

Original Research Article

Ultrasound Findings of Suspected Breast Cancer Lesions in Females Accessing Breast Ultrasound Services in Selected Hospitals in Lusaka, Zambia

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Abstract: Background: Breast cancer is the most common malignancy among women in Zambia. Ultrasound can be a useful tool for early diagnosis of breast cancer based on the breast lesions' features. However, an overlap in the ultrasound features of malignant and benign breast tumours has been noticed together with a paucity of information on the ultrasound features that are more suggestive of breast cancer. **Objective:** The purpose of this study was to identify ultrasound features of suspected breast cancer lesions which may assist in ascertaining a high breast cancer or benign breast disease suspicion index, that may be used to prioritise patients requiring further and urgent management for breast cancer. **Methods:** Systematic random sampling was used for the selection of participants in this study. The selected patients first underwent an ultrasound scan in the Ultrasound department to obtain the breast lesion ultrasound features. The histology results for the same patients were then obtained from the University Teaching Hospital (UTH) histology laboratory or the histology report filed in the patient's medical file. **Results:** Irregular shape of breast lesions, vertical orientation of breast lesions, hypoechogenicity of breast lesions, complex echo pattern of breast lesions, irregular or spiculated margin contours of breast lesions, compression of breast lesion surrounding tissue, absence of hyperechogenic spots in breast lesions and a breast lesion boundary with neither a hyperechoic halo nor thin capsule (None) were found to be associated with breast cancer. No breast lesion showed less than 3 ultrasound features suspicious for breast cancer. Hyperechoic spots in breast lesions were found to be associated with non-cancerous breast lesions. **Conclusion:** Low-resource countries, such as Zambia, where access to imaging diagnostic equipment such as Mammography and Magnetic Resonance Imaging machines (MRI), and histology examinations are scarce, the preceding ultrasound findings should suggest a high index of suspicion of breast cancer prompting intervention to avoid late-stage breast cancer at the time of diagnosis while awaiting histology confirmation.

Key words: Breast cancer, Histology, Ultrasound, Sonographer, Zambia.

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BACKGROUND

Globally, breast cancer among females is the number one cause of morbidity at 11.6% and is the leading cause of mortality at 6.6 % (Bray *et al.*, 2018). In 2018, 2,100,000 new breast cancer cases and 626,679 deaths resulting from breast cancer were reported, globally (Bray *et al.*, 2018). Breast cancer is the most common malignancy among women in Zambia,

followed by cervical cancer (Ferlay *et al.*, 2018). Global Cancer Incidence, Mortality and Prevalence (GLOBOCAN) estimates the incidence of breast cancer in Zambia to be 19.9 cases per 100,000 women, and mortality at 8.5 deaths per 100,000 women (Bray *et al.*, 2018). To reduce this mortality rate, the Ministry of Health (MOH) in Zambia established a national early diagnosis of breast cancer programme in 2019 which involves breast health awareness, clinical breast

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examinations, laboratory tests, and medical imaging examinations: Ultrasound, Mammography, and Magnetic Resources Imaging (MRI) (MOH, 2019).

In Zambia, all three mentioned medical imaging modalities used in the diagnosis of breast cancer are available. Firstly, Mammography is the imaging examination of the breast using low-energy X-radiation. The first mammography services were introduced in 1990 in Lusaka (Bwanga *et al.*, 2021). Secondly, Magnetic Resources Imaging (MRI) is another medical imaging method that uses a magnetic field and can be used to image the breast. The first MRI was installed at the Cancer Diseases Hospital (CDH) of Lusaka in 2010. At the time of writing, there were 16 mammographic and 7 MRI machines in the country. These services are mostly available in urban areas of Lusaka and Copperbelt provinces because they are costly. In addition, they require radiologists to interpret the images. This is a challenge in Zambia where only 12 radiologists are employed in the public sector. Thirdly, ultrasound uses sound waves and can also be used to image the breast. Ultrasound services have been available in Zambia since the 1980s. In addition, there are several ultrasound machines both in urban and rural parts of the country. This is because ultrasound is cheap, and many radiographers and a few sonographers available can provide this service. This is why this research was initiated to enhance breast ultrasound services in the diagnosis of breast cancer.

Breast cancer mortality rates have been linked to patients' late presentation of breast cancer at health facilities (Songiso *et al.*, 2020). In countries with sufficient resources, mass mammography screening for breast cancer has resulted in earlier presentation and reduced mortality rates (Breast Health Global Initiative Guidelines, 2008). In Zambia, the availability of mammography, considered the gold standard for screening and early detection of breast cancer in medical imaging, is inadequate country-wide (Kapambwe, 2015; Bwanga *et al.*, 2021). In addition, histology, being the gold standard in cancer diagnosis, is inadequate, severely inhibiting efforts for early breast cancer diagnosis (MoH, 2019). In the absence of the aforesaid, it has been shown that ultrasound can be a useful tool for early diagnosis of breast cancer based on the features that the breast lesions exhibit. However, an overlap in the ultrasound features of malignant and benign breast tumours has been noticed (Namazi *et al.*, 2017). Further, there is a paucity of information on the ultrasound features that are more suggestive of breast cancer (Namazi *et al.*, 2017). If an early diagnosis of breast cancer is not enhanced, the current number of patients presenting with late-stage breast cancer will continue to be on the rise in Zambia and other developing countries. The study, therefore, identified ultrasound features of suspected breast cancer lesions which may assist in ascertaining a high breast cancer or benign breast disease suspicion index, that may be used

to prioritise patients requiring further and urgent management for breast cancer.

METHODS

Study design

The study was quantitative, cross-sectional and prospective. Data were collected from July 2021 to June 2022.

Study setting and sampling frame

The study was carried out in the surgical breast clinics and ultrasound departments of CDH and Matero General Hospital (MGH) of Lusaka. Ultrasound departments were used to scan patients while surgical breast clinics were used to recruit patients into the study and access histology results. Firstly, the patients undertook an ultrasound scan in the ultrasound department to obtain the ultrasound features. The histology results for the same patients were then obtained from the UTH histology laboratory or the histology report filed in the patient's medical file. Systematic random sampling was used for the selection of participants in this study. The sampling interval was calculated by dividing the total patient population size by the calculated sample size. The total population stood at 972 patients (International Agency for Research on Cancer, 2020), while the total calculated sample size was 200. The Cochran formula (1977) was used to determine the sample size at a 5% level of significance. Dividing the patient population size with the calculated sample size yielded a sampling interval of 4.86, rounded off to 5. The researcher then randomly selected the first participant (patient) from between the first patient and the patient falling on the sampling interval of 5 in the patient queue. Once the first participant was selected, the researcher then selected the rest of the participants using a count interval of 5 until the sample size was attained. These were patients that were prescribed histology and breast ultrasound examinations for suspected breast cancer. This sampling technique was applied to both study sites.

Data collection tools and equipment

The researcher used standard tools to collect data, including the American College of Radiologists (ACR) BI-RADS Atlas fifth edition checklist and the Royal College of Pathologists reporting proformas (checklist). The Medison Accuvix Vio ultrasound machine and Echoston ultrasound machine, model CA 225, using high-frequency transducers (7-11Mhz) were used to scan the patients.

Data analysis

Statistical analyses were performed using Stata SE version 15. The Shapiro-Wilk test for normality of data was performed for continuous data. In this study, continuous data were not normally distributed and as such were presented as medians and IQR, while categorical data were presented as a percentage frequency distribution. To assess if there was any

significant difference between ultrasound features found in histology-confirmed breast cancer lesions and histology-confirmed non-breast cancer lesions, a multivariate analysis using Pearson’s chi-square test, $p < 0.05$ was done. Tables were prepared using the Microsoft excel work package.

Ethical considerations

Approval to conduct the study was sought from Excellence in Research Ethics and Science (ERES) Converge [Ref. No. 2021-Jan-004], and National Health Research Authority (NHRA) [Ref No. NHRA0000I7 129 /0612021]. Further, authority was sought from the Lusaka provincial health office and the study sites, which included CDH, UTH-Adult Hospital, and Matero General Hospital. Principles of patient confidentiality, patients’ privacy, informed consent/assent and voluntary participation in the study were observed.

RESULTS

The findings in this study were presented according to the shape, orientation, echogenicity and

echo pattern of the breast lesions. Hyper-echoic spots in the breast lesions, margin contour of the breast lesions, lesions boundary and posterior acoustic features of the breast lesions were also examined and presented.

Ultrasound features of suspected breast cancer lesions among females accessing breast ultrasound services

The majority of the breast lesions for suspected breast cancer females accessing breast ultrasound services showed irregularly shaped breast lesions (48.6%), vertically orientated breast lesions (57.3%), hypoechoic breast lesions (54.1%) and irregular/spiculated breast lesions (53%). The other findings included posterior acoustic shadowing (41%), hyperechoic spots (68.1%), compressed breast lesion surround tissue (81.1%), complex echo pattern (50.3%), and lesion boundary without either a hyperechoic halo or thin capsule (57.3%). Table 1 shows the ultrasound features of suspected breast cancer lesions among females accessing breast ultrasound services.

Table 1: Ultrasound features of suspected breast cancer lesions

Ultrasound findings		Number	Percentage
Shape	Irregular	90	48.6
	Round	23	12.4
	Oval	72	39.0
	Total	185	100
Orientation	Vertical	106	57.3
	Indifferent	14	7.6
	Parallel	65	35.1
	Total	185	100
Echogenicity	Hypoechoic	100	54.1
	Isoechoic	77	41.6
	Hyperechoic	8	4.3
	Total	185	100
Echo pattern	Complex	93	50.3
	Homogenous	92	49.7
	Total	185	100
Margin contour	Irregular/spiculated	98	53
	Smooth/lobulated	87	47
	Total	185	100
Lesion boundary	Hyperechoic halo	19	10.3
	No hyperechoic halo or thin capsule	106	57.3
	Thin capsules	60	32.4
	Total	185	100
Posterior acoustic features	Shadowing	76	41
	Enhancement	21	11.4
	Indifferent	88	47.6
	Total	185	100
Surrounding tissue	Architectural distortion	9	4.9
	Compression	150	81.1
	Indistinct	26	14.0
	Total	185	100
Hyperechoic spots	Absent	59	31.9
	Present	126	68.1
	Total	185	100

Ultrasound features of histology-confirmed breast cancer lesions and histology-confirmed non-breast cancer lesions

There were significant differences in the ultrasound features of histology-confirmed breast cancer lesions and histology-confirmed non-breast cancer lesions, $P < 0.001$.

1. Irregularly shaped breast lesions were more in histology-confirmed breast cancer lesions (77.8%) compared to histology-confirmed non-breast cancer lesions (22.2%).
2. Vertically oriented breast lesions were more in histology-confirmed breast cancer lesions (51%) compared to histology-confirmed non-breast cancer lesions (15.7%).
3. Hypoechoic breast lesions were more in histology-confirmed breast cancer lesions (89.2%) compared to histology-confirmed non-breast cancer lesions (10.8%).
4. Breast lesions with a complex echo pattern were more prevalent in histology-confirmed breast cancer lesions (71.6%) compared to histology-confirmed non-breast cancer lesions (24.1%).
5. Breast lesions with irregularly/spiculated margin contours were more prevalent in histology-

confirmed breast cancer lesions (74.5%) compared to histology-confirmed non-breast cancer lesions (26.5%).

6. Breast lesions with neither hyperechoic halo nor thin capsule (none) were more prevalent in histology-confirmed breast cancer lesions (69.6%) compared to histology-confirmed non-breast cancer lesions (42.1%).
7. Breast lesions with posterior acoustic shadowing were more prevalent in histology-confirmed breast cancer lesions (70.6%) compared to histology-confirmed non-breast cancer lesions (4.8%).
8. Breast lesions with compressed surrounding tissue were more prevalent in histology-confirmed breast cancer lesions (94.1%) compared to histology-confirmed non-breast lesions (65.1%).
9. Breast lesions with hyper-echogenic spots were more prevalent in histology-confirmed non-breast cancer lesions (91.6%) compared to histology-confirmed breast cancer lesions (49%).

Table 2 below shows ultrasound features of histology-confirmed breast cancer lesions and histology-confirmed non-breast cancer lesions.

Table 2: Ultrasound features of histology-confirmed breast cancer lesions and histology-confirmed non-breast cancer lesions

Ultrasound features		Proportion (%) of confirmed breast cancer patients	Proportion (%) of confirmed non-breast cancer patients	Total (%)	P-value
Shape	Irregular	70(77.8)	20(22.2)	90(100)	p<0.0001
	Round	14(60.9)	9(39.1)	23(100)	
	Oval	18(25)	54(75)	72(100)	
	Total	102(55.1)	83(44.9)	185(100)	
Orientation	Vertical	52(51.0)	13(15.7)	65(35.1)	p<0.0001
	Indifferent	7(6.9)	7(8.4)	14(7.6)	
	Parallel	43(42.1)	63(75.3)	106(57.3)	
	Total	102(100)	83(100)	185(100)	
Echogenicity	Hypoechoic	91(89.2)	9(10.8)	65(35.1)	p<0.0001
	Isoechoic	7(6.9)	70(84.4)	14(7.6)	
	Hyperechoic	4(3.9)	4(4.8)	106(57.3)	
	Total	102(100)	83(100)	185(100)	
Echopattern	Complex	73(71.6)	20(24.1)	93(50.3)	p<0.0001
	Homogenous	29(28.4)	63(75.9)	92(49.7)	
	Total	102(100)	83(100)	185(100)	
Margin contour	Irregular	76(74.5)	22(26.5)	98(53)	p<0.0001
	Homogenous	26(25.5)	61(73.5)	87(47)	
	Total	102(100)	83(100)	185(100)	
Lesion boundary	Hyperechoic halo	9(8.8)	10(12.1)	19(10.3)	p=0.001
	None(No hyperechoic halo nor a thin capsule)	71(69.6)	35(42.1)	106(57.3)	
	Thin capsule	22(21.6)	38(45.8)	60(32.4)	
	Total	102(100)	83(100)	185(100)	
Posterior acoustic features	Shadowing	72(70.6)	4(4.8)	76(41.1)	p<0.0001
	Enhancement	6(5.9)	15(18.1)	21(11.3)	
	Indifferent	24(23.5)	64(77.1)	88(47.6)	
	Total	102(100)	83(100)	185(100)	
Surrounding	Compression	96(94.1)	54(65.1)	150(81.1)	p<0.0001

Ultrasound features		Proportion (%) of confirmed breast cancer patients	Proportion (%) of confirmed non-breast cancer patients	Total (%)	P-value
tissue	Architectural distortion	1(1.0)	8(9.6)	9(4.9)	p<0.0001
	Indistinct	5(4.9)	21(25.3)	14(14.0)	
	Total	102(100)	83(100)	185(100)	
Hyperechoic spots	Absent	52(51.0)	7(8.4)	59(31.9)	
	Present	50(49.0)	76(91.6)	126(68.1)	
	Total	102(100)	83(100)	185(100)	

When the histology-positive breast cancer lesions were further assessed regarding the number of breast ultrasound features suspicious for breast cancer seen in each breast lesion, only 8 (7.8%) breast lesions showed all the ultrasound features suspicious for breast

cancer. The majority of the breast lesions however showed 5 and more ultrasound features suspicious of breast cancer. No breast lesion showed only 1 or 2 ultrasound features suspicious for breast cancer. Table 3 below illustrates these findings.

Table 3: Number of ultrasound features suspicious for breast cancer in each breast cancer lesion

Number of Ultrasound features	Number of histology-positive breast lesions. N/102 (%)
9	8 (7.8)
8	24 (23.5)
7	17 (16.7)
6	22 (21.6)
5	20 (19.6)
4	5 (4.9)
3	6 (5.9)

DISCUSSION

The rise of breast cancer cases in low-resource countries has been attributed to the late presentation of cancer at the time of diagnosis by patients (Songiso *et al.*, 2020). This has been linked to inadequate imaging diagnostic equipment such as Mammography and MRI, further compounded by the inadequacy of histology examinations, the gold standard in cancer diagnosis. Ultrasound on the other hand is readily available and has been a useful tool in breast cancer diagnosis based on various ultrasound features. Multiple studies have however found an overlap in the ultrasound features that suggest breast cancer and those that suggest benign breast lesions (Ga *et al.*, 2018; Namazi *et al.*, 2017). In addition, there is a paucity of evidence on which of the ultrasound features is more suggestive of breast cancer (Namazi *et al.*, 2017). This study also found an overlap in the ultrasound features for malignant and benign breast lesions. However, a significant difference exists between ultrasound features for malignant and benign breast lesions. Further, all breast lesions showed a minimum of 3 ultrasound features suspicious for breast cancer in this study. The study discusses the findings according to the shape, orientation, echogenicity, echo pattern, margin contour, lesion boundary, posterior acoustic features and hyper-echogenic spots in the breast lesions.

Shape of breast lesions

In this study, the irregular shape of breast cancer lesions was found to be associated with breast cancer whereas the oval shape of the breast lesions was

found to be associated with benign breast lesions. This finding is in agreement with D’Orsi *et al.* (2013) who described malignant and benign breast lesions as having different shape characteristics, with the former usually being irregularly shaped and the latter commonly having an oval shape. Boujelben *et al.* (2012) affirmed the aforementioned findings by describing irregular shape as one of the most frequently appearing features for malignant masses used to identify breast tumours as malignant. Okello *et al.* (2014) in a study conducted in Uganda, a poor resource environment also found the irregular shape and oval shape of breast lesions to be sonographic features typical of breast malignancy and benign mass lesions respectively. Further, Gregorio *et al.* (2007) in a study conducted in Brazil to identify echographic criteria which are most closely related to lesion benignancy and malignancy found that among the breast lesions with irregular margins, 70.4% (76/108) were malignant with the micro-lobular type being the most frequently found at 30.5% of cases (33/108). In another study carried out in Lebanon by Nasser *et al.* (2016) to determine predictors of malignancy in hyper-echoic breast lesions, irregular shape, vertical orientation, and non-circumscribed margins were significantly associated with the risk of malignancy (P = .002, .02, and .01, respectively). However, a paucity of recent and old literature to thoroughly discuss the shape of breast lesions was encountered.

Orientation of breast lesions

In our study, the vertical orientation of breast lesions was also found to be associated with breast cancer whereas the parallel orientation of the breast lesions was found to be associated with benign breast lesions. Again, the findings of this study agree with the findings of other similar studies. Okello *et al.* (2014) found the vertical and parallel orientation of breast lesions to be sonographic features typical of breast malignancy and benign mass lesions respectively, while another study by Nasser *et al.* (2016) to determine predictors of malignancy in hyper-echoic breast Lesions, vertical orientation was significantly associated with the risk of malignancy ($P = .02$). Further, a study done by Gregorio *et al.* (2007) in Brazil to identify echographic criteria which are most closely related to lesions benignancy and malignancy found vertical orientation to be present in 57.6% (34/59) of the malignant lesions.

Echo pattern of breast lesions

In our study, the complex echo pattern was found to be associated with breast cancer whereas the homogenous echo pattern was found to be associated with benign breast lesions. A study by Steven *et al.* (2018) on ultrasound characteristics of malignant lesions described complex or hypo-echoic lesions, spiculations and angular margins as typical ultrasound characteristics of malignant breast lesions, while a study carried out by Gregorio *et al.* (2007) to identify echographic criteria related to benignancy and malignancy, found the majority of breast lesions with heterogeneous echotexture to be benign (51%). Whereas there is an agreement between the findings of the current study and the former, there is a discrepancy with the findings of the latter. This discrepancy may be attributed to differences in study settings and populations. However, further interrogation of this discrepancy is recommended.

Echogenicity of breast lesions

The hypoechoogenicity of the breast lesions was found to be associated with breast cancer whereas the isoechogenicity of the breast lesions was found to be associated with benign breast lesions. Again, the findings of this study are comparable with the findings of other similar studies. Wojcinski *et al.* (2013) found hypo-echogenicity to be the most frequently observed echogenicity in breast cancer lesions (86%) while Nassar *et al.* (2016) also found hypo-echogenicity to be more often associated with breast malignancy. Further, Wheeler *et al.* (2014) outline several ultrasound characteristics of breast lesions suggestive of breast cancer including hypo-echogenicity, acoustic shadowing, a branching pattern or micro-lobulation, a duct extension, a 'taller than wide' shape, angular margins, the presence of micro-calcifications appearing on ultrasound as bright punctate foci and spiculation.

Margin contour of breast lesions

The margin contour of breast lesions found to be associated with breast cancer in this study was the irregular margin contour whereas the homogenous margin contour of the breast lesions was associated with benign breast lesions. Again, a study was done by Gregorio *et al.* (2007) to identify echographic criteria related to benignancy and malignancy and found that amongst lesions with regular margins, 98.2% (336/342) were benign whilst amongst lesions with irregular margins, 70.4% (76/108) were malignant. In another study carried out by Lazarus *et al.* (2006), the sonographic features predictive of malignancy were found and included spiculated margins of breast lesions (Positive Predictive Value 86%), whereas breast masses with a circumscribed margin (Negative Predictive Value 90%) were predictive of benignity. Again, the findings of this study are comparable to the findings of the preceding studies regarding the margin contour of the breast lesions.

Boundary of breast lesion

The boundary of breast lesions with neither a hyperechoic halo nor a thin capsule was found to be associated with breast cancer while the boundary with a thin capsule was found to be associated with benign breast lesions. A study conducted by Okello *et al.* (2014) to determine the incremental breast cancer detection rate using ultrasound scanning in symptomatic women with mammography-dense breasts in a resource-poor environment found features typical of breast malignancy to be irregular shape, non-parallel orientation (vertical), non-circumscribed margin, hyperechoic halo, and increased lesion vascularity (p values < 0.005). The findings of our study are in contrast with the findings of the preceding study regarding the boundary of breast lesions. Again, further interrogation to fully comprehend this discrepancy is recommended. Related literature on this topic is also inadequate.

The tissue surrounding the breast lesion

The compressed surrounding tissue of breast lesions was found to be associated with breast cancer whereas the breast lesion surrounding tissue with neither architectural distortion nor compression (Indistinct) was found to be associated with benign breast lesions. These findings are in agreement with the findings of a study by Gaur *et al.* (2013), where architectural distortion was found to be the third most common mammographic appearance of breast cancer, representing nearly 6% of abnormalities detected on screening mammography. Similarly, the findings of this study found architectural distortion to be a scarce finding in breast cancer. Again, related literature is not readily available on the topic under discussion.

Hyperechoic spots in breast lesions

The absence of hyperechoic spots in breast lesions was found to be associated with breast cancer

whereas the presence was found to be associated with benign breast lesions. In a study by Gufler *et al.* (2000) to evaluate the capabilities of breast ultrasound in identifying micro-calcifications in benign breast changes, in situ breast carcinomas, and small non-palpable invasive carcinomas, 49 clustered micro-calcifications were examined using histology with 27 being found to be benign while 22 malignant. Again, a paucity of literature, recent and old, on the topic was observed.

Posterior acoustic features of breast lesions

In this study, posterior acoustic shadowing of breast lesions was found to be associated with breast cancer whereas the indifferent posterior acoustic feature (neither posterior shadowing nor posterior enhancement) was found to be associated with benign breast lesions. The National Cancer Institute (NCI), breast cancer treatment report of 2014 describes the typical sonographic features of breast cancer as irregular margins, a long axis perpendicular to the skin (vertical), a heterogeneous echo texture, and posterior acoustic shadowing (NCI, 2014). A study by Alexander and Frank (2018) to examine ultrasound characteristics of breast malignant lesions, found lesions with sonographic posterior acoustic shadowing to have a Positive Predictive Value of 50% for malignancy among other findings. Further, Wojcinski *et al.*, (2013), found the posterior acoustic feature of breast cancer lesions to be more often described as an enhancement (33% versus 13%, $p=0.001$) and less often as shadowing (20% versus 47%, $p < 0.001$). The cause of the discrepancy is unclear and hence raises concern for further investigation.

Study limitations

This study had two limitations. Firstly, patients' medical files would go missing impeding the search for the histology results which were normally filed there. Secondly, patient medical files would at times have incomplete documentation missing vital documents such as histology reports. However, a search for these results would be done in appropriate histology registers where results were recorded

CONCLUSION

This study found evidence that the irregular shape of breast lesions, vertical orientation of breast lesions, hypoechogenicity of breast lesions, complex echo pattern of breast lesions and irregular or spiculated margin contours of breast lesions are associated with breast cancer. Other breast ultrasound findings that showed association with breast cancer are compression of breast lesion surrounding tissue, absence of hyperechogenic spots in breast lesions and a breast lesion boundary with neither a hyperechoic halo nor thin capsule (none). Further, no breast lesion showed less than 3 ultrasound features suspicious for breast cancer in this study. Low-resource countries, such as Zambia, where access to imaging diagnostic equipment

such as Mammography and MRI, and histology examinations are scarce, the preceding ultrasound findings should suggest a high index of suspicion of breast cancer prompting intervention to avoid late-stage breast cancer at the time of diagnosis while awaiting histology confirmation.

What is already known on this topic

- Ultrasound is a useful tool in breast cancer diagnosis based on various ultrasound features and is readily available and relatively cheap.
- There is an overlap in the ultrasound features for malignant breast disease and benign breast disease (Namazi *et al.*, 2017)
- Finally, there is a paucity of evidence on the ultrasound features which are more suggestive of breast cancer (Namazi *et al.*, 2017).

What this study adds

- This study has shown evidence of the ultrasound features of breast lesions that show a high index of suspicion for breast cancer
- It has also shown evidence of the ultrasound features of breast lesions that suggest benign breast disease.
- Finally, this study is proposing that patients with breast lesions showing a high index of suspicion of breast cancer especially a minimum number of 3 breast cancer suspicious ultrasound features should have an immediate intervention for the disease as they await histology confirmation. This is to avoid a late-stage breast cancer diagnosis.

Competing Interests

The authors declare that they have no competing interests.

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