

Functionality of Patients 75 Years and Older Undergoing Mohs Micrographic Surgery: A Multicenter Study

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BACKGROUND Mohs surgery is indisputably a highly effective treatment for nonmelanoma skin cancers. In the current health care environment, physicians are challenged to provide high quality, efficacious care in a manner that is mindful of the patient's general health and well-being. We have used a functional assessment to evaluate older patients who present for Mohs surgery.

OBJECTIVE The purpose of this study is to categorize the functional status, using the Karnofsky Performance Status (KPS) Scale, of patients 75 years and older undergoing Mohs surgery of a nonmelanoma skin cancer and to identify distinguishing characteristics of lower functioning patients.

METHODS Patients 75 years and older undergoing Mohs surgery for nonmelanoma skin cancer at 8 separate geographically diverse sites were included. Patient and tumor characteristics were recorded. Physicians scored subjects on the KPS scale and administered a questionnaire to categorize the symptoms and impact of their skin cancer.

RESULTS A total of 291 subjects completed the study. The average KPS score was 90.1. 93.1% of our subjects had a KPS score of ≥ 70 . Subjects with a KPS score < 70 were more likely to be older with larger symptomatic tumors.

CONCLUSION The vast majority of patients 75 years and older undergoing Mohs surgery are highly functioning. Lower functioning patients are older with larger symptomatic tumors that negatively impact their lives.

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There are more than 5.4 million nonmelanoma skin cancers diagnosed each year in the United States.¹ This number steadily rose over the last decade and will continue to do so as the aging population increases. In fact, the United States Census estimates the number of individuals older than 75 years will increase from 19.2 million in 2010 to 46.2 million in 2050.² Furthermore, the average lifespan at birth has increased to 76 years for men and 81 years for women. In addition, individuals who survive until the age of 75

years have an increased expected lifespan of 86 years for men and 87.9 years for women. With these factors combined, dermatologists will be faced with treating an increasing number of elderly patients with nonmelanoma skin cancers.

The population increase of older Americans combined with the increasing costs of health care has spurred the debate as to which treatments, tests, and screenings are warranted in those of increased age. Much of this

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debate surrounds appropriate care of nonfatal conditions in the last several years of life, including nonmelanoma skin cancer. Nonmelanoma skin cancers can affect patients' quality of life not only because of associated symptoms (bleeding, pain, etc.) but also because of their concern of tumor spread, tumor recurrence, and potential disfigurement, thus warranting treatment.^{3–5} Mohs surgery provides excellent cure rates for nonmelanoma skin cancers: 99% and 97% for basal cell and squamous cell carcinomas, respectively.⁶ Furthermore, it is cost-effective,⁷ has a low incidence of adverse events, and is well tolerated, even by nonagenarians.^{8–12} Still, some question the use of Mohs surgery in the elderly and suggest that patients of advanced age should forgo Mohs surgery in favor of "less invasive" treatments.¹³ As the Mohs technique by design minimizes the tissue removed to extirpate the cancer and is performed with local anesthesia in an outpatient setting, it is debatable that some of the alternative therapies are truly less invasive. It has been shown that the treatment chosen for nonmelanoma skin cancers can also affect patients' quality of life. In fact, patients treated with Mohs surgery have a greater improvement in quality of life than those treated with the "less invasive" treatment of electro-dessication and curettage.¹⁴ Furthermore, a survey of individuals undergoing Mohs surgery found that patients considered it most important that their skin cancer treatment had the highest cure rate of all treatment options.¹⁵ The value placed on this aspect of care was the same for individuals younger or older than 65 years.

A recent study aimed to characterize the treatment of nonmelanoma skin cancers in patients with limited life expectancy (LLE).¹³ Ultimately, the study concluded that Mohs surgery was performed as often in patients with LLE and without LLE—suggesting that a patient's overall health status was not taken into consideration before treatment. In this study, LLE was determined based on the patients' Charlson Comorbidity Index (CCI).¹³ This scale is designed to predict the 10-year survival of patients based on designated comorbid conditions and age. It does not, however, take into account the severity of comorbid conditions, the overall health of the patient, and their ability to carry on normal activity. Furthermore, the CCI has

been used to predict the 10-year mortality of patients. There are, however, many nonmelanoma skin cancers that can cause functional deformities or bothersome symptoms in this amount of time. The CCI is more suited to predicting outcomes of complex medical conditions or invasive surgeries in which their underlying conditions may interfere with the recovery process.^{16–18} It is not as applicable to the treatment of nonmelanoma skin cancers that have low morbidity and mortality.

Ultimately, life expectancy prognostication is extremely difficult. Even if LLE could be accurately determined, we must consider the quality of a patient's life during that period. We believe that a functional assessment is as valuable as a comorbidity assessment in determining the appropriateness of Mohs surgery in patients with nonmelanoma skin cancer. Using a functionality assessment, the physician can consider the patient as a whole—including signs and symptoms of disease, medical care needs, ability to care for oneself, and daily activity level. It is a complete tool for assessing an individual's ability to undergo the procedure, perform postoperative care, and the potential improvement in their quality of life. The KPS scale is a type of functional assessment that describes a patient's functional status as a comprehensive 11-point scale whose percentage values range from 0% (death) to 100% (no disease) (Table 1). It is widely considered the gold standard in quantifying the functional status of oncology patients to determine treatment regimens.^{19,20} More recently, it has been applied to varied medical issues such as end-stage pulmonary disease requiring transplantation, chronic pain syndromes, and acute renal failure requiring hemodialysis.^{21–23} Application of the KPS scale in treatment of skin cancers has primarily been limited to advanced squamous cell carcinoma of the head and neck and advanced melanoma in regard to chemotherapy.^{24–33} In these studies, the KPS score cutoff for treatment ranged from 60% to 80%.

The purpose of this study was to determine the functional status, using the KPS scale, of all patients aged 75 years and older undergoing Mohs surgery for nonmelanoma skin cancers. We also sought to identify

TABLE 1. KPS Scale

<i>KPS Score</i>	<i>Description</i>
100	Normal, no complaints, no evidence of disease.
90	Able to carry on normal activity, minor signs, or symptoms of disease.
80	Normal activity with effort, some signs or symptoms of disease.
70	Cares for self, unable to carry on normal activity or do active work.
60	Requires occasional assistance, but is able to care for most of his needs.
50	Requires considerable assistance and frequent medical care.
40	Disabled, requires special care and assistance
30	Severely disabled, hospitalization is indicated although death is not imminent.
20	Hospitalization necessary, very sick, active supportive treatment necessary.
10	Moribund, fatal processes progressing rapidly.
0	Dead.

KPS, Karnofsky Performance Status.

any distinguishing characteristics of lower functioning patients undergoing Mohs surgery.

Methods

We conducted a multicenter prospective cohort study of consecutive patients aged 75 years and older undergoing Mohs surgery for the treatment of non-melanoma skin cancer. Approval for this study was obtained from Cooper University Hospital's Institutional Review Board. Eight separate geographically diverse study sites were selected. All patients aged 75 years and older undergoing Mohs surgery for non-melanoma skin cancer were asked to participate in the study. These patients were not just referred for Mohs surgery but were actually treated with Mohs. Study physicians personally identified patients who met the inclusion criteria. They were instructed to offer enrollment to every patient who met the inclusion criteria until at least 25 subjects were enrolled at their site. Patients unable to provide informed consent were excluded from enrollment. On study enrollment, the study physician at each site scored the subject on the KPS scale. All study physicians were familiarized with

the scale and based their scoring on subjects' reporting of their functioning. Five questions were also asked of each subject to categorize the symptoms and impact of their skin cancer (Table 2). Patient and tumor characteristics (age, sex, tumor type, tumor location, and tumor size) were recorded. If a patient had more than one skin cancer treated, characteristics of the first tumor listed were used in the data analysis.

The primary outcome measure was the KPS score. The secondary outcome measures were patient responses to the 5-question questionnaire.

After descriptive analysis, KPS scores were dichotomized according to the KPS threshold of 70 to proceed with Mohs surgery (KPS score ≥ 70 = yes vs KPS score < 70 = no). One-way analysis of variance models were fit to age and tumor size, with dichotomized KPS scores as the predictor of interest. Fisher's exact test for independence was used to determine the relationship between the KPS threshold and categorical outcomes, including sex, tumor type, tumor location, and responses to the patient questionnaire.

Results

The study was conducted at 8 geographically diverse study locations, with a mixture of private practices and academic centers. A total of 291 patients meeting inclusion and exclusion criteria were enrolled and completed the study per protocol. The mean patient

TABLE 2. Patient Questionnaire

1.
 - a. Are you having discomfort at the site of your lesion?
 - b. Is it hurting, throbbing, stinging, or sensitive in some other way?
2. Is your lesion making you unhappy, depressed, or worried?
3.
 - a. Is your lesion making it hard for you to do daily activities?
 - b. That is, wearing glasses, combing your hair, or wearing clothes?
4.
 - a. Has your lesion bled or is it messy in some other way?
 - b. Is it difficult to keep clean?
5. Does your lesion make you avoid others or socializing because you think others find it unattractive?

age was 82.1 years. One hundred eleven women and 180 men were included in the study with a total of 168 basal cell carcinomas, 119 squamous cell carcinomas, and 4 basosquamous cell carcinomas. The average tumor size was 1.3×1 cm (Table 3). The most common tumor locations were nose ($n = 61$), cheek ($n = 47$), and forehead ($n = 34$). KPS scores ranged from 40 to 100 with an average score of 90.1 (Table 3).

92.8% of subjects had a KPS score of 70 or more (Table 4). Subjects who did not meet the KPS score threshold of 70 were significantly more likely to be older ($p = .0028$) with larger tumors ($p = .0330$ and $p = .0147$) (Table 5) but were not significantly associated with sex, tumor type, or tumor location (Table 6). Those with a KPS score less than 70 were also more likely to answer positively to questions 1a, 1b, 2, 4b, and 5 from the patient questionnaire.

Discussion

The vast majority of our patients undergoing Mohs surgery for nonmelanoma skin cancer were high functioning. Previous applications of the KPS scale have been used to decide treatment for advanced squamous cell carcinoma of the head and neck and chemotherapy for advanced melanoma. In these scenarios, the target KPS score was 60 to 80.^{23–32,34–36} 92.8% of our study patients had a KPS score of 70 or more. In fact, 89.7% had a KPS score greater than 80, indicating that these patients can carry on normal activity with effort with some signs or symptoms of disease.

There were, however, 7.3% of our patients who underwent Mohs surgery that had a KPS score of less than 70. As may be expected, this group was found to be older as functionality tends to decrease with age. The group was also found to have larger tumors than the higher functioning group. This may be because of lower functioning patients delaying initial evaluation of their skin lesions, “watchful waiting” by their physician until the suspicious skin lesion reaches a size threshold to warrant biopsy, or because smaller nonmelanoma skin cancers in lower functioning patients were being treated with an alternative method. Lower functioning patients ($KPS < 70$) were also more likely to have discomfort and/or emotional distress from

TABLE 3. Patient Characteristics and Study Descriptive Statistics

Patients Treated					291
Characteristic	Mean	Range	IQR	SD	
Age	82.1	75–99	78–85	5.0	
No. of women	111	—	—	38.1%	
No. of men	180	—	—	61.9%	
Tumor size, long axis, cm	1.3	0.2–5.0	0.7–1.7	0.8	
Tumor size, short axis, cm	1	0.2–3.5	0.5–1.2	0.6	
KPS score	90.1	40–100	80–100	12.8	
					Occurrence (%)
Tumor Type					
BCC					168 (57.7)
SCC					119 (40.9)
Basoquamous cell carcinoma					4 (1.4)
Location					
Nose					61 (21.0)
Cheek					47 (16.2)
Forehead					34 (11.7)
Ear					26 (8.9)
Leg					22 (7.6)
Scalp					14 (4.8)
Chin					13 (4.5)
Temple					12 (4.1)
Arm					12 (4.1)
Hand					10 (3.4)
Neck					8 (2.8)
Lip					7 (2.4)
Trunk					7 (2.4)
Eyelid					6 (2.1)
Digit					5 (1.7)
Canthus					3 (1.0)
Foot					2 (0.7)
Glabella					2 (0.7)
KPS Score					
100					136 (46.7)
90					82 (28.2)
80					43 (14.8)
70					9 (3.1)
60					13 (4.5)
50					6 (2.1)
40					2 (0.7)

BCC, basal cell carcinoma; IQR, interquartile range; KPS, Karnofsky Performance Status; SCC, squamous cell carcinoma; SD, standard deviation.

TABLE 4. Dichotomized Response Frequencies to KPS Score and Patient Questionnaire

	<i>Occurrence (%)</i>
KPS Score	
≥70	270 (92.8)
<70	21 (7.2)
Question 1a	
Yes	74 (25.4)
No	217 (74.6)
Question 1b	
Yes	84 (28.9)
No	207 (71.1)
Question 2	
Yes	68 (23.4)
No	223 (76.6)
Question 3	
Yes	27 (9.3)
No	264 (90.7)
Question 4a	
Yes	92 (31.6)
No	199 (68.4)
Question 4b	
Yes	39 (13.4)
No	252 (86.6)
Question 5	
Yes	18 (6.2)
No	273 (93.8)

KPS, Karnofsky Performance Status.

their skin cancer, find it difficult to adequately care for their skin cancer, and avoid social situations because of its appearance. Overall, lower functioning patients undergoing Mohs surgery were more likely to be older but with larger more symptomatic tumors which explains the use of a well-tolerated treatment with the highest cure rate to prevent recurrence.

TABLE 5. Results of 1-Way Analysis of Variance to Determine Difference in Patient Age and Tumor Size Due to KPS

<i>Outcome</i>	<i>Mean, KPS 70+</i>	<i>Mean, KPS <70</i>	<i>p</i>
Age	81.90	85.29	.0028
Tumor size, long axis, cm	1.22	1.62	.0330
Tumor size, short axis, cm	0.94	1.29	.0147

KPS, Karnofsky Performance Status.

TABLE 6. Fisher's Exact Test for Characteristics Related to KPS Score <70

<i>Predictor</i>	<i>Wald Chi-Sq.</i>	<i>p</i>
Gender	1.9443	.1702
Tumor type	3.4871	.1113
Tumor location	14.6743	.7499
Question 1a	15.8796	.0003
Question 1b	12.0319	.0017
Question 2	7.4335	.0130
Question 3	2.5662	.1168
Question 4a	1.3231	.3290
Question 4b	7.7471	.0127
Question 5	6.4524	.0316

KPS, Karnofsky Performance Status.

There are some potential limitations to this study. First, study physicians were instructed to offer enrollment to consecutive patients who met the inclusion criteria. This was their way to limit selection bias for the study. However, they did not document the number of patients who did not meet inclusion criteria (those who could not provide informed consent) or patients who declined to participate in the study. While this combined number is presumably low from informal reports of study physicians, if a high number of patients fall into these 2 groups, there may be an inherent selection bias toward higher functioning patients.

Second, we chose 75 years of age and older as an inclusion criteria. At this age, most men and women have an average 10-year life expectancy. This is the life expectancy that the CCI is used to predict. It is also an age that serves as a common cutoff point for routine cancer screenings such as breast and colon. While Mohs surgery is not a screening examination, this age range addresses the argument that nonmelanoma skin cancers are being unnecessarily treated while other specialties have limited their detection and treatment of nonfatal conditions in those of advanced age. Still, as discussed previously, advanced age is difficult to define and some may argue that 75 years old is too young to be “advanced age.” Further study may be needed to evaluate an older age cohort alone, so as to not be skewed by younger, presumably higher functioning, subjects.

Every attempt was made to standardize the reporting of KPS scores. However, KPS scores were determined

based on subjects' self-reporting of functional abilities. If present, family members provided supplemental information on a subject's activities of daily living. Still, subjects could overestimate their abilities to make themselves appear more independent and thus artificially increase their KPS scores. Second, a different physician at every site determined the KPS scores. Training materials and multiple examples were provided to each physician in an attempt to decrease intersite variability. Also, a limited amount of information on tumor type was gathered. It may be helpful to know the subtype of nonmelanoma skin cancer and whether the tumor was recurrent. These factors may also contribute to the decision to perform Mohs surgery on patients of lower functioning.

Finally, our study categorized only patients undergoing Mohs surgery for nonmelanoma skin cancers. They did not categorize the functionality of patients undergoing alternative treatments for nonmelanoma skin cancers. Further studies may seek to explore the decision-making process of physicians performing the original biopsy in deciding on a treatment for nonmelanoma skin cancer. It is likely that a variety of factors influence treatment, including functional status, patient preference, and life expectancy. Evaluating and quantifying these other factors may also serve as a valuable tool in the decision-making process.

It is our belief that most physicians take a patient's overall functionality into account when discussing treatment options for nonmelanoma skin cancer. This discussion may occur with the physician who first performs the skin biopsy or with the Mohs surgeon when patients present for surgery. We are not suggesting that all patients with nonmelanoma skin cancer should undergo Mohs surgery. Not all patients are appropriate candidates and some may opt for alternative therapies such as excision with clinical margins, electrodesiccation and curettage, or topical chemotherapy. Most dermatologic surgeons, however, have seen patients with recurrent nonmelanoma skin cancers that were first treated with a "less invasive" method. These recurrent tumors are often more aggressive, larger, require more extensive reconstruction, and have a greater impact on the patient's quality of life than they would have

originally. What we are suggesting is that patients should not be refused or discouraged from a treatment based on comorbidities alone—the patient as a whole must be taken into account.

The Appropriate Use Criteria for Mohs surgery is a useful guide on patient selection for and optimization of Mohs surgery.³⁷ It helps to identify appropriate tumors for Mohs surgery but does not require that Mohs be used, allowing for consideration of other patient factors. As the use of Mohs surgery continues to be scrutinized by patients, press, insurance carriers, and our peers, we must continue to show our value to the health care system and our diligence in appropriate use, both for appropriate tumors and appropriate patients. Quantifying a patient's functional status is just one data point by which we can do so. The KPS scale is a quick and easy way to formally document the informal functional assessment of patients that most physicians are already performing.

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