

Outcomes of Referral to Dermatology for Suspicious Lesions

Implications for Teledermatology

Kate V. Viola, MD; Whitney L. Tolpinrud, BA; Cary P. Gross, MD;
Robert S. Kirsner, MD, PhD; Suguru Imaeda, MD; Daniel G. Federman, MD

Objectives: To determine the proportion of suspicious lesions referred by nondermatologists that are found to be malignant and the number of incidental skin cancers identified at the time of dermatology referral.

Design: Retrospective cohort study.

Setting: Veterans Affairs Connecticut Healthcare System.

Patients: Four hundred patients referred by nondermatologists for skin lesions suspected of being malignant between January 1, 2006, through December 31, 2009.

Main Outcome Measures: Data collected included the type of referring provider, the final diagnosis by the dermatologist, and the number and type of incidental lesions.

Results: Only 22.0% of the index lesions (ie, the lesions that prompted the referral) were found to be cancerous. In aggregate, 149 cancerous lesions were noted

in 98 patients. However, only 88 (59.1%) were identified in the index lesion; 111 incidental lesions were biopsied by the consulting dermatologist, with 61 (55.0%) additional skin cancers identified. Twelve of the 61 incidental cancers (19.7%) were found in patients whose index lesion was clinically benign and was not biopsied.

Conclusions: Nondermatologists may benefit from focused educational initiatives on skin cancer detection, particularly the significance of the total body skin examination and the expectations for and limitations of teledermatology. A substantial proportion of malignant lesions was incidentally identified by the consulting dermatologist in addition to the primary lesion of concern. The use of teledermatology to assess a specific lesion of concern may be associated with underdiagnosis of clinically significant lesions that are not appreciated by the referring physician. Therefore, teledermatology must not be used as a substitute for a total body skin examination.

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Author Affiliations: Robert Wood Johnson Clinical Scholars Program (Drs Viola and Gross) and Departments of Dermatology (Dr Imaeda) and Medicine (Dr Federman), Yale University School of Medicine (Drs Viola and Gross and Ms Tolpinrud), New Haven, Connecticut; Department of Dermatology, University of Miami Leonard M. Miller School of Medicine, Miami, Florida (Dr Kirsner); and Departments of Dermatology (Dr Imaeda) and Medicine (Dr Federman), Veterans Affairs Connecticut Healthcare System, West Haven.

MORE THAN 1 MILLION skin cancers are diagnosed annually in the United States, with 1 in 5 Americans developing skin cancer during their lifetime.¹ The World Health Organization estimates that between 2 million and 3 million nonmelanoma skin cancers and 132 000 melanomas are diagnosed globally each year.² Nondermatologists, particularly primary care physicians (PCPs), play an important role in skin lesion assessment and initiation of referrals to the dermatologist.

The use of teledermatology in linking the health care provider to the nondermatologist has gained momentum in the past decade. Teledermatology, originally used in specialist-sparse (ie, rural) areas, is now used for the triage of patients with suspected skin cancer lesions. Teledermatology has been associated with decreased time to diagno-

sis and surgical treatment when compared with the standard referral system.³⁻⁶

Substantial research has addressed the specific roles, challenges, and innovations in the relationship between the referring provider and the dermatologist. More than 270 research articles on teledermatology have been published worldwide to date; this fairly novel resource is being integrated into the nondermatologist's clinical practice as an additional tool for skin cancer recognition and to facilitate an open forum for communication between the referring provider and the consulting service.^{7,8} One potential limitation of teledermatology is the use of a digital image in place of a total body skin examination (TBSE). If the reviewing dermatologist has access only to a digital image of a specific lesion rather than interaction with the patient, other malignant lesions and/or lesions of concern that are

outside the field of digital transmission may be overlooked.

Previous research⁹⁻¹⁴ on the role of PCPs and PCP referrals in the diagnosis of skin cancer has focused on the role of patient education and physician training. Little is known about the frequency of characteristics associated with incidental cancers detected by the dermatologist at the consultation visit or about the implications for the use of teledermatology. Therefore, we studied a cohort of patients with a single lesion suspected of being skin cancer who were referred by nondermatologists to identify the proportion of suspicious lesions found to be malignant. In addition, we sought to ascertain the impact of teledermatology if only an image of the lesion of concern was transmitted.

METHODS

SETTING

We performed a medical record review of patients referred to the dermatology service at the Veterans Affairs (VA) Connecticut Healthcare System. The referrals by nondermatologists represent lesions that were suspected of being malignant. The VA Connecticut Healthcare System cares for more than 46 800 veteran patients at 2 major academic health care centers (the West Haven and Newington VA medical centers) and 6 community-based clinics. Referring providers may be attending physicians, midlevel practitioners (nurse practitioners and physician assistants), or internal medicine residents who practice under the supervision of attending physicians.

STUDY DESIGN

Our medical record review represents a convenience sample of VA patients from January 1, 2006, through December 31, 2009. Patient inclusion criteria from the electronic medical record consisted of specific terminology (eg, "rule out basal cell carcinoma"), statements of general concern (eg, "possibly skin cancer, please check"), or a lesion descriptor (eg, "irregular border," "pearly," or "ulcerated") within the dermatology referral for a single cutaneous lesion. Patients who were referred for TBSEs without a specific lesion of concern or patients who were referred for follow-up visits were excluded to ensure that the main outcome measure of nondermatologist accuracy could be assessed. The electronic medical record was reviewed by 2 separate investigators (K.V.V. and W.L.T.) who also reviewed the consultation request by the nondermatologist, the completed consultation by the dermatologist, and the dermatopathology report if a skin biopsy was performed. We defined the *index lesion* as the lesion that prompted the referral by the nondermatologist and the *incidental lesion* as any additional lesion identified by the dermatologist. Demographic and additional variables collected included the patient's age, sex, and dermatologic history; anatomical location of the lesion; index and incidental lesion characteristics; and health care provider's lesion descriptors. Institutional review board approval was obtained before the study.

STATISTICAL ANALYSIS

Sample sizes were calculated using positive biopsy results (non-melanoma and melanoma skin cancer) as our outcome variable. Data were summarized using descriptive characteristics for patient, lesion, and health care provider variables. We per-

Table 1. Patient and Provider Characteristics

Characteristic	No. (%) (n=400)
Age, mean (range), y	77.7 (49-98)
Sex	
Male	392 (98.0)
Female	8 (2.0)
History of skin cancer	
None	324 (81.0)
Actinic keratosis	2 (0.5)
Nonmelanoma skin cancer	64 (16.0)
Melanoma	6 (1.5)
"Skin cancer" per patient report	4 (1.0)
Anatomical location	
Lip	8 (2.0)
Eyelid	8 (2.0)
External ear	36 (9.0)
Skin of other unspecified parts of face	140 (35.0)
Scalp/neck	48 (12.0)
Trunk	40 (10.0)
Back	40 (10.0)
Upper limb	32 (8.0)
Lower limb	48 (12.0)
Index lesion	
Malignant	88 (22.0)
Benign	88 (22.0)
Benign lesion on clinical examination, no biopsy	224 (56.0)
Incidental lesion	
Malignant	61 (55.0)
Benign	50 (45.0)
Referring health care provider, cancer diagnostic rate ^a	
Primary care physician	55/245 (22.4)
Nondermatology resident	8/27 (29.6)
Other physician type ^b	8/37 (21.6)
Midlevel practitioner	17/88 (19.3)
Other health care provider	0/3

^aThe cancer diagnostic rate per provider is calculated from the number of cancers diagnosed in the index lesion divided by the total number of patient referrals.

^bIncludes physicians from the departments of general surgery, ophthalmology, orthopedics, cardiology, rheumatology, geriatrics, endocrinology, gastroenterology, obstetrics/gynecology, and emergency medicine.

formed bivariate comparisons of the baseline characteristics between biopsy results (malignant/benign) using χ^2 analysis or the Fisher exact test. All statistical analyses were performed with the SAS statistical software package (version 9.1; SAS Institute, Inc, Cary, North Carolina).

RESULTS

PATIENT AND HEALTH CARE PROVIDER CHARACTERISTICS

Four hundred patients were included in our study (mean age, 77.7 years; 98.0% were white men) (**Table 1**). Seventy-four patients (18.5%) had a history of skin cancer. The face was the most frequent location of the index lesion (35.0%), with the scalp/neck (12.0%) and lower limb (12.0%) also notably represented. Most lesions (224 of 400 [56.0%]) were considered by the consulting dermatologist to be nonmalignant by clinical assessment, requiring no biopsy. Of the 176 index lesions biopsied, 88

Table 2. Diagnostic Biopsy Results of Index and Incidental Lesions

Biopsy Result	Lesion, No. (%) ^a	
	Index (n=400)	Incidental (n=111)
Malignant	88 (22.0)	61 (55.0)
Basal cell carcinoma	61 (69.3)	39 (63.9)
Squamous cell carcinoma	21 (23.9)	16 (26.2)
Melanoma	5 (5.7)	6 (9.8)
Other	1 (1.1)	0
Benign	312 (78.0)	50 (45.0)
Atypical nevi	24 (7.7)	8 (16.0)
Actinic keratosis	47 (15.1)	12 (24.0)
Other	17 (5.4)	30 (60.0)
Benign lesion on clinical examination, no biopsy	224 (71.8)	NA

Abbreviation: NA, not applicable.

^aPercentages are calculated using the biopsy result (malignant or benign) as the denominator.

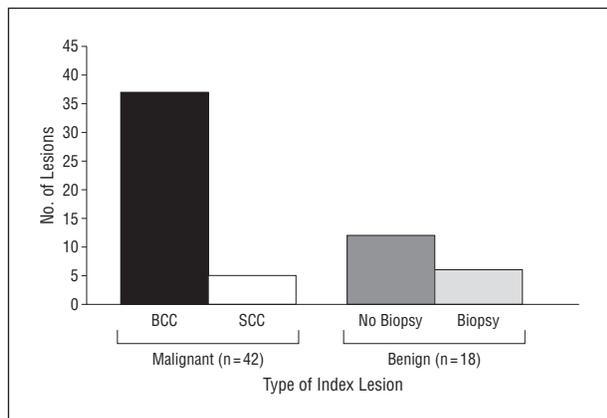


Figure 1. Biopsy results of index lesions associated with malignant incidental lesions. BCC indicates basal cell carcinoma; SCC, squamous cell carcinoma.

were malignant according to the dermatopathology report; thus, 88 of 400 patients (22.0%) had an index lesion that was positive for cancer. An additional 111 incidental lesions were biopsied, of which 61 (55.0%) were malignant. Twelve of 61 patients (19.7%) in whom an incidental lesion was biopsied and found to be malignant had index lesions that were not biopsied.

Most patients were referred by PCPs (n=245), midlevel practitioners (n=88), and other physicians (n=37). The cancer diagnostic rate for all providers was 22.0% but ranged from 19.3% for midlevel practitioners to 29.6% for nondermatology residents; PCPs and other physicians had similar diagnostic rates (22.4% and 21.6%, respectively). Of the 88 lesions yielding a positive biopsy result, 55 (62.5%) were referred by PCPs and 8 (9.1%) were referred by midlevel practitioners.

INDEX AND INCIDENTAL LESION BIOPSY CHARACTERISTICS

Most of the lesions initially suspected of being malignant and referred to a dermatologist were ultimately benign (312 lesions [78.0%]; **Table 2**). Basal cell carcinomas (61 le-

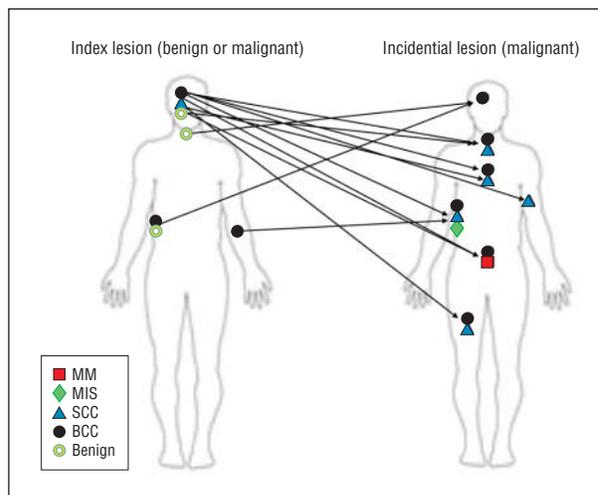


Figure 2. Relationship of location and lesion type. BCC indicates basal cell carcinoma; MIS, melanoma in situ; MM, malignant melanoma; and SCC, squamous cell carcinoma.

sions [69.3%]) constituted the largest group of the 88 index lesions that were found to be malignant. Almost one-quarter of the malignant lesions were squamous cell carcinomas (21 lesions [23.9%]); melanoma represented 5.7% (n=5) of the malignant lesions. Most benign lesions (224 [71.8%]) were deemed benign on examination by the consulting dermatologist and were not biopsied.

Of the 149 malignant lesions, 61 (40.9%) were detected in incidental lesions. Dermatologists identified malignant incidental lesions in 18 patients referred with a benign index lesion and 42 patients referred with a malignant index lesion (**Figure 1**). Melanoma was discovered in 6 incidental lesions for which the associated index lesion was not a melanoma.

There was a similar proportion of basal cell carcinomas within the total cancers identified when we compared index and incidental lesions (69.3% vs 63.9%); squamous cell carcinoma was found slightly more often in incidental lesions (26.2% vs 23.9%). A slightly larger percentage of melanoma was found in incidental lesions compared with index lesion biopsy results (9.8% vs 5.7%). Most index lesions with associated incidental lesions were located on the head and neck, whereas malignant incidental lesions tended to be more widely distributed on the head, neck, trunk, back, and extremities, including basal cell carcinoma, squamous cell carcinoma, melanoma in situ, and malignant melanoma skin cancers (**Figure 2**).

BIVARIATE ANALYSIS

In the bivariate analysis, having a history of skin cancer was associated with a positive biopsy result (nonmelanoma or melanoma skin cancer) in both index lesions ($P < .001$) and incidental lesions ($P < .001$) (**Table 3**). Biopsy of the index lesion ($P < .001$) and a positive biopsy result for the index lesion ($P < .001$) were associated with the finding of a malignant incidental lesion. There was a significant association between index lesions located on the head/neck and a positive biopsy re-

sult ($P < .001$); the relationship of incidental lesions on the head/neck and a positive biopsy result only trended toward significance ($P = .06$).

COMMENT

In our study, a substantial proportion of patients referred to the dermatologist for a worrisome lesion were diagnosed as having a skin cancer in another area of the body. In fact, almost half of all skin cancers identified were not the referred lesion. Of great concern, 9.8% of the incidental lesions discovered by the dermatologist were melanomas. Our research demonstrates the significance of performing a TBSE and questions the utility of teledermatology for evaluation of only 1 potentially malignant lesion.

Although teledermatology was not used by health care providers within our study, we believe that its role in the referral process is significant within the context of this research. Globally, teledermatology is rapidly evolving with the speed of modern technology. This potential resource has been proposed and used between health care providers and physicians for their respective patients in 2 modalities: store-and-forward and live interactive technology.^{15,16} New advancements in this field continue to emerge, most recently, epiluminescence dermoscopy¹⁷ and mobile teledermoscopy.¹⁸ Teledermatology has been studied in remote areas, including Antarctica,¹⁹ and for key target populations, such as the military.²⁰ Recently, the Netherlands became the first country to adopt teledermatology as a fully reimbursed component of their health care system, and physicians in that country have performed more than 33 000 virtual consultations since the technology's inception.²¹ Overall, this technology has been considered cost-effective, timely, and optimal for appropriate referring diagnosis and prompt treatment. However, 2 recent studies^{22,23} examined the accuracy of teledermatology for pigmented and nonpigmented skin cancers and concluded that the accuracy of teledermatology was inferior to in-person examination but that the accuracy of management plans was equivalent. In some aspects, referral to a dermatologist mimics a teledermatology consultation. We found that, although teledermatology may be appropriate for identifying the 224 benign index lesions not requiring further diagnostic studies, a significant number of incidental cancerous lesions would have been missed.

The proportion of skin cancer types in our index lesions parallels the overall distribution of skin cancer in the United States¹; basal cell carcinoma was the most frequent diagnosis and melanoma the least common. Melanoma, which accounts for most skin cancer deaths, was identified in 9.8% of the incidental cancers found, of which 2 lesions were associated with benign index lesions; the majority of melanomas identified in our study were missed by the referring physician.

Recently, the US Preventive Services Task Force²⁴ concluded that there was insufficient evidence to recommend for or against routine screening for skin cancer using a TBSE for the early detection of all skin cancers. However, without thorough TBSEs in our cohort, the majority of melanomas would have been missed. An Australia-

Table 3. Predictors of Positive Biopsy Results

Variable	Positive Biopsy Results, No. (%)	P Value ^a
Malignant index lesion (n=88)		
History of skin cancer	36 (40.9)	<.001
Anatomical location on head/neck	53 (60.2)	<.001
Malignant incidental lesion (n=61)		
History of skin cancer	26 (42.6)	<.001
Biopsy of index lesion	51 (83.6)	<.001
Positive biopsy result for index lesion	45 (73.8)	<.001
Anatomical location on head/neck	21 (34.4)	.06

^a P values are χ^2 or Fisher exact test statistics for comparing distribution of variables (with listed percentages) and positive biopsy results.

lian study²⁵ demonstrated that, when a TBSE was performed, most patients were found to have additional malignant lesions. Physicians also have questioned the decision of the US Preventive Services Task Force and expressed continued interest in providing TBSEs to their patients.²⁶ Greater than 60% of malignant index lesions in our study were located on the head or neck, whereas most of the incidental lesions were identified in other areas of the body. Although in our study it is unknown whether the nondermatologist performed a TBSE as per the consultation, most index lesions were located "above the neck," whereas the majority of skin cancers were incidental lesions, were identified by the dermatologist as being located throughout the body (Figure 2), and may be a reflection of health care provider behavior with respect to TBSE performance.

Of note, this study did not assess the overall risk of skin cancers within the cohort but rather assessed the proportion of cancers found within referred skin lesions and additional incidental lesions discovered at the time of the consultation.

The major limitation to our study was a nondiverse study population of elderly white men (98.0%), who incidentally represent a group at high risk for skin cancers. Although it would be ideal to follow up our patients over time for determination of patient demographic and lesion characteristics leading to skin cancer, we believe that a younger cohort would provide richer data for evidence-based practice. Furthermore, we used the clinical dermatology assessment as the criterion standard for diagnoses that were deemed clinically benign by examination and not biopsied. It is possible that some of the dermatologists' clinical assessment was inaccurate and that a TBSE was not performed. However, previous research²⁷ has shown that dermatologists are highly accurate in their clinical assessment of cutaneous malignant lesions. Nondermatologists might have assumed that the dermatologist would perform a TBSE at the consultation visit and therefore did not perform a thorough skin examination. However, at our institution, like many centers in the community, whether patients referred for suspicious lesions undergo TBSE is subject to the clinical judgment of the examining physician. It is quite possible that some patients did not undergo a TBSE and that our findings may underestimate the number of incidental lesions.

There is a paucity of research addressing the dermatologic evaluation of patients with potentially malignant skin lesions referred by nondermatologists; however, data are available on the diagnostic accuracy of the nondermatologist. The involvement of these providers in the diagnosis and management of skin cancers differs worldwide and may represent a limitation in our study from a global perspective. Nondermatologists in many parts of the world may be involved in the treatment of skin cancers; therefore, sensitivity for the detection of skin cancers may be greater. A British study⁹ demonstrated 68% sensitivity in the detection of cutaneous malignant lesions by general practitioners; the Australian literature²⁸ has shown that up to 79% of nondermatologists are accurate in diagnosing skin cancer. Results of a recent US study²⁹ noted that only 26% of practitioners were accurate in cancer diagnosis. In addition, our findings may be applicable only to the potential use of teledermatology for the detection of lesions suspected of being skin cancer. One should not generalize to other forms of skin disease.

CONCLUSIONS

Nondermatologists may benefit from focused educational initiatives on skin cancer detection, particularly the significance of the TBSE. As physicians integrate teledermatology into their health care systems globally, expectations and limitations must be defined to maximize its effectiveness. If teledermatology is going to play a significant role in our armamentarium, nondermatologists should have a lower threshold for including images of all lesions that represent potential concern following a TBSE. In our study, a substantial proportion of malignant lesions were incidentally identified by the consulting dermatologist in addition to the primary lesion of concern. Assessment solely of a single specific lesion of concern, as may occur when using teledermatology, may be associated with underdiagnosis of clinically significant lesions that are not appreciated by the referring physician. Therefore, teledermatology must not be used as a substitute for a TBSE when skin cancer is suspected.

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Correspondence: Daniel G. Federman, MD, VA Connecticut Healthcare System (Mail Code 11ACSL), 950 Campbell Ave, West Haven, CT 06516 (Daniel.federman@va.gov).

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