

Epidemiological characterization of benign and malignant breast tumors in a Senegalese population

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Abstract

Breast cancer is a growing burden in sub-Saharan Africa, with epidemiological characteristics that differ from those seen in Western populations. This study, conducted in Senegal, aimed to characterize the profiles of benign and malignant breast tumors by analyzing clinical and demographic parameters.

The retrospective and prospective study involved 48 women divided into three groups: controls (n=19), benign tumors (n=12), and malignant tumors (n=17). Data were collected via questionnaires and entered into an Excel spreadsheet, then analyzed using SPSS v23.

The results reveal a significantly earlier age at diagnosis for cancers (peak at 30-45 years) and a very young age for benign lesions (majority between 13-21 years), confirming the young profile of patients in West Africa. An overwhelming majority of cancers (70%) were diagnosed at an advanced stage (III/IV), partly explaining the almost systematic use of surgery (84% of cases) as the main treatment, due to the lack of widespread access to adjuvant therapies. A slight predominance of benign tumors in the right breast (54%) was noted. The ethnic distribution among malignant cases showed a predominance of the Peul (47%), Wolof (23%), and Manding (18%) groups.

The study concludes that there is an urgent need for appropriate public health policies, including screening campaigns targeting young women (from the age of 30), strengthening diagnostic (anatomopathology, genetics) and therapeutic (radiotherapy, chemotherapy) capacities, and continuing research on the specific determinants in the Senegalese and African context.

Keywords: Breast cancer; Benign tumor; Malignant tumor; Senegal

1. Introduction

Breast cancer is the most common malignant tumor in women worldwide. Its medical, psychological, and social impact makes it the leading cause of cancer death in women in many countries, with incidence rates rising steadily over several decades. However, there are significant geographical disparities in incidence, ranging from 27 per 100,000 women in East Asia and Africa to 85-94 per 100,000 in Australia, North America, and Western Europe [1]. In 2020, an estimated 2.26 million new cases of breast cancer were diagnosed worldwide, resulting in approximately 685,000 deaths [2]. The African continent contributed to this burden with nearly 186,600 new cases and 85,800 deaths [3]. At the national level, Senegal recorded 1,817 new cases and 951 deaths attributable to this disease in the same year [3].

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Furthermore, sub-Saharan Africa faces a dual health challenge. While still struggling with high morbidity and mortality rates linked to infectious diseases, malnutrition, and reproductive health issues, the growing burden of noncommunicable diseases, including cancer, is now exacerbating the situation [4]. This relentless burden of disease is the result of changes in behavior and lifestyle, an aging population, genetics, infections, and environmental factors. The epidemiological transition in sub-Saharan Africa is reflected in a doubling of cancer incidence over 30 years, which now stands at 128.2 cases per 100,000 inhabitants [5]. This phenomenon, which is more pronounced than elsewhere in low- and middle-income countries, is largely fueled by the rise of hormone-dependent and infectious cancers, with breast cancer playing a central role [6]. Breast cancer, along with cervical and prostate cancer, now dominates the regional cancer burden in terms of new cases and deaths.

This heterogeneous distribution worldwide and rapid evolution in Africa highlight the need for in-depth epidemiological surveillance to better guide prevention and management policies. Accurate knowledge of risk factors is crucial for identifying vulnerable populations, optimizing screening strategies, and implementing primary prevention measures targeting modifiable factors. While factors such as age, genetic predisposition, hyperestrogenism, and certain benign breast lesions are well established in Western countries, the profile of patients in sub-Saharan Africa appears to be distinct. In Senegal, as in most countries in the region, the epidemiological profile is characterized by younger patients and ethnocultural diversity, which raises questions about the influence of specific determinants. In the absence of detailed mapping of these risk factors, any attempt at awareness-raising or primary prevention tailored to the Senegalese population remains difficult.

It is in this context that the present study is conducted. It adopts an integrative epidemiological approach, aiming to go beyond simple description to analyze the interaction between clinical and demographic parameters in the occurrence of breast cancer in Senegal.

2. Methodology

2.1. Study population

This study focuses on Senegalese women with breast cancer, women with benign breast tumors (17 and 12 cases, respectively), and 19 control cases for comparison. These patients were recruited at the Juliot Curie Institute at Aristide Le Dantec Hospital. Each patient diagnosed with breast cancer or benign breast tumors and scheduled for surgery was interviewed. The objectives of the study, the protocol, the benefits, and the confidentiality criteria were explained to each patient to give her the opportunity to accept or refuse to participate. In the event of acceptance, a duly completed and signed informed consent form was required for admission to the study, after which a structured questionnaire was administered.

2.2. Data collection

After obtaining informed consent, patients are interviewed according to three characteristics:

- Their identity, age, weight, height, body mass index (BMI), marital status, gestational age (number of pregnancies), parity (number of births), ethnicity, and geographical origin;
- Their lifestyle (diet, contraceptive use, physical activity, alcohol and/or tobacco consumption);
- Medical history of breast cancer or benign breast tumors.

2.3. Descriptive statistics

The data obtained through the survey were entered into an Excel 2013 spreadsheet, with each condition considered as a study population (Table 1). All statistical analyses were performed using SPSS Statistics version 23 (IBM Corp., 2015, IBM SPSS Statistics for Windows, version 23.0, Armonk, NY: IBM Corp.), taking into account for comparative purposes the data obtained simultaneously in the three populations (Table 1), except for data specific to benign and malignant tumors, namely: type of treatment, tumor stage, tumor location, and ethnicity. Age was subdivided into four classes: young adults (under 35); middle-aged adults with a 15-year age difference [35–49] and [50–64]; and older adults (65 and over).

Table 1 Characteristics of epidemiological parameters

Population	Individuals	AGE	SM	Con	Men	Ant	Tumor	Treatment	stage	Ethnicity
Controls (T)	T1	39	M	No	No	Yes	-	-	-	-
	T2	24	M	Yes	No	No	-	-	-	-
	T3	32	M	Yes	No	No	-	-	-	-
	T4	28	M	Yes	No	No	-	-	-	-
	T5	39	M	No	No	No	-	-	-	-
	T6	36	M	Yes	No	No	-	-	-	-
	T7	43	M	No	No	Yes	-	-	-	-
	T8	56	M	Yes	Yes	No	-	-	-	-
	T9	30	M	Yes	No	No	-	-	-	-
	T10	23	M	Yes	No	No	-	-	-	-
	T11	25	M	No	No	No	-	-	-	-
	T12	22	M	No	No	No	-	-	-	-
	T13	19	M	No	No	No	-	-	-	-
	T14	21	M	No	No	No	-	-	-	-
	T15	23	M	No	No	No	-	-	-	-
	T16	34	M	No	No	No	-	-	-	-
	T17	50	M	Yes	Yes	No	-	-	-	-
	T18	30	M	No	No	No	-	-	-	-
	T19	19	C	No	No	No	-	-	-	-
Benign tumors (TB)	TB1	17	C	-	-	-	left breast	Surgery	-	-
	TB2	22	M	-	-	-	left breast	Surgery Chemotherapy	-	-
	TB3	26	C	-	-	-	right breast	Surgery	-	-
	TB4	20	C	-	-	-	left breast	Surgery	-	-
	TB5	13	C	-	-	-	right breast	Chemotherapy	-	-
	TB6	35	C	-	-	-	right breast	Surgery	-	-
	TB7	17	C	-	-	-	right breast	Surgery	-	-
	TB8	15	C	-	-	-	right breast	Surgery	-	-
	TB9	24	C	-	-	-	left breast	Surgery	-	-
	TB10	18	C	-	-	-	right breast	Surgery	-	-
	TB11	21	C	-	-	-	left breast	Surgery	-	-
	TB12	22	C	-	-	-	left breast	Surgery	-	-

Malignant tumors (TM)	TM1	45	M	No	-	No	-	-	3	WOLOF
	TM2	45	M	No	-	No	-	-	3	MAURE
	TM3	73	V	No	-	No	-	-	1	PEULE
	TM4	41	M	No	-	No	-	-	3	PEULE
	TM5	54	C	No	-	No	-	-	3	PEULE
	TM6	35	M	No	-	No	-	-	3	WOLOF
	TM7	56	M	No	-	No	-	-	4	PEULE
	TM8	60	M	No	-	No	-	-	2	WOLOF
	TM9	40	M	No	-	No	-	-	3	PEULE
	TM10	47	C	No	-	No	-	-	3	MANDING
	TM11	70	V	No	-	No	-	-	3	MANDING
	TM12	39	M	No	-	No	-	-	3	WOLOF
	TM13	54	M	No	-	No	-	-	2	PEULE
	TM14	30	M	No	-	No	-	-	3	PEULE
	TM15	54	M	No	-	No	-	-	1	SERERE
	TM16	58	M	No	-	No	-	-	3	PEULE
	TM17	45	D	No	-	No	-	-	3	MANDING

SM= marital status; Con = birth control; Men = menopause; Ant = family history; M=married; C= single; D= divorced; V= Widow

3. Results

3.1. Population distribution by age

3.1.1. Control population

The bar chart showing the distribution of control subjects by age was obtained by calculating the percentage of control subjects according to different age groups with intervals spaced at 13 years. The sample is heavily skewed toward young adults (18-31 years old), with people over 47 years old underrepresented (11%). These results are presented in Figure 1.

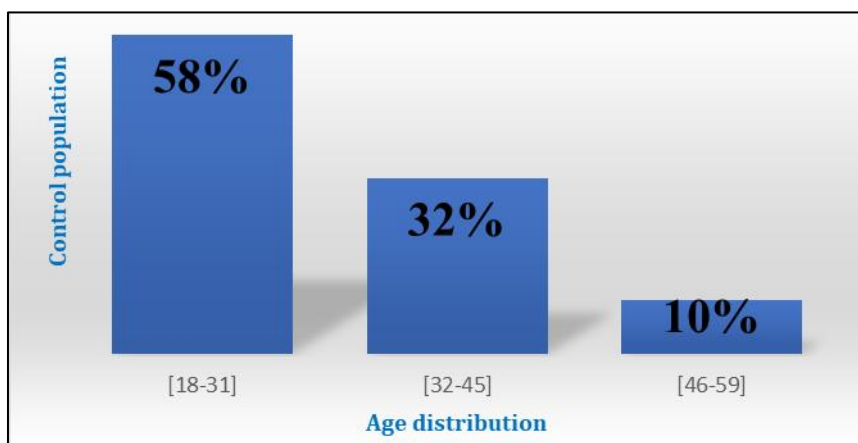


Figure 1 Distribution of control subjects by age

3.1.2. Population with benign tumors

In this series, benign breast tumors predominantly affect young women: 54% of patients are between 13 and 21 years old, 38% are between 22 and 30 years old, and only 8% are between 31 and 39 years old (Figure 2). This reflects the typically juvenile nature of most benign breast lesions. The risk of cancer remains extremely low before the age of 30-35. The fact that only 8% are between 31 and 39 years old shows that, in this study or center, older women are likely to consult more often for suspicious lesions that turn out to be malignant (hence a lower proportion of purely benign tumors in this age group). These parameters are shown in Figure 2.

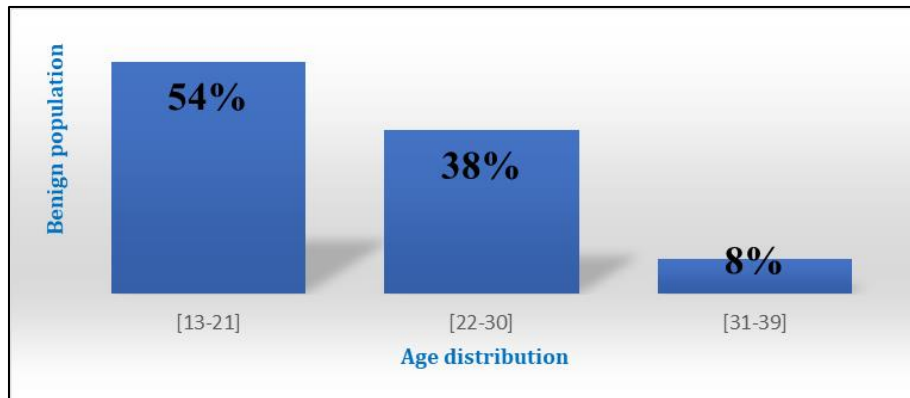


Figure 2 Distribution of patients with benign breast tumors by age

3.1.3. Malignant tumor population

The distribution of patients with malignant breast tumors by age shows an atypical distribution compared to current global epidemiological data (Figure 3). Nearly 88% of cases (47% + 41%) involve patients aged 30 to 61. This indicates a marked predominance of breast cancer in women of childbearing age or in the middle of their working lives, with a clear peak in the 30-45 age group (almost half of all cases). The 46-61 age group follows closely behind, representing a significant but slightly lower proportion.

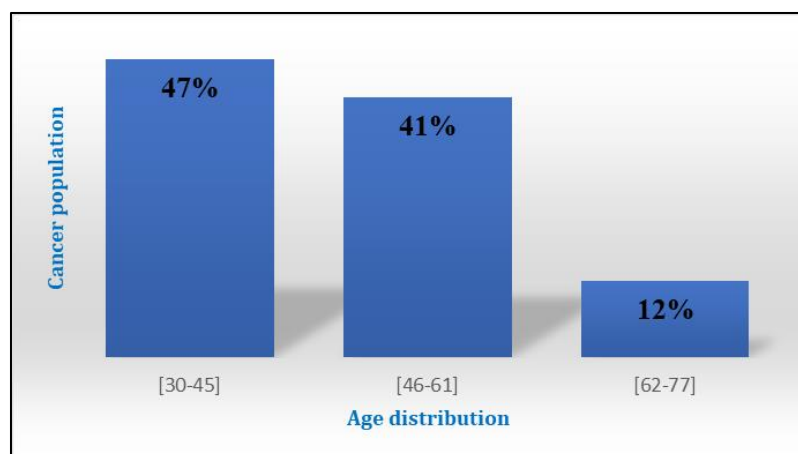


Figure 3 Distribution of patients with malignant breast tumors by age

3.2. Distribution according to marital status

3.2.1. Control population

The bar chart below in Figure 4 shows the marital status of the sample population as a percentage. This analysis allows us to characterize the sociodemographic profile of the sample population, which is essential for assessing the representativeness of this group in the context of the study. The analysis shows that 95% of the sample population are married women, compared to 5% who are single.

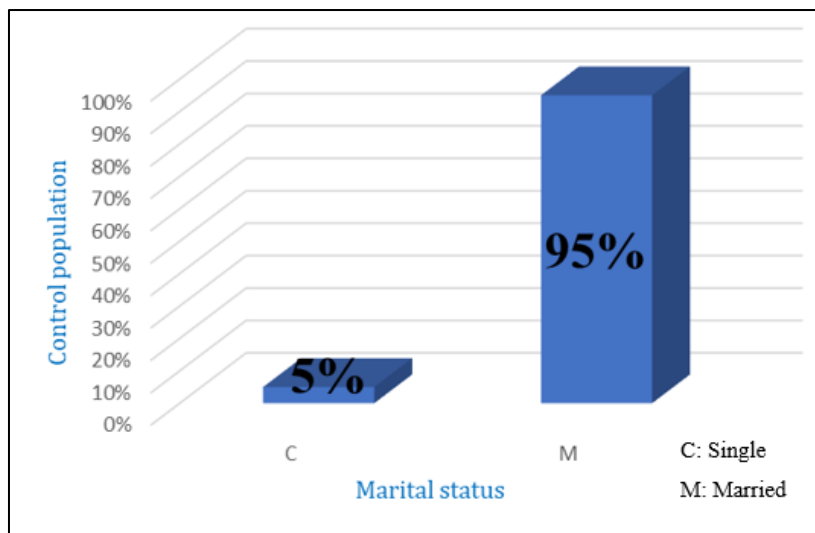


Figure 4 Distribution of control subjects according to marital status

3.2.2. Population with benign tumors

The marital status profile of patients with benign breast tumors is characterized by a distribution of 92% single patients and only 8% married patients (Figure 5). This sociodemographic configuration should be taken into account in the overall understanding of the factors associated with this pathology.

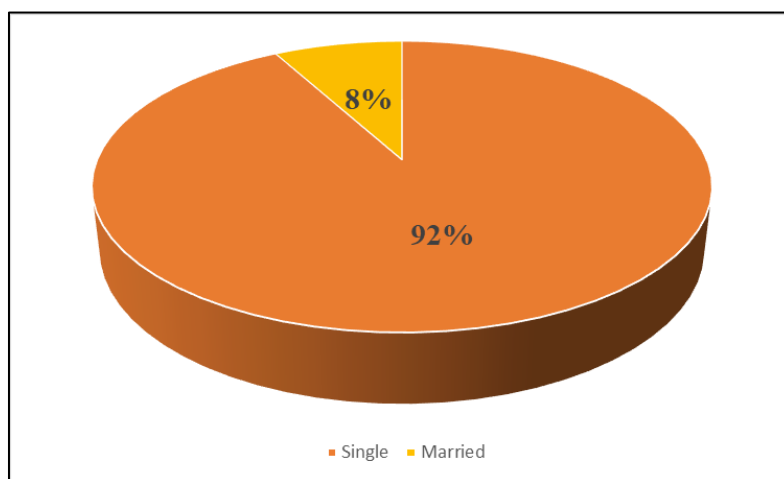


Figure 5 Distribution of patients with benign breast tumors according to marital status

3.2.3. Population with malignant tumors

The marital profile of patients with malignant breast tumors is characterized by an overwhelming predominance of married women (70%), followed equally by single and widowed women (12% each), and marginally by divorced women (6%) (Figure 6). This configuration strongly suggests the influence of factors related to age, health behaviors, or perhaps certain protective or risk factors associated with marital status.

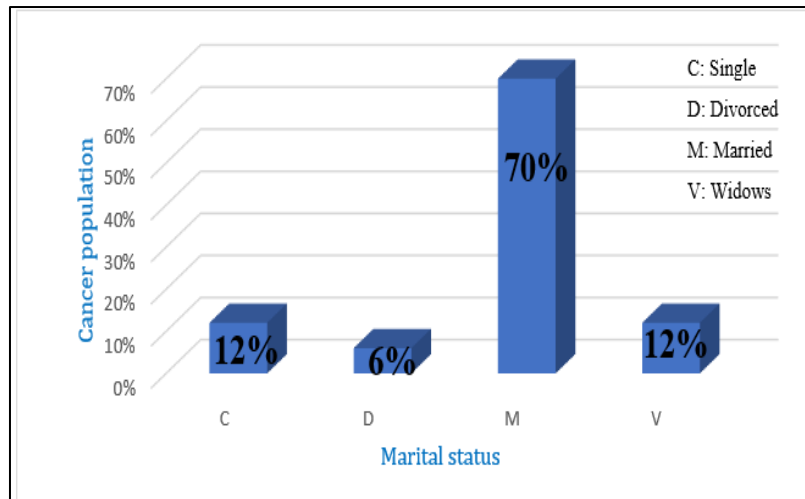


Figure 6 Distribution of patients with malignant breast tumors according to marital status

3.3. Distribution according to the location of the benign tumor

The location of benign breast tumors shows that tumors on the right side were observed in 54% of individuals and tumors on the left side were observed in 46% of individuals (Figure 7).

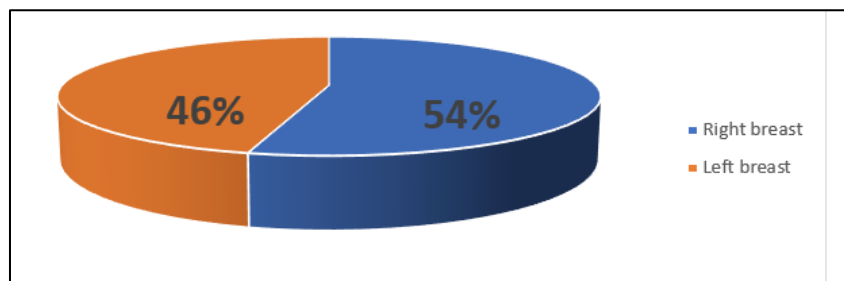


Figure 7 Distribution of patients according to the location of benign breast tumors

3.4. Distribution by type of treatment

The type of treatment for patients with benign breast tumors reveals that 84% of patients are treated with surgery, 8% with chemotherapy, and 8% with surgery combined with chemotherapy (Figure 8).

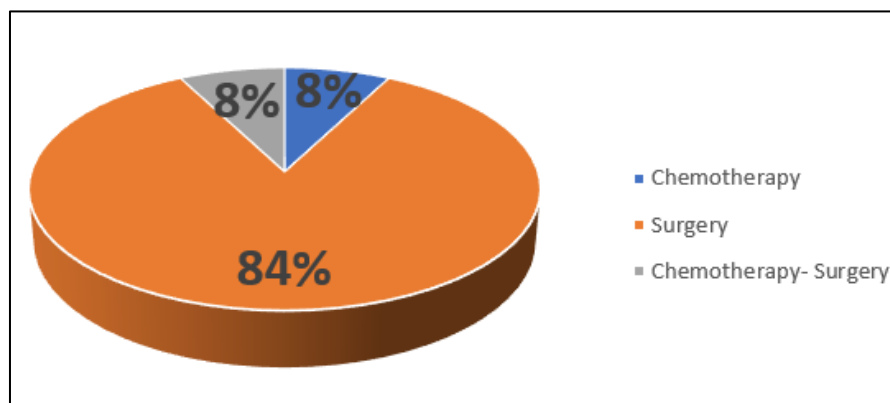


Figure 8 Distribution of patients with benign breast tumors according to type of treatment

3.5. Ethnic distribution of the malignant population

The ethnic distribution of patients with malignant breast tumors shows a predominance of the PEULE (47%), WOLOF (23%), and MANDIN (18%) groups, while the MAURE and SERERE groups are underrepresented (6% each) (Figure 9). This distribution raises important questions about the ethnic determinants of breast cancer and potential disparities in access to diagnosis and care.

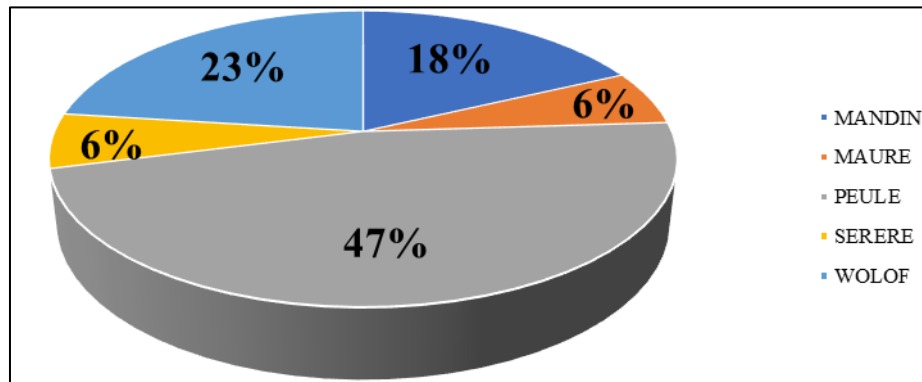


Figure 9 Distribution of patients with malignant breast tumors by ethnicity

3.6. Classification according to the stage of the malignant tumor

The stage of development of malignant breast tumors shows that 70% are at stage 3, 12% at stages 1 and 2, and only 6% at stage 4 (Figure 10).

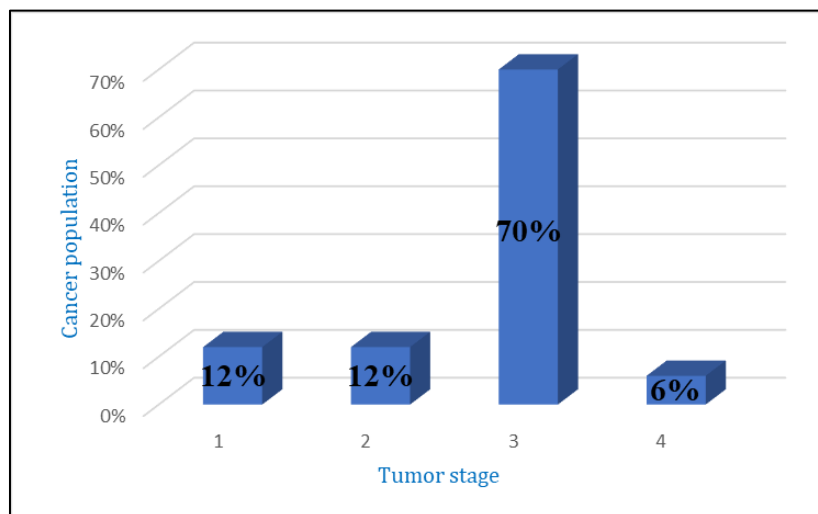


Figure 10 Distribution of patients according to the stage of development of malignant breast tumors

4. Discussion

Breast cancer is a malignant tumor of the mammary gland, in other words, it is a cancer that originates in the cells whose function is to secrete milk and in the lobular ducts of the breast, mainly in women. This study aims to characterize mammary gland tumors in the Senegalese population, in particular to monitor their distribution according to clinical and demographic parameters, as well as the underlying genetic determinants of the tumor.

Statistical analyses reveal that among the controls, the most represented age group was 18–31 years (58%), with an average age not significantly different from that reported by Diop *et al.* [7] in a cohort of 405 Senegalese patients (46.9 years). This distribution potentially reflects the young demographic structure of Senegal, where a large proportion of the female population is of reproductive age. This age group, characterized by the youthfulness of the control population, was approximately the same as that found in the population with benign tumors, where more than half (54%) were aged 13 to 21, with extremes ranging from 13 to 35. This predominance among young women is consistent

with the literature on benign breast lesions, such as fibroadenomas, which are common at this age due to hormonal factors [8]. In contrast to these two populations, the malignant tumor population shows that 47% of cases were in the 30-45 age group, with extremes ranging from 30 to 73 years, and a similar average age to that reported by Diop [7]. This difference in age group between the malignant and benign populations could be due to late diagnosis of cancer. This phenomenon may be exacerbated by difficulties in accessing care due to a lack of infrastructure and qualified local personnel, combined with socioeconomic factors such as financial barriers [8]. Similarly, Gueye *et al.* [9], in a study conducted at the Aristide Le Dantec Hospital in Dakar on women under 35 years of age, report similar clinical profiles, with an often unfavorable prognosis due to late diagnosis. However, the high incidence of cancer in young people reflects awareness of the seriousness of the disease in the face of countless awareness-raising and screening methods. This young age at diagnosis is a recurring feature among African and African American populations, compared to Caucasian populations, where the average age is often over 60 [9, 10]. In sub-Saharan Africa, the epidemiology of breast cancer confirms this trend: recent studies indicate an average age at diagnosis of around 46-48 years in Senegal and West Africa [11, 12]. In short, this study reinforces the idea that breast cancer in Senegal affects younger women than in high-income countries, highlighting the need for awareness campaigns tailored to the 30-45 age group.

Marital status appears to be a socio-demographic factor that differentiates patient profiles. In our study, the predominance of married women among malignant cases (70%) and controls (95%) could be explained by lifestyle factors such as married women often having a higher parity (number of children), which is a known protective factor against breast cancer, but in sub-Saharan Africa, this could also reflect better access to care thanks to family support. Conversely, the overrepresentation of single women among benign tumors (92%) suggests that these women, who are potentially younger and nulliparous (childless), have more frequent fibrocystic or benign lesions, linked to hormonal fluctuations that are not mitigated by pregnancy.

The higher prevalence of benign tumors in the right breast does not show a significant difference between the two sides, as evidenced by a Senegalese study that even reports a slight predominance of benign lesions on the left side [13]. Furthermore, most benign tumors are caused by factors such as hormonal changes, cysts, or fibroadenomas, which can occur in either breast [14, 15]. However, a predominance of malignant tumors in the right breast, albeit moderate, has been observed in several African populations, particularly in sub-Saharan Africa (56.19% in Togo, 62.5% in Mali, 52-60% in Senegal) [13]. This finding contrasts with older meta-analyses conducted mainly in Western or Asian populations, which reported a slight predominance on the left side, often explained by a higher frequency of breastfeeding on the right breast or volumetric asymmetry [16]. Several cultural and behavioral hypotheses can be put forward in the African context: the traditional practice of carrying infants on the back with preferential support of the left breast could promote longer breastfeeding on that side, exerting a relative protective effect. In addition, manual laterality (90% right-handed) could influence the quality of self-examination.

Statistical analyses reveal a predominance of patients with stage III malignant tumors (70%), which is consistent with Malian series, where a high proportion (44.90%) are diagnosed at an advanced stage [17]. This situation contrasts with Moroccan series, where only 6% of cases are detected at stage I [18]. This difference could be explained by the absence of a real breast cancer screening policy in our country.

Surgery is the most commonly used treatment for breast cancer, with a frequency of 84%. This rate is higher than that reported by [19] in Geneva. This difference could be explained by the small size of the study population, but it also reflects the contextual constraints in Senegal, where surgery often remains the mainstay of treatment due to the scarcity of facilities for chemotherapy and radiotherapy. Although this widespread use of surgery partially compensates for frequent diagnostic delays (advanced stages in 70-80% of patients in sub-Saharan Africa), it raises issues of long-term morbidity, such as post-mastectomy sequelae and the lack of multimodal approaches. The rate of 84% of surgical treatments in the Senegalese population is in line with trends observed in sub-Saharan Africa, where surgery is the main treatment for 48.75% of breast cancer cases [21], compared to less than 50% in some West African countries such as Nigeria due to advanced inoperable tumors and financial barriers [21]. This predominance is consistent with the study by Rapiti *et al.* [19], which reported 81.9% in Malaysia (a middle-income country with better access to care) and Geneva (a high-income setting). However, our results show slightly higher rates and may reflect local adaptation to limited resources. In Senegal, as in other SSA countries, approximately 80% of cancers require surgery, but only 25-30% of patients receive multimodal treatment including chemotherapy or radiotherapy due to the small number of equipped centers (only 2-3 nationwide).

5. Conclusion

The clinical and demographic study of patients with breast cancer in a Senegalese population. It confirms and refines several epidemiological characteristics already documented in sub-Saharan Africa, while highlighting the structural challenges of care.

Our results reinforce the finding that the age at diagnosis is significantly younger than in the West, with a peak in the 30-45 age group for malignant tumors. This young profile, consistent with regional data, means that awareness and screening campaigns must target women well before the age of 50. In addition, there is a significant overrepresentation of advanced stages (stage III) at the time of diagnosis, a phenomenon that is unfortunately widespread in sub-Saharan Africa, where 70-80% of cases are detected late. This reality is the main driver of the almost systematic use of surgery (84% in our cohort), often in the absence of comprehensive multimodal adjuvant treatments, reflecting the constraints of access to radiotherapy and diversified chemotherapy regimens.

The tendency toward right-sided predominance for malignant lesions observed in this study population and in other West African studies contrasts with Western data, suggesting that this distribution requires further investigation to move beyond behavioral hypotheses and explore possible biological correlates.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare that the research was conducted in the absence of any commercial relationships that could be construed as a potential conflict of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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