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REVIEW ARTICLE

Status of Pathology Services and Molecular Pathology in Sub-Saharan Africa: Implications for Combating Breast Cancer

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ABSTRACT

African breast cancer patients benefit less from classical pathology services owing to the complex molecular and clinicopathological nature of the disease, poor quality of laboratory supplies, and shortage of experts in the field. This review presents evidence and confirms the need for improving anatomic pathology services in Africa. Peer-reviewed international journal articles available in Medline, Scopus, PubMed, and Google scholars, describing the status of pathology services in Africa, were included. Besides the late presentation of patients, anatomic pathology laboratories are accountable for the escalated mortality of breast cancer patients in several parts of Africa. Conversely, molecular diversity and biological heterogeneity of breast cancers, which disprove the one-size-fits-all therapeutic approach, have been reported from different parts of the continent. Irrespective of the geographical background, the choice of therapeutic options and predicting disease outcome depends on the right identification of the molecular signature of the cancer type. In conclusion, we propose that upgrading and integrating anatomic pathology with molecular diagnostic pathology is essential in order to provide better diagnostic results that will profoundly impact curbing mortality from breast cancers.

INTRODUCTION

Pathology is a gold standard for detecting and treating all types of cancers, including breast cancers [1]. On the other hand, deprived pathology service imposes negative impacts on the patient satisfaction, clinician confidence and disease outcomes. For instance, inadequate pathology services result in ineffective therapeutic approaches due to delayed or inaccurate diagnoses, which in turn affect patient outcome directly and lead to erroneous estimates of cancer prevalence in the general population [1, 2].

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This, in turn, results in an impaired capacity in health care systems and policy-makers to plan for resource mobilization for fighting cancer [3, 4]. The fact is that pathology needs a very complex laboratory set ups with well-trained technicians and pathologists, the latter playing crucial role in defining the given patient sample. To this end, the capacity of a pathologist to identify a given tumor depends on the quality of facilities in the lab and skills of the expert her/himself. In this regard, most of high-income countries (HICs) have high caliber pathologists with sub-specialty and well-established advanced pathology laboratories that are equipped with the state-of-art laboratory technologies [5, 6]. As a result, they have good pathology services and standard cancer patient care systems, which

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partly contributed to significantly decreased mortality and increased quality of life of cancer patients [7, 8]. In contrast, the scarcity of a skilled pathology workforce and poorly equipped pathology laboratories resulted in limited access and underprivileged quality of cancer diagnosis and treatment in Africa [2, 3]. The existing pathology services in most African countries exclusively rely on the error-prone morphologic investigation of the patient specimen [3, 4]. Coupled with late presentation of the patient, limited skills of the expert and impaired anatomic pathology laboratory are accountable for the escalated mortality of cancer patients in many parts of Africa [2-4].

To improve the diagnostic and therapeutic decisions of cancer patients in many HICs anatomic pathology is supported by the cutting-edge diagnostic molecular and imaging technologies. The application of molecular biology techniques enabled these countries to introduce personalized and targeted breast cancer therapies [8, 9]. In similar fashion, the accuracy of diagnostic pathology can be improved by coupling morphological investigation with advanced molecular diagnostic modalities in order to save the lives of many citizens in Africa. The application of molecular diagnostic methods can also increase the confidence of the pathologists and oncologists in diagnostic and therapeutic decisions of the breast cancer patients. By doing so, it can improve the prognosis of the patient and make life easy for the pathologist and the treating clinician. Thus, this narrative review assesses the status of anatomic pathology in Sub-Sahara Africa and discloses the urgent need of molecular pathology for appropriate diagnosis and treatment of breast cancer patients. It addresses also the general need for molecular pathology for breast cancer prevention and management in Africa.

MAIN ISSUE

Studies included in this review were those published between January 2000 and July 2019. All articles written in English language, published in peer reviewed international journals and describing about the status of pathology services in Africa and the role of molecular biology in detection, monitoring, therapeutic applications and prognostic predictions of breast cancer were explored extensively. In addition, other documents from internationally acknowledged organization such as the World Health Organization or on websites run by credible organizations available in Medline, Scopus, PubMed and Google scholars were included in this review. Charts and tables were generated based on the data from previously published studies. Finally, conclusions and recommendations are formulated based on the literatures reviewed. The selection of breast cancer was based on the fact that it is one of the most prevalent cancer types with high mortality rate in Africa. In addition, breast cancer is heterogeneous at biological and molecular level and there is marked racial variation in prevalence, aggressiveness and genetic profile of the disease. In addition, it is one of the most preventable cancers provided that accurate detection and effective treatments are available in the settings.

1. The Pathos of Pathology Services in Sub-Saharan Africa

Pathology is a complex discipline including several other streams such as histology, cytology, hematology, microbiology, chemical pathology, immunology, and molecular pathology, all of which are critically important in managing and controlling cancer successfully [10]. An accurate and timely diagnosis of cancer has multiples of benefits for the patient and the treating clinicians. With regard to the patient, it decreases the chance of being exposed for the wrong treatment decisions, which will expose the patient for unintended health risks. For instance, false positive reports (over-diagnosis) can lead into unnecessary over-treatments that might result in serious health problems. False negative reports (under-diagnosis) also can result in delayed detection of cancer, where the patient will be presented with advanced stage of the disease later [3, 11]. Thus, accurate detection of cancer is critical for the right and timely treatment decision and clearly has significant

implications in patient follow-up and determining the prognosis of the disease. Furthermore, diagnostic pathology plays pivotal roles in screening for cancer, assessing margins in tumor excision specimens and determining predictive tumor markers [1, 12]. Thus, standard pathology services make life easier for the treating clinicians apart from helping the patient get best benefits from the existing treatment modalities.

Despite the aforementioned facts the status of pathology service in most African countries is disappointing [2, 3]. Good number of literatures indicate that pathology services in this continent are struggling with ill-equipped facilities, limited and deprived skilled man-power, and lack of attention by the public authorities [13, 14]. In addition, the number of pathology centers is extremely limited in many parts of Africa. The number of pathologists in some African countries is also disproportionally low compared to Western countries (Figure 1) [15]. The technical skills of pathologists are also limited, which in turn leads to lack of confidence of the experts on oneself and the society on the experts as well [2, 3, 11, 15].

Poor quality supplies and shortage of consumables also result in unnecessarily longer turnaround times,

Table 1. Results of African Pathology Centers Survey by Country, Providers and Services

Country	Population (No.)	No. of Persons per Pathologist	Providers (No.)				Services				
			Pathologists	Histopathology Technicians	Cytopathology Technicians	Oncologists	IHC	Molecular	Chemotherapy	Radiation Therapy	% of Cancers With Pathologic Diagnosis
Angola	24,906,000	2,075,500	12	23	7	24			Y	Y	
Benin	10,567,000	NA	0	4	0	4	Y	N	Y	Y	< 10
Botswana	2,156,000	359,333	6	3	8	6	N		Y	Y	10-50
Burkina Faso	18,184,000	2,273,000	8	4	0	3	N	N	Y	Y	
Burundi	9,684,000	3,228,000	3	3*	0	0	N	N	N	N	
Cameroon	21,636,000	3,606,000	6	2	3		N	N	Y	Y	10-50
Central African Republic	5,462,000	1,365,500	4	3	0	0	N	N	Y	N	
Chad	13,439,000	6,719,500	2	2	0	0	N	N	N	N	
Cote d'Ivoire	24,926,000	1,661,733	15	8	1	4	Y	N	Y	N	10-50
Democratic Republic of Congo	74,081,000	4,938,733	15	21	4	4	Y	N	Y	Y	10-50
Ethiopia	89,060,000	1,619,273	55	19	†	6	Y		Y	Y	
Gabon	2,337,000	779,000	3	8	0	4	Y	N	Y	Y	
Ghana	27,379,000	912,633	30	6+	4	7	Y	N	Y	Y	> 50
Kenya	43,558,000	725,967	60	10+	4	10+	Y		Y	Y	> 50
Madagascar	22,747,000	NA									
Malawi	16,056,000	1,784,000	9	1	1	1	Y		Y	N	< 10
Mali	17,512,000	3,502,400	5	3	0	2	N	N	Y	N	> 50
Mauritania	3,716,000	1,238,667	3	4	1	1	N	N	Y	Y	> 50
Mauritius	1,262,000	84,133	15	4	3	11	Y	Y	Y	Y	> 50
Mozambique	25,392,000	3,174,000	8	17‡	6	4	Y		Y	N	10-50
Namibia	2,217,000	554,250	4	5	3	4	N		Y	Y	10-50
Niger	18,529,000	9,264,500	2	2					Y	N	
Nigeria	182,336,000	1,072,565	170	1,400‡	‡	20	Y		Y	Y	10-50
Republic of Congo	4,638,000	1,546,000	3								
Rwanda	11,180,000	2,236,000	5	10+	2	0	Y		Y	N	< 10
Senegal	13,950,000	1,992,857	7			12§	Y		Y	Y	10-50
Sierra Leone	6,432,000	6,432,000	1	0	0	0	N	N	N	N	10-50
South Africa	54,425,000	224,897	242	69	94	40+‖	Y	Y	Y	Y	> 50
South Sudan	12,165,000	6,082,500	2	0	0	0	N		N	N	< 10
Tanzania	48,126,000	2,187,545	22	20	20	12¶	Y		Y	Y	< 10
Togo	6,967,000	2,322,333	3	2	0	0	N	N	Y	N	10-50
Uganda	35,225,000	1,467,708	24	13	5	6	Y	N	Y	Y	10-50
Zambia	15,254,000	2,542,333	6	4+	2	5	N		Y	Y	
Zimbabwe	13,426,000	2,685,200	5	1	0	4	N	N	Y	Y	10-50

NOTE. Empty cells indicate no response or no data available. There are no public sector pathologists in Equatorial Guinea, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, and Swaziland.
Abbreviations: IHC, immunohistochemistry; N, no; NA, not available; Y, yes.
*Technicians have bench training only.
†Pathologists do cytology screening.
‡Technologists do histology and cytology.
§Medical and surgical oncologists.
‖General surgeons also practice some oncology.
¶Oncology fellowships.

Figure 1. Comprehensive view of the status of pathology in Africa. Adapted from the article of Nelson et al. (J Clin Oncol. 2016;34:20-26) with original copyright holder's permission [15].

which in turn lead to patient dissatisfaction. Poorly skilled laboratory technologists coupled with low quality reagents lead into under-quality stained slides, which could be one of the reasons for false results in many parts of Africa [2, 3, 15]. Superficially to cover these problems, some African countries are inclining the balance of resources toward treatment intense efforts rather than investing in providing accurate diagnosis-advanced pathology services [16, 17]. However, the fact is that social, financial and psychological gain from accurate and timely diagnosis is more comfortable and worth than the initial expenditures in establishing good pathology services.

In many African countries, there is lack of understanding and appreciation of the role of pathologists by other authorities, non-pathologist health professionals and the general population [18-21]. For instance, a study conducted in Ghana indicated that nonmedical professionals and other health workers are obscure of the importance of activities of the pathologist. As a result, significantly fewer pathologists have specialized in the field in the last decades [18]. New medical graduates in Africa are not willing to join pathology specialty program because they think that pathology is considered only as a forensic specialty and economically unsatisfactory for career development [20]. Consequently, for example, a comprehensive survey conducted by American Society of Clinical Pathology in between 2011 and 2013 indicated that a pathologist is for more than 500,000 people in some Sub-Saharan Africa whereas an equivalent expert is for 15,000 to 20,000 people in the United States and United Kingdom [15]. This is striking disparity indicating low attention given to the prevention and control of cancer in the African continent. The same survey further revealed that some African countries regretfully lack pathologists and pathology services completely (Figure 1) [15].

2. The Burden and Molecular Characteristics of Breast Cancer: Evidences for the Need for Molecular Pathology in Africa

In this review, the burden of cancer in general and breast cancer in particular has been investigated very briefly. Recent reports indicated that cancer accounts for an estimated 9.6 million deaths in 2018, from which nearly 70% occur in low- and middle-income countries (LMICs). In Africa, cancer is one of the most commonly evolving public health challenges affecting millions per year [8, 22]. Cancer causing infections such as Hepatitis B and C viruses, Helicobacter pylori and Human papilloma virus, are accountable for up to one-fourth of cancer cases in LMICs, including Sub-Saharan Africa. Whereas mortality from cancer is alarmingly increasing in LMIC, it is significantly declining in HICs [22, 23]. The secret of substantial decline in cancer mortality in these countries is partly attributed to the applications of molecular techniques for diagnostics and treatments (particularly targeted and personalize therapy), in addition to the well-established public awareness and screening programs [23]. Late-stage presentation, inaccessible health facilities, poor diagnostic modalities and hardly available treatment options are common contributors for the disproportionately high mortality rate of cancer in Africa [2, 3].

Breast cancer is the most common types of cancer in women in the globe and in Sub-Saharan Africa [22, 23]. Morbidity and mortality from breast cancer is alarmingly increasing in low income countries, including Africa (Figure 2). The evolution of advanced diagnostic and treatment modalities that apply the state-of-art molecular and imaging technologies played great role in the declined mortality from breast cancer in HICs [24, 25]. The emerging role of molecular biology can be appreciated with the realization that breast cancer is not a single disease, and subgroups of breast cancer with different clinical outcomes can be clearly identified with molecular technologies [26]. More detailed molecular studies have revealed that even

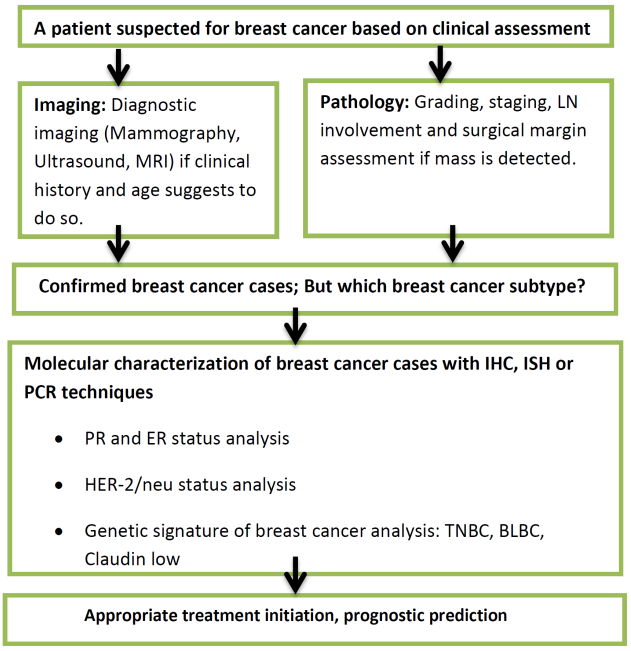

Figure 2. Overview of comprehensive and evidence-based breast cancer diagnosis.
Abbreviations: MRI, magnetic resonance imaging; LN, lymph node; IHC, immunohistochemistry; ISH, in situ hybridization; PCR, polymerase chain reaction; PR, progesterone; ER, estrogen; HER-2, human epidermal growth factor receptor 2; TNBC, triple negative breast cancer; BLBC, basal like breast cancer.

morphologically similar sub-types of breast cancer can display molecular heterogeneity [27, 28]. In this regard, the 2013 St. Galen consensus conference made use of the application of immunohistochemistry and other molecular techniques for determining the surrogate definitions of intrinsic subtypes of breast cancer [29]. Accordingly, there are four intrinsic subtypes of breast cancer. These are (a) Luminal A, (b) Luminal B, (c) human epidermal growth factor receptor 2 (HER2) and (d) Basal-like intrinsic subtypes of breast cancers. Further detailed molecular investigation of breast cancer revealed several additional subgroups of breast cancers [30-36]. The intrinsic molecular subtypes of breast cancer, their prognostic and pathological features, corresponding molecular diagnosis, and treatment options are briefly elaborated in Table 1 [12, 37-43].

The critical importance of uncovering the molecular subtypes of breast cancer in such a way is that the treatment approaches and the clinical outcomes for all of these sub-groups vary accordingly [32-34]. Fore instances, molecular investigation indicated that the receptor positives and triple negatives have good prognosis and aggressive nature, respectively [31]. Thus, the therapeutic approach for such heterogeneous groups of breast cancer is determined by the molecular characteristics of the respective breast cancer subtypes [7, 35, 36, 44]. No matter there exists well-established anatomic pathology laboratory and how skilled the anatomic pathologist performing the diagnosis, it is impossible to determine the molecular subtypes of breast cancer without the application of molecular techniques. The complex nature of molecular profile of breast cancer can only be revealed with the application of molecular techniques. Furthermore, advanced breast cancer diagnosis should apply molecular techniques in combination with histopathology and imaging modalities, and investigate the genetic signature of every breast cancer before initiating corresponding treatment. This is because of the fact that molecular biology has opened new avenues for treatment of breast cancer through the identification of signaling molecules that are important in the proliferation and survival of the neoplastic cells [36, 45].

Recent reports by European Society for Medical Oncology Committee indicated that the treatment of breast cancer has been shifted from the conventional approach of "one-size-fits-all" to one of personalized treatment tailored to the specific characteristics of the tumor [46]. There has been a significant progress in the understanding of molecular events and critical molecular pathways involved in breast cancer development. This has led to the identification of novel diagnostic targets and development of effective anticancer therapies known as targeted therapy [47, 48]. Targeted therapy has high specificity for the molecules involved in key molecular signatures that are accountable for tumor phenotype such as cell growth, survival, migration, invasion, metastasis, apoptosis, cell-cycle progression, and angiogenesis [49]. Some of the targeted therapeutic agents that have been approved for breast cancer treatment include trastuzumab [36, 37] and lapatinib-

Table 1. Surrogate definitions of intrinsic subtypes of breast cancer

Intrinsic molecular subtypes	Proportion of associated breast cancer (%)	Prognosis and clinico-pathological charactestics	Patterns of selected genes/proteins expression					Molecular diagnosis	Therapeutic options	Reference
			ER	PR	HER2	Ki-67	Other key genes/proteins			
Luminal A	40	Best prognosis, low grade and slow growth	High	High	Neg/low	Normal	Neg or low CK5/6; Pos CK8/18	IHC	Endocrine therapy	12, 37, 39, 40
Luminal B	20	Worse prognosis, tend to grow more quickly than luminal A	Positive	Normal	Variable	High	Neg or low CK5/6; High AURKA	IHC	Endocrine, Anti-HER2 and or cytotoxic therapy	12, 37, 39, 40
Her-2 enriched	20~30	Worse prognosis than both luminals, grows faster	Neg/low	Neg/low	High	High	Neg or low CK5/6, High GRB7, Low CK5, High mut TP53, PIK3CA	IHC or ISH, RTPCR, FISH	Anti-HER2 and cytotoxics	12, 39, 40, 43
TNBC	15~20	More heterogenous than BLBC; and more aggressive than luminals and HER2-enriched	Neg/low	Neg/low	Neg/low	High	Increased genomic instability: High mutBRCA1, mutTP53, Negative CK5/6	IHC or ISH, RTPCR	Chemotherapy	37, 40-42
Basal-like	15	Aggressive tumors with poor prognosis and clinical outcome; presence of distant metastases and high histological grade	Neg/low	Neg/low	Neg/low	High	High mutBRCA1, mutTP53, mutPIK3CA; High Ki67, EGFR,VEGF, c-Kit; positive CK5/6, CK14,CK17	IHC, ISH, Microarray, RTPCR	Chemotherapy: Anthracyclines and Taxanes	37-40
Claudin-low	7~14	Worse overall survival than luminal A; associated with a low local recurrence rate	Neg/low	Neg/low	Neg/low	Variable	Low genomic instability; High vimentin, Low claudin3,4,7 and E-Cadherin, integrin a5	IHC, ISH, Microarray, RTPCR	Chemotherapy: PARP-inhibitors	12, 37, 40, 41

Abbreviations: ER, estrogen; PR, progesterone; HER2, human epidermal growth factor receptor-2; Ki-67, kiel-67; Neg, negative; CK, cytokeratin; AURKA, aurora kinase A; IHC, immunohistochemistry; GRB7, growth factor receptor bound protein 7; CK, cytokeratin; mut, mutant; TP53, tumor protein 53; PIK3CAs, phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha; ISH, in situ hybridization; RTPCR, reverse transcription polymerase chain reaction; FISH, fluorescence in situ hybridization; TNBC, triple negative breast cancer; BLBC, basal like breast cancer; BRCA1, breast cancer type 1 susceptibility protein; EGFR, epidermal growth factor receptor; VEGF, vascular endothelial growth factor; c-kit, receptor tyrosine kinase; PARP, poly ADP ribose polymerase.

directed against HER2 [37], and bevacizumab-directed against vascular endothelial growth factor, cetuximab for epidermal growth factor receptor inhibition [48]. This is owing to the reality that every breast cancer is unique in characteristics even though it is evolved from similar cells in the same breast tissue. Generally, without the application of molecular techniques, it is not possible to talk about personalized or targeted therapy [38, 50]. As a result, breast cancer patients from advanced countries benefited more from the growing fields of molecular oncology [44] whereas African breast cancer care is unfairly limited to morphological diagnosis and generalized treatments [15, 38]. Similarly, the introduction of molecular technology is urgently needed in African countries in order to fairly benefit from the globally exiting advanced oncology services. However, apart from scarcely available radiotherapy centers [15, 38], the treatment approaches for breast cancer in many African countries is almost completely conven tional-a wholistic approach with a principle of "one-size fits all" and patients usually do not benefit from the evolving technologies of molecular biology [51, 52].

3. Uncertainty of Conventional Breast Cancer Diagnosis: Why Molecular Techniques?

The conventional method of breast cancer detection relies on morphological investigations of tissue changes by an expert pathologist. Breast tissue can be acquired by fine needle aspiration or surgical resection by the trained expert. The biopsy should go through a serious of complex technical procedures and a slide gets ready for a pathologist to be observed under microscope and interpreted for further decision by the clinician (Figure 3) [8].

However, literature review on the status of laboratory medicine in Africa showed extremely elevated level of subjectivity in interpretation of the results owing partly to the poor quality of the reagents used for processing the materials, the quality of the tissue obtained, the

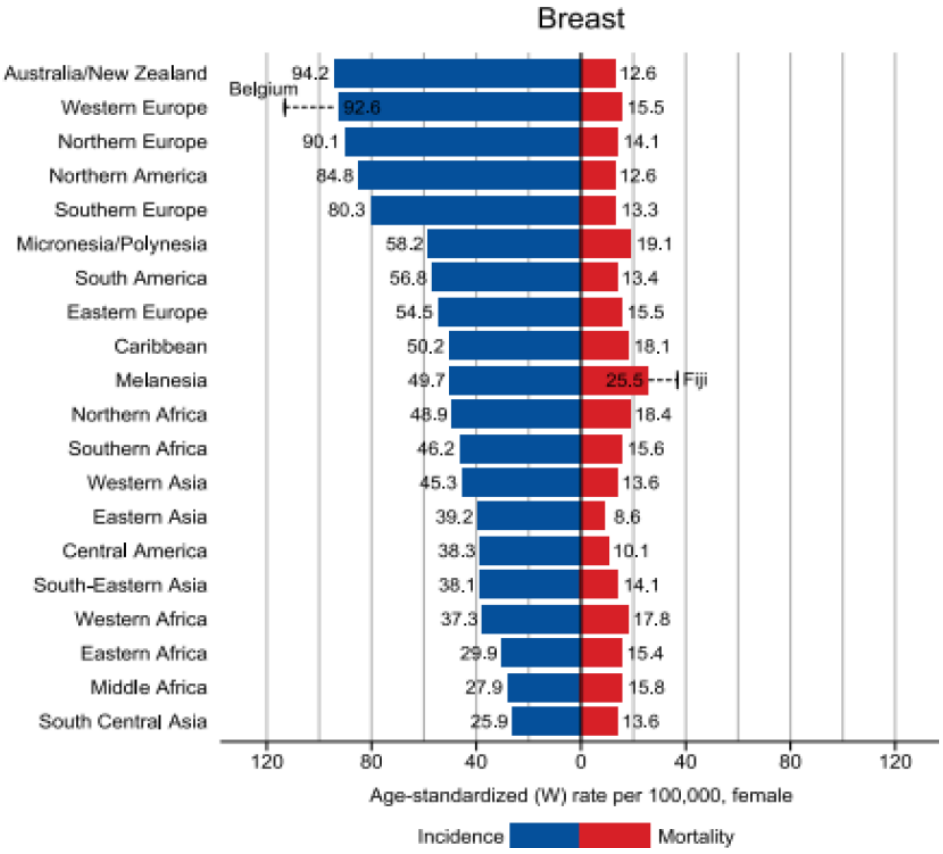

Figure 3. Bar chart of region-specific incidence and mortality age-standardized rates for cancers of the female breast in 2018. Rates are shown in descending order of the world (W) age-standardized rate, and the highest national age-standardized rates for incidence and mortality are superimposed. Adapted from the article of Bray et al. (CA Cancer J Clin. 2018;68:394-424) with original copyright holder's permission [8].

potential errors in the tissue processing steps and the technical skill of the Histotechnologist and pathologist [12]. In some instances, there are unavoidable serious errors observed in pathological diagnosis of the patient samples, even in advanced settings that own latest pathology services [12, 51]. This type of diagnostic subjectivity and the rate of errors can be substantially minimized by the application of molecular technology. Data concerning the error rate of pathological reports in Africa are not available in the literature. This might be due to lack of commitment by the public authorities and professionals, absence of health insurance inquiry and poor awareness of the patients. Besides, cancer misdiagnosis lawsuits are not filed when the clinicians fail to order timely screenings, use outdated tools and procedures, or simply fail to diagnose. However, based on the current status of pathology services in the continent, it is possible to speculate the existence of high rate of cancer misdiagnosis. In addition to financial and psychological costs, a failure to diagnose cancer timely can delay potentially life-saving treatments and lead to premature death, along with painful and debilitating side effects [12, 39, 52].

Detections of molecular alteration provide a genetic signature for the presence of certain tumor subtypes and the indication for drugs targeting the specific abnormal molecular functions [29, 40, 44]. Currently, it is possible to phenotype and genotype different tumor subtypes to increase the precision and reproducibility of cancer diagnosis. Research findings also showed that clinically confirmed use of molecular biomarkers aid detecting small numbers of malignant cells in cytological preparations or biopsies that are acquired through minimally invasive diagnostic techniques [41]. To this end, comprehensive cancer pathology should include complete investigation of biological tissues through combined histological, immunohistochemical and molecular evaluations.

4. Molecular Pathology Reveals Heterogeneity of Breast Cancer

Particular studies on the genetic profile of breast cancer tissue indicated substantial variation in the distribution of triple negative breast cancers (TNBCs) in the globe. For example, a comprehensive observational retrospective study in Saudi Arabia on 359 breast cancer cases indicated 14.8% of the breast cancer cases as triple negative [40]. Another study conducted in the National Cancer Institute in Mexico City from 1998 to 2008 on Hispanic population identified 23% of breast cancer patients as triple negative [42]. With regard to African breast cancer, significant discrepancies exist in the findings. Recent reports indicated that the receptor status of breast cancer, particularly, the TNBC differs in between the Western and the Eastern Africa. Accordingly, the West African breast cancer is characterized with more proportion of TNBC whereas the Eastern Africa displays proportion of TNBC that is nearly equivalent to the Western Europe and America [53, 54]. For example, a study conducted on 137 Ethiopian breast cancer patients in 2017 revealed 18% triple negative cases [43]. In contrary, a research on Nigerian breast cancer patients showed a larger percentage of cases as TNBC [46, 55]. An international study by the team of Stark from Michigan University indicated strikingly high proportion of TNBC from Ghanaian breast cancer patients [56]. The later study included 1008 white Americans, 581 African Americans and 75 Ghanaians. According to Stark et al [56] the highest prevalence of TNBC was observed in Ghanaian female (82.2%), followed by African Americans (32.8%) and white Americans (10.2%). Taken together, all of the molecular profile of breast cancer study confirms that breast cancer is not a single disease; and the genetic variants of breast cancer cannot be differentiated by the conventional pathological diagnosis. The existing histopathological techniques in Africa have limited capacity in determining prognostication and initiating right therapeutic means for specific subtypes of breast cancer. In addition to

diagnostic subjectivity, morphologically identical tumors can show variable clinical outcomes and responses to therapies. Thus, uncovering the molecular profile of a given breast cancer is more powerful than anatomic pathology for therapeutic decision, patient follow ups and defining disease outcome.

CONCLUSION

Pathology services in Sub-Saharan Africa is staggering with ill-equipped facilities, scarcity of man power, shortage of supplies and undermined attention by the authorities, professionals and the general population. To provide accurate and satisfactory oncology services in Africa, the public authorities and professionals should revise the forefront importance of standard pathology laboratories in combating cancer in general and breast cancer in particular. In addition, the role of diagnostic pathology should be expanded from mere morphologic observation into comprehensive tissue analysis through combined histological, immunohistochemical and molecular evaluations. Thus, Africa needs to integrate anatomical pathology with molecular biology to provide better diagnostic results and open a window of opportunities for the state-of-art oncology services.

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