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Original Article

Cytotoxic Effect of Chemotherapy in Women with Breast Cancer in the Wilaya of Oran

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Abstract

Introduction: Chemotherapy is a widely used treatment for cancer that involves the use of powerful drugs to destroy cancer cells or inhibit their growth. These drugs can target rapidly dividing cells, which includes cancer cells, but they can also affect healthy cells, leading to side effects. Chemotherapy is often used in combination with other treatments such as surgery or radiation therapy, depending on the type and stage of cancer. While it can be highly effective in shrinking tumors and preventing cancer spread, it also carries risks of toxicity and long–term health effects.

Breast cancer is a neoplastic disease that represents the leading cause of cancer–related mortality in women worldwide and also in Algeria. Cytotoxic chemotherapy helps inhibit the proliferation of tumor cells. Cytotoxic drugs such as alkylating agents, antimetabolites, and others are treatments with a narrow therapeutic window, where the occurrence of toxic effects is significant. The mechanism of action varies depending on the type of drug.

Methodology: In the first research axis, we studied the risk factors through appropriate questionnaires and performed a histopathological study followed by an immunohistochemical study of tumor markers: HER2, ER, and PR in breast carcinomas in a series of 569 cases. In the second axis of this study, our objective was to study was conducted to assess the cytotoxic effects of chemotherapy in women with breast cancer in Oran, Algeria. The study included women diagnosed with breast cancer who were undergoing chemotherapy at healthcare facilities in the Wilaya of Oran. We conducted a study on 569 women diagnosed with breast cancer at the medical oncology department of the University Hospital Center of Oran.

Results and Discussion: Based on the results of a follow–up on tolerance and biological examination conducted after several chemotherapy cycles, we observed that side effects were noted in 569 patients. 199 patients had an abnormal liver function test, and 63 patients experienced severe hepatotoxicity. In our study series, the results show that the most frequent histological type is the invasive ductal carcinoma (IDC) with a SBR grade II. Cytotoxic drugs such as taxanes, platinum salts, etc., can cause side effects on the entire body (digestive, skin, hepatic, etc.). They are generally administered as combination therapy. According to the results obtained, only 63 patients exhibited hepatic toxicity, evaluated through various biological parameters predictive of hepatic status.

Conclusion: These preliminary results indicate that the toxic effects of chemotherapy delay the patients' recovery, which is why doctors take into account the symptoms reported by the patients and these biological assessments.

Keywords: Breast cancer, chemotherapy, toxicity, therapy.

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Introduction

Breast cancer is the most diagnosed cancer in women worldwide, both before and after menopause. One in eight women will be diagnosed with breast cancer during their lifetime. Men can also be affected; they account for 1% of all cases. Breast cancer most commonly occurs after the age of 50. The 5–year survival rate after a breast cancer diagnosis ranges from 80% to 90%, depending on age and the type of cancer[1].

In Algeria, breast cancer is the leading cancer among women. It is the most common cancer in women and has reached epidemic proportions, highlighting the need for comprehensive care, both preventive and curative [2].

There are various types of breast cancer, with the most common histological type being adenocarcinoma, particularly invasive ductal carcinoma and invasive lobular carcinoma [3]. Epidemiologists aim to determine the risk factors. These factors, in a broad sense, include diet, physical activity, obesity, as well as tobacco and alcohol consumption [4].

Chemotherapy for cancer involves medications that interfere with cellular function, leading to cell death or halting cell proliferation. Many normal cells are damaged by the treatment, which primarily targets cancer cells [5].

Chemotherapy treatments, which include various types of drugs, have a narrow therapeutic index, and their side effects are often the direct consequence of drug toxicity. These toxicities are often dose–limiting and can lead to severe complications.

The management of breast cancer patients depends on the stage of the disease and the extent of the spread, in order to define the optimal treatment in each case. The effectiveness of treatment is still limited due to certain severe side effects, which impair the patients' quality of life during treatment and sometimes even after recovery [6].

Our work focused on studying the cytotoxic effects of certain chemotherapy molecules in women with breast cancer in the Wilaya of Oran.

Patients and Methods

This study was conducted to evaluate the cytotoxic effects of chemotherapy in women diagnosed with breast cancer in the Wilaya of Oran, Algeria. An analysis was performed on a total of 569 women who had been diagnosed with breast cancer and were undergoing chemotherapy treatment at the medical oncology department of the University Hospital Center of Oran. The inclusion criteria for the study were women aged 18 and above who had been diagnosed with confirmed breast cancer, and who had completed at least two cycles of chemotherapy treatment. Women who had received other forms of cancer treatment (e.g., surgery or radiation therapy) prior to the initiation of chemotherapy or who had concurrent serious illnesses were excluded from the study.

The study primarily focused on assessing the side effects and cytotoxicity of chemotherapy drugs administered to these patients. Data collection was done through patient records, which included demographic information (age, socioeconomic status, and lifestyle factors) as well as clinical data (chemotherapy regimen, and treatment history). To evaluate the cytotoxic effects, clinical follow–up assessments and laboratory tests were carried out after each chemotherapy cycle. Biological samples, including blood tests, liver function tests, kidney function, and complete blood counts, were taken regularly to monitor any adverse effects. Side effects of chemotherapy were recorded in terms of their severity and frequency, and included common toxicities such as nausea, vomiting, fatigue, hair loss, liver toxicity, and neutropenia.

In addition to the clinical and biological follow–up, a histopathological examination was performed on tumor samples from the patients, and immunohistochemistry was conducted to assess the expression of key tumor markers such as HER2, estrogen receptor (ER), and progesterone receptor (PR). These markers were analyzed to correlate with the cytotoxic effects observed during treatment. The chemotherapy regimen most commonly used among the participants included a combination of taxanes, anthracyclines, and platinum–based agents, which are known to have a narrow therapeutic window.

Statistical analysis was performed to evaluate the relationship between the patients' response to chemotherapy, their baseline characteristics, and the development of any adverse effects. The study also aimed to investigate the correlation between the severity of cytotoxic effects and the type of chemotherapy drugs used, as well as the patients' overall health status.

This study seeks to contribute to a better understanding of the challenges associated with the cytotoxic effects of chemotherapy in breast cancer patients, particularly in the context of a developing country like Algeria, where healthcare resources are often limited and where the burden of cancer is increasing.

Results and Discussion

Breast cancer is a complex and multifactorial disease that represents a major cause of morbidity and mortality among women worldwide. In this study, we explored the relationship between the epidemiological characteristics

of breast cancer and the cytotoxicity of chemotherapy treatments. The analysis of clinical and biological data helped to better understand the impact of chemotherapy on patient health, particularly regarding the side effects related to the toxicity of the drugs used.

Our results show that the most affected age group in our study is between 45–49 years, which aligns with previously reported epidemiological data in numerous international studies [1]. While breast cancer often occurs after the age of 50, it is increasingly being diagnosed in younger women, particularly those with a family history or specific hormonal and reproductive factors (Table 1 and 2) [7, 8].

Hormonal factors play a major role in the development of breast cancer. Indeed, we observed that a large number of patients had their menarche between the ages of 12 and 15 and were in premenopause at the time of diagnosis. Oral contraception and breastfeeding history have also been identified as factors influencing the incidence of the disease [9, 10]. Furthermore, family predisposition and personal history of breast pathologies are well–established risk factors in the literature [11], which are also present in our studied population.

Regarding histological types, our study revealed that infiltrating ductal carcinoma (IDC) was the most common type, which is consistent with international data [12, 13]. Tumor grade, on the other hand, showed that the majority of patients had grade II tumors, indicating intermediate malignancy. Tumor grade is a key factor in breast cancer prognosis, with a clear correlation between a high grade and an unfavorable prognosis [14, 15].

One of the most important aspects of this study lies in the analysis of side effects associated with chemotherapy. Our results showed that the majority of patients presented at least one side effect related to treatment. The most commonly used protocols were Taxol® and Taxotere®, with 28.57% and 19.05%, respectively (Table 3 and 4). Digestive effects, such as nausea and vomiting, were the most frequent and are directly linked to chemotherapy agents such as taxanes and anthracyclines [16]. These side effects are well–known and can significantly affect the quality of life of patients during the treatment period [17].

Additionally, hepatic toxicity was observed in some patients, as evidenced by increases in transaminases (AST/ALT) and bilirubin. This underscores the importance of regular biological monitoring to assess liver function in patients undergoing chemotherapy [18]. However, renal tests remained within normal limits, indicating that renal function was generally preserved, which is a good indicator of tolerance to nephrotoxic drugs [19].

The chemotherapy protocols used in this study include a combination of taxanes, anthracyclines, and other agents such as carboplatin. The results indicate that taxane–based protocols were the most commonly used due to their proven efficacy, although their toxicity is also significant. The use of drugs such as Taxol® and Taxotere® has shown effective tumor control but with significant side effects, such as hepatotoxicity and myelotoxicity [20]. It is essential to strike a balance between treatment efficacy and the management of side effects to maximize benefits while minimizing risks to patient health.

Although chemotherapy remains a cornerstone in the treatment of breast cancer, its side effects highlight the need for continuous research to improve patient care. Newer, less toxic and more targeted therapeutic protocols are under development. The use of targeted therapies, such as hormone therapy or HER2–targeted therapies, has shown promising results with fewer side effects [21].

Moreover, better management of side effects through adjunctive treatments, such as antiemetics for nausea and vomiting, and enhanced biological monitoring, could improve patients' quality of life while maintaining therapeutic efficacy [22]. The integration of new molecular biology techniques and personalized approaches could also offer new perspectives for managing breast cancer, particularly in developing countries where access to treatments and quality care may be limited [23, 24].

This study has highlighted the importance of epidemiological factors in the development of breast cancer and demonstrated the complex relationship between the efficacy of chemotherapy treatments and their toxicity. The side effects of chemotherapy, particularly hepatic toxicity and digestive disorders, are significant challenges to overcome in managing breast cancer. Further research is needed to improve therapeutic protocols, reduce side effects, and optimize care for patients with breast cancer.

Conclusion

Through our study, we concluded that breast cancer is one of the most complex and poorly managed diseases, especially in developing countries, due to the numerous and varied risk factors associated, which are often strongly linked to socioeconomic status. It is well known that the diagnosis and treatment of breast cancer are very costly. The medical decision regarding the diagnosis and management of breast cancer is particularly difficult, as many risk factors must be considered, which may be complementary, contradictory, and/or competitive. Screening remains the only effective means to detect breast cancer at an early stage. Breast cancer is a disease characterized by uncontrolled cellular proliferation in normal tissue of the breast. There are several treatments used for breast cancer, such as surgery, radiation therapy, and chemotherapy. In our study series, the results show

Clinicopathological Characteristics	Patients (N)	Percentage (%)
Age at Diagnosis (n=569)		
≤ 50	267	47%
> 50	302	53%
Age at Menarche (n=569)		
≤ 14	467	82%
> 14	102	18%
Histopathological Prognostic Grade SBR (n=569)		
Grade 1	11	2%
Grade 2	358	63%
Grade 3	199	35%
Histological Type (n=569)		
Invasive Ductal Carcinoma	530	93%
Invasive Lobular Carcinoma and Other Subtypes	39	7%
Tumor Size TNM (n=569)		
T1	85	15%
T2–T3	336	59%
T4	114	20%
Tx	34	6%
Distant Metastasis (n=569)		
Present	301	53%
Absent	268	47%
ER Receptor Status (n=569)		
Positive	182	32%
Negative	387	68%
PR Receptor Status (n=569)		
Positive	216	38%
Negative	353	62%
HER2 Status (n=569)		
Positive	449	79%
Negative	120	21%
Ki–67 Expression (n=569)		
Positive	17	3%
Negative	552	97%
Location of Affected Breast (n=569)		
Left Breast	273	48.1%
Right Breast	258	45.4%
Bilateral	38	6.5%
Weight Status (n=569)		
Normal weight	148	26%
Overweight	222	39%
Obesity	199	35%

Table 1: Clinicopathological and Demographic Characteristics of the Study Population

Treatments	Pourcentage %
Breast Surgery	
– Not performed	13.5
– Patey	73.8
– Tumorectomy	12.7
Chemotherapy	
– Not performed	1.4
– Adjuvant	68.4
– Neoadjuvant	14.0
– Combination of both	16.2
Hormone Therapy	
– Yes	56.6
– No	43.4
Radiotherapy	
– Yes	62.7
– No	37.3
Targeted Therapy	
– Yes	40.9
– No	59.1

Table 2: Distribution of Breast Cancer Cases According to Treatments Received

Main Treatment Protocols	Percentage (%)
Taxol®	28.57
Taxotere®	19.05
Taxotere® + Herceptin®	11.90
Taxol® + Bevacizumab®	7.14
Taxol® + Herceptin®	4.76
Gemzar® + Taxol®	4.76
Gemzar® + Carboplatin®	4.76
Tamoxifen®	2.38
FEC®	2.38
Xeloda®	2.38
Navelbine®	2.38
Herceptin® + Tamoxifen®	2.38
Taxol® + Carboplatin®	2.38
Taxol® + Zometa®	2.38
Herceptin® + Zometa®	2.38
Total	100

Table 3: Distribution of Cases According to Therapeutic Protocol

Types of Side Effects	Frequency	Percentage (%)
Nausea	Frequent	35
Vomiting		35
Diarrhea		26
Alopecia		32
Asthenia		30
Anorexia		29
Neuropathy		21
Neutropenia	Infrequent	10
Constipation		11
Fever		11
Ototoxicity		04

Table 4: Distribution of cases based on their side effects.

that the most frequent histological type is invasive ductal carcinoma (IDC) with an SBR grade II.

Cytotoxic drugs such as taxanes, platinum salts, etc., can have side effects on the entire body (digestive, skin, hepatic, etc.). They are generally administered as combination therapy. According to the results obtained, only 63 patients exhibited hepatic toxicity, evaluated through various biological parameters predictive of hepatic status.

Therapeutic follow–up of patients helps monitor the tolerance to medications through clinical examination, which reveals the side effects reported by the patient, and a biological examination that includes predictive parameters of the patient's condition.

In the future, we aim to continue our research on using molecular biology techniques for better management of patients.

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