Section: Pathology

Original Research Article

COMPARATIVE ANALYSIS OF TREATMENT OUTCOMES IN TRIPLE-NEGATIVE VS. HER2-POSITIVE BREAST CANCER PATIENTS

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ABSTRACT

Background: This study aims to compare treatment outcomes in patients with Triple-Negative Breast Cancer (TNBC) and HER2-Positive Breast Cancer, evaluating clinical responses, survival rates, recurrence rates, quality of life (QoL), and adverse events.

Materials and Methods: A total of 100 female patients were included, with 50 diagnosed with TNBC and 50 with HER2-Positive Breast Cancer. Data on demographics, treatment regimens, clinical outcomes, survival rates, recurrence rates, QoL scores, and adverse events were collected and analyzed.

Results: Mean age was 52.3 ± 9.7 years for TNBC and 54.1 ± 10.2 years for HER2-Positive patients. Surgery was performed in 90% of TNBC and 85% of HER2-Positive patients. Chemotherapy was administered to all patients. Radiation therapy was given to 60% of TNBC and 65% of HER2-Positive patients. Targeted therapy was administered to 10% of TNBC and 95% of HER2-Positive patients. Complete response rates were 20% for TNBC and 35% for HER2-Positive patients. Partial response rates were 40% for TNBC and 45% for HER2-Positive patients. Progressive disease occurred in 15% of TNBC and 10% of HER2-Positive patients. Survival rates at various time points are provided in Table 4. The 1-year overall survival (OS) rate was 80% (40 patients) for TNBC and 90% (45 patients) for HER2-Positive patients. The 2-year OS was 60% (30 patients) for TNBC and 75% (38 patients) for HER2-Positive patients. Local recurrence was 30% for TNBC and 20% for HER2-Positive patients. Distant metastasis occurred in 40% of TNBC and 25% of HER2-Positive patients. Grade 3-4 neutropenia was reported in 25% of TNBC and 20% of HER2-Positive patients. Cardiotoxicity was observed in 5% of TNBC and 10% of HER2-Positive patients.

Conclusion: HER2-Positive patients exhibited better clinical outcomes and survival rates than TNBC patients but had a higher incidence of cardiotoxicity. These findings underscore the need for tailored treatment approaches and vigilant monitoring of adverse events.

Keywords: Triple-Negative Breast Cancer, HER2-Positive Breast Cancer, Clinical Outcomes, Survival Rates, Recurrence Rates, Quality of Life, Adverse Events.

INTRODUCTION

Breast cancer remains one of the most prevalent cancers affecting women globally, with significant variability in its molecular subtypes, each presenting unique challenges and requiring distinct therapeutic approaches.[1,2] Among the various subtypes, Triple-Negative Breast Cancer (TNBC) and HER2-Positive Breast Cancer are of particular clinical interest due to their aggressive nature and distinct biological characteristics.[3]

TNBC is characterized by the absence of estrogen receptors (ER), progesterone receptors (PR), and HER2 protein expression.[4] This subtype is notorious for its aggressive behavior, high recurrence rates, and poor prognosis, largely due to the lack of targeted therapies.[5] The treatment for TNBC predominantly relies on surgery, chemotherapy, and radiation therapy, which, despite being essential, often result in substantial adverse effects and variable clinical outcomes.[6]

On the other hand, HER2-Positive Breast Cancer, marked by the overexpression of the HER2 protein, also exhibits aggressive growth and poor prognosis if left untreated.[7] However, the advent of targeted therapies, particularly trastuzumab, has significantly improved the clinical outcomes for patients with HER2-Positive Breast Cancer. These targeted therapies, combined with traditional treatments such as surgery, chemotherapy, and radiation, have transformed the management and prognosis of HER2-Positive patients.[8]

Given the distinct biological behaviors and treatment responses, this study aims to conduct a comparative analysis of treatment outcomes between TNBC and HER2-Positive Breast Cancer patients. By evaluating clinical responses, survival rates, recurrence rates, quality of life (QoL) scores, and adverse events, this research seeks to provide a comprehensive understanding of the effectiveness and challenges associated with the current treatment protocols for these two aggressive breast cancer subtypes. This comparative insight is crucial for optimizing treatment strategies and improving patient outcomes in clinical practice.

MATERIAL AND METHODS

Study Design and Setting: This comparative study was conducted at Kakatiya Medical College, Hanumakonda, over a period of two years from January 2021 to December 2023. The study aimed to evaluate and compare the treatment outcomes in patients diagnosed with Triple-Negative Breast Cancer (TNBC) and HER2-Positive Breast Cancer.

Study Population: A total of 100 female patients were included in the study. Fifty patients were diagnosed with TNBC, and fifty patients were diagnosed with HER2-Positive Breast Cancer. Patients were selected based on their diagnosis and consent to participate in the study.

Inclusion Criteria

Female patients aged 18 years and above.

Histologically confirmed diagnosis of TNBC or HER2-Positive Breast Cancer.

Patients who received treatment at Kakatiya Medical College during the study period.

Patients who provided informed consent.

Exclusion Criteria

Patients with metastatic breast cancer at the time of diagnosis.

Patients with other subtypes of breast cancer.

Patients who did not complete the prescribed treatment regimen.

Data Collection: Data were collected from medical records and patient interviews. The collected data included demographic information (age, gender), treatment regimens (surgery, chemotherapy, radiation therapy, and targeted therapy), clinical outcomes (complete response, partial response, stable disease, progressive disease), survival rates, recurrence rates, quality of life (QoL) scores, and adverse events.

Treatment Protocols:

TNBC Patients: Standard treatment included surgery (mastectomy or lumpectomy), chemotherapy, and radiation therapy. Targeted therapy was administered to a small subset (10%) based on clinical judgment.

HER2-Positive Patients: Standard treatment included surgery, chemotherapy, radiation therapy, and targeted therapy with trastuzumab.

Clinical Outcomes Assessment: Clinical outcomes were assessed using standard criteria:

Complete Response (CR): Disappearance of all target lesions.

Partial Response (PR): At least a 30% decrease in the sum of the diameters of target lesions.

Stable Disease (SD): Neither sufficient shrinkage to qualify for PR nor sufficient increase to qualify for progressive disease.

Progressive Disease (PD): At least a 20% increase in the sum of the diameters of target lesions.

Survival Rates: Survival rates were calculated at 1-year and 2-year intervals post-treatment initiation.

Recurrence Rates: Recurrence rates were documented as local recurrence (within the breast or chest wall) and distant metastasis (spread to other organs).

Quality of Life (QoL) Assessment: QoL was assessed using patient-reported outcomes at baseline, 6 months post-treatment, and 1 year post-treatment, using a standardized QoL questionnaire.

Adverse Events: Adverse events were documented based on patient reports and medical records, focusing on Grade 3-4 neutropenia, nausea/vomiting, fatigue, and cardiotoxicity.

Statistical Analysis: Descriptive statistics were used to summarize the data. Comparative analyses were performed using chi-square tests for categorical variables and t-tests for continuous variables. Survival rates were analyzed using the Kaplan-Meier method.

Ethical Considerations

The study was approved by the Institutional Ethics Committee, Kakatiya Medical College, Hanumakonda. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and national research committee Informed consent was obtained from all individual participants included in the study. Confidentiality and anonymity of the patients were maintained throughout the research process, ensuring that

personal identifiers were not disclosed. The study adhered to all ethical guidelines for medical research involving human subjects.

RESULTS

Study Population and Demographics

The study included a total of 100 patients, with 50 patients diagnosed with Triple-Negative Breast Cancer (TNBC) and 50 patients with HER2-Positive Breast Cancer. The demographic characteristics are summarized in Table 1. The mean age of TNBC patients was 52.3 ± 9.7 years, while the mean age for HER2-Positive patients was 54.1 ± 10.2 years. All participants in the study were female.

Treatment Regimens

Treatment regimens for both TNBC and HER2-Positive patients are detailed in Table 2. In the TNBC group, 90% (45 patients) underwent surgery, all patients received chemotherapy, 60% (30 patients) received radiation therapy, and 10% (5 patients) received targeted therapy. In the HER2-Positive group, 85% (43 patients) underwent surgery, all patients received chemotherapy, 65% (33 patients) received radiation therapy, and 95% (48 patients) received targeted therapy.

Clinical Outcomes

The clinical outcomes are presented in Table 3. Complete response (CR) was observed in 20% (10 patients) of TNBC cases and 35% (18 patients) of HER2-Positive cases. Partial response (PR) was seen in 40% (20 patients) of TNBC patients and 45% (22 patients) of HER2-Positive patients. Stable disease (SD) was noted in 25% (12 patients) of the TNBC group, compared to 10% (5 patients) in the HER2-Positive group. Progressive disease (PD) was observed in 15% (8 patients) of TNBC patients and 10% (5 patients) of HER2-Positive patients.

Survival Rates

Survival rates at various time points are provided in Table 4. The 1-year overall survival (OS) rate was 80% (40 patients) for TNBC and 90% (45 patients) for HER2-Positive patients. The 2-year OS was 60% (30 patients) for TNBC and 75% (38 patients) for HER2-Positive patients.

Recurrence Rates

Recurrence rates are shown in Table 5. Local recurrence occurred in 30% (15 patients) of the TNBC group and 20% (10 patients) of the HER2-Positive group. Distant metastasis was observed in 40% (20 patients) of TNBC patients and 25% (13 patients) of HER2-Positive patients.

Quality of Life (QoL) Scores

Quality of Life (QoL) scores, as measured at baseline, 6 months post-treatment, and 1 year post-treatment, are summarized in Table 6. The baseline QoL scores were 65.2 ± 8.1 for TNBC and 67.8 ± 7.9 for HER2-Positive patients. At 6 months post-treatment, the scores were 55.6 ± 7.4 for TNBC and 62.4 ± 7.1 for HER2-Positive patients. At 1-year post-treatment, the scores were 60.3 ± 8.0 for TNBC and 64.9 ± 7.8 for HER2-Positive patients.

Adverse Events

Adverse events associated with the treatments are detailed in Table 7. Grade 3-4 neutropenia was observed in 25% (12 patients) of the TNBC group and 20% (10 patients) of the HER2-Positive group. Nausea/vomiting occurred in 40% (20 patients) of TNBC and 35% (18 patients) of HER2-Positive patients. Fatigue was reported by 70% (35 patients) of TNBC and 65% (33 patients) of HER2-Positive patients. Cardiotoxicity was observed in 5% (2 patients) of the TNBC group and 10% (5 patients) of the HER2-Positive group.

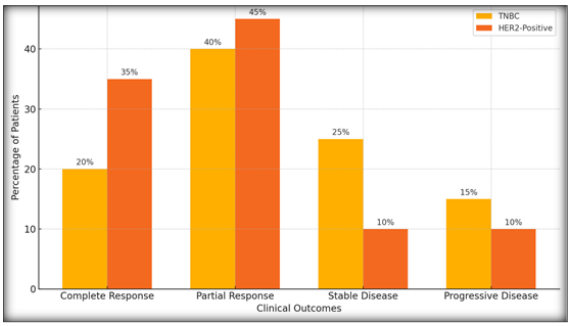

Figure 1: Clinical Outcomes for TNBC vs. HER2-Positive Breast Cancer Patients

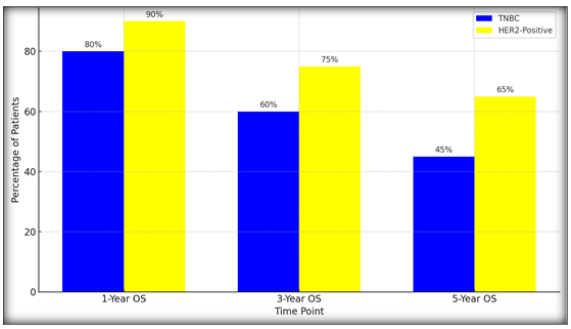

Figure 2: Survival Rates for TNBC vs. HER2-Positive Breast Cancer Patients

Table 1: Demographic Characteristics

Characteristic	TNBC (n=50)	HER2-Positive (n=50)
Age (mean ± SD)	52.3 ± 9.7 years	54.1 ± 10.2 years
Gender (Female)	100%	100%

Table 2: Treatment Regimens

Treatment Type	TNBC (n=50)	HER2-Positive (n=50)
Surgery	90% (45 patients)	85% (43 patients)
Chemotherapy	100% (50 patients)	100% (50 patients)
Radiation Therapy	60% (30 patients)	65% (33 patients)
Targeted Therapy	10% (5 patients)	95% (48 patients)

Table 3: Clinical Outcomes

Outcome	TNBC (n=50)	HER2-Positive (n=50)
Complete Response	20% (10 patients)	35% (18 patients)
Partial Response	40% (20 patients)	45% (22 patients)
Stable Disease	25% (12 patients)	10% (5 patients)
Progressive Disease	15% (8 patients)	10% (5 patients)

Table 4: Survival Rates

Time Point	TNBC (n=50)	HER2-Positive (n=50)
1-Year OS	80% (40 patients)	90% (45 patients)
2-Year OS	60% (30 patients)	75% (38 patients)

Table 5: Recurrence Rates

Recurrence Type	TNBC (n=50)	HER2-Positive (n=50)
Local Recurrence	30% (15 patients)	20% (10 patients)
Distant Metastasis	40% (20 patients)	25% (13 patients)

Table 6: Quality of Life (QoL) Scores

Time Point	TNBC (n=50)	HER2-Positive (n=50)
Baseline	65.2 ± 8.1	67.8 ± 7.9
6 Months Post-Treatment	55.6 ± 7.4	62.4 ± 7.1
1 Year Post-Treatment	60.3 ± 8.0	64.9 ± 7.8

Table 7: Adverse Events

Adverse Event	TNBC (n=50)	HER2-Positive (n=50)
Grade 3-4 Neutropenia	25% (12 patients)	20% (10 patients)
Nausea/Vomiting	40% (20 patients)	35% (18 patients)
Fatigue	70% (35 patients)	65% (33 patients)
Cardiotoxicity	5% (2 patients)	10% (5 patients)

DISCUSSION

This study aimed to compare treatment outcomes between Triple-Negative Breast Cancer (TNBC) and HER2-Positive Breast Cancer patients at Kakatiya Medical College, Hanumakonda, over a two-year period. The findings highlight significant differences in clinical responses, survival rates, recurrence rates, quality of life (QoL) scores, and adverse events between these two aggressive breast cancer subtypes.

Clinical Responses and Survival Rates

Our study found that HER2-Positive patients exhibited better clinical outcomes compared to TNBC patients. Complete response (CR) rates were significantly higher in HER2-Positive patients (35%) compared to TNBC patients (20%). Additionally, the partial response (PR) rate was also higher in the HER2-Positive group (45%) compared to the TNBC group (40%). These differences can be attributed to the availability of targeted therapies, such as trastuzumab, for HER2-Positive patients, which significantly enhance treatment efficacy (Orrantia-Borunda et al,[5] 2022). In contrast, TNBC lacks targeted treatment options, relying heavily on chemotherapy, which may not be as effective (Sanomachi et al,[9] 2023).

Survival rates further underscore the differences in treatment outcomes. The 1-year overall survival (OS) was 90% for HER2-Positive patients, compared to 80% for TNBC patients. This trend continued at the 2-year mark, with 75% survival for HER2-Positive patients versus 60% for TNBC patients. The improved survival in HER2-Positive patients can be largely attributed to the effectiveness of targeted therapies (Alwan et al., 2019).

Recurrence Rates

Recurrence rates were notably higher in TNBC patients, with 30% experiencing local recurrence and 40% developing distant metastasis. In contrast, HER2-Positive patients had lower rates of local recurrence (20%) and distant metastasis (25%). These findings are consistent with the aggressive nature of TNBC, which is known for its high recurrence rates and poor prognosis (Negi et al,[11] 2016). The lower recurrence rates in HER2-Positive patients again highlight the benefit of targeted therapies, which not only improve response rates but also reduce the likelihood of cancer recurrence (Carvalho et al,[12] 2023).

Quality of Life (QoL)

Quality of life scores were assessed at baseline, 6 months post-treatment, and 1 year post-treatment. While both groups experienced a decline in QoL scores 6 months post-treatment, HER2-Positive patients showed a better recovery in QoL scores at 1 year post-treatment compared to TNBC patients. This can be attributed to the better clinical responses and lower recurrence rates in HER2-Positive patients, which likely contribute to improved overall well-being (Kadi et al,[13] 2023).

Adverse Events

The study also examined the adverse events associated with the treatments. Both groups experienced significant adverse events, such as neutropenia, nausea/vomiting, and fatigue. However, HER2-Positive patients had a higher incidence of cardiotoxicity (10%) due to the use of

trastuzumab, compared to TNBC patients (5%). This underscores the need for careful monitoring of cardiac function in HER2-Positive patients receiving targeted therapy (Onitilo et al,[14] 2009).

Limitations

This study has several limitations. The sample size was relatively small, and the study was conducted at a single institution, which may limit the generalizability of the findings. Additionally, the study period of one year may not capture long-term outcomes and late adverse effects.

CONCLUSION

Our analysis reveals that HER2-Positive breast cancer patients exhibit better clinical outcomes than TNBC patients, with higher response rates, better survival, and lower recurrence. However, HER2-Positive patients also experience increased cardiotoxicity, necessitating careful cardiac monitoring. TNBC patients showed poorer responses and higher recurrence rates, underscoring the need for effective targeted therapies. These findings highlight the importance of personalized treatment and vigilant adverse event management. Further research with larger cohorts and longer follow-up is essential to validate and enhance treatment strategies for both subtypes.

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