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Use of NHS PREDICT Tool and Prognostic Factors for Survival in Patients with Breast Cancer

Meme Kanserli Hastalarda Hayatta Kalma için NHS PREDICT Aracının Kullanımı ve Prognostik Faktörler

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ABSTRACT

Aim: The PREDICT tool is used to estimate survival in breast cancer patients according to the types of treatment given. This study aimed to assess the accuracy of the PREDICT tool and identify the prognostic factors for survival in patients with breast cancer.
Material and Methods: A retrospective study was performed based on data collected from the Hospital Sultanah Nur Zahirah, Terengganu, Malaysia. All female patients diagnosed with stage I to IV breast cancer were identified from the year 2011 to 2017.
Results: Based on data from 355 eligible patients, the predicted and observed 5-year overall survival rates were 75.8% and 75.2%, respectively. The model performed fairly well, with the area under the curve (AUC) of 0.747 (95% confidence interval (CI): 0.69-0.81) in the predicted 5-year overall survival. Among the 585 patients diagnosed with stage I to IV breast cancer, stage at the presentation (stage III hazard ratio (HR): 5.80, 95% CI: 1.69-19.94, p=0.005, stage IV HR: 10.61, 95% CI: 3.09-36.49, p<0.001), without surgical treatment (HR: 2.29, 95% CI: 1.73-3.00, p<0.001), without radiotherapy (HR: 1.92, 95% CI: 1.41-2.62, p<0.001), and without neoadjuvant chemotherapy (HR: 0.63, 95% CI: 0.47-0.86, p=0.003) were associated with death in breast cancer patients.
Conclusion: The PREDICT tool accurately estimated the 5-year overall survival in the study center. It might serve as a useful prognostication tool during consultation. Late stages of the disease, patients without surgical treatment, and patients without radiotherapy were associated with a higher risk of death in breast cancer.
Keywords: PREDICT; breast cancer; 5-year overall survival.

ÖZ

Amaç: PREDICT aracı, meme kanseri hastalarında verilen tedavi türlerine göre sağkalımı tahmin etmek için kullanılır. Bu çalışmanın amacı, PREDICT aracının doğruluğunu değerlendirmek ve meme kanserli hastalarda sağkalım için prognostik faktörleri belirlemektir.
Gereç ve Yöntemler: Malezya'nın Terengganu şehrindeki Sultanah Nur Zahirah Hastanesi'nden toplanan verilere dayalı olarak geriye dönük bir çalışma yapıldı. 2011 ve 2017 yılları arasında evre I ila IV meme kanseri tanısı alan tüm kadın hastalar belirlendi.
Bulgular: Uygun 355 hastadan elde edilen verilere dayanarak, öngörülen ve gözlemlenen 5 yıllık genel sağkalım oranları sırasıyla %75,8 ve %75,2 idi. Model, öngörülen 5 yıllık genel sağkalımda 0,747 (%95 GA: 0,69-0,81) eğri altında kalan alan (area under the curve, AUC) ile oldukça iyi performans gösterdi. Evre I ila IV meme kanseri tanısı alan 585 hasta arasında, başvuru anındaki evre (evre III hazard oranı (hazard ratio, HR): 5,80, %95 GA: 1,69-19,94, p=0,005, evre IV HR: 10,61, %95 GA: 3,09-36,49, p<0,001), cerrahi tedavi olmaması (HR: 2,29, %95 GA: 1,73-3,00, p<0,001), radyoterapi olmaması (HR: 1,92, %95 GA: 1,41-2,62, p<0,001) ve neoadjuvan kemoterapi olmaması (HR: 0,63, %95 GA: 0,47-0,86, p=0,003) meme kanseri hastalarında ölümle ilişkiliydi.
Sonuç: PREDICT aracı çalışma merkezindeki 5 yıllık genel sağkalımı doğru bir şekilde tahmin etti. Konsültasyon sırasında yararlı bir prognoz aracı olarak hizmet edebilir. Hastalığın ileri evreleri, cerrahi tedavi uygulanmayan hastalar ve radyoterapi uygulanmayan hastalar meme kanserinde daha yüksek ölüm riskiyle ilişkilidir.
Anahtar kelimeler: PREDICT; meme kanseri; 5 yıllık genel sağkalım.

INTRODUCTION

Breast cancer remains the most common cancer among women in Malaysia. According to the National Cancer Registry (NCR), breast cancer constituted 19% of all the cancers registered in Malaysia, with an age-standardized rate (ASR) of 34.1 per 100,000 population from 2012 to 2016. Compared with the ASR of other Asian countries such as Beijing (24.6), Hiroshima (36.6), Chennai (23.9), and Seoul (20.8), the ASR of Malaysia is still higher. The incidence of breast cancer in Malaysia also showed variation between different ethnicities. It is highest among Chinese, followed by Indian and Malay, with ASR of 59.9, 54.2, and 34.9, respectively (1).

Patients in Malaysia tend to delay seeking treatment and present at a later stage of the disease. This contributed to the low survival rate of patients with breast cancer in Malaysia (2). The 5-year overall survival rate was 49.0% among all breast cancer patients diagnosed from January 2000 to December 2005 (3). The 5-year overall survival rates were 82.5% in stages 0 to II, and 30.2% in patients with stage III and IV diseases, respectively (4).

Low survival may be related to delay. Two types of delays have been described in breast cancer, namely patient delay and provider delay (5). Patient delay is defined as the period when the patient discovers the symptoms to first contact with a physician, and provider delay is defined as the initial contact with a physician for definitive treatment for breast cancer. Delay in presentation is associated with a lower education level and lack of knowledge (6).

In order to improve patients' adherence to treatment, we need to provide objective data for patient references, such as the survival rate if they receive treatment. Multiple online prognostic tools, such as Adjuvant! Online, CancerMath.net, and PREDICT have been used. However, all of these prognostic tools are developed and validated in the Western population. PREDICT is an online free prognostication tool developed in the United Kingdom (UK). Using the tool required the clinician to key in the required data such as age, tumor size, lymph node number, tumor grading, estrogen receptor (ER), and human epidermal growth factor receptor 2 (HER2) status. However, it does not consider patient comorbidity. The tool will then generate the predicted 5- and 10-year overall survival rates based on different types of treatment given. Therefore, it will guide the clinician in choosing the best treatment modality to provide the best survival rate for the patients.

PREDICT predicts overall survival reliably in most Dutch breast cancer patients (7). The Cambridge Breast Unit uses the tools to guide the need for adjuvant chemotherapy. If the improvement in survival is more than five percent with chemotherapy, adjuvant chemotherapy is recommended. As with PREDICT, studies conducted among Asian patients showed that it was accurate in most subgroups. However, it overestimates predicting survival in patients younger than 40 years old (8). Besides this study, PREDICT also accurately estimated the 5- and 10-year overall survival in Japanese populations (9). Therefore, in this study, it was aimed to assess the accuracy of the PREDICT prognostic tool in the Malaysian population, especially for patients from East Coast Malaysia, Kuala Terengganu. It will help in consultation towards the best treatment options.

MATERIAL AND METHODS

This is a retrospective study based on the breast cancer database of the Hospital Sultanah Nur Zahirah (HSNZ), a tertiary medical center in Kuala Terengganu, Terengganu, Malaysia. Inclusion criteria for this study included all adult female patients aged more than 18 years old with stage I to IV breast cancer diagnosed in HSNZ with follow-up for at least 5 years. Patients who defaulted follow-up after treatment and patients with incomplete data were excluded from the study.

For comparison of the observed and predicted 5-year overall survival rates, a dataset comprised of 355 patients from stage I to III breast cancer who underwent surgical intervention in the form of mastectomy or breast-conserving surgery with axillary clearance was analyzed. Data from 585 patients who had been diagnosed with stage I to IV breast cancer from the year 2011 to 2017 were included for analysis of prognostic factors for survival in patients with breast cancer.

The sample size for the first objective was calculated using the sample size calculator by Wan Nor Arifin available at https://wnarifin.github.io/ssc/sssnsp.html. The required sample size was calculated using parameters such as the expected sensitivity as 0.98, the expected specificity as 0.91, and the prevalence of the disease as 0.20 with a significance level (α) of 0.05, and a precision of 10%. The final targeted sample size was determined by considering a 10% drop-out rate. For the second objective, which is to determine the factors affecting the 5-year survival rate in patients with breast cancer, the sample size was calculated using the PS: Power and Sample Size Calculation v.3.1.6 based on parameter estimates obtained from Nordin et al. (10), with the significance level (α) of 0.05, and the power of the study ($1-\beta$) of 80%. The final targeted sample size was determined by considering a 20% drop-out rate. The estimated sample size for this study was 504 samples.

Data from patients diagnosed with stage I to IV breast cancer between the years 2011 to 2017 in the HSNZ were extracted from electronic medical records, the hospital information system. The patients' medical records were reviewed and followed up for more than five years. If the patient is still present for follow-up after five years, the 5-year overall survival outcome was classified as alive for a patient who defaulted or lost follow-up within five years. Their identification data was submitted to the Jabatan Pendaftaran Negara (JPN) for mortality data matching service. For those patients who passed away within five years, the outcome was classified as dead. Their date of death was recorded, and the time of survival was recorded in months. Patients diagnosed with stage I to III breast cancer and who underwent operation were selected. Their predicted 5-year overall survival rates were calculated using PREDICT and expressed in percentages.

All required information was entered into the data collection form to avoid bias. Variables required for the study included patient demographics, age at diagnosis, menopausal status, hormonal status (ER and HER2 status), tumor size (cm) and grade, lymph node involvement, stage at diagnosis, hormonal therapy, surgical treatment, radiotherapy, chemotherapy regime, duration from symptoms to a hospital visit and duration from a hospital visit to definitive treatment.

The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki (6^{th} revision, 2008) as reflected in a priori approval by the Human Research Ethics Committee, Universiti Sains Malaysia in Kelantan, Malaysia (13.02.2022, USM/JEPeM/21090640) and the Medical Research & Ethics Committee, Ministry of Health Malaysia (19.08.2021, NMRR-21-1560-59266 (IIR)).

Statistical Analysis

The data were descriptively analyzed in mean and standard deviation or median and interquartile range for continuous data. For categorical data, frequency and percentage were used. Kaplan-Meier analysis was used to analyze the observed 5-year overall survival. The predicted 5-year survival was obtained from PREDICT. The survival probabilities were used to compare the observed and predicted 5-year overall survival. A chi-square goodness-of-fit test was performed to assess the accuracy of PREDICT. Receiver-operating characteristic (ROC) curve analysis was performed to test the sensitivity and specificity of the PREDICT tool. The value of the area under the curve (AUC) was recorded. Survival analysis was performed using the Cox proportional hazards regression model to identify the important prognostic factors of death. The model was presented as crude hazard ratio (HR), 95% confidence interval (CI), Wald statistics, and p-value. Data analyses were performed using IBM SPSS Statistics for Windows, v.26.0 (IBM Corp., Armonk, NY, USA). The limit of significance was set at 0.05.

RESULTS

Patient Demographics and Clinical Characteristics

A total of 585 patients included who had been diagnosed with stage I to IV breast cancer from the year 2011 to 2017. Of all patients, 556 (95.0%) were Malays, and 29 (5.0%) were non-Malays, including Chinese and Indian patients. This is consistent with the demographic data of the Terengganu, Malaysia population where more than 90% of the population is Malay. The mean age at diagnosis was 50.4±12.1 years and the mean tumor size was 5.3±3.3 cm. ER and HER2 status were expressed in 397 (67.9%) and 116 (19.8%) patients, respectively, and 294 (50.3%) of the tumors are grade 2 tumors. While 356 (60.8%) patients presented with late-stage disease (stage III and IV, 28.7% and 32.1%, respectively), 229 (39.2%) of the patients presented with early disease (stage I and II, 5.6% and 33.5%, respectively). The mean duration from symptoms to the first visit was 9.7 months. Most patients came to the hospital visit because of breast lumps (86.7%, n=507). Other reasons included breast ulcer (2.7%, n=16), presence of axillary nodes (1.2%, n=7), breast pain (0.9%, n=5), and nipple discharge (0.9%, n=5). Only 21 (3.6%) patients came because of a positive screening mammogram. From this study, 126 (21.5%) patients received neoadjuvant chemotherapy, mainly for locally advanced diseases. Of all patients, 334 (57.1%) patients received hormonal therapy, in which most patients received tamoxifen. However, only 39.5% (n=132) of these 334 patients complied and completed hormonal therapy for at least five years. Among the 116 patients with HER2-positive breast cancer, only 18.1% (n=21) of them received trastuzumab as part of their treatment. The 5-year overall survival rate according to staging was 90.9% (stage I), 80.6% (stage II), 52.4% (stage III), and 17.6% (stage IV).

Predictive Accuracy of PREDICT Tool

The distribution of the predicted 5-year overall survival as estimated by PREDICT in the study group, excluding patients with stage IV diseases and patients who did not undergo surgical treatment was shown in Figure 1. It included 355 patients from stage I to III breast cancer who underwent surgical intervention in the form of mastectomy or breast-conserving surgery with axillary clearance.

The results of the observed and predicted 5-year overall survival were shown in Table 1. PREDICT accurately predicted the 5-year overall survival in most subgroups, as most of the results showed no significant differences between the observed and predicted 5-year overall survival. In the subgroup of tumor size 2 to 5 cm (p=0.006), ER-positive patients (p<0.001), and patients who underwent neoadjuvant chemotherapy (p=0.001) showed significant differences. PREDICT seems to overestimate the 5-year overall survival of these subgroups with a difference of 7.5% compared to the predicted value. The most significant difference observed in patients who received neoadjuvant chemotherapy as PREDICT overestimated the 5-year overall survival with a difference of 15.2%. The ROC analysis of PREDICT showed that the online prognostication tool discrimination performance was fairly good, with an AUC of 0.747 (95% CI: 0.69-0.81) in predicting 5-year overall survival (Figure 2).

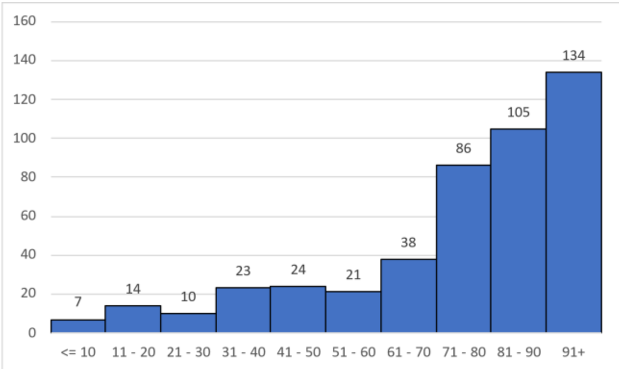

Figure 1. Distribution of the predicted 5-year overall survival using PREDICT

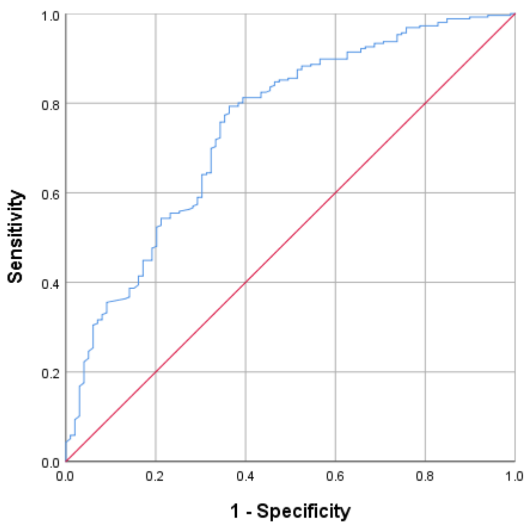

Figure 2. Discriminatory performance of 5-year overall survival by PREDICT

Table 1. Comparison of the observed and predicted 5-year overall survival rates in patients stage I to III (n=355)

	n (%)	Observed (95% CI)	PREDICT score*	Difference+	p#
Age					
<40 years	60 (16.9)	66.1 (66.1-67.8)	69.7	3.6	0.260
40-64.9 years	265 (74.6)	78.2 (77.4-78.5)	78.2	0	0.180
≥65 years	30 (8.5)	72.4 (72.4-72.4)	70.3	-2.1	0.690
Ethnicity					
Malay	330 (93.0)	74.7 (74.1-75.6)	75.3	0.6	0.075
Non-Malay	25 (7.0)	88.0 (88.0-88.0)	85.4	-2.6	0.585
Menopausal status					
Pre-menopause	180 (55.0)	75.2 (75.2-75.9)	76.6	1.4	0.053
Menopause	147 (45.0)	74.7 (73.6-74.7)	75.5	0.8	0.443
Tumor size					
<2 cm	29 (8.2)	86.2 (86.2-86.2)	90.8	4.6	0.542
2-5 cm	228 (64.2)	78.8 (78.8-79.7)	81.5	2.7	**0.006**
>5 cm	98 (27.6)	63.3 (63.3-64.3)	59.0	-4.3	0.538
Lymph nodes involvement					
Yes	202 (56.9)	67.8 (65.8-67.8)	67.0	-0.8	0.052
No	153 (43.1)	89.3 (89.3-89.3)	88.0	-1.3	0.802
ER status					
Positive	232 (65.4)	78.0 (77.5-78.0)	82.7	4.7	**<0.001**
Negative	123 (34.6)	72.1 (70.5-73.0)	63.6	-8.5	0.190
HER2 status					
Positive	67 (18.9)	69.2 (67.7-69.2)	67.5	-1.7	0.603
Negative	218 (61.4)	78.6 (77.7-79.5)	78.4	-0.2	0.188
Grade					
Low	57 (16.1)	87.5 (87.5-87.5)	91.6	4.1	0.160
Moderate	176 (49.6)	76.9 (76.3-76.9)	78.0	1.1	0.147
High	122 (34.4)	69.2 (67.5-70.0)	66.0	-3.2	0.703
Neoadjuvant chemotherapy					
Yes	42 (11.8)	54.8 (52.4-59.5)	70.1	15.2	**0.001**
No	313 (88.2)	78.5 (78.2-78.8)	76.9	-1.6	0.688

*: using mean predicted 5-year overall survival by PREDICT, +: difference between the predicted and observed 5-year overall survival (predicted - observed), #: Chi-square goodness-of-fit test comparing predicted and observed mortality estimates, CI: confidence interval, ER: estrogen receptor, HER2: human epidermal growth factor receptor 2

Prognostic Factors for Survival in Patients with Breast Cancer

The factors that affect 5-year overall survival in this cohort of 585 patients were shown in Table 2. The number of deaths from breast cancer in 5 years was 47.2% (n=276). The means survival time in stage III and IV disease were 44.6 (95% CI: 41.6-47.6) and 25.3 (95% CI: 22.4-28.3) months, respectively. The prognostic factors contributing to death were identified with the Cox proportional hazards regression model. A significant factor can be defined as a factor associated with death caused by breast cancer.

The stage at diagnosis, surgical treatment, and radiotherapy were found as significant prognostic factors contributing to breast cancer death. For the stage of disease, patients with stage III (p=0.005) and IV (p<0.001) disease had an increase in the hazard of death of 5.80 times and 10.61 times compared with stage I disease. For patients who did not receive surgical treatment, the hazard of death increased by 2.29 times compared to those who underwent surgical intervention (p<0.001). Patients who did not undergo radiotherapy also showed an increased hazard of death by 1.92 times compared to those who underwent radiotherapy (p<0.001). Age, ethnicity, and patient delay of more than 3 months to hospital visits were not significantly associated with an increased risk of death in patients with breast cancer. Patients who did not receive neoadjuvant chemotherapy showed a lower risk of death, with a hazard ratio of 0.63 in comparison to the patients who received neoadjuvant chemotherapy (p=0.003).

DISCUSSION

From the study, PREDICT seems to accurately predict the 5-years overall survival of the study population in Kuala Terengganu. The result was consistent with previous studies conducted in Asia countries (8,9,11,12). Studies concluded that the PREDICT tool accurately estimated the 5- and 10-year overall survival in Asian populations, with some exceptions within their subgroup. From our result, PREDICT overestimates the 5-year overall survival in patients with tumor sizes from 2 to 5 cm, ER-positive breast cancer, and those who underwent neoadjuvant chemotherapy.

In patients with ER-positive breast cancer, PREDICT overestimated the 5-year overall survival by 4.7%. Among the 355 patients (stage I to III), 65.4% (n=232) expressed ER receptors and were offered endocrine therapy as adjuvant therapy in the form of tamoxifen or aromatase inhibitors after surgery. Five years of endocrine therapy in hormone receptor-positive patients are proven to reduce the recurrence rate from 26.1% to 15.4%, increasing the overall survival in ER-positive breast cancer patients (13). Among all the patients with ER-positive breast cancer, 87.5% (n=203) were given hormonal therapy. However, only 53.7% (n=109) of them completed hormonal therapy for at least five years. This might contribute to the lower observed 5-year overall survival compared to PREDICT.

A study was done in East Coast Malaysia, with a similar demographic background to our populations, mainly Malay populations. The percentage of diagnosis delays for

Table 2. Prognostic factors for survival in patients with breast cancer (n=585)

	n (%)	Crude HR (95% CI)	Wald statistics (df)	p#
Age				
<40 years	103 (17.6)	1.00		
40-64.9 years	412 (70.4)	0.87 (0.64-1.18)	0.76 (1)	0.383
≥65 years	70 (12)	0.72 (0.47-1.11)	2.21 (1)	0.137
Ethnicity				
Non-Malay	29 (5.0)	1.00		
Malay	556 (95)	1.98 (0.81-4.89)	2.22 (1)	0.137
Stage at diagnosis				
Stage I	33 (5.6)	1.00		
Stage II	196 (33.5)	2.14 (0.61-7.52)	1.42 (1)	0.234
Stage III	168 (28.7)	5.80 (1.69-19.94)	7.80 (1)	**0.005**
Stage IV	188 (32.1)	10.61 (3.09-36.49)	14.06 (1)	**<0.001**
Surgical treatment				
Yes	462 (79)	1.00		
No	123 (21)	2.29 (1.73-3.00)	33.73 (1)	**<0.001**
Radiotherapy				
Yes	339 (40.9)	1.00		
No	346 (59.1)	1.92 (1.41-2.62)	16.96 (1)	**<0.001**
Neoadjuvant chemotherapy				
Yes	381 (65.1)	1.00		
No	204 (34.9)	0.63 (0.47-0.86)	8.76 (1)	**0.003**
Symptoms to first visit				
<3 months	207 (35.4)	1.00		
≥3 months	223 (38.1)	1.21 (0.92-1.58)	1.89 (1)	0.169

#: Cox proportional hazards regression test, HR: hazard ratio, CI: confidence interval

more than three months was 72.6% as patients tend to seek alternative treatment, such as traditional medicine, due to cultural beliefs. Interpretation of the symptoms as not dangerous is associated with delay in presentation. This is because most of the time it was not painful, not other associated symptoms and they felt well. Other factors, which include negative perception towards side effects of chemotherapy, non-cancer interpretation, and negative attitude towards therapy, contribute to delays in diagnosis and non-compliance to treatment planned (14).

The other factor that showed a significant difference between the observed and predicted values is among the patients who received neoadjuvant chemotherapy. PREDICT overestimated the survival by 15.2%. As PREDICT was developed in the UK, the selection of patients for neoadjuvant chemotherapy might be different compared to our center. Patients with high-risk features such as triple-negative breast cancer or HER2-enriched breast cancer will be offered neoadjuvant chemotherapy even in early breast cancer, as the pathological complete response rate is higher than luminal breast cancer (15). However, this practice is not a routine in our center. Neoadjuvant is often offered to patients with locally advanced breast cancer in which the tumor was deemed unresectable at initial diagnosis. The chemotherapy aims to downsize the tumor to allow resection of the tumor and closure of the wound later. Among the 42 patients (stage I to III) who received neoadjuvant chemotherapy, the mean tumor size was 6±2.9 cm, and 76.2% (n=32) of them presented with stage III disease at their initial presentation. Only 23.8% (n=10) of patients were stage II breast cancer who underwent neoadjuvant chemotherapy. This might contribute to the difference in the observed and predicted survival values.

As for the factors associated with death from breast cancer, 585 patients have been identified and analyzed using the Cox proportional hazards regression model. The late-stage presentation of breast cancer, no surgical treatment, and no radiotherapy showed significant results, which were associated with a higher risk of death in patients with breast cancer. Cancer staging is an important prognostic factor in breast cancer (4). Of the patients, 60.8% (n=356) patients presented with stage III and IV disease at initial presentation with a mean survival time of 44.6 (95% CI: 41.4-47.6) months and 25.3 (95% CI: 22.4-28.3) months respectively, and a 5-year survival rate of 34.0% (n=121) in stage III and stage IV disease. This result was consistent with the study by Pathy et al. (4), conducted at the UMMC and the National University Hospital, Singapore, that showed a 5-year survival rate of 30.2%. Stage III diseases are associated with higher mortality compared with stage I disease, with a hazard ratio of 5.8; meanwhile, stage IV diseases are 10.6 times at risk of death compared to stage I disease. A bigger mean tumor size also has been observed in the present study, with a mean tumor size of 5.3 cm, compared with 2.6 cm in the same study (4). Larger tumor size is related to delay in presentation. The study showed a delay in presentation for more than 3 months associated with a bigger tumor size, 2.3 cm, compared with 1.8 cm without delay. However, there was no significant difference in outcome compared between patients with and without diagnosis delay of more than three months (16).

Many factors are causing a patient delay in seeking medical treatment. From a study, patients who go for alternative therapy (odds ratio (OR): 1.77), who had breast ulcer (OR: 5.71), palpable axillary lymph nodes (OR: 2.19), false diagnostic test (OR: 5.32), non-cancer interpretation (OR: 1.68), and negative attitude toward therapy (OR: 2.09) are more likely to result in a delay in seeking treatment (14). Other factors, such as negative perception towards side effects of chemotherapy, fear of surgery and treatment, fear of being unable to take care of the family after treatment, and fear of husband may divorce them and remarry. All these factors contribute to patient delay in seeking treatment (14). Delays in treatment carry significant morbidity. Patient delay seeking treatment for more than three months was found to be associated with higher mortality with a 12.0% lower 5-year survival rate (17). Other factors, such as Malay ethnicity, stage III or IV at diagnosis, and patients without surgical treatment had lower survival rates (10). However, from our study, delay in seeking treatment for more than three months did not significantly increase the risk of death in patients with breast cancer, with a hazard ratio of 1.21. This was consistent with the study by Tartter et al. (16).

Multiple treatment options are available in patients with breast cancer, such as surgery, endocrine therapy, radiotherapy, chemotherapy, bisphosphonate, and targeted therapy. However, not all options are available in all centers. Surgery remains the mainstay of treatment in patients with breast cancer. From our study, patients who did not undergo surgery had a risk of 2.3 times death compared with those who underwent surgery. The findings in the present study are consistent with the findings of Pathy et al. (4) and Bello et al. (18). Other than that, the risk of death in patients who did not undergo radiotherapy is 1.9 times higher. Studies have shown that radiotherapy reduces local recurrence risk and improves overall survival (19). Patients who did not receive neoadjuvant chemotherapy show a lower risk of death, with a hazard ratio of 0.63. As in our center, 92% of patients who received neoadjuvant chemotherapy are diagnosed with locally advanced disease at initial presentation. This might result in a higher risk of death than those who did not receive neoadjuvant chemotherapy.

The strength of this study is that this study is the first study that validated the use of the PREDICT tool among patients in the East Coast. However, the limitation of this study is that this is a single-center study. The number of patients involved might not be representative of the management and outcome of breast cancer in Malaysia, particularly in the East Coast. This is because the different center has their own practice in managing breast cancer patients and not all centers have a breast and endocrine surgeon, so the outcome might be different. Data from other centers are needed to represent the whole population in Malaysia. In addition, PREDICT overestimated the 5-year overall survival in a few of the subgroups. Therefore, we need to improve our current practice to meet the international standard.

CONCLUSION

PREDICT tool proved to be accurate in predicting 5-year overall survival in our center. It may be a valuable tool during consultation and aid in treating our patients. The clinician will be able to provide an estimated 5-years overall survival rate to the patient according to different treatment options. However, it overestimates survival in some subgroups, such as patients with tumor sizes from 2 to 5 cm, ER-positive breast cancer, and those who underwent neoadjuvant chemotherapy. In addition, patients who presented at later stages of the disease and those who did not undergo surgery and radiotherapy are among the factors related to a higher risk of death in breast cancer patients. The patient's delay in seeking treatment for more than three months seems unrelated to a higher risk of death.

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