ± 6.7%, and 78.8 ± 18%, respectively. The mean contralateral breast dose was 4.5 ± 1.4 Gy. The ipsilateral lung V20Gy and V5Gy were 31.5 ± 4.7% and 80 ± 11%, respectively.

For patients treated with a hypofractionated dose, the D98% mean dose ± SD was 41 ± 1.6 Gy, PTV D2% was 45 ± 01.9 Gy and, D50 was 43 ± 1.8 Gy. V95 was 98.7 ± 0.74%. The HI and CI were 0. 1 ± 0.02, and 0.1± 0.34, respectively. Evaluating organs at risk (OAR) showed that the average mean dose to the heart was 10.5 ± 3.55 Gy, while the V25Gy and V5Gy dose to the heart were 7.1 ± 6.2%, and 76 ± 21%, respectively. The contralateral breast dose was 3.7 ± 1.4 Gy. The ipsilateral lung V20Gy and V5Gy were 31.5 ± 4.7% and 74 ± 11%, respectively.

Conclusion

VMAT is an innovative widely used radiotherapy technology and may be very promising with complex patient anatomy or when used in higher volumes to include the internal mammary region. our results are consistent with previous reported results from the western world as our learning curve improved. Continuous quality assurance assessments and education are essential to maximize the safe and optimal use of VMAT.

Keywords: Breast cancer, Radiotherapy, VMAT, Dosimetry