
Functional status and survival in patients ≥ 85 years of age who have keratinocyte carcinoma: A retrospective cohort study



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Background: Functional status assessment may help estimate which patients ≥ 85 years of age will benefit from surgical treatment for keratinocyte carcinoma (KC), but predictive value for short-term survival in this population has not been determined.

Objective: We sought to assess the predictive value of functional status for short-term survival in patients ≥ 85 years of age who have KC.

Methods: This was a retrospective cohort review of 238 patients ≥ 85 years of age who presented for the management of KC between 2010 and 2015. Functional status was assessed with the Karnofsky Performance Scale (KPS) and Katz Activities of Daily Living (ADL) index. Overall survival was determined.

Results: Lower functional status scores of KPS ≤ 40 and Katz ADL ≤ 4 were associated with 37% and 53% survival at 2 years, respectively.

Limitations: Retrospective design and single-center study.

Conclusion: In this study, KPS and Katz ADL predicted short-term survival. Patients with low functional status scores had significantly decreased survival at 2 years, with double the death rate of patients with high functional status. Functional status should be considered during shared decision-making for elderly individuals who are seeking treatment for KC. (*J Am Acad Dermatol* 2020;83:463-8.)

Key words: functional assessment; geriatrics; keratinocyte carcinoma; oncology; Karnofsky Performance Scale; Katz ADL.

The incidence of keratinocyte carcinoma (KC) increased by 35% between 2006 and 2012, with the largest increase in rates among the Medicare fee-for-service population in the United States.¹ Given that those ≥ 85 years of age represent the fastest growing segment of the US population with a projected growth from 5.9 million in 2012 to 8.9 million in 2030,² the incidence rates and

treatment of KC in the very elderly (defined as ≥ 85 years of age) are also expected to increase.

There is debate regarding the appropriate management of KC in this age group because the majority of KC cases are nonfatal, asymptomatic, and demonstrate indolent growth. While some have proposed age as a relative contraindication to surgical treatment of KC because of limited life expectancy,³⁻⁵

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others have demonstrated relatively prolonged survival in the very elderly and low morbidity with surgical treatment for KC.⁶⁻⁹ With the expected increase in the very elderly seeking KC care, a key issue will be assessing who will benefit from treatment of KC and determining the most appropriate treatment approach for each patient.^{6,10-14}

Given the limited life expectancy of this age group, assessing patient factors that contribute to short-term survival can assist clinicians in choosing the best treatment option for patients presenting with KC. To help estimate these factors, the evaluation of functional status has been proposed.^{4,6,11} The Karnofsky Performance Scale (KPS) and Katz Activities of Daily Living (ADL) are 2 validated indices used in geriatric populations to assess overall health and have been shown to be predictive of survival in older adults.^{15,16} However, the role of indices such as the KPS and Katz ADL to assess functional status and predict short-term survival has not been explored in this population.

To assess overall health and survival in the very elderly with KC who are seeking treatment, the objectives of this study were: 1) to describe functional status in patients ≥ 85 years of age presenting for management of KC and 2) to assess the predictive value of functional status measures for short-term survival in this specific population using the KPS and Katz ADL.

METHODS

Design, setting, and study population

This was a single-center retrospective cohort study of patients ≥ 85 years of age who presented for skin cancer management to a department of dermatology at a tertiary cancer center between 2010 and 2015. Patients who were diagnosed with basal cell carcinoma (BCC) or cutaneous squamous cell carcinoma (SCC) and who completed an ambulatory health assessment including functional status measures were included. Patient charts were reviewed for clinical and functional status metrics. Clinical data extracted included patient demographics, tumor characteristics, treatment details, follow-up, and survival.

Treatment types were categorized as follows: 1) Mohs micrographic surgery (MMS); 2) surgical excision; 3) nonsurgical (electrodessication and curettage, cryotherapy, topical therapy, photodynamic therapy, intralesional therapy, or radiation); 4) observation/referral; and 5) other (eg, treated elsewhere). To assess survival, the last follow-up with a

dermatologist at our institution and date of death were collected. For all patients, time began at the date of procedure or if no procedure was performed, at the date of consultation. Elapsed time was calculated until death or last follow-up. Participants were considered censored if they were alive or lost to follow-up at the date of last assessment.

Functional status assessment

Functional status metrics were collected from the health assessment form completed by patients during their initial evaluation and graded according to the KPS¹⁷ and the Katz ADL.¹⁸ Assessments were included if they were completed within a year of the pertinent KC diagnosis. The KPS describes functional status as an 11-point scale with values ranging from 100% (normal, no symptoms) to 0% (death). The Katz ADL grades whether a patient can independently perform 6 functions: bathing, dressing, toileting, transferring, continence, and feeding. The scores are coded as a 0 for no and 1 for yes. Total scores range from 0 to 6, with a 0 indicating no functional independence and a 6 indicating the highest level of functional independence.

Statistical analysis

Statistical analyses were performed with StataSE software (v 14.2; StataCorp, LP, College Station, TX). Alpha was set at 5% and all analyses were 2-tailed. Patient characteristics were summarized by procedure status (ie, MMS, excision, nonsurgical, observation/referral, or other). The one-way analysis of variance and the chi-square test were used to assess differences in the distribution of patient characteristics, tumor characteristics, and patient functional status scores for continuously and categorically scaled variables. For univariate assessments of overall survival, Kaplan-Meier survival curves were stratified by KPS and Katz ADL scores.

CAPSULE SUMMARY

- Very elderly patients presenting for management of keratinocyte carcinoma had overall high functionality and prolonged survival.
- The Karnofsky Performance Scale and Katz Activities of Daily Living predicted short-term survival in this study. Functional status should be considered during shared decision-making for elderly individuals seeking treatment for keratinocyte carcinoma.

Table I. Distribution of participant characteristics by treatment type

Variable	Overall, N = 238	MMS, n = 127	Excision, n = 18	Nonsurgical, n = 68	Observation/referral, n = 12	Other, n = 13	P value
Age, years, mean (SD)	88.2 (3.5)	87.8 (3.3)	88.2 (3.0)	88.6 (3.5)	89.8 (3.6)	88.7 (3.5)	.22*
Sex, n (%), mean (SD)							
Female	121 (50.8)	64 (50.4)	7 (38.9)	42 (61.8)	2 (16.7)	6 (46.2)	.04 [†]
Male	117 (49.2)	63 (49.6)	11 (61.1)	26 (38.2)	10 (83.3)	7 (53.9)	
Marital status, mean (SD)							
Married	88 (37)	58 (45.7)	6 (33.3)	17 (25)	5 (41.7)	2 (15.4)	.01 [†]
Widowed	99 (41.6)	44 (34.7)	10 (55.6)	37 (54.4)	5 (41.7)	3 (23.1)	
Single	21 (8.8)	12 (9.5)	1 (5.6)	6 (8.8)	0 (0)	2 (15.4)	
Divorced	6 (2.5)	3 (2.4)	1 (5.6)	1 (1.5)	0 (0)	1 (7.7)	
Unknown	24 (10.1)	10 (7.9)	0 (0)	7 (10.3)	2 (16.7)	5 (38.5)	
Diagnosis, mean (SD)							
BCC	119 (50)	73 (57.5)	8 (44.4)	28 (41.2)	5 (41.7)	5 (38.5)	.18 [†]
SCC	119 (50)	54 (42.5)	10 (55.6)	40 (58.8)	7 (58.3)	8 (61.5)	
Karnofsky Performance Scale score, mean (SD)	81.1 (19.8)	81.1 (19.8)	80.6 (19.1)	80.4 (20.5)	88.3 (14.7)	78.3 (15.8)	.75*
Katz ADL Performance Scale score, mean (SD)	4.8 (1.6)	4.8 (1.5)	4.3 (2.2)	4.8 (1.8)	5.7 (0.5)	4.8 (1.9)	.32*

ADL, Activities of daily living; BCC, basal cell carcinoma; MMS, Mohs micrographic surgery; SCC, squamous cell carcinoma; SD, standard deviation.

*Based on one-way analysis of variance.

[†]Based on Pearson chi-square test.

RESULTS

Patient and lesion characteristics

A total of 345 patients ≥ 85 years of age presented for management of KC. After patients with incomplete health assessments were excluded, 238 patients were included in this study. Of these, 127 patients (53.4%) underwent MMS and 18 patients (7.56%) underwent excision. Of patients who did not undergo surgery, 68 patients (28.6%) underwent nonsurgical treatment. Twelve were observed and 13 opted for treatment elsewhere or were lost to follow-up. Characteristics of participants and the presenting skin cancer are shown in Table I. The mean age was 88.2 years and 50.8% of patients were female. The location of lesions included 43.7% on the head and neck area, 31.9% on the trunk, and 24.4% on the extremities.

Functional status and survival

Functional status scores demonstrated a relatively high level of independence, with a mean KPS score of 81.1 and a mean Katz ADL of 4.8 (Table I). For patients with follow-up, estimates of 7-year overall survival by KPS and Katz ADL functional status indices are presented in Fig 1. In addition, 24-month survival is demarcated for each functional status index in the survival curves and presented with lower and upper bounds (95% confidence interval [CI]) for each index in Table II.

Survival estimates for KPS were calculated using 3 groups: low functional status (KPS = 0-40), medium functional status (KPS = 50-70), and high functional status (KPS = 80-100). Katz ADL survival estimates were calculated using 3 groups: low to moderate functional status (Katz = 0-4), high functional status (Katz = 5), and the highest functional status (Katz = 6). Patients with a low KPS score had a 2-year survival of 37% (95% CI 0.01-0.80) compared with 75% in the high KPS score group (95% CI 0.64-0.83). Similarly, patients with low to moderate Katz ADL scores had a 2-year survival of 53% (95% CI 0.34-0.69) compared with 79% in the highest scoring Katz ADL group (95% CI 0.68-0.87).

Hazard ratios (HRs) with lower and upper bounds (95% CI) for each index are shown in Table II. Compared with the highest KPS scores (80-100), patients with the lowest KPS scores (0-40) had significantly worse survival (HR 3.39 [95% CI 1.18-9.69]; $P = .023$). Similar results were found for Katz ADL, with patients in the lowest functioning group (0-4) having significantly worse survival compared with patients in the highest functioning group (HR 2.49 [95% CI 1.39-4.47]; $P = .002$).

DISCUSSION

In this study, patients ≥ 85 years of age presenting for treatment of KC at a tertiary care center were a

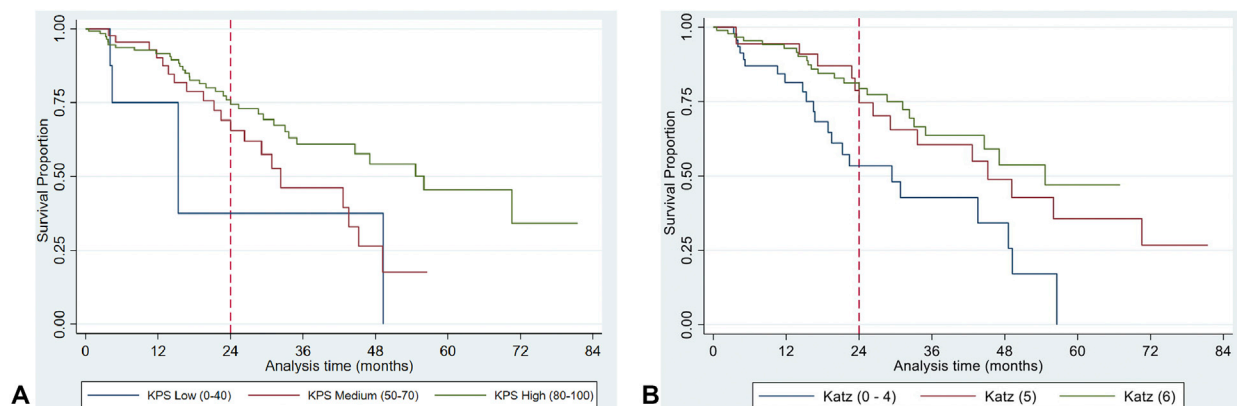


Fig 1. **A**, Overall survival by Karnofsky Performance Scale categorized as low (0-40), medium (50-70), and high (80-100). A vertical reference line shows 2-year survival. **B**, Overall survival by Katz Activities of Daily Living scores categorized as 0 to 4, 5, and 6. A vertical reference line shows 2-year survival.

Table II. Two-year estimated survival with 95% CIs

Scale	n	Survival proportion (95% CI)	HR (95% CI)	P value
Karnofsky				
Low (0-40)	13	0.37 (0.01-0.80)	3.39 (1.18-9.69)	.023
Medium (50-70)	59	0.67 (0.48-0.81)	1.69 (0.96-2.98)	.069
High (80-100)	155	0.75 (0.64-0.83)	1.0	Referent
Katz				
0-4	62	0.53 (0.34-0.69)	2.49 (1.39-4.47)	.002
5	62	0.74 (0.53-0.87)	1.17 (0.60-2.27)	.641
6	113	0.79 (0.68-0.87)	1.0	Referent

CI, Confidence interval; HR, hazard ratio.

mean age of 88.2 years and demonstrated high functionality comparable to that in previous studies.^{19,20} A large cohort of patients ≥ 75 years of age who presented for MMS was previously shown to have a mean KPS score of 90.1, demonstrating excellent functionality.¹⁹ In that study, a small percentage of patients (7.3%) had a KPS score of ≤ 70 , and these lower-functioning patients were more likely to be older with larger, more symptomatic tumors. The lower mean KPS score of 81.1 in this study is likely because of the older population (≥ 85 years of age) included. Based on the mean functional status scores, it can be extrapolated that this cohort is generally high functioning with normal ADL and few symptomatic comorbidities that would interfere with access to dermatologic care.

KPS and Katz ADL scores, which are both validated to assess functional status in elderly patients with cancer, were similar across treatment groups in this study.^{16,21,22} A previous study of patients receiving MMS, excision, and electrodesiccation and curettage similarly found no difference in functional status, along with other factors predictive

of limited life expectancy.³ However, another study found that dermatologists consider patient functionality when selecting treatment for KC, using nonsurgical management options in patients with poor functional status even when tumors met appropriate use criteria for MMS.²⁰ In this study, functional status scores were similar across treatment groups and may be related to the overall higher functional status of this population. The study setting in a metropolitan city and tertiary care center may have caused preselection of patients with higher functionality and therefore may not be representative of the average 85-year-old in the community or in rural practices. High-functioning patients in this study were likely offered more treatment choices, leading to factors such as lesion risk and patient preference having a greater influence on the treatment received.

This study showed that functional status scores stratify for survival, with lower scores associated with shorter survival. This finding supports the importance of functional status in assessing life expectancy in the very elderly presenting for KC treatment. In addition to life expectancy, tumor biology and

patient preferences should be considered during the shared decision-making process for the very elderly.¹⁰ Other factors to consider in management decisions include tumor symptomatology and growth rate, expected treatment morbidity, and the patient's ability to perform postprocedure care. These additional factors may have been drivers for the observation/referral group because they opted for minimal management despite their high functional status. Gender and marital status were also significantly associated with treatment modality in this patient cohort. Marital status has been established as a factor impacting treatment choice and faster recovery.²³ It is possible that less aggressive treatments for KC in elderly, unmarried patients were favored when decisions were not influenced by a spouse.

In this study both the KPS and Katz ADL were useful in stratifying survival. A KPS ≤ 40 and a Katz ADL ≤ 4 were associated with 37% and 53% survival at 2 years, respectively, while $>75\%$ of patients with higher KPS (>40) and Katz ADL (>4) scores were estimated to survive, demonstrating the utility of these measures as predictive tools in this population. Rogers et al⁶ found that the very elderly treated with MMS survived by a median of 20 months longer compared with those who did not have MMS despite comparable comorbidity status, indicating that additional factors such as functional status may impact survival or choice of treatment modality. HRs for the KPS and Katz ADL indicate that the rate of death in patients with low functional status scores is significantly greater than the rate of death in high-functioning patients. Notably, the rate of death in patients with low KPS scores is >3 times the rate at 2 years compared with those with high KPS scores, indicating that the KPS may be particularly useful in predicting survival in the elderly seeking skin cancer treatment.

Our study categorized low functional status as a KPS score ≤ 40 and a Katz ADL score ≤ 4 , consistent with definitions used in similar studies.²⁴⁻²⁶ Cancer patients with a KPS score between 60 and 100 are generally considered to be fit enough to receive standard cancer treatment, such as surgery or chemotherapy.²⁷ However, treatment of an advanced melanoma or an aggressive head and neck SCC with systemic chemotherapy or an operating room surgical procedure has a different risk/benefit ratio than an in-office procedure; therefore, a discussion taking into consideration factors such as functional status, comorbidity, life expectancy, cost of care, and patient desires is warranted. As our study has shown, both the KPS and Katz ADL are effective tools in predicting short-term survival in very elderly

patients seeking skin cancer treatment and can be formally implemented into patient counseling during a shared decision-making process.

There are limitations to this study, including its retrospective, observational design. The patient population was from a tertiary care center that may have a socioeconomic and functional status profile different from similar patients presenting for management in other settings. Future studies with geographic diversity may lead to greater generalizability of the data. The KPS and Katz ADL indices were originally developed to assess functional status in patients with high mortality cancers and may not accurately capture the functional status of a healthier population presenting with slow-growing, lower mortality malignancies. Patients who are very ill are unlikely to be referred or to prioritize skin cancer treatment leading to selection bias as well. BCC and SCC were also analyzed together because of the limited number of cases in this specific population (≥ 85 years of age); however, we acknowledge that the tumor biology and progression of a BCC and SCC can differ.

In conclusion, the vast majority of patients ≥ 85 years of age presenting to a tertiary care center for management of KC had high functional status scores and prolonged survival. Low functional status correlated with poorer short-term survival. A KPS score ≤ 40 and Katz ADL score ≤ 4 were significantly associated with decreased survival at 2 years, with the rate of death of patients with low KPS scores >3 times those with high KPS scores. While low functional status was shown to correlate with poorer short-term survival, it should not be used as the sole determinant in choice of treatment. However, functional status can contribute to a comprehensive patient-centered approach in the very elderly presenting for management of KC. The KPS or Katz ADL can be a component of patient intake and should be considered during patient counseling and the shared decision-making process. Further research should be conducted on functional status in the elderly presenting for KC management in outpatient dermatology centers with a wider demographic and socioeconomic background.

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