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CLINICAL & BASIC RESEARCH

Trends and Outcomes of Non-Small-Cell Lung Cancer in Omani Patients

Experience at a university hospital

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اتجاهات ونتائج علاج سرطان الرئة ذو الخلايا غير الصغيرة في المرضى العمانيين

خبرة مستشفى جامعي

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abstract: ***Objectives:*** The incidence of lung cancer in Oman has shown a gradual but definitive increase since 2002. This study aimed to evaluate the demographic and epidemiological characteristics and survival outcomes of patients with non-small-cell lung cancer (NSCLC) at a university hospital in Oman. ***Methods:*** This study was conducted from January to June 2016. A retrospective analysis was performed of consecutive patients diagnosed with NSCLC presenting to the Sultan Qaboos University Hospital (SQUH) in Muscat, Oman, between March 2000 and December 2015. Clinical features at presentation and prognostic and predictive markers were reviewed. Kaplan-Meir estimates were used to determine relapse-free survival, progression-free survival (PFS) and overall survival (OS). ***Results:*** A total of 104 patients presented to SQUH during the study period. The median age at diagnosis was 64 years. Overall, 62 patients (59.6%) had adenocarcinomas. Only 12 patients (11.5%) presented in the early stages (I or II) of the disease and the majority of patients had an Eastern Cooperative Oncology Group performance status of 1 (27.9%) or 2 (26.0%). The prevalence of *epidermal growth factor receptor* mutations was 27.9%. The median PFS for patients with advanced disease (stages III or IV) was five months and the median OS for all patients was seven months. After five years, 50.0%, 60.0%, 10.0% and 8.0% of patients with disease stages I, II, III and IV, respectively, were alive. ***Conclusion:*** Patients with NSCLC in Oman were found to present at an advanced stage. However, patient outcomes were similar to those reported in the USA.

Keywords: Non-Small-Cell Lung Carcinomas; Adenocarcinomas; Epidermal Growth Factor Receptor; Patient Outcome Assessment; Survival Analysis; Oman.

الملخص: الهدف: أظهرت الإحصائيات أن الإصابة بسرطان الرئة في عمان تواجه زيادة تدريجية مضطردة منذ عام 2002. تهدف هذه الدراسة إلى تقييم الخصائص الديموغرافية والوبائية و نتائج نجاة المرضى الذين يعانون من سرطان الرئة ذو الخلايا غير الصغيرة في مستشفى الجامعة في سلطنة عمان. **الطريقة:** أجريت هذه الدراسة في الفترة من يناير إلى يونيو 2016. تم إجراء تحليل استعادي للمرضى المتتابعين الذين تم تشخيصهم بسرطان الرئة ذو الخلايا غير الصغيرة في مستشفى جامعة السلطان قابوس بمسقط، عمان، بين مارس 2000 وديسمبر 2015. تمت مراجعة الخصائص السريرية ووقت التشخيص بالإضافة لتحليل عوامل الإنذار والتنبؤ بمستقبل المرض. وقد استخدمت تقديرات كابلان-مير لتحديد البقاء على قيد الحياة بدون انتكاسة، البقاء على قيد الحياة بدون تقدم المرض والبقاء على قيد الحياة الكلي. **النتائج:** تمت مراجعة ما مجموعه 104 مريضا في مستشفى الجامعة خلال فترة الدراسة. وكان متوسط أعمار المرضى عند التشخيص 64 عاما. إجمالا، كان 62 مريضا (59.6%) يعانون من سرطان الرئة الغدي. 12 مريضا فقط (11.5%) تم تشخيص حالاتهم في المراحل المبكرة (I أو II) من المرض وكان لدى غالبية المرضى حالة الأداء تتراوح بين 1 (27.9%) أو 2 (26.0%) حسب مؤشر مجموعة التعاون الشرقية للأورام. وكان معدل انتشار الطفرات في مستقبلات عامل نمو البشرة 27.9%. كان متوسط البقاء على قيد الحياة بدون تقدم المرض لدى المرضى من ذوي المراحل المتقدمة وقت التشخيص (المرحلة III و IV) خمسة أشهر. بينما كان متوسط البقاء على قيد الحياة الكلي لجميع المرضى سبعة أشهر. كما وجدنا أن 50.0% من مرضى المرحلة I و 60.0% من مرضى المرحلة II، 10.0% من مرضى المرحلة III و 8.0% من مرضى المرحلة IV بقوا على قيد الحياة بعد مرور خمسة سنوات من تاريخ التشخيص. **الخلاصة:** المرضى الذين يعانون من سرطان الرئة ذو الخلايا غير الصغيرة في عمان يتم تشخيص حالاتهم في مراحل متقدمة. ومع ذلك، كانت نتائج علاج المرضى مماثلة لتلك التي وجدت في الولايات المتحدة الأمريكية.

الكلمات المفتاحية: سرطان الرئة ذو الخلايا غير الصغيرة؛ سرطان غدي؛ مستقبلات عامل نمو البشرة؛ تقييم نتائج المرضى؛ تحليل البقاء على قيد الحياة؛ عمان.

Advances in Knowledge

- *This study presents the clinical and pathological features, treatment details and median progression-free and overall survival of Omani patients with non-small-cell lung cancer (NSCLC). To the best of the authors' knowledge, this study is the first to describe the trends and outcomes of patients with NSCLC in Oman.*

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- *These findings may act as a reference regarding associated clinicopathological features for patients with NSCLC from Oman as well as other countries in the Gulf Cooperative Council region.*

Application to Patient Care

- *Patient outcomes and survival rates are vital to help decide upon appropriate treatment regimens for patients with malignant disorders.*
- *The availability of these local data from Oman may serve as a benchmark regarding lung cancer survival rates and will help clinicians during the treatment decision-making process.*

Lung cancer has recently been identified as the most frequently occurring cancer and leading cause of cancer-related deaths worldwide, with an age-standardised incidence and mortality rate among men alone of 33.8% and 29.2%, respectively.[1] Globally, it remains the most common form of cancer in men, with high rates in Europe, the USA and Eastern Asia and lower rates in Africa.[1] Since 2002, the incidence of lung cancer in Oman has been steadily rising over time; according to the Ministry of Health, lung cancer was ranked as the sixth most common cancer among men in 2013 (6.2%) and was the second most frequent cause of hospital-based cancer-related deaths (8.7%) following stomach cancer.[2] However, there is as yet no information regarding prognostic markers, presenting features and treatment outcomes among Omani patients.

Lung cancer is associated with tobacco smoking and the risk of developing the disease increases with smoking duration and the number of cigarettes smoked; hence, lung cancer is considered to be a preventable disease.[3] In the USA, the prevalence of heavy smoking (i.e. >30 cigarettes/day) has declined considerably; in contrast, a survey from Oman has shown a steadily increasing trend in smoking from a crude incidence of 6.7% in 1995 to 7.0% in 2004.[4–6] In addition, the majority of smokers are male, with 13.4% of men smoking versus 0.5% of women.[6] Alarmingly, waterpipe smoking has also become more popular in Oman recently, especially among younger individuals.[7,8]

The current study aimed to describe the demographic characteristics, clinicopathological features, management details and outcomes of patients with non-small-cell lung cancer (NSCLC) presenting at the Sultan Qaboos University Hospital (SQUH), a tertiary university hospital in Muscat, Oman. The results were subsequently compared with those of previous research from the USA regarding lung cancer-related outcomes.[9]

Methods

This non-concurrent retrospective study was conducted from January to June 2016 and included consecutive patients diagnosed with NSCLC presenting to SQUH between March 2000 and December 2015. Clinical and demographic data were reviewed using the hospital's information system, including age, gender, race, weight loss, smoking habits, Eastern Cooperative Oncology Group (ECOG) performance status and the presence of any concurrent illnesses. Prognostic and predictive markers were also analysed, including histological subtype, tumour grade, disease stage, sites of metastasis, *epidermal growth factor receptor* (*EGFR*) mutation status, treatment offered, survival and the occurrence of side-effects. Tissue samples were sent abroad to a reference laboratory for *EGFR* and *echinoderm microtubule-associated protein-like 4* (EML4) *anaplastic lymphoma kinase* (ALK) genetic testing. Cancer stages were defined as per the International Staging Committee criteria of the International Association for the Study of Lung Cancer.[10] The histology results of patients who were referred from other hospitals to SQUH after diagnosis were reviewed, although the majority of patients had been diagnosed at SQUH. All patients with incomplete electronic data and those who had received treatment and follow-up elsewhere (n = 7) or individuals diagnosed with small-cell lung cancer (n = 14) were excluded from the study.

Data were analysed using the Statistical Package for the Social Sciences (SPSS), Version 20.0 (IBM Corp., Armonk, New York, USA). Relapse-free survival (RFS) was calculated as the period of time between the date of diagnosis until the date of documented relapse, while progression-free survival (PFS) was deemed to constitute the period of time between the date of diagnosis until the date of progression of the disease. Overall survival (OS) was measured as the period of time from the date of diagnosis to the date of death or until the last known date of follow-up as of June 2016. Kaplan-Meir estimates were used to determine RFS, PFS and OS and the log-rank test was used for the comparative analysis. The Cox regression model was used for the multivariate analysis and included all statistically significant variables indicated by the univariate analysis. A *P* value of ≤0.050 was considered statistically significant.

This study was approved by the Research & Ethics Committee of the College of Medicine & Health Sciences, Sultan Qaboos University (MREC #641).

Table 1: Baseline clinical, demographic and pathological characteristics of patients with non-small-cell lung cancer presenting to the Sultan Qaboos University Hospital, Muscat, Oman (N = 104)

Characteristic	n (%)
Gender	
Male	82 (78.8)
Female	22 (21.2)
Age in years	
≤60	38 (36.5)
>60	66 (63.5)
Subtype	
Adenocarcinoma	62 (59.6)
SCC	29 (27.9)
Undifferentiated	7 (6.7)
Carcinoid tumour	2 (1.9)
Large-cell cancer	2 (1.9)
ASCC	2 (1.9)
Metastasis	
None	37 (35.6)
Bone	20 (19.2)
Opposite lung	15 (14.4)
Liver	7 (6.7)
Adrenal glands	7 (6.7)
Brain and bone	6 (5.8)
Brain	5 (4.8)
Pleural effusion	4 (3.8)
Liver and bone	1 (1.0)
Liver and cord compression	1 (1.0)
Peritoneum	1 (1.0)
Tumour size*	
T1	6 (5.8)
T2	31 (29.8)
T3	41 (39.4)
T4	25 (24.0)
Unknown	1 (1.0)
Nodal status	
N0	8 (7.7)
N1	31 (29.8)
N2	51 (49.0)
N3	11 (10.6)
Nx	3 (2.9)
Stage	
I	2 (1.9)
II	10 (9.6)
III	25 (24.0)
IV	67 (64.4)
Grade	
Well-differentiated	4 (3.8)
Moderately differentiated	30 (28.8)
Poorly differentiated	62 (59.6)
Undifferentiated	7 (6.7)
Unknown	1 (1.0)

SCC = squamous cell carcinoma; ASCC = adenosquamous cell carcinoma; T1 = ≤3 cm; T2 = 3–7 cm; T3 = >7 cm; T4 = tumour of any size invading the mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, oesophagus, vertebral body, carina or separate tumor in different ipsilateral lobe; N0 = absence of nodal involvement; N1 = metastasis to the ipsilateral hilar or peribronchial lymp nodes; N2 = metastasis to the ipsilateral mediastinal or carinal lymp nodes; N3 = metastasis to the contralateral hilar, mediastinal or supraclavicular lymp nodes; Nx = nodal involvement unknown.

**On radiology.*

Results

A total of 104 patients with NSCLC were included in the study. The median age at diagnosis was 64 years (range: 35–85 years old) and the male-to-female ratio was 3:1. Over half of the patients (65.4%) were active or ex-smokers; of these, most were male (91.2%), with only six of the female patients (27.3%) having a history of smoking. The median time to presentation was two months (range: 1–5 months). There were 96 Omanis (92.3%) and only eight expatriates (7.7%). Most patients had an ECOG performance status of 1 (27.9%) or 2 (26.0%), while 10.6%, 20.2% and 15.4% of patients had ECOG performance statuses of 0, 3 and 4, respectively.

Almost half of the patients (48.1%) had a history of significant weight loss. Nearly one-third of the patients (35.6%) had more than one comorbidity, with hypertension (47.1%), diabetes (26.9%) and chronic obstructive lung disease (25.0%) being most common. A total of 62 patients (59.6%) had adenocarcinomas. Of these, 43 (69.4%) were assessed for activating mutations in exons 19 or 21 of the *EGFR* gene, of which 12 (27.9%) harboured mutations. Of the 14 patients (13.5%) who underwent *EML4-ALK* gene testing, only one (7.1%) had an ALK rearrangement. The commonest site of metastasis was in the bone (19.2%). The clinical, demographic and pathological characteristics of the patients are presented in Table 1.

Only 12 patients (11.5%) presented with early-stage disease, including one patient (8.3%) at stage I and 11 patients (91.7%) at stage II. Of the patients

Table 2: First-line treatment regimens among patients with non-small-cell lung cancer presenting at the Sultan Qaboos University Hospital, Muscat, Oman (N = 104)

Regimen	n (%)
Adenocarcinoma	**62 (59.6)**
Pemetrexed and carboplatin	17 (16.3)
BSC and palliative XRT	16 (15.4)
Gemcitabine and carboplatin	9 (8.7)
Erlotinib	5 (4.8)
Vinorelbine and carboplatin/cisplatin	4 (3.8)
Paclitaxel and carboplatin	4 (3.8)
Pemetrexed	2 (1.9)
Gemcitabine, carboplatin and bevacizumab	1 (1.0)
Pemetrexed, carboplatin and bevacizumab	1 (1.0)
Gefitinib	1 (1.0)
Pemetrexed, carboplatin and erlotinib	1 (1.0)
5-FU and platinum	1 (1.0)
ASCC	**2 (1.9)**
Paclitaxel and carboplatin	2 (1.9)
SCC	**29 (27.9)**
Gemcitabine and carboplatin	12 (11.5)
BSC	10 (9.6)
Gemcitabine	2 (1.9)
Paclitaxel and carboplatin	2 (1.9)
Nab-paclitaxel and carboplatin	1 (1.0)
Docetaxel and carboplatin	1 (1.0)
Etoposide, carboplatin and XRT	1 (1.0)
Undifferentiated	**7 (6.7)**
BSC	3 (2.9)
Gemcitabine and carboplatin	2 (1.9)
Paclitaxel and carboplatin	2 (1.9)
Large-cell cancer	**2 (1.9)**
Gemcitabine and carboplatin	1 (1.0)
Pemetrexed and carboplatin	1 (1.0)
Carcinoid tumour	**2 (1.9)**
Surveillance	2 (1.9)

BSC = best supportive care; XRT = radiotherapy; 5-FU = 5-fluorouracil; ASCC = adenosquamous cell carcinoma; SCC = squamous cell carcinoma.

who presented with early-stage NSCLC, 10 (83.3%) underwent surgical resection. Seven patients received adjuvant chemotherapy, one patient was deemed unfit for chemotherapy and received adjuvant radiation therapy instead and two patients opted not to receive adjuvant therapy and later died due to progressive cancer (including one patient with an adenocarcinoma and another with squamous cell carcinoma [SCC]). Local and distant relapse was documented in two patients each, while four patients had both local and distant relapses. A total of 92 patients (88.4%) presented with more advanced disease (stage III or IV) and were treated palliatively; of these, 30 patients (32.6%) did not receive chemotherapy because they either refused treatment or were deemed unfit due to their poor ECOG performance status.

Patients who received first-line chemotherapy were treated with a median of four cycles (range: 1–6 cycles). Only seven patients received tyrosine-kinase inhibitors (TKIs) during the first line of chemotherapy, including erlotinib (n = 5), a combination of erlotinib and chemotherapy (n = 1) and gefitinib (n = 1). All of these patients experienced disease progression requiring second-line chemotherapy, except for one patient who died while receiving erlotinib. A total of 62 patients (59.6%) were treated with platinum doublets as first-line therapy. The first-line treatment regimens prescribed are shown in Table 2. Maintenance chemotherapy after induction therapy was offered to 11 patients who received a median of 14 maintenance cycles (range: 4–26 cycles) before progression. A median of three cycles of second-line chemotherapy was administered (range: 1–17 cycles). Docetaxel alone was administered to 10 patients in the second line, while five patients received pemetrexed or gemcitabine with platinum. The remaining patients were treated with other single agents or a combination of regimens. Of the 35 patients who received second-line chemotherapy, 19 (54.3%) also received third-line chemotherapy. Docetaxel and erlotinib were the most commonly used third-line agents (21.1% each). Five patients (4.8%) were treated with five lines of chemotherapy.

In total, 83 patients (79.8%) died secondary to disease progression and eight (7.7%) died of non-disease-related causes. At the time of writing, five patients (4.8%) were alive and actively receiving treatment, three patients (2.9%) who had received adjuvant chemotherapy were in remission, one patient (1.0%) was alive on best supportive care and one patient (1.0%) was alive and diseased, but under active observation due to a bronchial carcinoid tumour. The status of the remaining three patients (2.9%) was unknown as they were lost to follow-up. According to gender, median PFS was 19.0 months in females versus 7.4 months in males and OS was 22.2 months in females versus 10.5 months in males. Median RFS among patients with early-stage disease (stage I or II) was 29 months (range: 1–74 months), while median PFS among patients with more advanced disease (stage III or IV) was five months (range: five days–97 months)

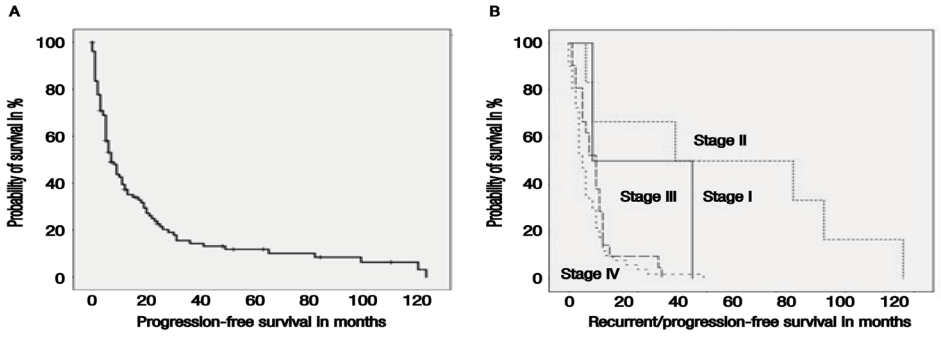

Figure 1: Median (**A**) progression-free survival for all patients and (**B**) recurrence-free or progression-free survival according to stage among patients with non-small-cell lung cancer presenting to the Sultan Qaboos University Hospital, Muscat, Oman (N = 104).

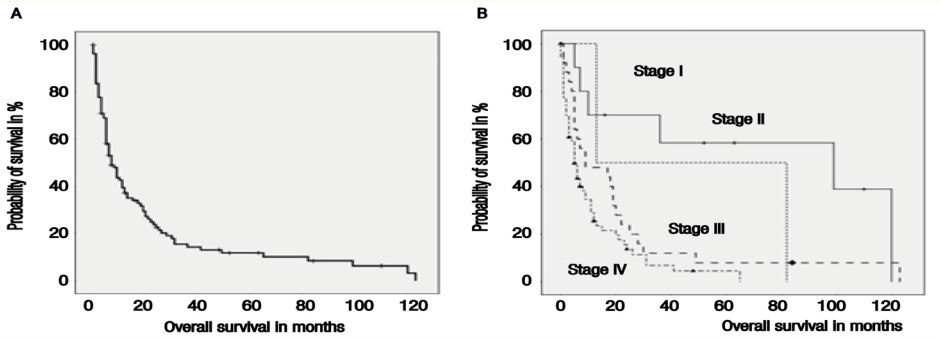

Figure 2: Median overall survival for (**A**) all patients and (**B**) according to stage among patients with non-small-cell lung cancer presenting to the Sultan Qaboos University Hospital, Muscat, Oman (N = 104).

Table 3: Univariate analysis of factors affecting recurrence-free survival, progression-free survival and overall survival among patients with non-small-cell lung cancer presenting to the Sultan Qaboos University Hospital, Muscat, Oman (N = 104)

Variable	RFS/PFS		OS	
	95% CI	*P* value	95% CI	*P* value
Gender (male versus female)	3.40–6.59	0.007	2.96–35.03	0.055
Age group (<60 versus ≥60-year-olds)	3.41–6.58	0.220	4.82–13.17	0.023
Curative surgery	23.16–48.83	<0.001	0.00–187.72	<0.001
Disease stage at diagnosis	2.89–5.10	0.001	3.46–6.53	0.001
Smoking history	3.59–6.40	0.019	2.87–27.12	0.003
ECOG performance status	4.15–11.84	0.001	18.527–21.47	<0.001
Weight loss	2.46–7.54	0.070	5.31–16.68	0.011
N0 nodal status	25.26–46.73	0.003	0.0–173.65	0.001
Site of metastasis	5.93–10.06	0.005	7.65–28.34	<0.001
Chemotherapy approach (adjuvant versus palliative)	25.26–46.73	0.003	7.98–16.01	<0.001
Number of chemotherapy cycles	5.76–10.24	0.043	7.98–16.01	0.005
Chemotherapy-associated side-effects	3.12–6.87	0.006	3.17–18.82	0.120
Treatment response	6.76–9.24	<0.001	4.29–9.70	<0.001
Radiation treatment	-	-	4.45–7.54	0.050
PFS	-	-	5.37–12.63	0.001

RFS = recurrence-free survival; PFS = progression-free survival; OS = overall survival, CI = confidence interval; ECOG = Eastern Cooperative Oncology Group; N0 = absence of nodal involvement.

[Figure 1]. The median OS for all patients was seven months (range: 7 days–123 months). At two and five years, OS was 96.0% and 7.0%, respectively. At two years, OS was 50.0%, 70.0%, 22.0% and 17.0% for patients with disease stages I, II, III and IV, respectively. After five years, 50.0%, 60.0%, 10.0% and 8.0% of patients with stages I, II, III and IV were still alive [Figure 2].

On univariate analysis, females had a significantly higher median PFS rate (19.0 versus 7.4 months; $P = 0.003$) in comparison to males, although OS was not significantly different (19.0 versus 6.0 months; $P = 0.055$). Moreover, curative surgical resection, an early-stage diagnosis, never smoking, ECOG performance status, the absence of nodal involvement, the site of metastasis, chemotherapy approach, the number of cycles of chemotherapy administered, the presence of chemotherapy-associated side-effects and treatment response to first-line chemotherapy were also significantly associated with PFS ($P < 0.050$ each). In addition, a younger age, curative surgical resection, an early-stage diagnosis, never smoking, ECOG performance status, weight loss, the absence of nodal involvement, the site of metastasis, chemotherapy approach, the number of chemotherapy cycles, receiving radiation therapy, treatment response to first-line chemotherapy and PFS were significant factors affecting increased OS ($P < 0.050$ each) [Table 3]. However, none of these factors were found to be statistically significant during the multivariate Cox regression analysis.

Discussion

In Oman, lung cancer is a major cause of cancer-related deaths, warranting patient, physician and specialist awareness.[2] While fewer patients are diagnosed with lung cancer in Oman as compared to neighbouring countries like the United Arab Emirates and Saudi Arabia, the age-standardised ratio for lung cancer is higher in Oman at 6.7 for males and 2.1 for females.[2] Nevertheless, the incidence of lung cancer in Oman is lower than in other nearby countries like Egypt, Kuwait and Jordan.[11,12] The mean age of the patient population in the current study (64 years) was consistent with that reported in previously published research (59.2 years).[13] Moreover, age was significantly associated with poorer survival in the current study; while age is reportedly not prognostic for survival, it is known to be a poor prognostic factor for toxicity to chemotherapy.[14]

In the present study, NSCLC was more frequent among men; the lower incidence among Omani women may perhaps reflect the cultural taboo of tobacco smoking in females. Women also showed superior median PFS and OS compared to men; this correlates favourably with Western findings reported by Wisnivesky *et al*.[15] A Norwegian study similarly reported that men with adenocarcinomas had a 24% higher risk of death than women.[16] However, environmental exposure, genetic predisposition, hormonal factors and viral infections may all play a role in lung cancer among women and never smokers, both of whom have a higher prevalence of adenocarcinomas.[3,17] Zang *et al*. found that the odds ratio for adenocarcinomas was higher among females due to their greater susceptibility to carcinogens, regardless of level of exposure to tobacco smoke.[18] Adenocarcinoma subtypes are usually related to subpleural scars.[19] While the incidence of SCC has decreased over the past few decades, that of adenocarcinomas has increased in both genders due to the introduction of filter vents that facilitate easier and deeper inhalation of tobacco-specific carcinogens.[3] This was reflected in the current study in which a higher incidence of adenocarcinomas was observed in comparison to SCC. Additionally, according to the univariate analysis, never smokers in the present study had a significantly better PFS rate. Furthermore, the vast majority of smokers were male. Various carcinogens and cell signal pathways have been proposed to contribute to lung oncogenesis among never smokers.[4]

Loss of body weight at presentation was associated with poorer survival in the present study, with almost half of the study sample losing >5% of their baseline weight; in addition, decreased ECOG performance status was associated with poor outcomes. Yang *et al*. also found that weight loss was associated with poorer survival.[20] In a study of various chemotherapy regimens for patients with advanced NSCLC, Schiller *et al*. indicated that the absolute benefit of chemotherapy for one year and median OS varied inversely with poor ECOG performance status.[21] Multiple concurrent illnesses were noted in the current study which is understandable considering the fact that most of the patients were quite elderly. However, the frequency of these variables was too low to predict survival. The severity or burden of comorbidity has been reported to have a clear relationship with poor survival in lung cancer; for example, the Charlson Comorbidity Index is associated with increasing toxicity to chemotherapy.[22,23] Ethnicity has also been found to have an impact on survival; a recent article indicated that African Americans had poorer survival prospects even though Caucasians had a higher risk of developing lung cancer.[24] Most patients in the current study were Omani, with eight patients originating

Table 4: Comparison of stage distribution and survival rates of patients with non-small-cell lung cancer in Oman and the USA

Stage at diagnosis	Frequency	Percentage	
		Two-year OS	Five-year OS
Oman			
I	1.9	50.0	50.0
II	9.6	70.0	60.0
III	24.0	22.0	10.0
IV	64.4	17.0	8.0
USA*			
Localised disease	15	-	52.2
Regional metastasis to the lymph nodes	22	-	25.1
Distant metastasis	56	-	3.7
Unstaged	6	-	7.9

OS = overall survival.

**Data sourced from the results of the Surveillance, Epidemiology, and End Results Program of the National Cancer Institute for 2001–2008.[9]*

from either Africa, Pakistan, the Philippines, India or Europe; unfortunately, due to the low number of expatriates, it was not possible to correlate race or ethnicity with survival.

The majority of patients in the current study were treated with platinum doublets. Bevacizumab could not be administered to many of the patients due to the presence of absolute or relative contraindications.[25] At SQUH, anticancer therapy is customised based on the histological subtype of NSCLC; pemetrexed and platinum doublets with or without bevacizumab are usually prescribed for adenocarcinomas, while platinum and gemcitabine or nab-paclitaxel are prescribed for SCC and TKIs for patients with adenocarcinomas also harbouring *EGFR* mutations. Overall, *EGFR* mutations are present in 40–50% of East Asians and 10% of Caucasians.[26] However, the exact incidence of these mutations in the GCC region is unknown; in the current study, it was observed that 27.9% of patients with adenocarcinomas had *EGFR* mutations in exons 19 or 21. As of late 2010, selected NSCLC patients at SQUH are treated with maintenance therapy. Compelling data exist suggesting that patients with ECOG performance statuses of 0–1 receiving maintenance therapy have well-preserved organ function and that this form of therapy enhances OS by 2–3 months.[27–31] Several prognostic and predictive markers are also now available to guide oncologists in providing customised and individualised evidence-based care.[32]

A major cause of death in the present study was either local progression leading to respiratory failure, progressive metastasis (i.e. leptomeningeal and brain metastases, liver failure, pulmonary parenchymal relapse or pleural effusion or both) or infections (i.e. pneumonia and sepsis). No deaths were attributable to venous thromboembolic phenomena or pulmonary embolisms, which may be due to the strict thromboprophylaxis policy implemented at SQUH. Survival outcomes were very poor for patients who were diagnosed NSCLC at a late stage, which constituted the vast majority of patients in the studied cohort. This incidence of advanced stage NSCLC is very similar to that reported by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute in the USA [Table 4].[9] Advanced NSCLC has a median OS of 10 months.[32] Pemetrexed and targeted agents have been reported to enhance survival to 12 months and beyond, while the benefits of post-progression bevacizumab are currently under investigation.[33] In the current study, prolonged survival was observed in a few cases treated with either TKIs or maintenance therapy; these findings are in agreement with those from other studies.[34,35]

Conclusion

In the current study, the majority of patients with NSCLC were found to present at an advanced stage. However, survival outcomes were similar to those reported by the SEER Program in the USA. To the best of the authors' knowledge, this study is the first to describe the trends and outcomes of patients with NSCLC in Oman.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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