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Changes in Functional Capacity, Respiratory Health Status and Quality of Life in Breast Cancer Patients Undergoing Radiotherapy at Tertiary Health Care Hospital

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ABSTRACT

Background: Breast cancer is one of the most common malignancies among women worldwide. Radiotherapy is used in conjunct with chemotherapy, which improves survival rate in breast cancer patients. Radiotherapy posterior to the anterior axillary line exposes the lung directly which increases the risk of pneumonitis, lung fibrosis and other lung conditions. Subjective and objective criteria determine the changes in functional capacity, respiratory health status and quality of life in breast cancer patients undergoing radiotherapy.
Aim: This study aimed at finding out any changes in functional capacity, respiratory health status and quality of life in breast cancer patients undergoing radiotherapy at tertiary health care hospital.
Methods: A total of 45 patients with breast cancer undergoing radiotherapy were screened. Out of which 33 patients were included and 12 were excluded as they did not meet the inclusion criteria. The 6 min walk test (6MWT), St. George's Respiratory Questionnaire (SGRQ) and European Organization Research Treatment Cancer Quality Of Life Cancer-30 (EORTC QOL C-30) assessment were done pre and post radiotherapy to find out functional capacity, respiratory health status and quality of life. Data analysis was done by using SPSS 22 software.
Results: There was statistically significant difference in functional capacity (p=0.00) and respiratory health status (p=0.00) in breast cancer patients but no statistically significant difference in quality of life (p=0.63).
Conclusion: The study showed that there is change in functional capacity and respiratory health status but no change in quality of life in breast cancer patients undergoing radiotherapy in tertiary health care hospital.

Keywords: functional capacity, respiratory health status, quality of life, breast cancer, radiotherapy

INTRODUCTION

Cancer is a group of diseases involving abnormal cell growth with the potential to invade or spread to other parts of the body. [1] Breast cancer is one of the most common malignancies amongst women worldwide. According to 2020 GLOBACAN, approximately 2.2 million cases worldwide were diagnosed with breast cancer and 178361 cases found in India and mortality was 90408. [2] Due to increase in the incidence of breast cancer, there have been advances in its management. [3] Surgery, chemotherapy, and radiotherapy are the modalities of treatment.

Radiotherapy improves survival in several categories of women with breast cancer when irradiating the post-op breast bed or chest wall with or without the regional lymph nodes where exposure of lungs is unavoidable and this incidental exposure may increase the risk of subsequent primary lung cancer, pneumonitis, and lung fibrosis.[7]Exposure of radiotherapy to the lung fields increases the ill effects on the lungs so the doses should be noted accordingly, although they help to reduce breast cancer recurrence. [8] The radiation fields include the complete bed from medial to lateral aspect of chest wall. [7] Early effect is pneumonitis followed by lung fibrosis as a late complication. It is more common in women who receive chemotherapy in addition to the radiotherapy. [7]

There are two types of radiotherapy - EBRT and IBRT (brachytherapy). In EBRT there are 2D Conformal, 3D conformal, IMRT (intensity modulated radiotherapy), IGRT (image guided radiotherapy), SRT (stereotactic radiotherapy), PROTON beam therapy. [1] In 2D radiotherapy, single beam of radiation delivered to the patient from several directions are often front or back and both sides. [9]

How does radiation beam affect the lungs? [7] (Fig 1)

When radiation is given to the chest wall cavity, lung gets exposed to the radiation beam.

↓

Alveoli are very sensitive to the exposure of radiation particles.
There are type 1 and type 2 alveolar cells and endothelial cells.

↓

Whereas most tumor cells undergo necrotic forms of cell death upon radiation at clinically relevant doses.
Normal tissue epithelial cells and endothelial cells predominately show phenotypes cellular senescence.

↓

Radiation induced senescence is accompanied by an altered gene expression profile and the release of several pro-inflammatory cytokines and chemokine, constituting the senescence associated secretory phenotype (SASP)

↓

Major representatives of SASP cytokines include (TGF-beta) transforming growth factor beta, platelet- desired growth factor and chemokine receptors

↓

These mediators enforce cellular senescence in parenchymal cells which stimulate endothelial cell activation and contribute to the recruitment and activation of immune cells.

↓

DNA damage induced senescence and death of type 1 and 2 alveolar cells resulting in loss of barrier function and reduction in surfactant production, decreased surface tension and possible atelectasis due to lack of surfactant.

↓

Causes further damage in lung tissue which leads to pulmonary complications such as pneumonitis and late-stage fibrosis. [7]

What is Functional Capacity?

According to American Thoracic Society (ATS) guidelines, the six-minute walk test (6MWT) is the submaximal test to assess the functional capacity. The six-minute walk test is an important tool in the assessment of functional exercise capacity in patients with chronic illnesses.

Suesada MM, Carvalho HD et al. states that, there is an impact of radiotherapy on functional capacity. [7] The concept of functional capacity has been used extensively in disability and rehabilitation research as an indicator of an individual's ability to engage in physical activity. [8]

What is Respiratory Health Status (RHS)?

Respiratory health status is a good indicator of lung function. It can be measured by many scales, but St. George's respiratory questionnaire (SGRQ) is a valid and gold standard to assess the respiratory health status in lung cancer populations. [5] It is disease-specific instrument designed to measure impact on overall health, daily life, and perceived well-being.

What is Quality Of Life (QOL)?

QOL can be defined as a composite measure of physical and social well-being as perceived by each individual or by group of individuals. [6] QOL refers to multidimensional assessments that include other domains such as cognitive functioning. [3]

There are several studies done on QOL in breast cancer patients but with QOL it is important to assess the respiratory health status in these patients' undergoing radiation. [6]

EORTC-QOL C-30 questionnaire is valid and reliable in breast cancer patients. The questionnaire comprises of 30 questions used to assess physical health, emotional, cognitive and social functioning. There is validity and reliability of English translated version (Marathi and Hindi) of EORTC-QOL C-30 questionnaire. [10]

MATERIALS & METHODS

STUDY DESIGN:

- Research design: observational, prospective study
- Place of study: Radiotherapy and Breast OPD, Tertiary Health Care Hospital.

STANDARD PROTOCOL OF RADIATION AT TERTIARY HEALTH CARE HOSPITAL:

- Type of radiation is 2 D radiation.
- Each Patient received 25 cycles or 15 cycles of radiation as per the protocol.
- 25 cycles divided into 5 weeks (5days-from Monday to Friday/ per week)
- 15 cycles divided into 3 weeks (5 days-from Monday to Friday/ per week).

SAMPLE POPULATION: Breast cancer patients undergoing radiotherapy.

DURATION OF STUDY: 6 months

(30 minutes were given for data collection. 10 minutes for 6MWT & 20 minutes to fill SGRQ and EORTC QOL C-30 questionnaire.)

SAMPLE SIZE = 33

TYPE OF SAMPLING: convenient sampling

SOURCE OF SAMPLING: Radiotherapy OPD of Tertiary Health Care Hospital

SELECTION CRITERIA:

INCLUSION CRITERIA:

- Women above 18 years.
- Breast cancer patients undergoing radiotherapy.
- Patient willing to give written consent.

EXCLUSION CRITERIA:

- Illiterate patient.
- Any chronic conditions (stroke, Chronic Obstructive Pulmonary Disease, Bronchial Asthma).
- Poor psychological state.
- Metastatic breast cancer patient

MATERIALS USED:

Pen, Stethoscope, Sphygmomanometer, Pulse oximeter, 2 Cones, 100-ft hallway, Stopwatch (Mobile Phone), Modified Borg's scale (Rate of perceived exertion),

Marathi English and Hindi version of EORTC QOL C-30 and St George's respiratory questionnaire. (Approval taken from the respective authors for the scale)

Methodology is depicted in figure 2.

RESULT

A total of 33 participants between of 18-65 years were included in the study.

Mean and standard deviation of age which was 44.125±9.173378.

Mean and standard deviation of BMI which was 24.6±2.58785.

Figure 3 showed Descriptive analysis of functional capacity in which, mean and standard deviation (pre radiotherapy) was 64.2727±4.332 & (post-radiotherapy) was 56.512 ± 4.664. The median was 64 pre-radiotherapy and 55 post-radiotherapy which is suggestive that functional capacity was higher pre than post radiotherapy.

Figure 4 showed that, Mean and standard deviation of respiratory heath status (pre-radiotherapy) was 41.3939± 4.993 & (post-radiotherapy) was 55.939 ± 4.795. The median was 40 pre-radiotherapy and 56 post radiotherapy which is suggestive of respiratory health status being lower pre than post radiotherapy.

Figure 5 showed that, mean and standard deviation of quality of life (pre-radiotherapy) was 52.454 ±5.755 & (post-radiotherapy) was 52.545 ± 3.700. The median was 51 pre-radiotherapy and 52 post-radiotherapy which suggest no change in the quality of life.

By using Shapiro-Wilk test it was found that, functional capacity passed normality test with $p>0.05$ whereas, respiratory health status and quality of life did not pass normality test with $p<0.05$.

Table 1 showed, significant difference in functional capacity and respiratory health status with $p<0.01$ by using paired T-test which was statistically significant and no significant in quality of life with $p>0.01$ by using Wilcoxon Signed Rank test.

Table No. 1: Statistical Analysis

	Test used	**Pre-radiotherapy**		**Post- radiotherapy**		**P value**
		Mean	**SD**	**Mean**	**SD**	
Functional capacity	Paired T-test	64.272±4.332		56.515±4.664		0.00
Respiratory heath status (SGRQ)	Wilcoxon Signed Ranks Test	41.393±4.993		55.939±4.795		0.00
Quality of life (EORTC QOL)	Wilcoxon Signed Ranks Test	52.454±5.755		52.545±3.700		0.632

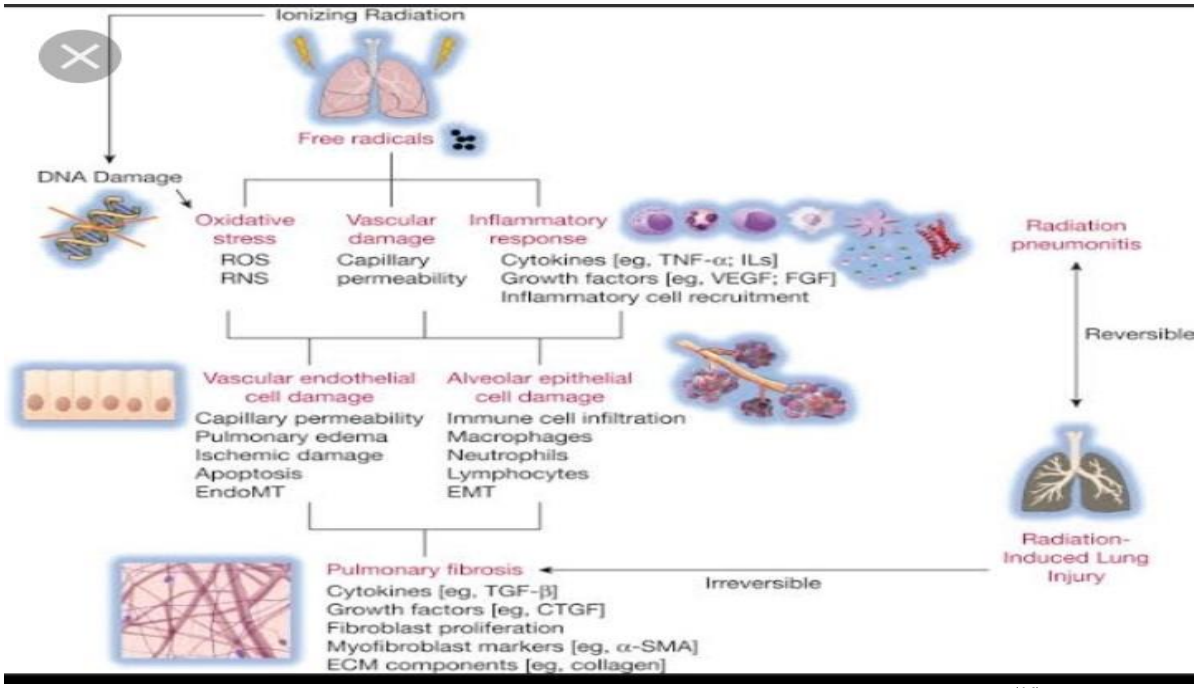

Figure no. 1; Radiation induced lung injury: Assessment and Management [14]

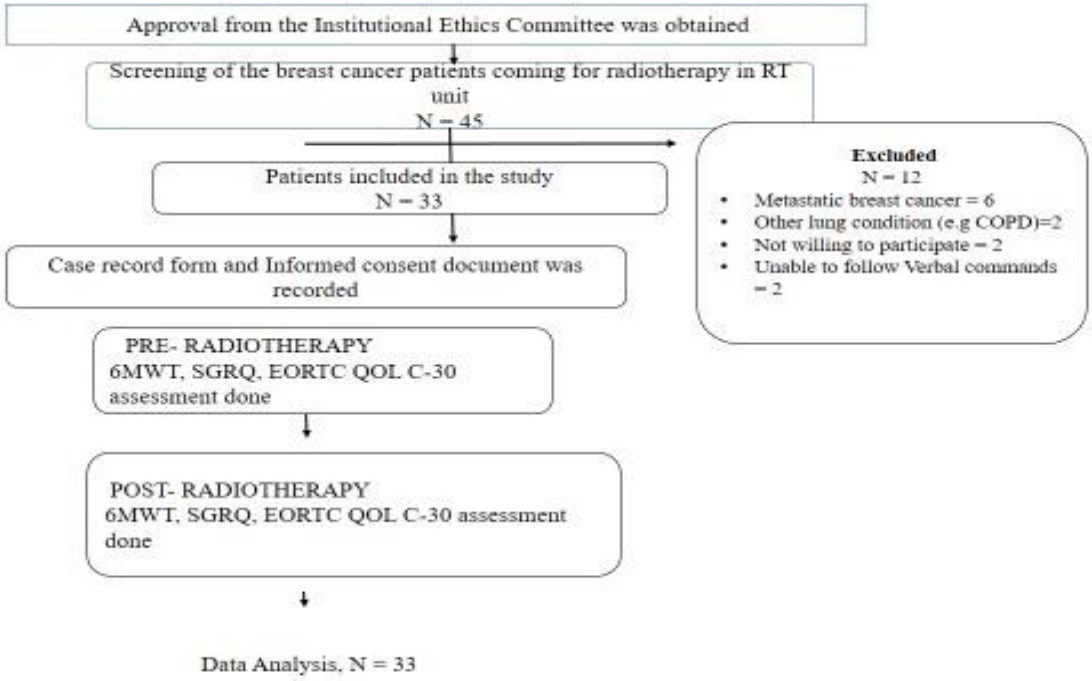

Figure no. 2: Methodology

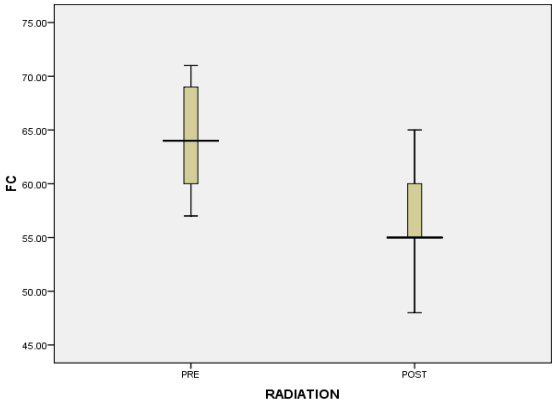

Figure no. 3: Descriptive analysis of functional capacity

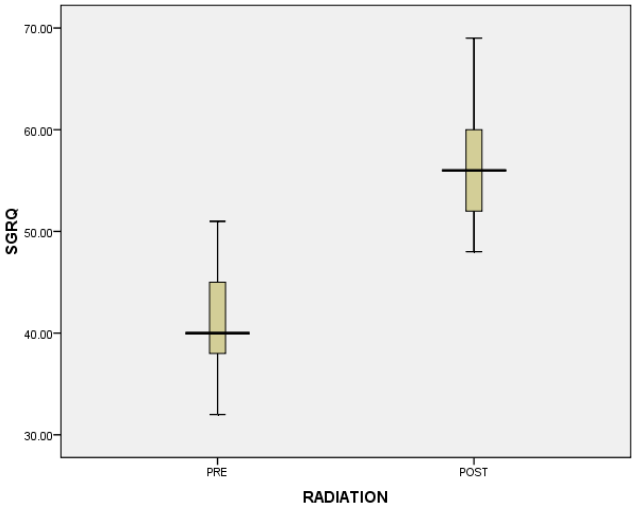

Figure no. 4: Descriptive analysis of respiratory health status

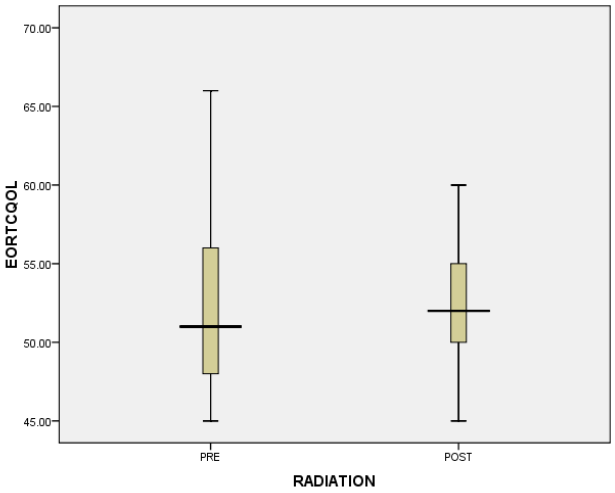

Figure no. 5: Descriptive analysis of quality of life

DISCUSSION

Radiotherapy reduces mortality rate in breast cancer patients. It improves survival in several categories of women with early breast cancer when irradiating the post-op breast bed or chest wall with or without the regional lymph nodes. Exposure to lungs is unavoidable and this incidental exposure may increase the risk of subsequent primary lung cancer, pneumonitis, and lung fibrosis. [7]

The aim of this study was to find out change in the functional capacity, respiratory health status and quality of life in breast cancer patients undergoing radiotherapy. In this study 33 participants with age group of 18-65 years who met the eligibility criteria were recruited from Breast OPD and Radiation Oncology OPD of tertiary health care hospital.

Age distribution of the participants ranged from 18-65 with mean of 44.125±9.173378. BMI distribution of the participants shows16 were overweight and 17 had normal BMI with mean and standard deviation of 24.6±2.58785.

Functional capacity was assessed pre and post radiotherapy by using 6-minute walk test which is submaximal test. Predicated percentage was calculated. Galiano-Castillo Net. al. states that 6MWT could be used as a measure of the major components of global health in women with breast cancer. [15]

Figure 3 shows descriptive statistics of functional capacity which was seen higher pre than post radiotherapy. The difference in function capacity is due to indirect effect of radiation beam particle on lung tissue which reduced the patient performance during submaximal test.

Käsmann L, Dietrich A et, al. summarized the current understanding of radiation-induced pneumonitis and pulmonary fibrosis, present predictive factors as well as recent diagnostic and therapeutic advances. [7] Aznar MC et. al. concluded that Lymph node inclusion and IMRT use increased lung exposure, while breathing adaptation and prone/lateral decubitus positioning reduced lung exposure. [9]Suesada MM, Carvalho HD et. al. concluded that, post radiotherapy there was significant decrease in respiratory muscle strength, chest wall mobility, exercise capacity, and pulmonary function test results ($p < 0.05$). DLCO was unchanged. HRCT showed changes related to radiotherapy in 87% of the patients, which was more evident in the patients submitted to SCLN irradiation. V_{25}% significantly correlated with radiation pneumonitis. [18]

Radiation induced lung toxicity included three phases: acute, subacute and late phase. [7] Acute phase occurs, minutes to days after radiation. In this phase, there is repair of radiation induced DNA damage taking place in the lung tissue. This includes base

modifications, single and double strand breaks of varying complexity, DNA crosslinks, and bulky lesions which arise from direct ionizing events or are indirectly mediated by free reactive oxygen species (ROS).[7]DNA damage induced senescence and death of alveolar type I and II cells result in loss of barrier function and reduced surfactant production, decreased surface tension leading to interstitial edema and further reduction of the alveolar septa. The micro vascular system of the lung tissue and particularly endothelial cells are also affected by radiation. [7]

Lung exposure to radiation increases the symptoms like breathlessness, cough with expectoration etc. which overall reduces the respiratory health status.[7] In our study, Respiratory health status was assessed pre and post radiotherapy by using SGRQ questionnaire and Scores were calculated. Quadri M, Damor H. et. al. suggested that the SGRQ is a valid measure to assess HRQOL and respiratory status with subject to lung cancer. [5]

Figure 4 showed descriptive statistics of respiratory health status which was seen lower pre than post radiotherapy. Higher scores indicate worst respiratory health status, and lower scores indicates good respiratory health status. The mean of SGRQ score was less pre radiotherapy which indicates good respiratory health status whereas the mean of SGRQ score was more post radiotherapy which indicates worst respiratory health status. This change suggests that respiratory health status reduces post radiotherapy.

EORTC-QOL C-30 questionnaire is valid and reliable in breast cancer patient. Quality of life was assessed pre and post radiotherapy by using EORTC-QOL C-30 questionnaire and scores were calculated. Pehlivan S et. al concluded that there was no statistical significance noted between comfort and QOL average score before and after RT, a positive relationship was determined between the pain and symptoms QOL. On the contrary, the QOL of patients increased along with their comfort levels and that comfort levels decreased as the experienced symptoms increased. [13]

Figure 5 showed that descriptive statistics of quality of life which was same pre and post radiotherapy. The mean of EORTC QOL C-30 was found to be same pre and post radiotherapy which suggested that there was no change in quality-of-life following radiation.

Table 1 showed a statistically significant difference in functional capacity and respiratory health status ($p<0.01$) and no statistically significant in quality of life ($p>0.01$).

Through this study, we observed that there is change in functional capacity and respiratory health status but no change in quality of life in breast cancer patients undergoing radiotherapy.

CONCLUSION

The study concluded that there is change in functional capacity and respiratory health status in breast cancer patient undergoing radiotherapy. Radiation induced lung toxicity increase the risk of pulmonary complication by decreasing the functional capacity and respiratory health status. There is increased level of comfort as radiation suggests end of adjuvant treatment, thus there may have been no change in quality of life.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. American cancer society: cancer.org
2. American cancer society journals: global cancer observatory (GCO)
3. Quality of life: WHO: www.who.int.in
4. American thoracic society guidelines. (ATS)
5. Quadri M, Damor H. Validity of St. George's respiratory questionnaire in lung cancer population. International Journal for Advance Research and Development. 2020;5(6):13-8.
6. Damodar G, Smitha T, Gopinath S, Vijayakumar S, Rao YA. Assessment of quality of life in breast cancer patients at a tertiary care hospital. Arch Pharm Pract. 2013 Jan 1;4(1):15
7. Galiano-Castillo N, Arroyo-Morales M, Ariza-Garcia A, Sánchez-Salado C, FernándezLao C, Cantarero-Villanueva I, Martín-Martín L. The six-minute walk test as a measure of health in breast cancer patients. Journal of aging and physical activity. 2016 Oct 1;24(4):508-15.:
8. Käsmann L, Dietrich A, Staab-Weijnitz CA, Manapov F, Behr J, Rimner A, Jeremic B, Senan S, De RuysscherD, Lauber K, Belka C. Radiation-induced lung toxicity–cellular and molecular mechanisms of pathogenesis, management, and literature review. Radiation Oncology. 2020 Dec;15(1):1-6
9. Amarsheda SB, Bhise AR. Association of Fatigue, Quality of Life and Functional Capacity in Breast Cancer Patients Receiving Adjuvant Chemotherapy. Asian Pacific Journal of Cancer Care. 2021 Mar 26;6(1):59-64.
10. Aznar MC, Duane FK, Darby SC, Wang Z, Taylor CW. Exposure of the lungs in breast cancer radiotherapy: a systematic review of lung doses published 2010–2015, Radiotherapy and Oncology. 2018 Jan 1;126(1):148-54.
11. Shinde CS, Mahajan AA, Sonawane PP. Quality of Life using EORTC QLQ C-30 and EORTC QLQ BR-23 Marathi Version in Post-Operative Breast Cancer Women from Rural Region of Maharashtra. Indian Journal of Physiotherapy & Occupational Therapy. 2020 Jan 1;13(1).
12. Zhang JJ, Shu H, Hu SS, Yu Y, Sun Y, Lv Y. Relationship between time elapsed since completion of radiotherapy and quality of life of patients with breast cancer. BMC cancer. 2018 Dec;18(1):1-7
13. Ahmed MS, Neyaz A, Aslami AN. Health-related quality of life of chronic obstructive pulmonary disease patients: Results from a community based cross-sectional study in undergoing radiation therapy. J. BUON. 2016 May 1; 21:549-55.
14. Hanania AN, Mainwaring W, Ghebre YT, Hanania NA, Ludwig M. Radiation-Induced Lung Injury: Assessment and Management. Chest. 2019 Jul;156(1):150-162. doi: 10.1016/j.chest.2019.03.033. Epub 2019 Apr 15. PMID: 30998908; PMCID: PMC8097634.

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